Board of Building Standards

EDUCATION COMMITTEE MEETING
AGENDA (AMENDED JUNE 22, 2022)

DATE: JUNE 23, 2022
TIME: 10:00 AM
LOCATION: TRAINING ROOM 3, 6606 TUSSING ROAD, REYNOLDSBURG, OHIO 43068
VIDEOCONFERENCE
DIAL-IN: 1 614-721-2972
Conference ID: 511538247

Call to Order

Consent Agenda

Course Applications

ER-1 101 Essential NEC 2020 Rules (Electrical League of Ohio)
ESI, BO, MPE, EPE, BI, RBO, RBI (4 hours)
Staff Notes: Recommend inclusion of RPE, NRIUI, RIUI.
ESIAC Recommendation: Recommend approval
Committee Recommendation:

ER-2 ERCES Bi-Directional Amplifier Systems (Radio Solutions)
BO, MPE, BPE, BI, FPI, RPE (1.5 hours)
Staff Notes: Recommend approval, include FPPE, RBO, RBI
Committee Recommendation:

ER-3 How to E-Learn and Study Skills (Building and Fire Code Academy)
All certifications (6 hours)
Staff Notes: Soft skills course on maximizing impact of online learning and study for work and exams. Recommend approval.
Committee Recommendation:

ER-4 Water-Based Fire Protection Inspection Process (Fire Code Academy)
BO, MPE, BPE, PPE, FPPE, BI, FPI, NRIUI, RBO, RBI, RIUI (3 hours)
Staff Notes: Recommend approval, include PI, RPE
Committee Recommendation:

ER-5 What Is It? Classifying Use and Occupancy (2- and 4- hour versions) (David Molnar)
All certifications (2-hour and 4-hour versions)
Staff Notes: A reduction and expansion, respectively, of the original three-hour course. The two-hour version is a Conference version. The attached "Outline" explains in detail how the three versions differ in content.
Committee Recommendation:

ER-6 What Is It? Classifying Use and Occupancy (3-hour version) (David Molnar)
All certifications (3 hours)
Staff Notes: This course is already approved for 2022 for all certifications except ESI. Request is to eliminate the exception.
Committee Recommendation:

ER-7 Atrium Design, Vertical Space Design, and Wide Span Opening Protectives (McKeon Door)
BO, MPE, BPE, BI, FPI, NRIUI (3 hours)
Staff Notes: Six sample slides provided.
Committee Recommendation:

ER-8 Substantial Damage Determinations (OBOA/Decker)
4 hours, all certifications.
Tabled to August meeting for slide submission.

Old Business

New Business

NB-1 Changes to BBS Education Classification system
At the May meeting BBS staff briefly introduced an updated education approval application which changes the way courses are approved for certifications. Staff email and proposed new application, existing application are attached.
Committee Recommendation:

Adjourn

EDUCATION COMMITTEE MEETING
CONSENT AGENDA

Course Applications

EC-1 Cincinnati Framing Checklist (Building and Fire Code Academy)
RBO, RPE, RBI, BI (6 hours in two 3-hour sessions)

EC-2 Raceway Fill and Correction (Ohio Certificate Renewal)
All certifications except PPE, MechPE, and PI (4 hours)

EC-3 2020 NEC Changes and Updates Article 230 through Chapter 4 (Labriola)
All certifications except plumbing and NRIUI (8 hours)

EC-4 2020 NEC Changes and Updates Article 90 through Chapter 8 (Labriola)
All commercial certifications except plumbing; RBO, RPE, RIUI (24 hours)

EC-5 2020 NEC Changes and Updates Articles 210.8(B) - 220 (Labriola)
All certifications except plumbing (4 hours)

EC-6 2020 NEC Changes and Updates Articles 230-250 (Labriola)
All certifications except plumbing (4 hours)

EC-7 2020 NEC Changes and Updates Articles 90 through 210.8(a) (Labriola)
All certifications except plumbing (4 hours)

EC-8 2020 NEC Changes and Updates Articles 90-220 (Labriola)
All certifications except NRIUI and plumbing (8 hours)

EC-9 2020 NEC Changes and Updates Chapter 5 (Labriola)
All certifications except plumbing (4 hours)

EC-10 2020 NEC Changes and Updates Chapters 3 and 4 (Labriola)
All certifications except plumbing (4 hours)

EC-11 2020 NEC Changes and Updates Chapters 5-8 (Labriola)
All certifications except NRIUI and plumbing (8 hours)

EC-12 2020 NEC Changes and Updates Chapters 6, 7, and 8 (Labriola)
All certifications except plumbing (4 hours)

EC-13 Analysis of Changes: 2020 NEC (International Code Council)
All certifications (8 hours)

File Attachments for Item:

ER-1 101 Essential NEC 2020 Rules (Electrical League of Ohio)

ESI, BO, MPE, EPE, BI, RBO, RBI (4 hours)

Staff Notes: Recommend inclusion of RPE, NRIUI, RIUI.

ESIAC Recommendation: Recommend approval

Committee Recommendation:

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: Terri Hanna Wiehn
(Contact Name)
Organization: Electrical League of Ohio
(Organization/Company)
Address: 20575 Center Ridge Road Suite 117
(Include Room Number, Suite, etc.)
City: Rocky River State: Ohio Zip: 44116
E-Mail: terrihanna-wiehn@sbcglobal.net
Telephone: 440-333-5040 Fax: _____
Course Sponsor: Electrical League of Ohio

COURSE INFORMATION:

Course Title: 101 Essential National Electrical Code Rules

New Course Submittal: ■ Update Course: ☐ Prior Approval Number: _____

Purpose and Objective: NEC 2020

Number of Instructional Contact Hours that can be obtained upon completion: 4 hours

If Multi-Session, Number of Instructional Contact Hours Per Session: _____

Program Applicable for the Following Participants:

Building Official ■	Master Plans Examiner ■	Building Inspector ■	Fire Protection Inspector ☐	Mechanical Inspector ☐
	Plumbing Plans Exam. ☐			Plumbing Inspector ☐
	Electrical Plans Exam. ■			Non-Res IU Inspector ☐
	Mechanical Plans Exam. ☐			

Res Building Official ■ Res Plans Examiner ☐ Res Building Inspector ■ Res Mechanical Inspector ☐ Res IU Inspector ☐

Electrical Safety Inspectors ☐
Location of ESI Course: 12875 Corporate Drive Unit F, Parma Date(s) of ESI Course(s): June 15, 2022

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	x
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	na
Completed Application:		x

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

Electrical League of Northeast Ohio
National Electrical Code 2020 Edition
4-hour Course

101 Essential National Electrical Code Rules

Presented By: Timothy G. Pool, PE, RCDD

Course Summary

Proper interpretation of the rules of the National Electrical Code is essential to the construction of electrical systems without damage to equipment or safeguarding of the public. This class will identify 101 of the most essential code rules for the practical electrician to follow in the workplace.

Chapter 1 – 25 minutes

Clearances (5 rules) – Working space, dedicated equipment space and Egress
Wire Termination Requirements (5 rules) – Temperature of lugs vs. conductor Insulation

Chapter 2 – 30 minutes

Multi-wire branch circuits (4 rules) – Disconnect phases, neutral sharing and AFCI Protection
Receptacle Spacing (6 rules) – Dwelling unit vs. commercial
Load Calculations (3 rules) – New, Existing and demand factors
Services (4 rules) – Clearances and calculating
Overcurrent Protection (5 rules) – Discussion of standard sizes and selecting
Grounding and Bonding (4 rules) – Grounding electrode and sizing ground conductors

Chapter 3 – 40 minutes

Conductor Sizing (5 rules) – Derating and temperature
Box sizing (3 rules) – Straight and Angle Pulls
Raceway Supports (4 rules) – Short sections between boxes

Chapter 4 – 25 minutes

Plug and Cord (3 rules) – No flexible cords in ceilings
Panelboards (2 rules) – Number of poles
Luminaire mounting arrangements (2 rules) – Heavy-duty fixture mounting boxes
Motors (4 rules) – Location of disconnect relative to controller
Transformer Overcurrent Protection (3 rules) – Primary vs Primary and Secondary

Chapter 5 – 30 minutes

Classified Locations (5 rules) – Class 1, Class 2 and Class 3 Locations
Service Stations (2 rules) – Fuel dispensing vs. minor repair
Health Care Facilities (6 rules) – Electrical System branch separation and GFP Protection

Chapter 6 – 30 minutes

Swimming Pools (4 rules) – Receptacle location, Methods of Grounding
Fire Pumps (3 rules) – Feeder protection and Overcurrent Protection

Chapter 7 – 35 minutes

Emergency systems (5 rules) – Types of emergency systems and separation
Maintaining Power (3 rules) – Time frame to transfer and wiring
Low voltage Wiring (4 rules) – Class 1, Class 2 and Class 3 wiring

Chapter 8 – 25 minutes

Communications Circuits (5 rules) – Abandoned cable, Power limited Cables
Plenum Rated (1 rule) – Low Smoke in Plenum Spaces

Timothy G Pool, PE, RCDD

Executive Vice President Engineering & Production | Principal

Tim has more than 25 years experience as an Electrical Engineer designing electrical systems, information technology systems and industrial/process design. In his role as Director, he manages the electrical engineering staff, serves as a technical resources providing design guidance as needed, and is actively involved in completing the engineering of power distribution, lighting and control systems. A Registered Communications Distribution Designer, Tim has designed technology infrastructures for libraries, educational institutions and healthcare facilities. Furthermore, Tim is a licensed Electrical Safety Inspector with the State of Ohio and a subject matter expert in National Electrical Codes and National Fire Codes.

Electrical League of Ohio
June 2022

101 Essential NEC Rules

Presented by: Timothy Pool, P.E., RCDD, ESI

RULE #1

Interrupting Rating

ARTICLE 110
Requirements for Electrical Installations

110.9 Interrupting Rating.

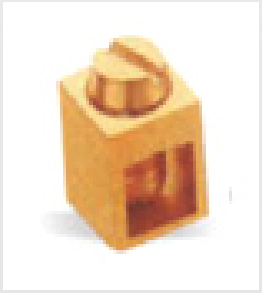
Equipment intended to interrupt current at fault levels shall have an interrupting rating sufficient for the nominal circuit voltage and the current that is available at the line terminals of the equipment.

Equipment intended to interrupt current at other than fault levels shall have an interrupting rating at nominal circuit voltage sufficient for the current that must be interrupted.

RULE #2

Electrical Connections

ARTICLE 110
Requirements for Electrical Installations



110.14 Electrical Connections.

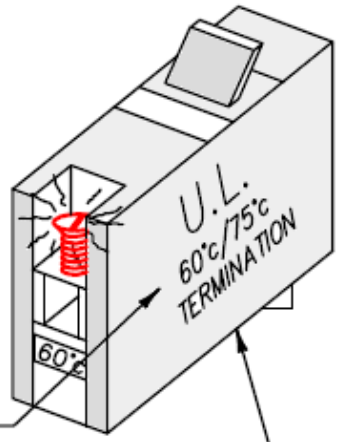
(C) Temperature Limitations.

The temperature rating associated with the ampacity of a conductor shall be selected and coordinated so as not to exceed the lowest temperature rating of any connected termination, conductor, or device. Conductors with temperature ratings higher than specified for terminations shall be permitted to be used for ampacity adjustment, correction, or both.

(1) TERMINATION PROVISIONS FOR 100 AMPERES OR LESS (No.14 THRU No.1) TERMINATIONS WILL LIMIT WIRE AMPACITY TO THE 60°c COLUMN OF TABLE 310.16

(2) TERMINATION PROVISIONS FOR OVER 100 AMPERES (LARGER THAN No.1 AWG.) TERMINATIONS WILL LIMIT WIRE AMPACITY TO THE 75°c COLUMN OF TABLE 310.16

CONDUCTORS WITH HIGHER INSULATION TEMPERATURE RATINGS (HIGHER THAN 60° OR 75°c) MAY BE USED PROVIDED THE TERMINATION TEMPERATURE LIMITATIONS SHOWN ABOVE ARE FOLLOWED.



TERMINATION RATINGS ARE USUALLY IDENTIFIED. IF NOT, ALWAYS ASSUME ONLY THE BASIC REQUIREMENTS SHOWN ABOVE WILL APPLY.

OFTEN EQUIPMENT IS LISTED AND IDENTIFIED FOR BOTH 60°C AND 75°C USE. IN THIS CASE THE HIGHER AMPACITY RATING OF THE WIRE CAN BE USED. SEE TABLE 310.16, HOWEVER 75°C/90°C TERMINATIONS ARE NOT COMMON.

Figure 110.14(C)(1) and (2) Temperature Limitations of Terminations.

ARTICLE 110
Requirements for Electrical Installations

Be careful! UL general information on electrical equipment directory says:

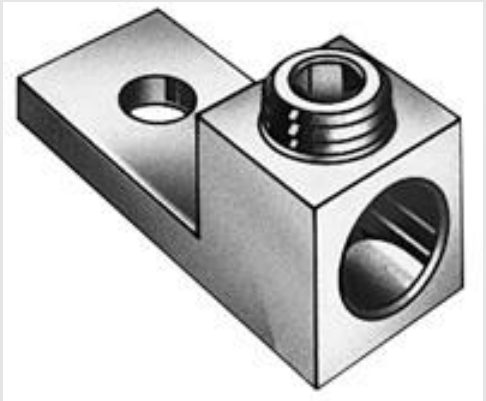
A 75°C conductor temperature marking on a circuit breaker or switch normally intended for wire sizes 14-1 AWG does not in itself indicate that 75°C insulated wire can be used unless 1) the circuit breaker or switch is used by itself, such as in a separate enclosure, or 2) the equipment in which the circuit breaker or switch is installed is also so marked.

A 75 or 90°C temperature marking on a terminal does not in itself indicate that 75 or 90°C insulated wire can be used unless the equipment in which the terminals are installed is marked for 75 or 90°C

ARTICLE 110
Requirements for Electrical Installations

Carefully read 110.14(C)(1)(b)(2)…

Notice the words “if the **equipment** is listed and identified for use with such conductors”



ARTICLE 110
Requirements for Electrical Installations

Carefully read 110.14(C)(2)…

Separate pressure connectors also do not allow you to use a 90 degree ampacity unless (C) (1) and (2) are followed.

ARTICLE 110
Requirements for Electrical Installations

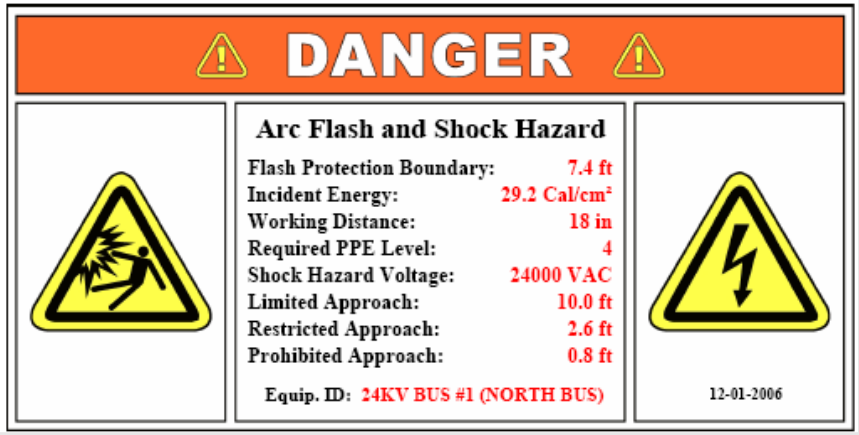
When can I use the 90 degree C column?

When applying derating for either higher ambient temperature (over 86°F, 30°C) or where more than 3 current carrying conductors are installed, always begin derating using the highest ampacity column (Table 310.16) corresponding to the conductors insulation temperature rating. Then follow the limitations for the terminations.

RULE #3

Flash Protection

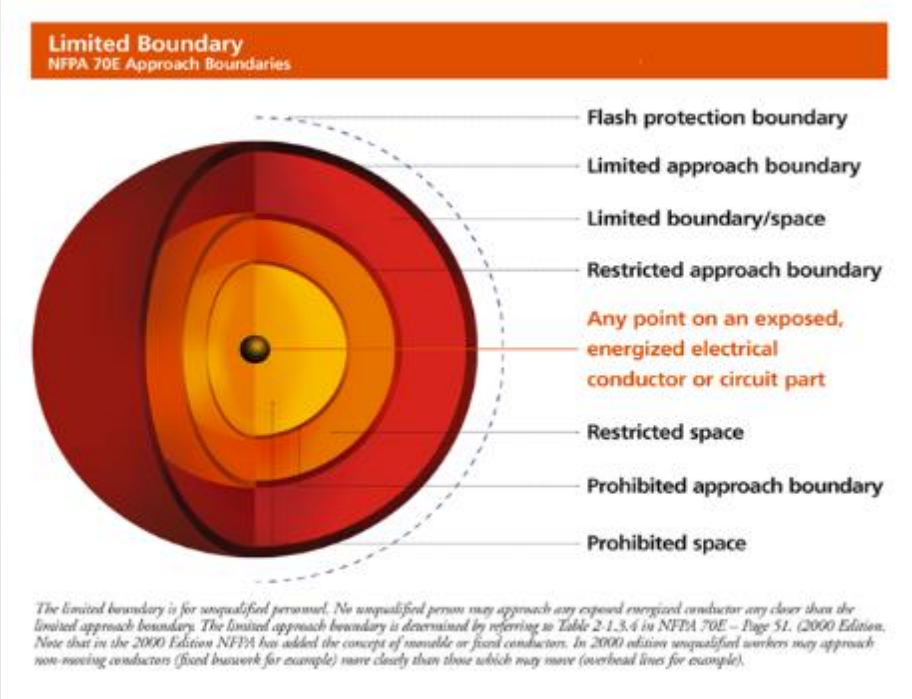
ARTICLE 110
Requirements for Electrical Installations



110.16 Flash Protection.

Electrical Equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential electric arc flash hazards.

ARTICLE 110
Requirements for Electrical Installations



110.16 Flash Protection.

FPN No. 1: NFPA 70E-2004, *Standard for Electrical Safety in the Workplace*, provides assistance in determining severity of potential exposure, planning safe work practices, and selecting personal protective equipment.

RULE #4

Spaces about Electrical Equipment

ARTICLE 110.26(A) Requirements for Electrical Installations

110.26 Spaces About Electrical Equipment.

(A) Working Space. Working space for equipment operating at 600 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized shall comply with the dimensions of 110.26(A)(1), (A)(2), and (A)(3) or as required or permitted elsewhere in this *Code*.

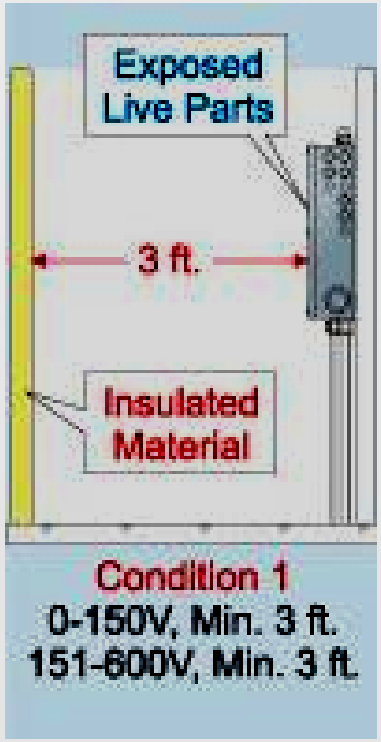
ARTICLE 110.26(A)(1) Requirements for Electrical Installations - Working Space

Table 110.26(A)(1) Working Spaces

Nominal Voltage to Ground	Minimum Clear Distance		
	Condition 1	Condition 2	Condition 3
0–150	914 mm (3 ft)	914 mm (3 ft)	914 mm (3 ft)
151–600	914 mm (3 ft)	1.07 m (3 ft 6 in.)	1.22 m (4 ft)

ARTICLE 110.26
Requirements for Electrical Installations - Working Space

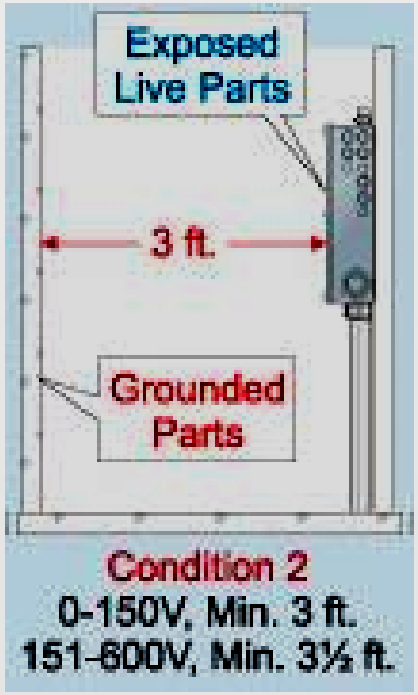
Note: Where the conditions are as follows:



Condition 1 — Exposed live parts on one side of the working space and no live or grounded parts on the other side of the working space, or exposed live parts on both sides of the working space that are effectively guarded by insulating materials.

Nominal Voltage to Ground	Condition 1
0–150	914 mm (3 ft)
151–600	914 mm (3 ft)

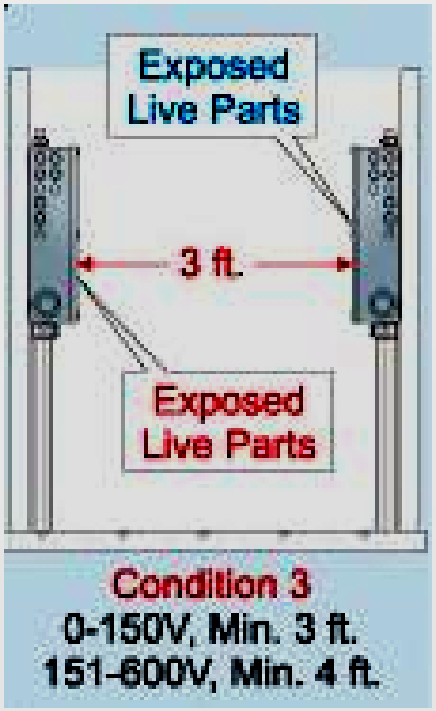
ARTICLE 110.26
Requirements for Electrical Installations - Working Space



Condition 2 — Exposed live parts on one side of the working space and grounded parts on the other side of the working space. Concrete, brick, or tile walls shall be considered as grounded.

Nominal Voltage to Ground	Condition 2
0–150	914 mm (3 ft)
151–600	1.07 m (3 ft 6 in.)

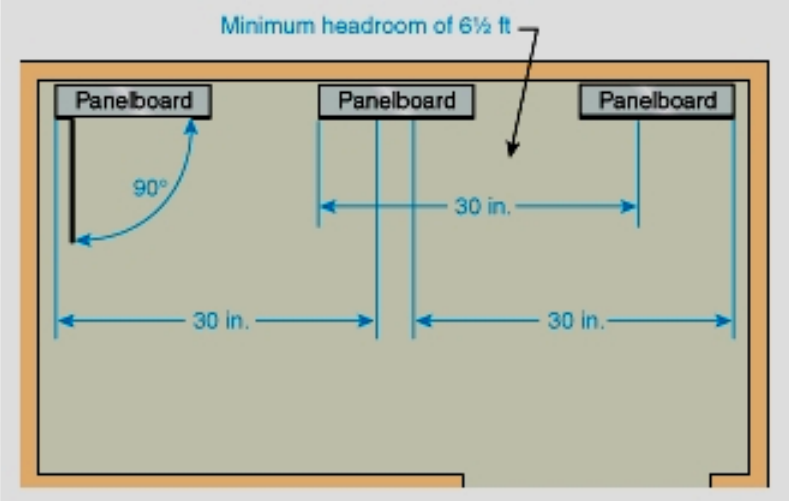
ARTICLE 110.26
Requirements for Electrical Installations - Working Space



Condition 3 — Exposed live parts on both sides of the working space.

Nominal Voltage to Ground	Condition 3
0–150	914 mm (3 ft)
151–600	1.22 m (4 ft)

ARTICLE 110.26(A)(2) Requirements for Electrical Installations



110.26 Spaces About Electrical Equipment.

(A) (2) Width of Working Space. The width of the working space in front of the electric equipment shall be the width of the equipment or 762 mm (30 in.), whichever is greater. In all cases, the work space shall permit at least a 90 degree opening of equipment doors or hinged panels.

ARTICLE 110.26(A)(3) Requirements for Electrical Installations

110.26 Spaces About Electrical Equipment.

(A) (3) Height of Working Space. The work space shall be clear and extend from the grade, floor, or platform to the height required by 110.26(E) (Headroom 6 1/2'). Within the height, other equipment that is associated with the electrical installation and is located above or below the electrical equipment shall be permitted to extend not more than 150 mm (6 in.) beyond the front of the electrical equipment.

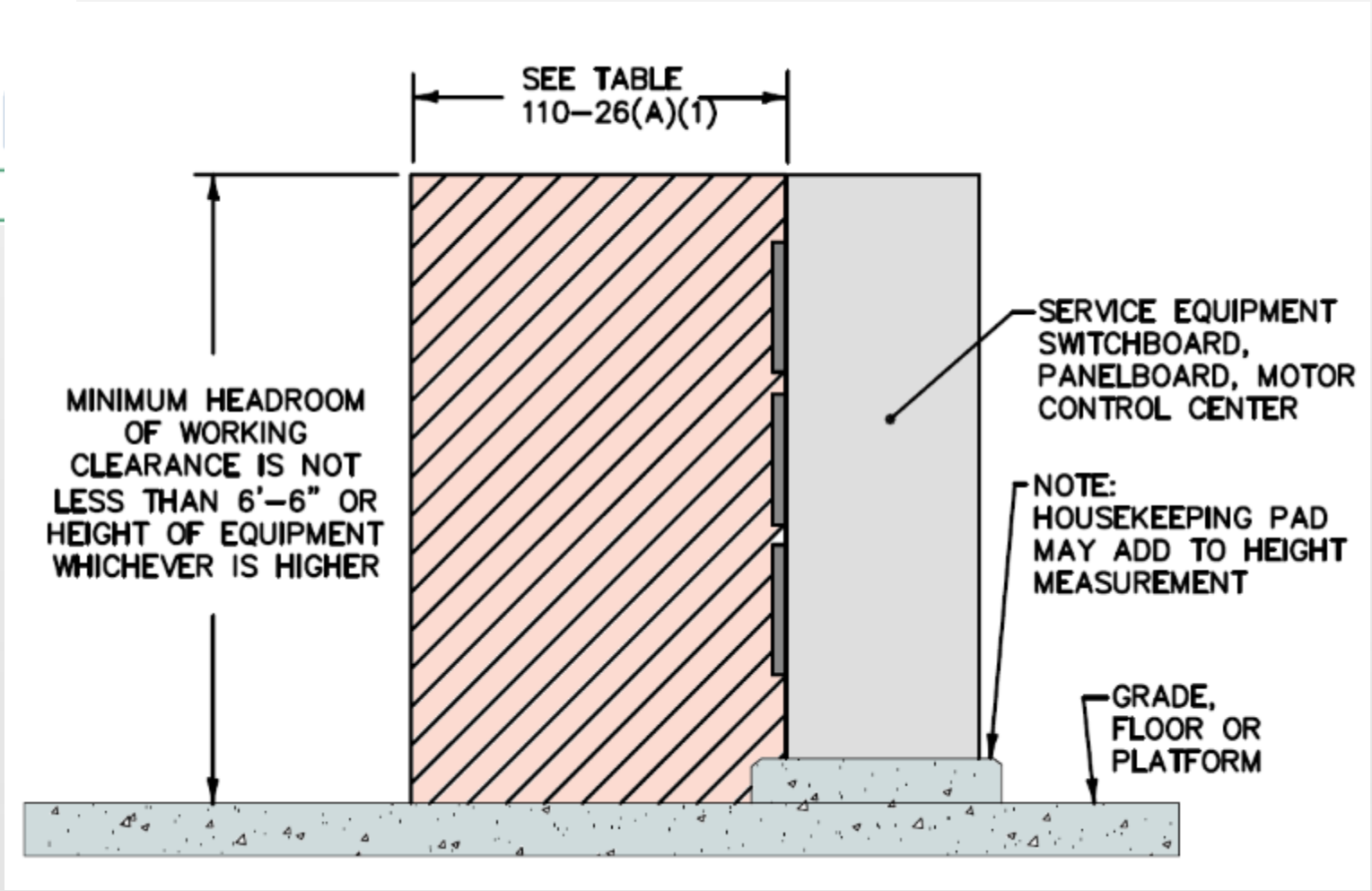


Figure 110.26(E) Headroom Height of Working Space.

RULE #5

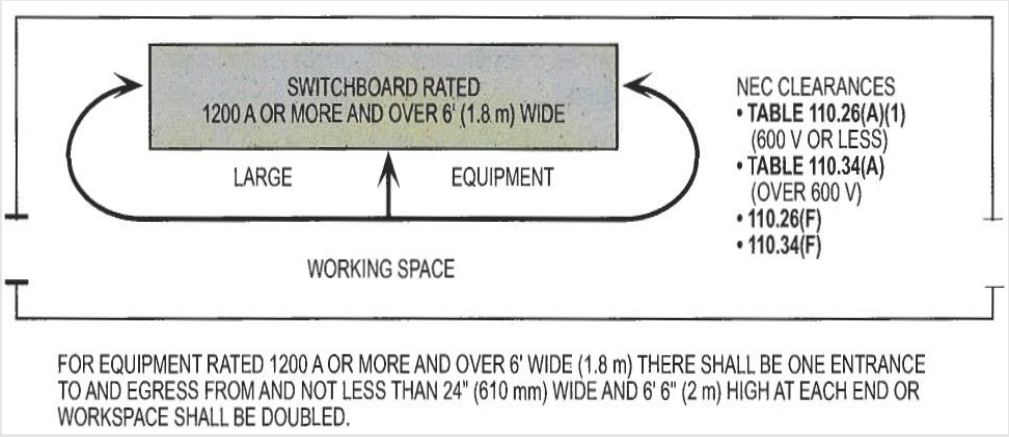
Entrance and Egress from the Working Space

Article 110.26(C)(2)

2008 NEC – 110.26

(C) Entrance to Working Space

(2) Large Equipment. For equipment rated 1200 amperes or more **and over 1.8 m (6 ft) wide** 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 610 mm (24 in.) wide and 2.0 m (6 1/2 ft) high at each end of the working space.



This change returns the requirement for large equipment to be considered over 6 ft in width, as well as being 1200 amperes or more. The over 6 ft requirement had been deleted for the 2005 NEC.

Article 110.26 (C)(3)

2008 NEC – 110.26

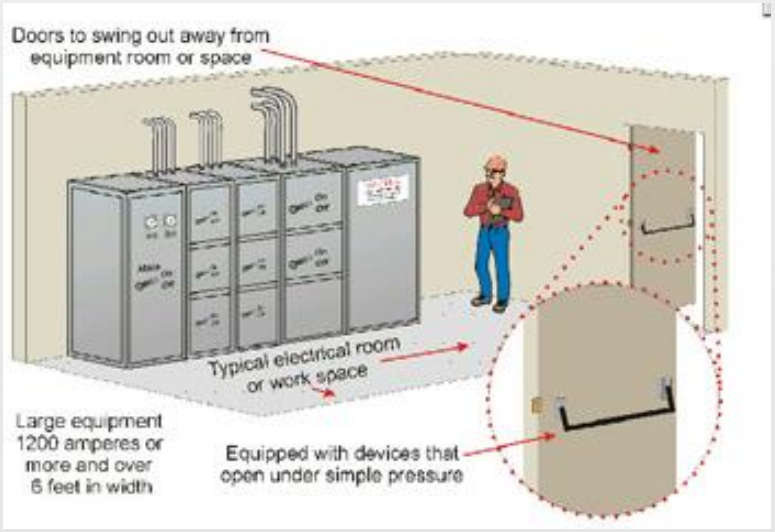
(C) Entrance to and Egress from Working Spaces

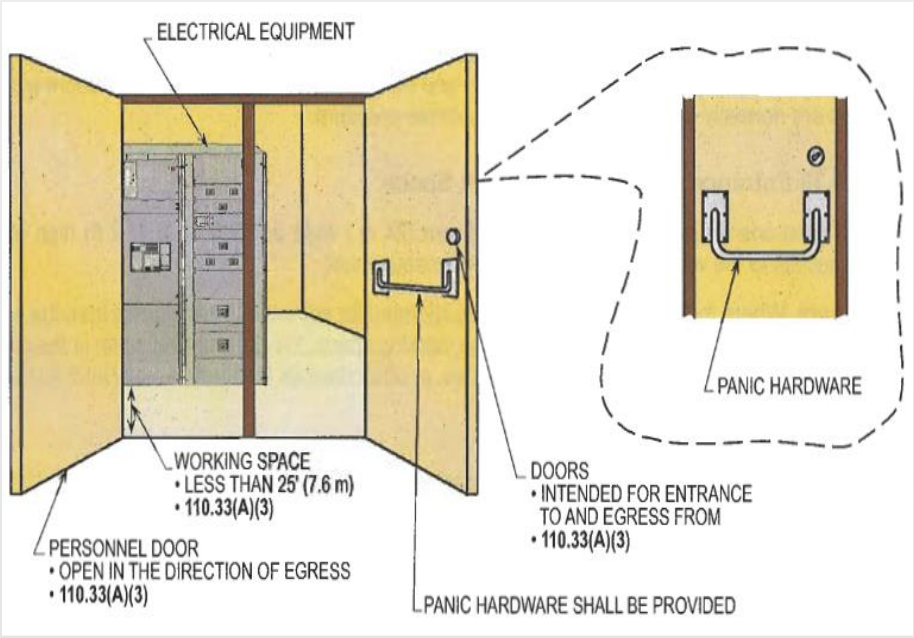
(a) *Unobstructed Egress.* Where the location permits a continuous and unobstructed way of **egress** travel, a single entrance to the working space shall be permitted.

(b) Extra Working Space. Where the depth of the working space is twice that required by 11 0.26(A)(1). a single entrance shall be permitted. It shall be located so 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.

(3) Personal Doors. Where equipment rated 1200 A or more that contains overcurrent devices, switching devices, or control devices is installed and there is a personal 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 panic bars, pressure plates, or other devices that are normally latched but open under simple pressure.

Article 110.26 (C)(3)Figure





This revision clarifies that by adding “egress from the working space” there will be equal emphasis on requiring sufficient room leaving the electrical equipment work space. New (3) will now require any door within 25 feet of working space about large equipment to have panic hardware and open in the direction of egress.

ARTICLE 110.26(D)
Requirements for Electrical Installations

110.26 Spaces About Electrical Equipment.

(D) Illumination. Illumination shall be provided for all working spaces about service equipment, switchboards, panelboards, or motor control centers installed indoors. Additional lighting outlets shall not be required where the work space is illuminated by an adjacent light source or as permitted by 210.70(A)(1), Exception No. 1, for switched receptacles. In electrical equipment rooms, **the illumination shall not be controlled by automatic means only.**

RULE #7

Protection from Damage

ARTICLE 110.26(F)
Requirements for Electrical Installations

110.26 Spaces About Electrical Equipment.

(F) Dedicated Equipment Space.

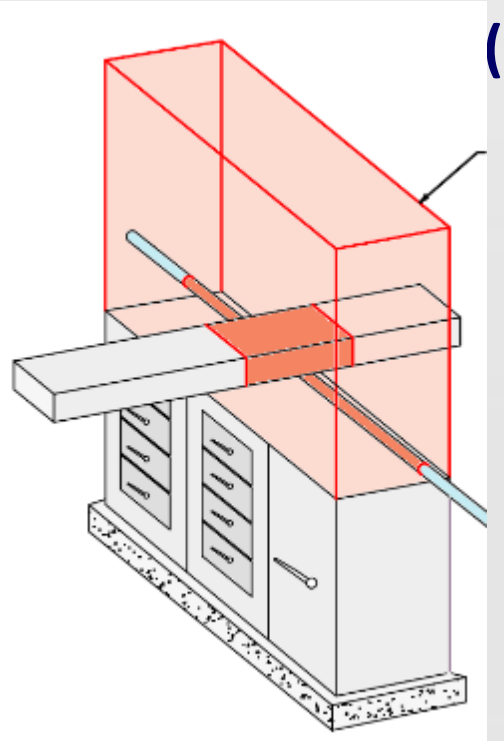
All switchboards, panelboards, distribution panels, and motor control centers shall be located in dedicated spaces and protected from damage.

Exception: For electrical equipment installed near machinery.

RULE #8

Dedicated Equipment Space

ARTICLE 110.26(F)
Requirements for Electrical Installations



110.26 Spaces About Electrical Equipment.

(F) (1) Dedicated Equipment Space.

(a) The space equal to the width and depth of the equipment and extending from the floor to a height of 1.8 m (6 ft) above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation. No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in this zone.

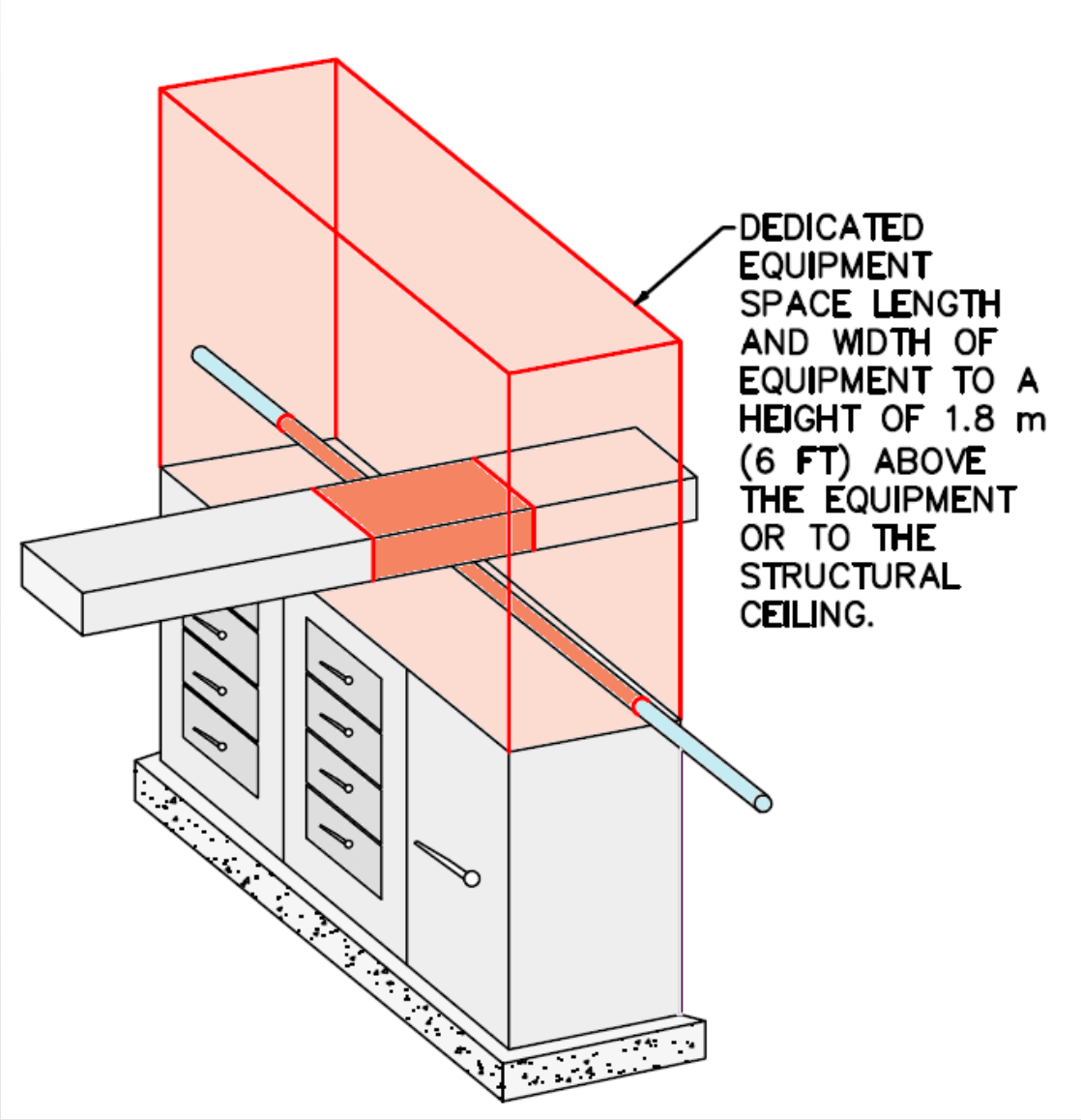
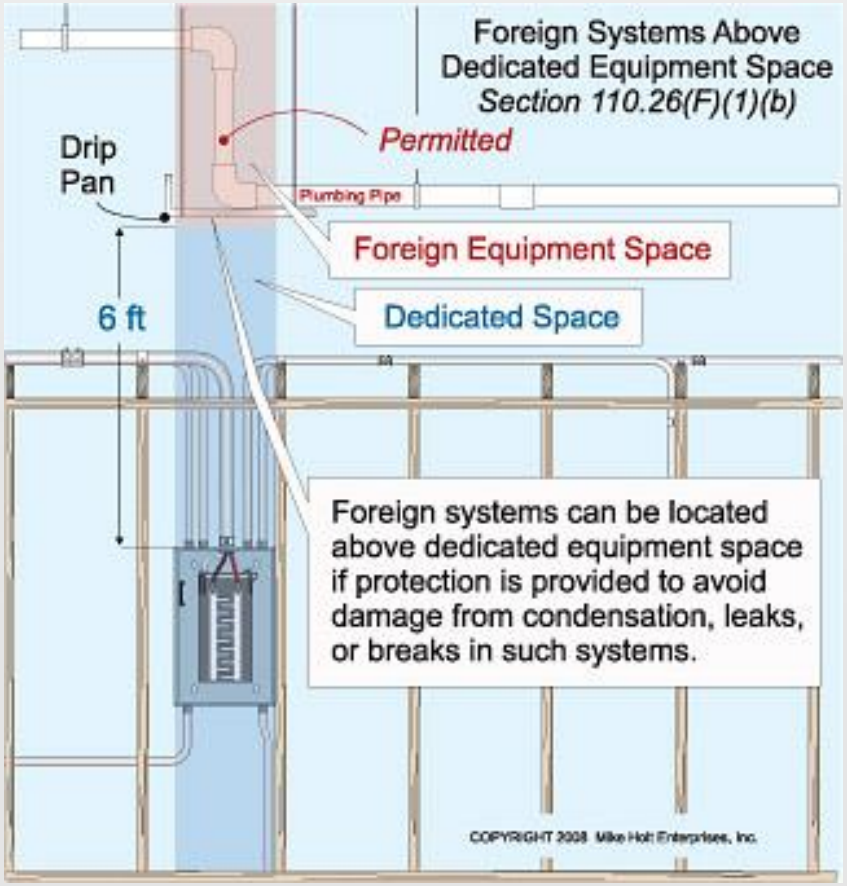


Figure 110.26(F)(1)(a) Dedicated Equipment Space.

ARTICLE 110.26(F) Requirements for Electrical Installations



110.26 Spaces About Electrical Equipment.

(F) (1) Dedicated Equipment Space.

(b) Foreign Systems. The area above the dedicated space required by 110.26(F)(1)(a) shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks, or breaks in such foreign systems.

RULE #9

Multi-wire Branch Circuit Disconnects

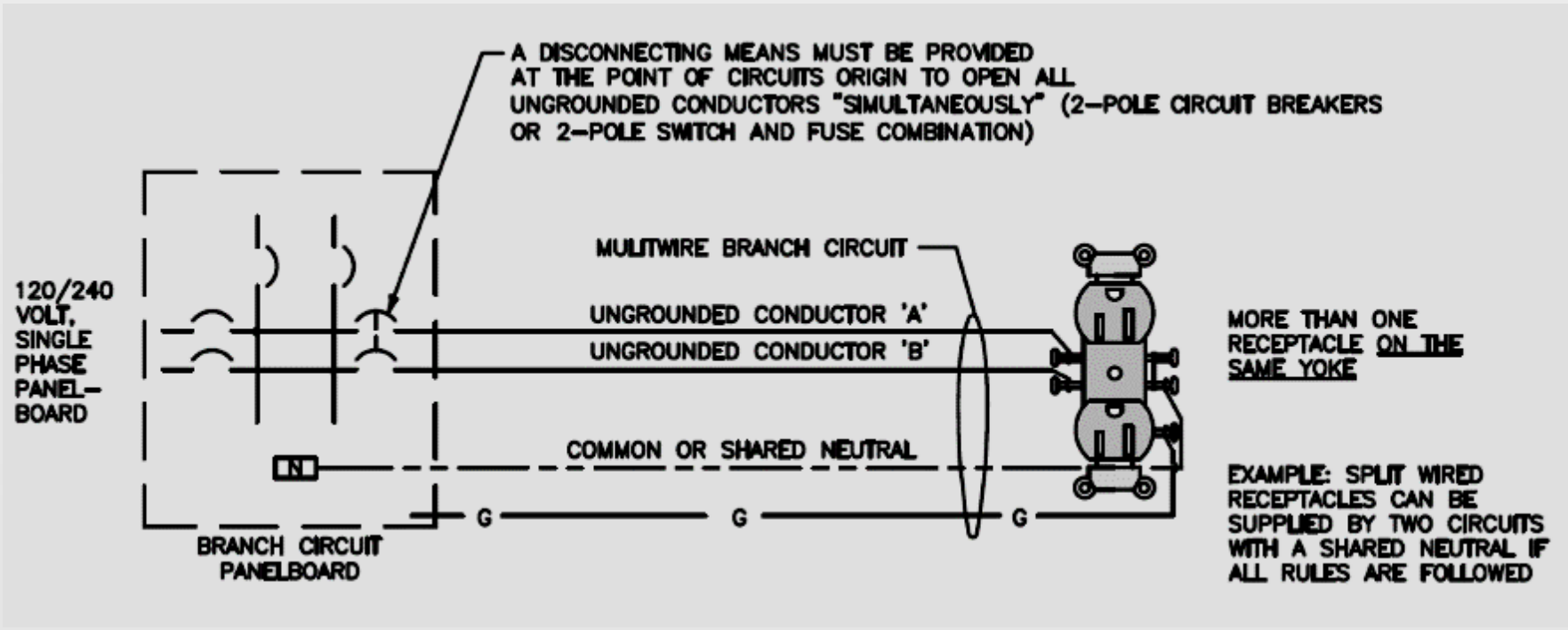
Article 210.4
Multiwire Branch Circuits

210.4 Multiwire Branch Circuits

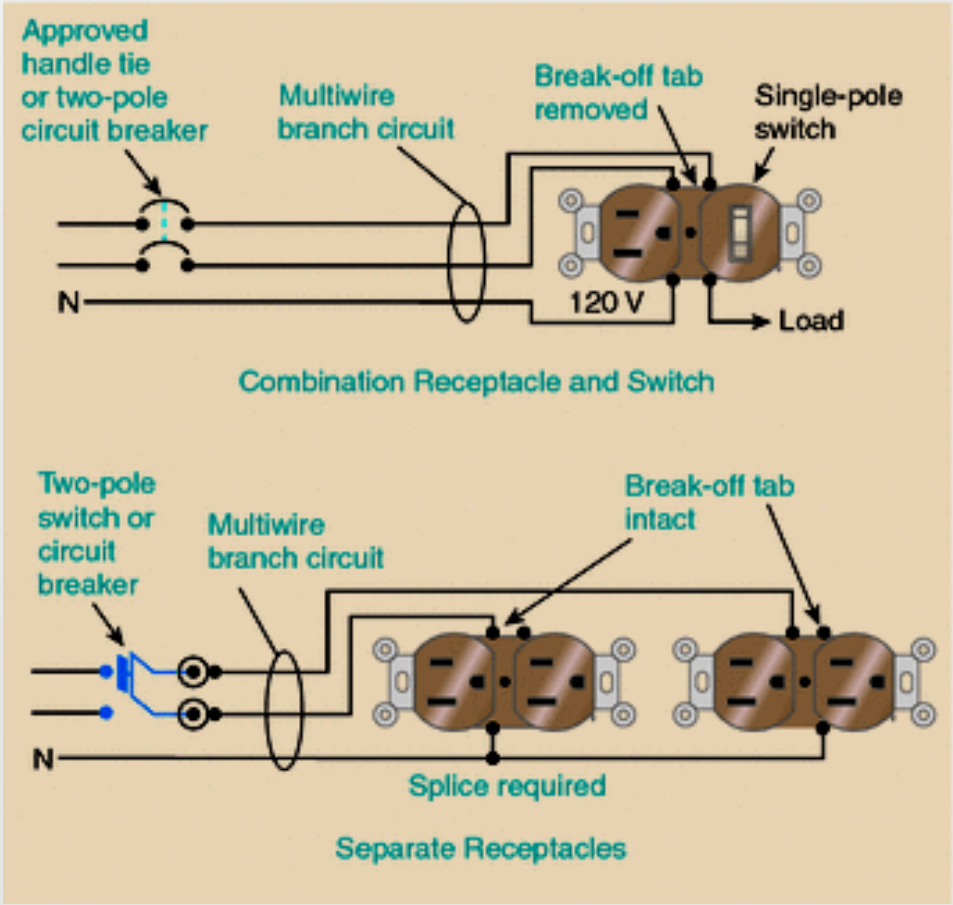
(B) Disconnecting Means. Each multiwire branch circuit shall be provided with a means that will simultaneously disconnect all ungrounded conductors at the point where the branch circuit originates.

This change was done to emphasize the safety concerns associated with unintentional voltage being present on multiwire branch circuits, especially during maintenance. Deleting the text that applied simultaneous disconnecting requirements for a multiwire branch circuit to a single device or equipment on the same yoke will require simultaneous disconnect of all ungrounded conductors on any multiwire branch circuit at its origin.

Figure 210.4 (B) and 210.7 (B)
Old 2005



Article 210.4 NEC 2008

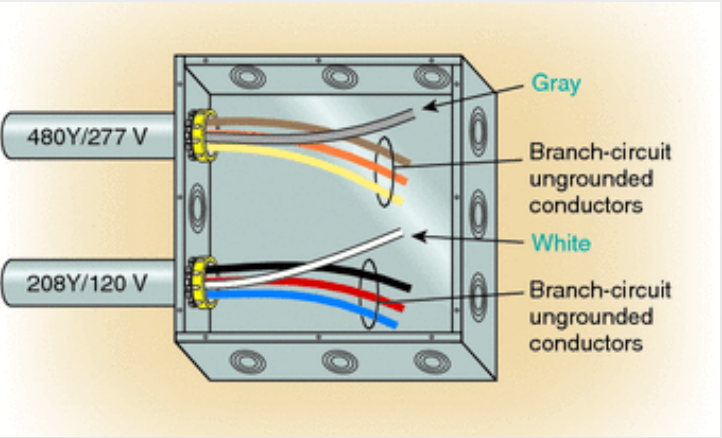


Examples where 210.4(B) requires the simultaneous disconnection of all ungrounded conductors to multiwire branch circuits supplying more than one device or equipment.

RULE #10

Identification of Branch Circuits

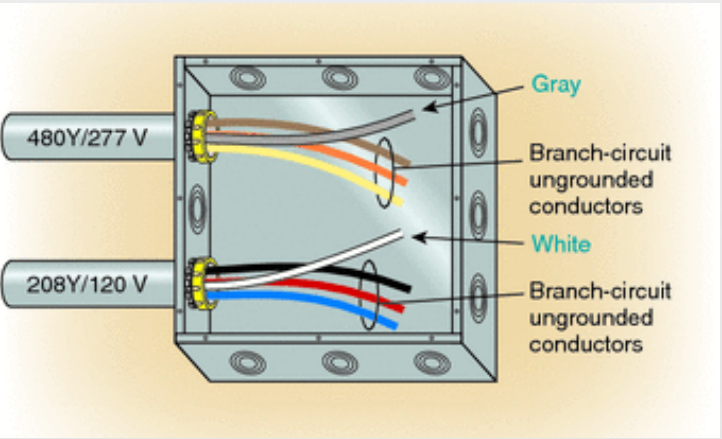
Article 210.5 Identification for Branch Circuits



210.5 Identification for Branch Circuits.

(C) Ungrounded Conductors. Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit, where accessible, shall be identified by phase or line and system at all termination, connection, and splice points.

Article 210.5 Identification for Branch Circuits

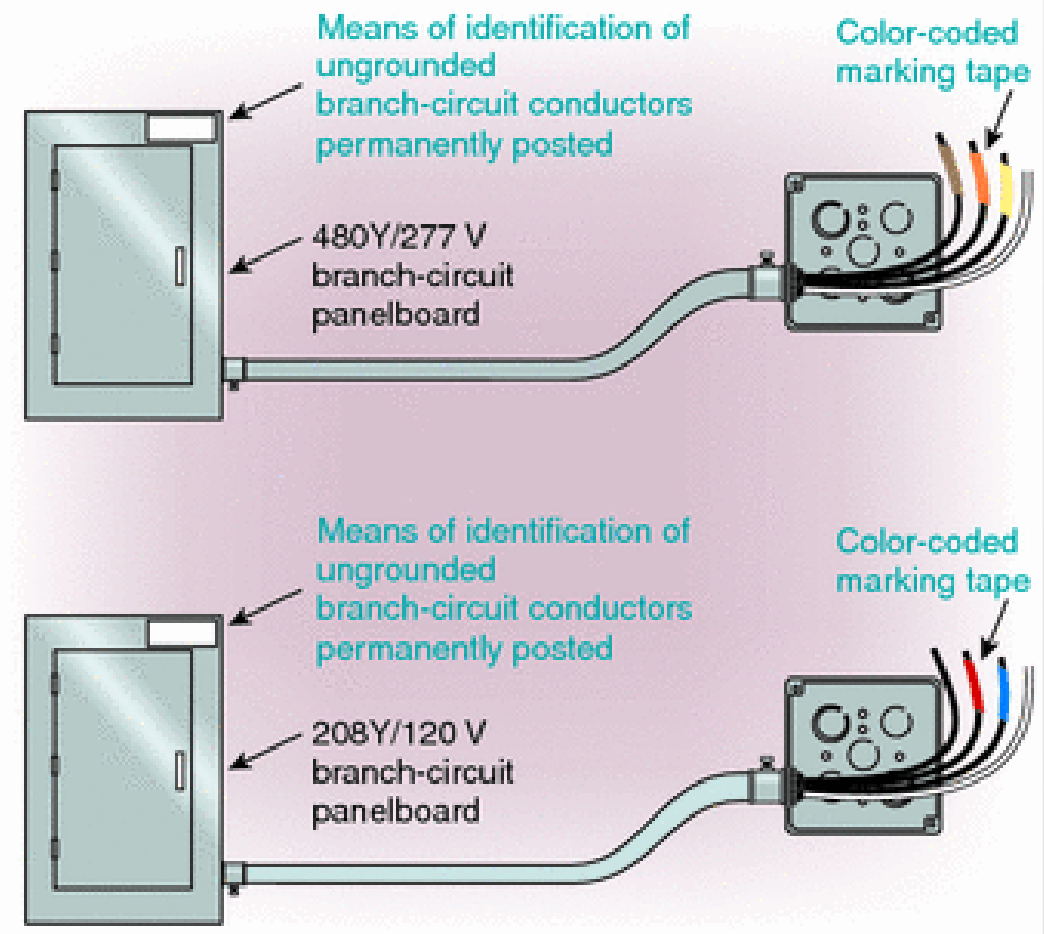


210.5 Identification for Branch Circuits.

(C) Ungrounded Conductors. (Con't)

The means of identification shall be permitted to be by separate color coding, marking tape, tagging, or other approved means. The method utilized for conductors originating within each branch-circuit panelboard or similar branch-circuit distribution equipment shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or similar branch-circuit distribution equipment.

Article 210.5



3 Examples of accessible (ungrounded) phase conductors identified by marking tape.

RULE #11

Branch Circuit Voltage Limitations

Article 210.6(D) Branch Circuits

210.6 Branch-Circuit Voltage Limitations.

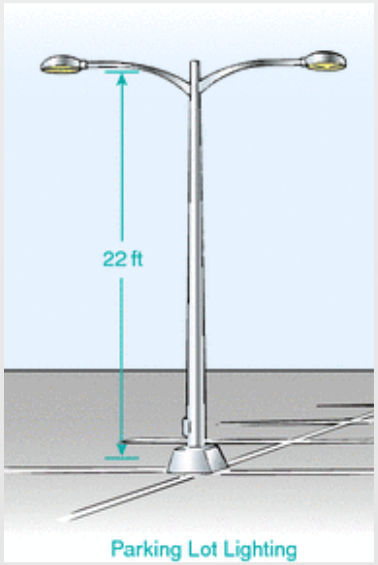
(D) 600 Volts Between Conductors. Circuits exceeding 277 volts, nominal, to ground and not exceeding 600 volts, nominal, between conductors shall be permitted to supply the following:

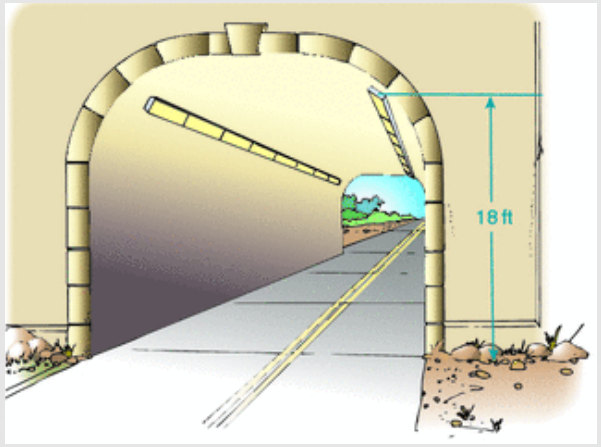
(1) The auxiliary equipment of electric-discharge lamps mounted in permanently installed luminaires (fixtures) where the luminaires (fixtures) are mounted in accordance with one of the following:

Article 210.6(D) Branch Circuits

a. Not less than a height of 6.7 m (22 ft) on poles or similar structures for the illumination of outdoor areas such as highways, roads, bridges, athletic fields, or parking lots

b. Not less than a height of 5.5 m (18 ft) on other structures such as tunnels





Voltage
120
208[2,3]
240[2,3,4]
277
347
480[2,3]
TB[5]
TBV[6]

RULE #12

Ground Fault Circuit Interrupter Requirements

Article 210.8 Ground-Fault Circuit-Interrupter Protection for Personnel

(A) Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in (1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(1) Bathrooms

(2) Garages

(3) Outdoors

(4) Crawl Spaces

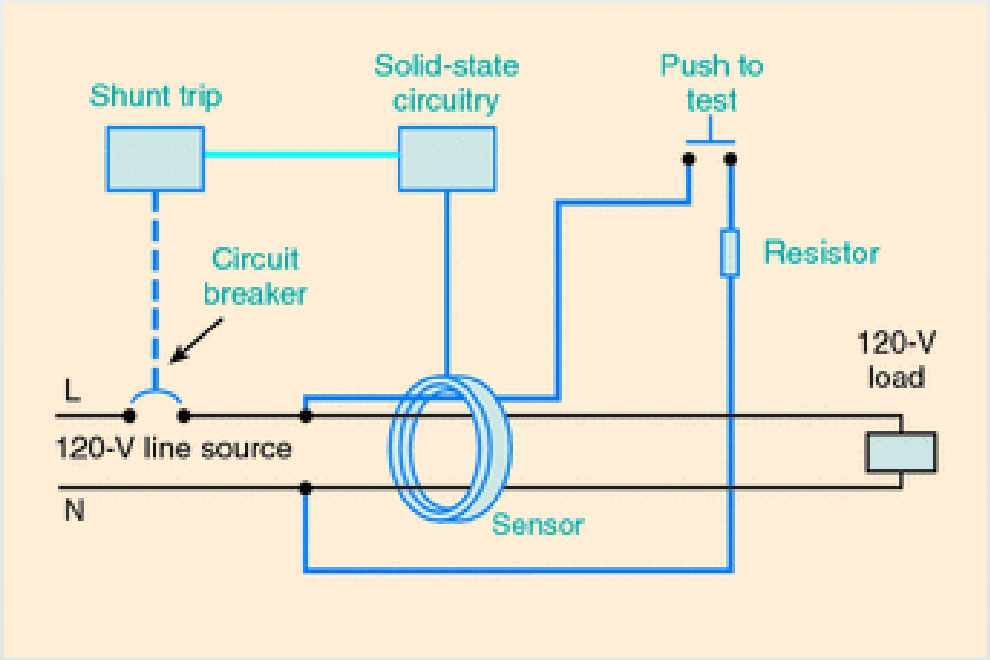
(5) Unfinshed Basements

(6) Kitchens

(7) Laundry, utility and Wet Bar Areas

(8) Boathouses

Article 210.8 Ground-Fault Circuit-Interrupter Protection for Personnel



The circuitry and components of a typical GFCI.

Article 210.8 Ground-Fault Circuit-Interrupter Protection

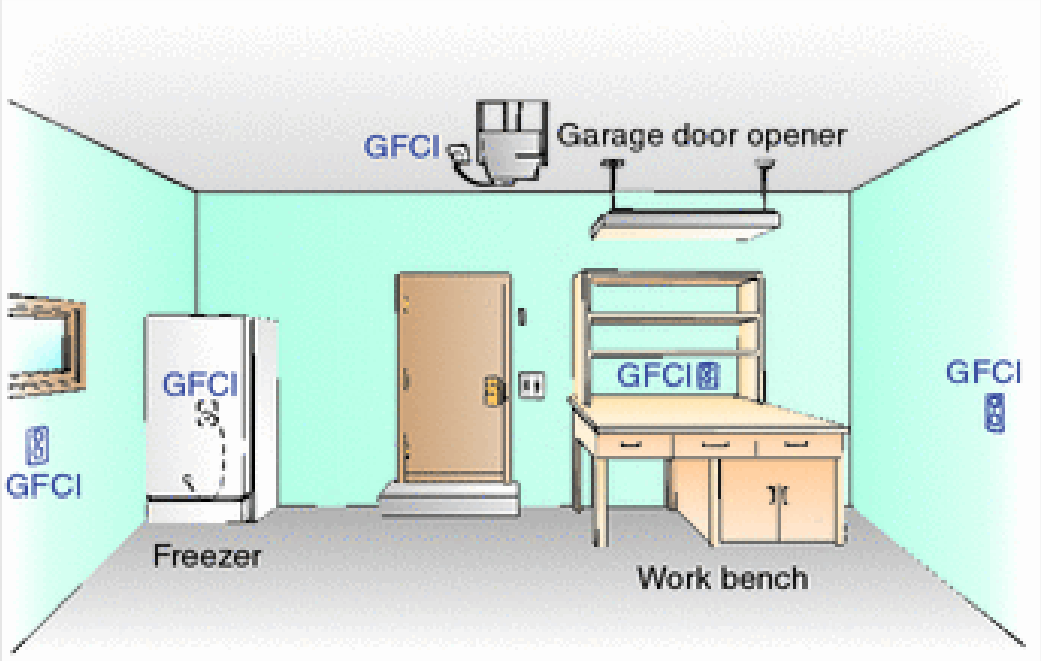
- NEC Article 210.8 requires GFCI protection in dwelling units for receptacles in the following:

  (1) Bathrooms

  (2) Garages and buildings with floors at or below grade not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use.

  - **Old Exception - unless the receptacle is not readily accessible. - Removed in 2008**
  - **Old Exception – one receptacle which is shared by two appliances not easily moved (Washer / Dryer) - Removed in 2008**

Article 210.8 Ground-Fault Circuit-Interrupter Protection



Examples of receptacles in a garage that are required by 210.8(A)(2) to have GFCI protection.

Article 210.8 Ground-Fault Circuit-Interrupter Protection

- (3) Outdoors
  - **Exception – not readily accessible and are supplied by a dedicated circuit used specifically for snow melting or deicing equipment.**
- (4) Crawl Spaces
- (5) Finished or Unfinished basements - storage areas and the like not intended for as habitable
  - **Old Exception - Not readily accessible receptacles, and 2 appliance receptacles. Removed in 2008.**
  - **Exception for fire alarm or burglar alarm system.**
- (6) Kitchens where the receptacles are installed to serve counter top surfaces
- (7) Laundry, utility and wet bar sinks
  - Where installed within 6’ of the edge of the sink.
- (8) Boathouses

Article 210.8 Ground-Fault Circuit-Interrupter Protection for Personnel

(B) Other Than Dwelling Units. All 125-volt, single phase, 15- and 20-ampere receptacles installed in the locations specified in (1) through (5) shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Kitchens

(3) Rooftops

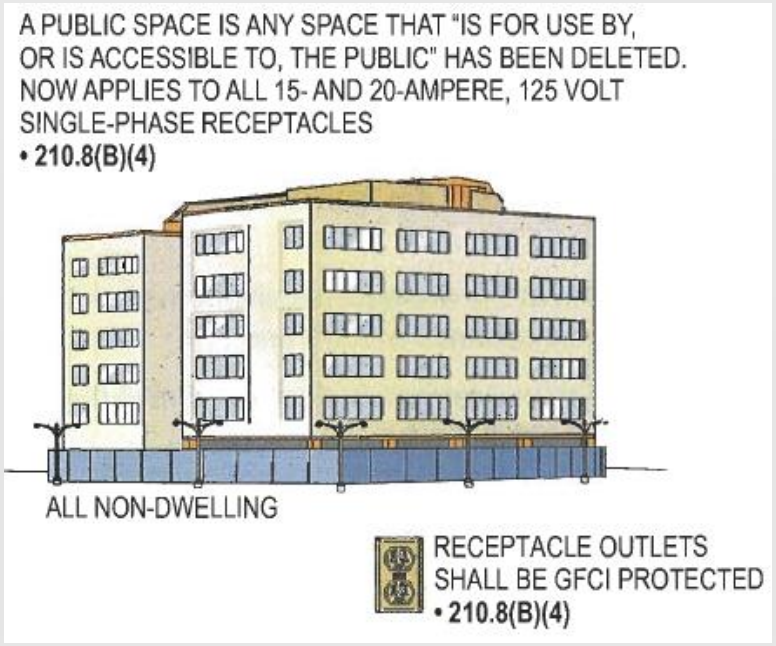
(4) Outdoors

(5) Sinks within 6' of the outside edge of the sink

Article 210.8 Ground-Fault Circuit-Interrupter Protection for Personnel

- Article 210.8 requires GFCI protection in other than dwelling units for receptacles in the following:
- (1) Bathrooms
  - No Exceptions for accessible or not. (must have GFCI for electronic faucets)
- (2) Kitchens.
  - No Exceptions, new 2008 code implies any type of kitchen per the definition (permanent facilities for food preparation and cooking.)
- (3) Rooftops
  - Exception – Non readily accessible or dedicated for a snow melting system.

Article 210.8 Ground-Fault Circuit-Interrupter Protection for Personnel



- (4) Outdoors -- New code removed "in Public Spaces".

  Exception 1 – Non readily accessible or dedicated for a snow melting system.

  Exception 2 - In industrial establishments
- (5) Sinks - Where installed within 6' of a sink.

RULE #13

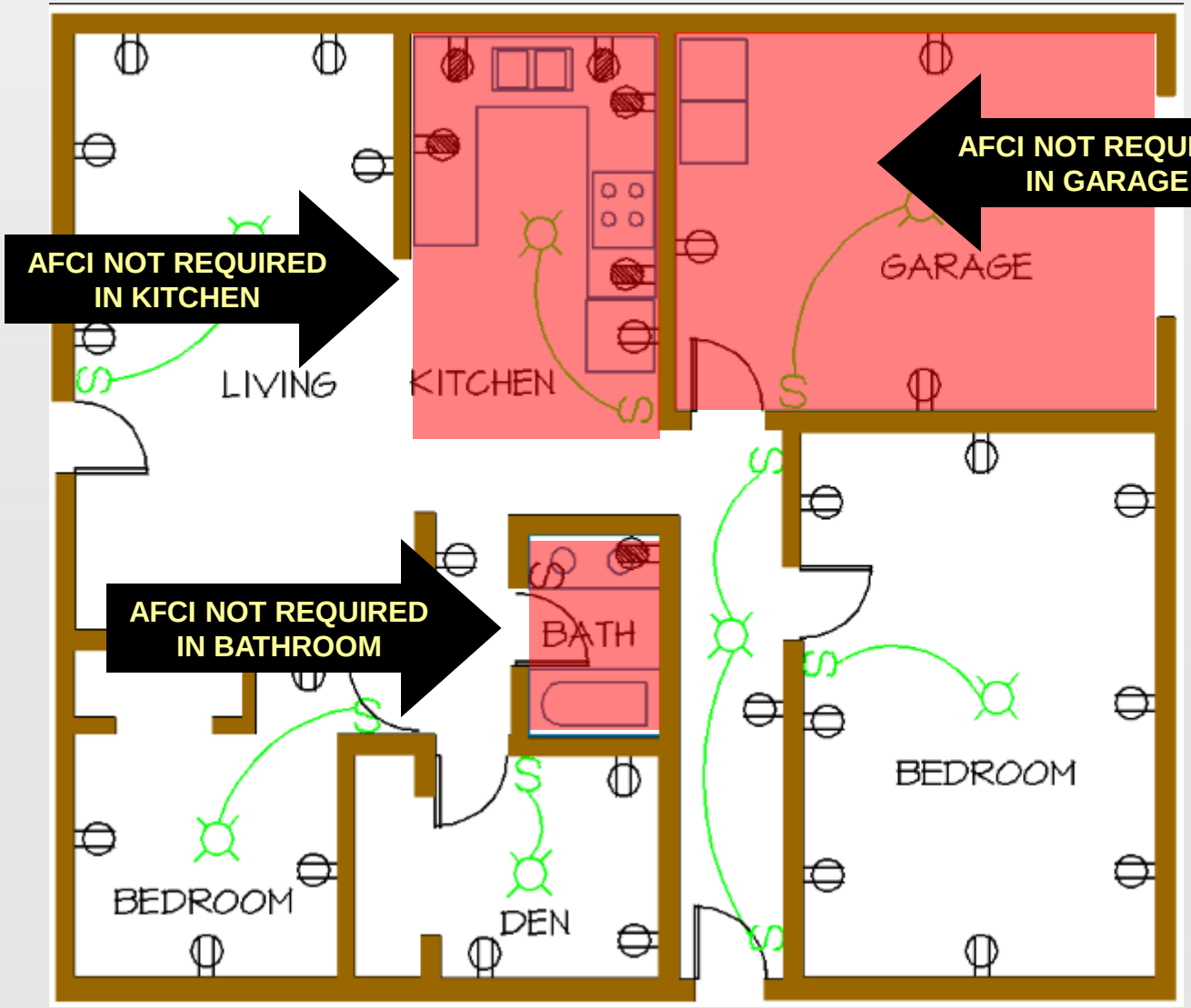
Arc-Fault Circuit-Interrupter Protection

Article 210.12
Arc-Fault Circuit-Interrupter Protection.

210.12 Arc-Fault Circuit-Interrupter Protection.

(B) Dwelling Units.. All 120-volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms,dining rooms, living rooms, parlors, libraries, dens, bedrooms, sun rooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed arc-fault circuit interrupter,combination type installed to provide protection of the branch circuit.

Article 210.12(B) Dwelling Units



RULE #14

Branch Circuit Voltage Drop

Article 210.19 Conductors Minimum Ampacity and Size

(A) Branch Circuits Not More Than 600 Volts.

(1) General. Branch-circuit conductors shall have an ampacity not less than the maximum load to be served.

FPN No. 4: Conductors for branch circuits sized to prevent a voltage drop exceeding 3 percent at the farthest outlet … and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent, provide reasonable efficiency of operation.

Figure 210.19

Single-phase VD = 2 x K x I x D/CM.

Three-phase VD = 1.732 x K x I x D/CM.

K = Direct-Current Constant. K represents the dc resistance for a 1,000-circular mils conductor that is 1,000 ft long, at an operating temperature of 75ºC. K is 12.9 ohms for copper and 21.2 ohms for aluminum.

I = Amperes: The load in amperes at 100% (not at 125% for motors or continuous loads).

D = Distance: The distance of the conductor length.

CM = Circular-Mils: The circular mils of the circuit conductor as listed in NEC Chapter 9, Table 8.

Article 210.19

- A good web site to calculate voltage drop is

  www.csgnetwork.com/voltagedropcalc.html

- Remember, the larger the load, the larger the voltage drop.

- Multi-wire branch circuits which have a balanced 3-phase current on the neutral wire only calculate voltage drop in one direction. Otherwise, use twice the distance.

RULE #15

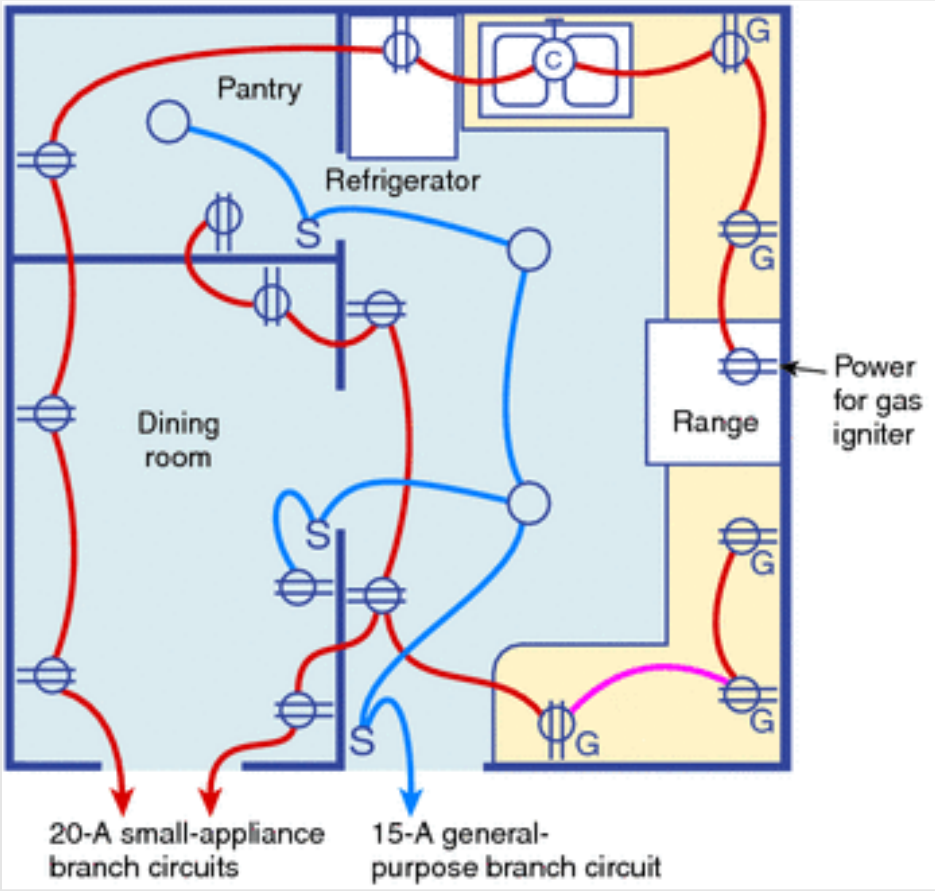
Small Appliance Branch Circuits shared with other rooms

Article 210.52 (B)

(B) Small Appliances.

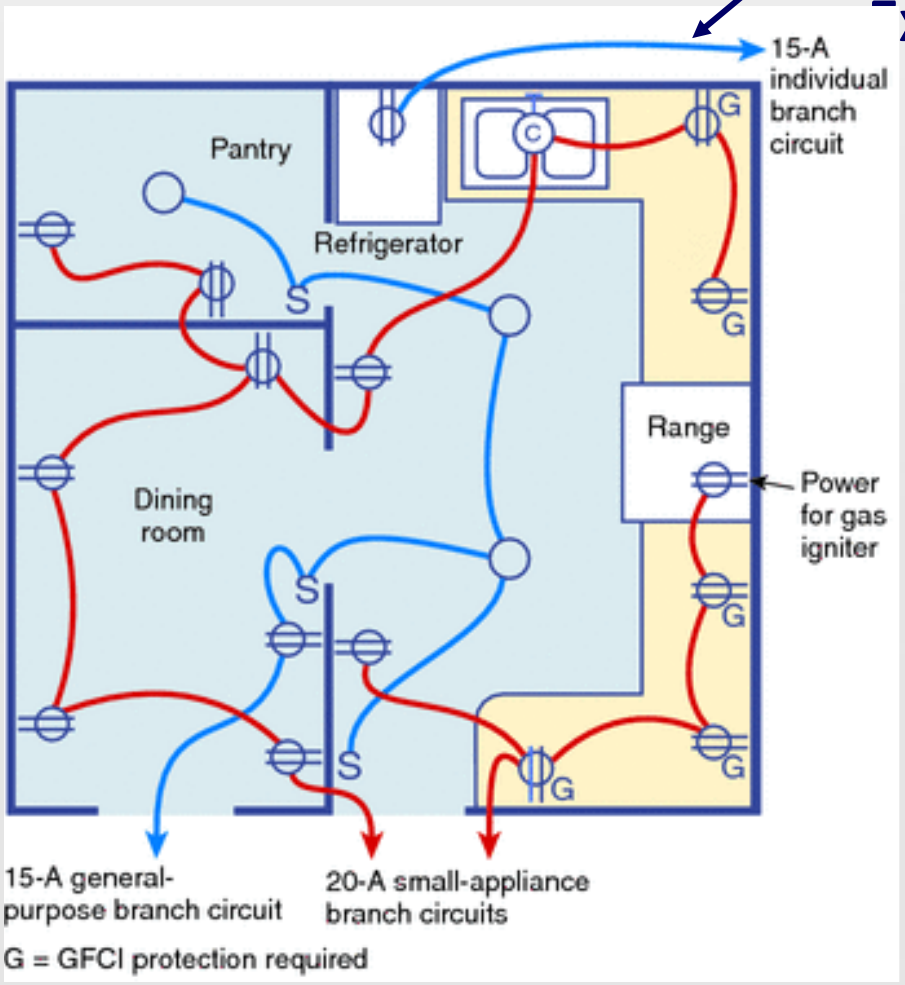
(3) Kitchen Receptacle Requirements. Receptacles installed in a kitchen to serve countertop surfaces shall be supplied by not fewer than two small-appliance branch circuits, either or both of which shall also be permitted to supply receptacle outlets in the same kitchen and in other rooms specified in 210.52(B)(1). (Kitchen, Pantry, dining room or similar) Additional small-appliance branch circuits shall be permitted to supply receptacle outlets in the kitchen and other rooms specified in 210.52(B)(1). No small-appliance branch circuit shall serve more than one kitchen.

Article 210.52 (B)



Article 210.52 (B)

210.52 (B) (1)
Ex. 2



RULE #16

Heating, Air-Conditioning, and Refrigeration Equipment Outlet

Article 210.63

210.63 Heating, Air-Conditioning, and Refrigeration Equipment Outlet.

A 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed at an accessible location for the servicing of heating, air conditioning, and refrigeration equipment. The receptacle shall be located on the same level and within 7.5 m (25 ft) of the heating, air-conditioning, and refrigeration equipment. The receptacle outlet shall not be connected to the load side of the equipment disconnecting means.

Article 210.63

210.63 Heating, Air-Conditioning, and Refrigeration Equipment Outlet.

NOTE: The requirement for a light at a rooftop unit was removed from the Ohio Building Code and is not required by the NEC.

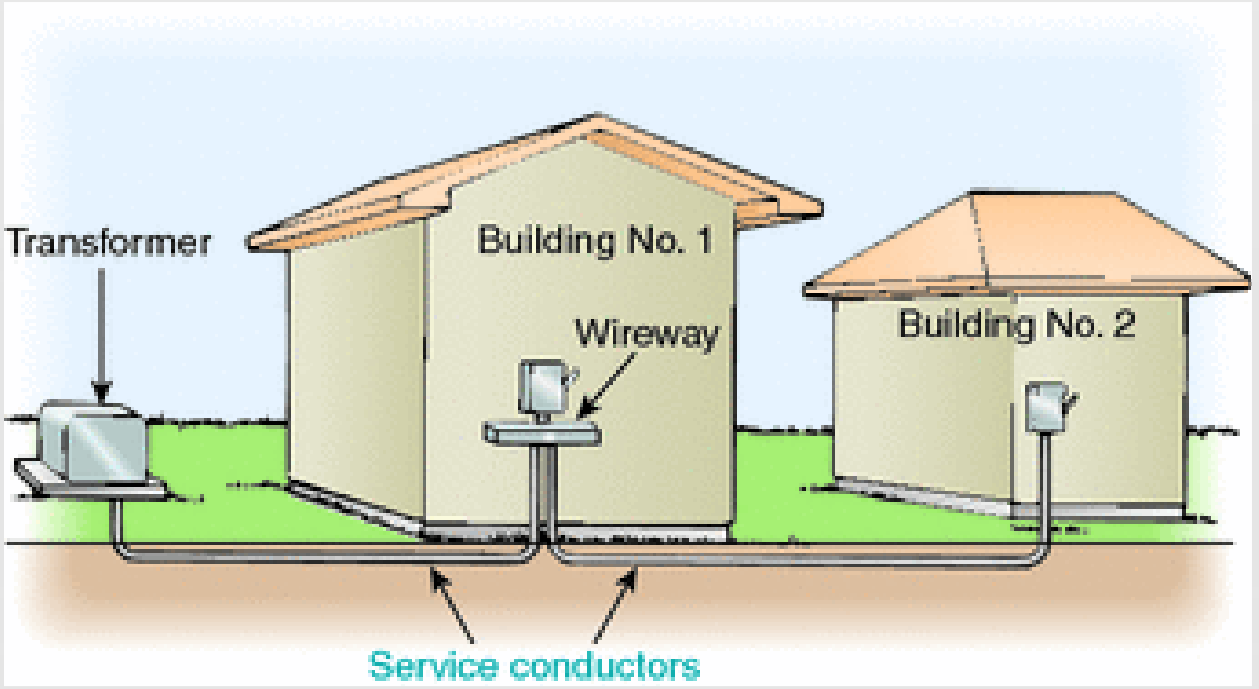
RULE #17

Services

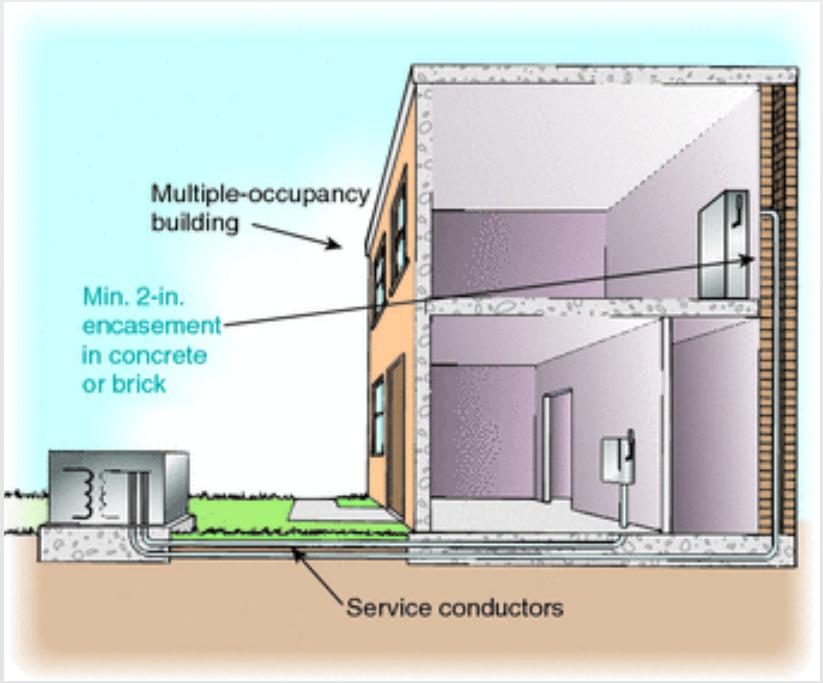
Article 230.9(A) Services

230.3 One Building or Other Structure Not to Be Supplied Through Another.

Service conductors supplying a building or other structure shall not pass through the interior of another building or other structure.



Article 230.9(A) Services



230.6 Conductors Considered Outside the Building.

Conductors shall be considered outside of a building or other structure under any of the following conditions:

(1) Where installed under not less than 50 mm (2 in.) of concrete beneath a building or other structure

(2) Where installed within a building or other structure in a raceway that is encased in concrete or brick not less than 50 mm (2 in.) thick

RULE #18

Overhead Service Clearances

Article 230.24(B) Services

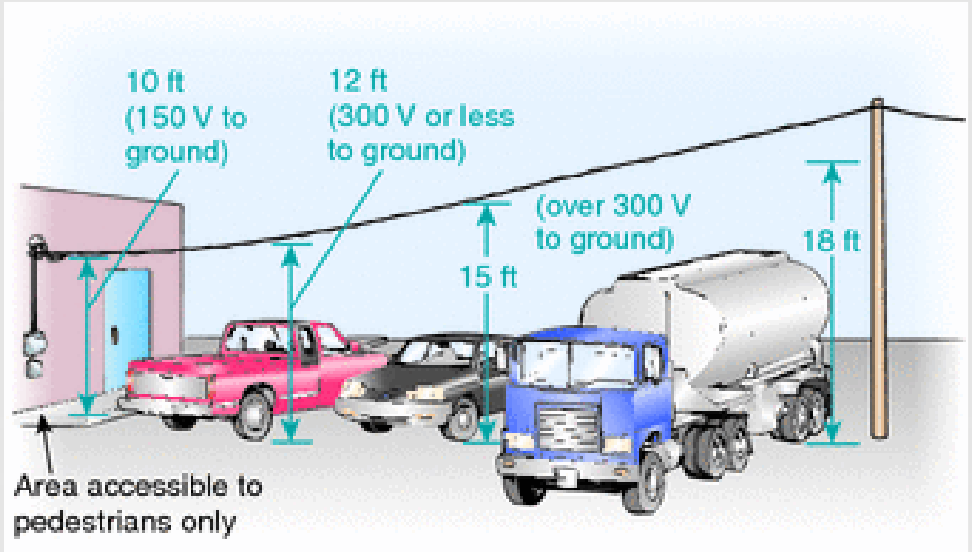
230.24 Clearances.

(B) Vertical Clearance from Ground. Service-drop conductors, where not in excess of 600 volts, nominal, shall have the following minimum clearance from final grade:

Article 230.24(B)(1) Services

230.24 Clearances.

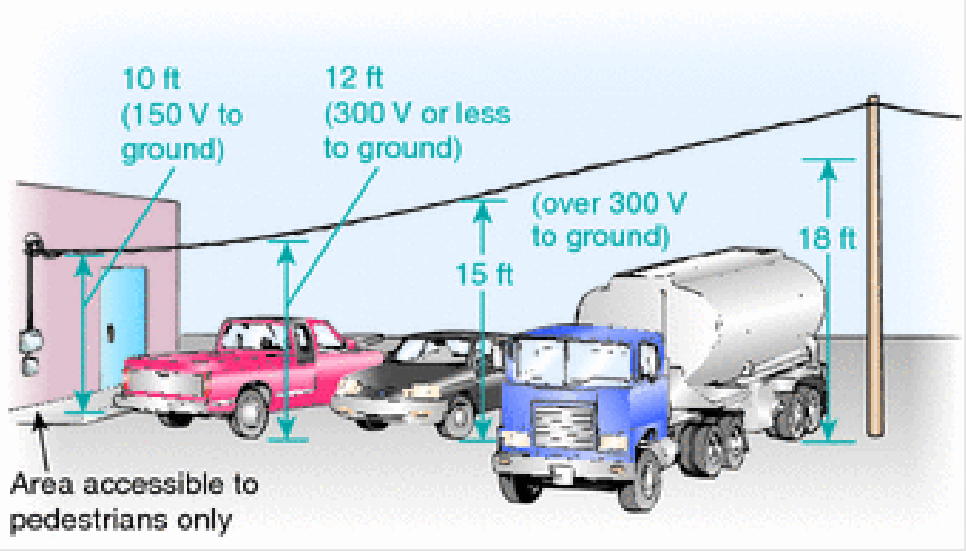
(1) 3.0 m (10 ft) — at the electric service entrance to buildings, also at the lowest point of the drip loop of the building electric entrance, and above areas or sidewalks accessible only to pedestrians, measured from final grade or other accessible surface only for service drop cables supported on and cabled together with a grounded bare messenger where the voltage does not exceed 150 volts to ground



Article 230.24(B)(2) Services

230.24 Clearances.

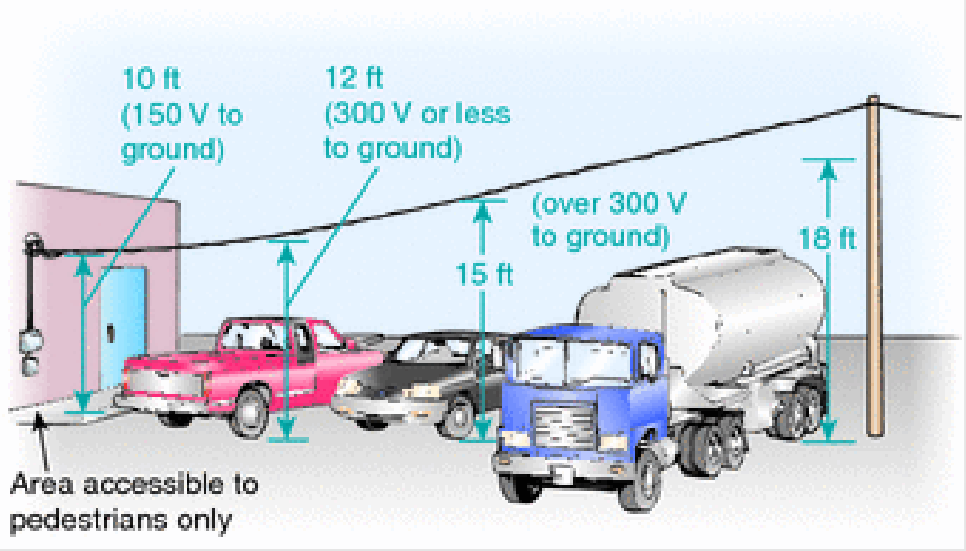
(2) 3.7 m (12 ft) — over residential property and driveways, and those commercial areas not subject to truck traffic where the voltage does not exceed 300 volts to ground



Article 230.24(B)(3) Services

230.24 Clearances.

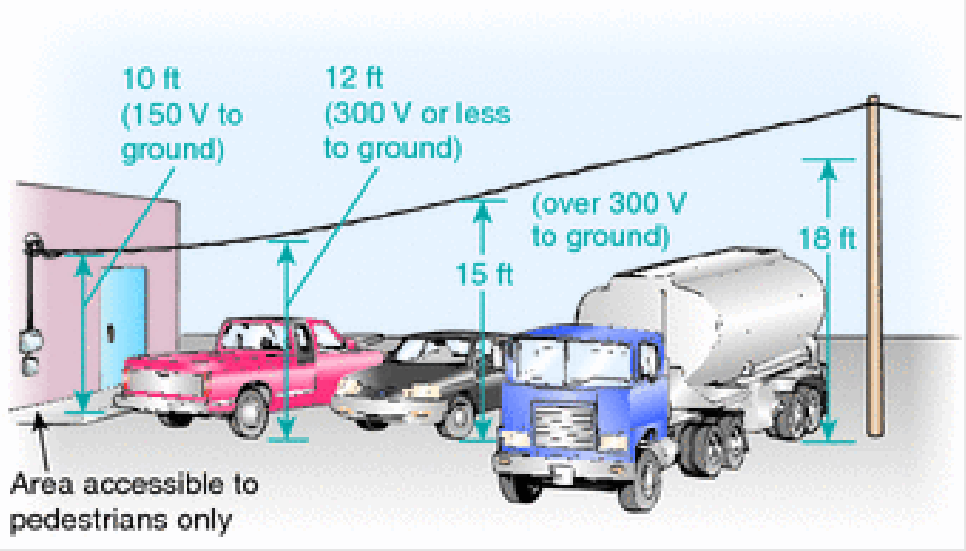
(3) 4.5 m (15 ft) — for those areas listed in the 3.7-m (12-ft) classification where the voltage exceeds 300 volts to ground



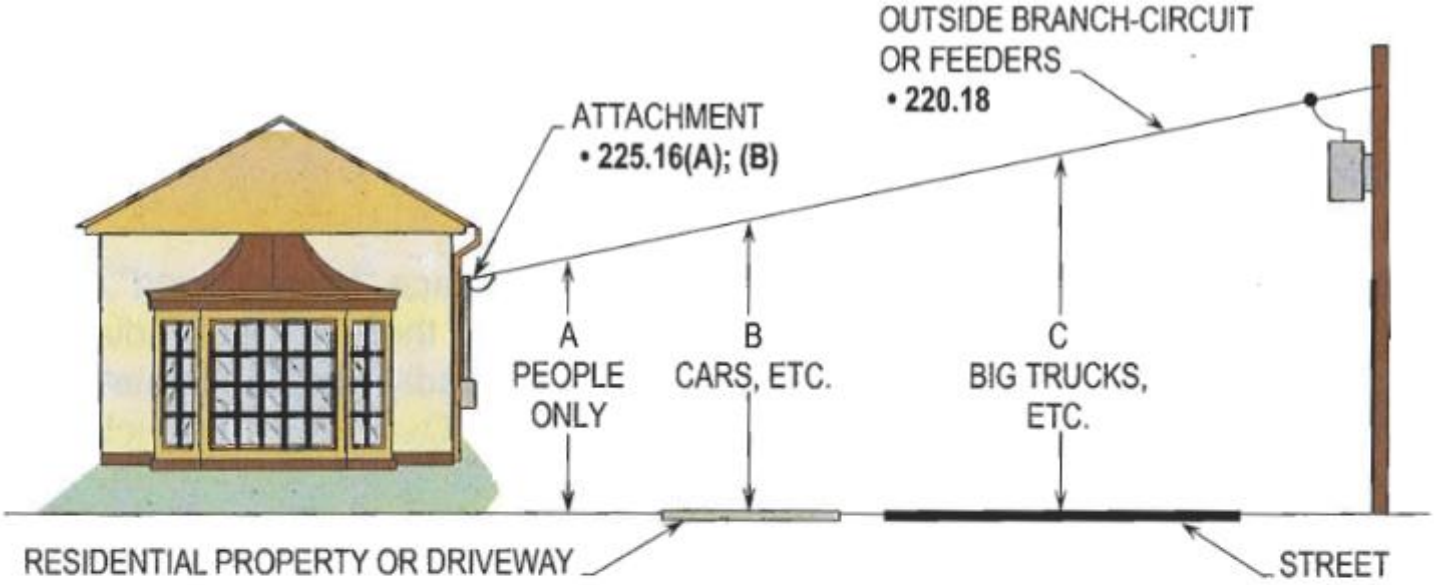
Article 230.24(B)(4) Services

230.24 Clearances.

(4) 5.5 m (18 ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land such as cultivated, grazing, forest, and orchards.



Article 230.24(B) Services



NOMINAL VOLTAGE TO GROUND			
150 V	10' (3.0 m)	12' (3.7 m)	18' (5.5 m)
300 V	12' (3.7 m)	12' (3.7 m)	18' (5.5 m)
600 V	15' (4.5 m)	15' (4.5 m)	18' (5.5 m)

CLEARANCE FOR OVERHEAD CONDUCTORS AND CABLES
225.18

RULE #19

Maximum Number of Disconnects

Article 230.71(A) Services

230.71 Maximum Number of Disconnects.

(A) General. The service disconnecting means for each service permitted by 230.2, or for each set of service entrance conductors permitted by 230.40, Exception Nos. 1, 3, 4, or 5, shall consist of not more than six switches or sets of circuit breakers, or a combination of not more than six switches and sets of circuit breakers, mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard. There shall be not more than six sets of disconnects per service grouped in any one location.

Article 230.71(A) Services

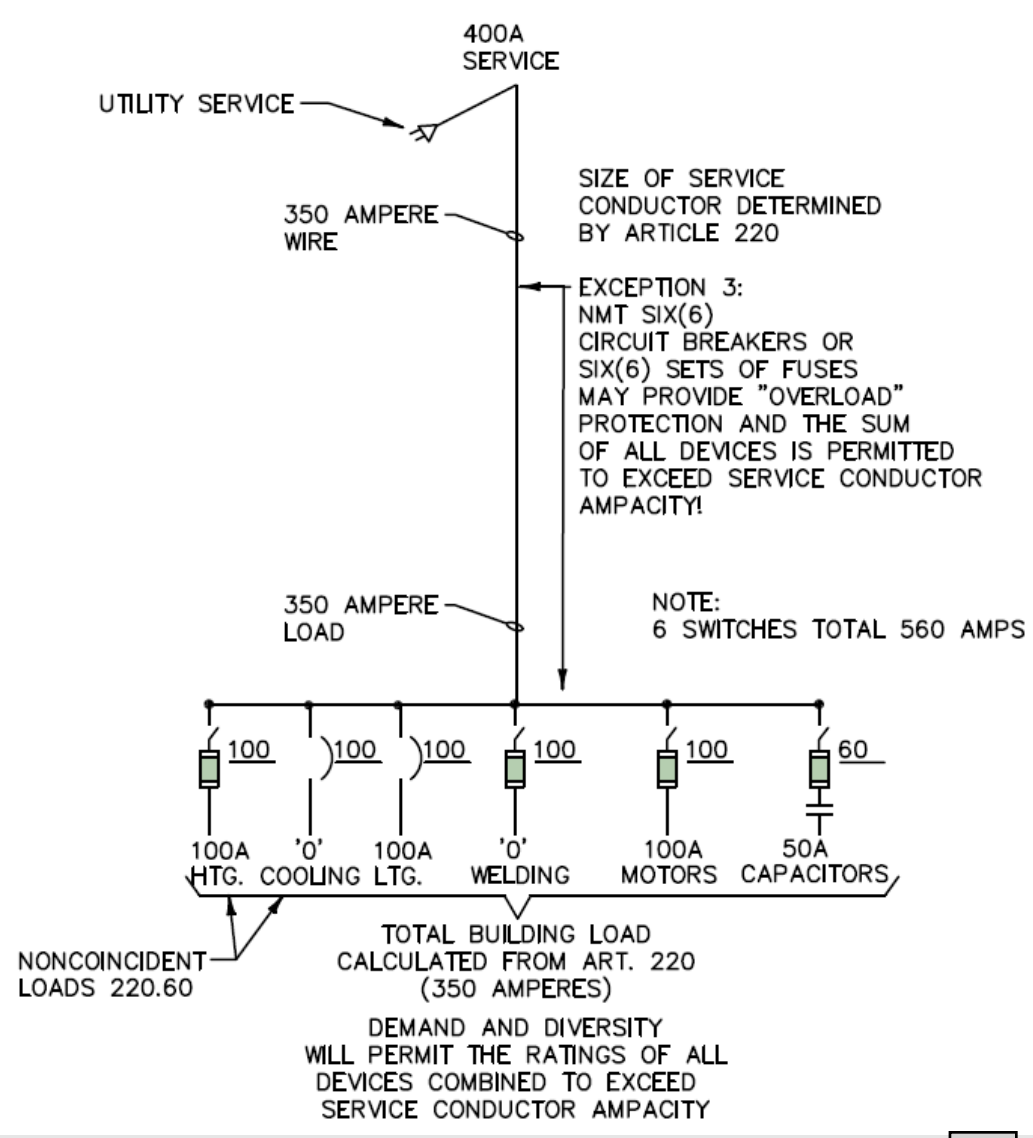
230.71 Maximum Number of Disconnects.

(A) General (Con't). The service disconnecting means used solely for power monitoring equipment, transient voltage surge suppressors, or the control circuit of the ground-fault protection system or power-operable service disconnecting means, installed as part of the listed equipment, shall not be considered a service disconnecting means.

Figure 230.71 Services

230.90 (A) exception 3…

The two to six overcurrent devices are permitted to exceed the service conductor ampacity.



Article 230.72(A) Services

230.72 Grouping of Disconnects.

(A) General. The two to six disconnects as permitted in 230.71 shall be grouped. Each disconnect shall be marked to indicate the load served.

Exception: One of the two to six service disconnecting means permitted in 230.71, where used only for a water pump also intended to provide fire protection, shall be permitted to be located remote from the other disconnecting means.

Article 230.72(B) Services

230.72 Grouping of Disconnects.

(B) Additional Service Disconnecting Means. The one or more additional service disconnecting means for fire pumps, emergency systems, legally required standby, or optional standby services permitted by 230.2 shall be installed remote from the one to six service disconnecting means for normal service to minimize the possibility of simultaneous interruption of supply.

RULE #20

Service Equipment Overcurrent protection

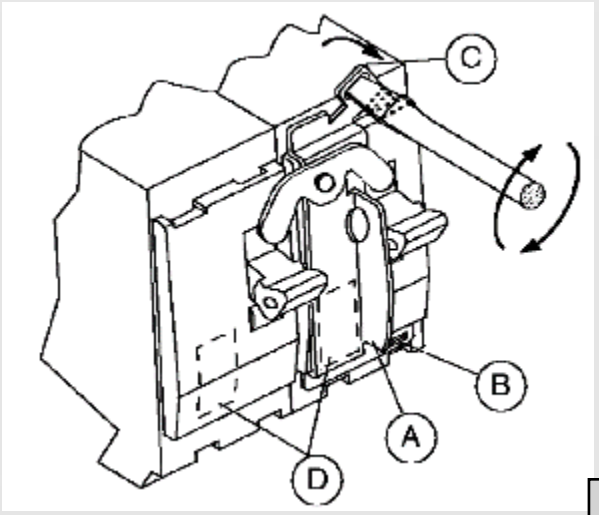
Article 230.90(A) Services

VII. Service Equipment — Overcurrent Protection

230.90 Where Required.

(A) Ungrounded Conductor.

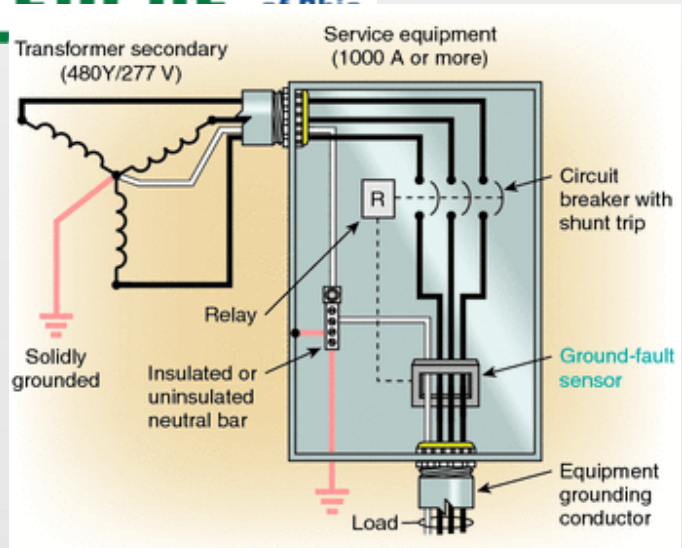
Exception 2: Fuses and Circuit breakers with a rating or setting that complies with 240.4(B) or (C) and 240.6 shall be permitted. (Next standard size higher)

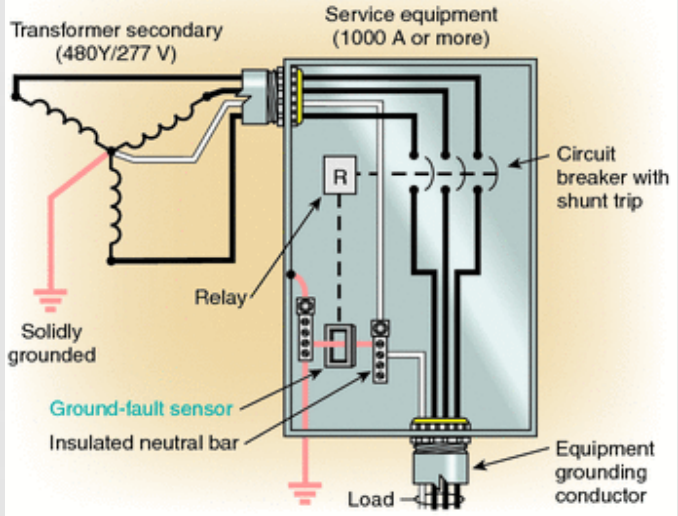


RULE #21

Ground Fault Protection

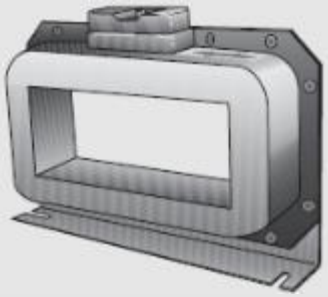
Article 230.95 Services

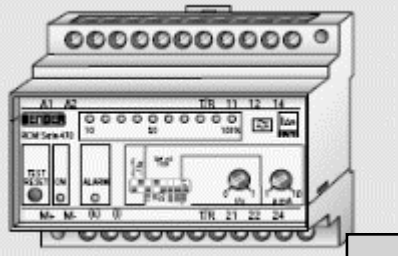




VII. Service Equipment — Overcurrent Protection

230.95 Ground-Fault Protection of Equipment. Ground fault protection of equipment shall be provided for solidly grounded wye electrical services of more than 150 volts to ground but not exceeding 600 volts phase-to-phase for each service disconnect rated 1000 amperes or more. The grounded conductor for the solidly grounded wye system shall be connected directly to ground without inserting any resistor or impedance device.

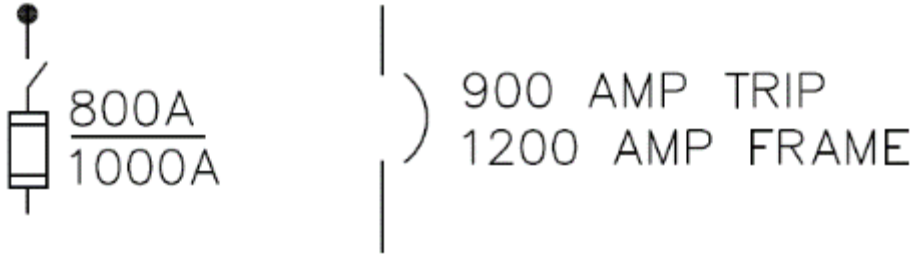




Article 230.95 Services

230.95 Ground-Fault Protection of Equipment.

The rating of the service disconnect shall be considered to be the rating of the largest fuse that can be installed or the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted.



RULE #22

Overcurrent Protection

Article 240.4 Overcurrent Protection

240.4 Protection of Conductors.(B) Devices Rated 800 Amperes or Less. The next higher standard overcurrent device rating (above the ampacity of the conductors being protected) shall be permitted to be used, provided all of the following conditions are met:

(1) Not part of a multioutlet branch circuit supplying receptacles

(2) The ampacity of the conductors does not correspond with the standard ampere rating of a fuse or a circuit breaker

(3) The next higher standard rating selected does not exceed 800 amperes. (Art. 240.6)

Article 240.4(C) Overcurrent Protection

(C) Devices Rated Over 800 Amperes. Where the overcurrent device is rated over 800 amperes, the ampacity of the conductors it protects shall be equal to or greater than the rating of the overcurrent device defined in 240.6.

RULE #23

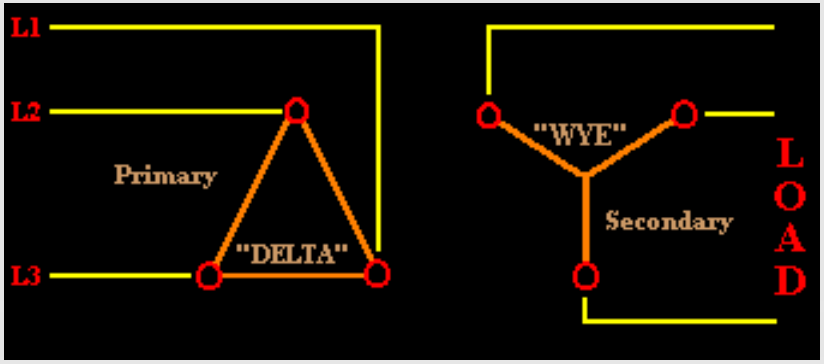
Transformer Secondary Conductor Overcurrent Protection

Article 240.4(F) Overcurrent Protection

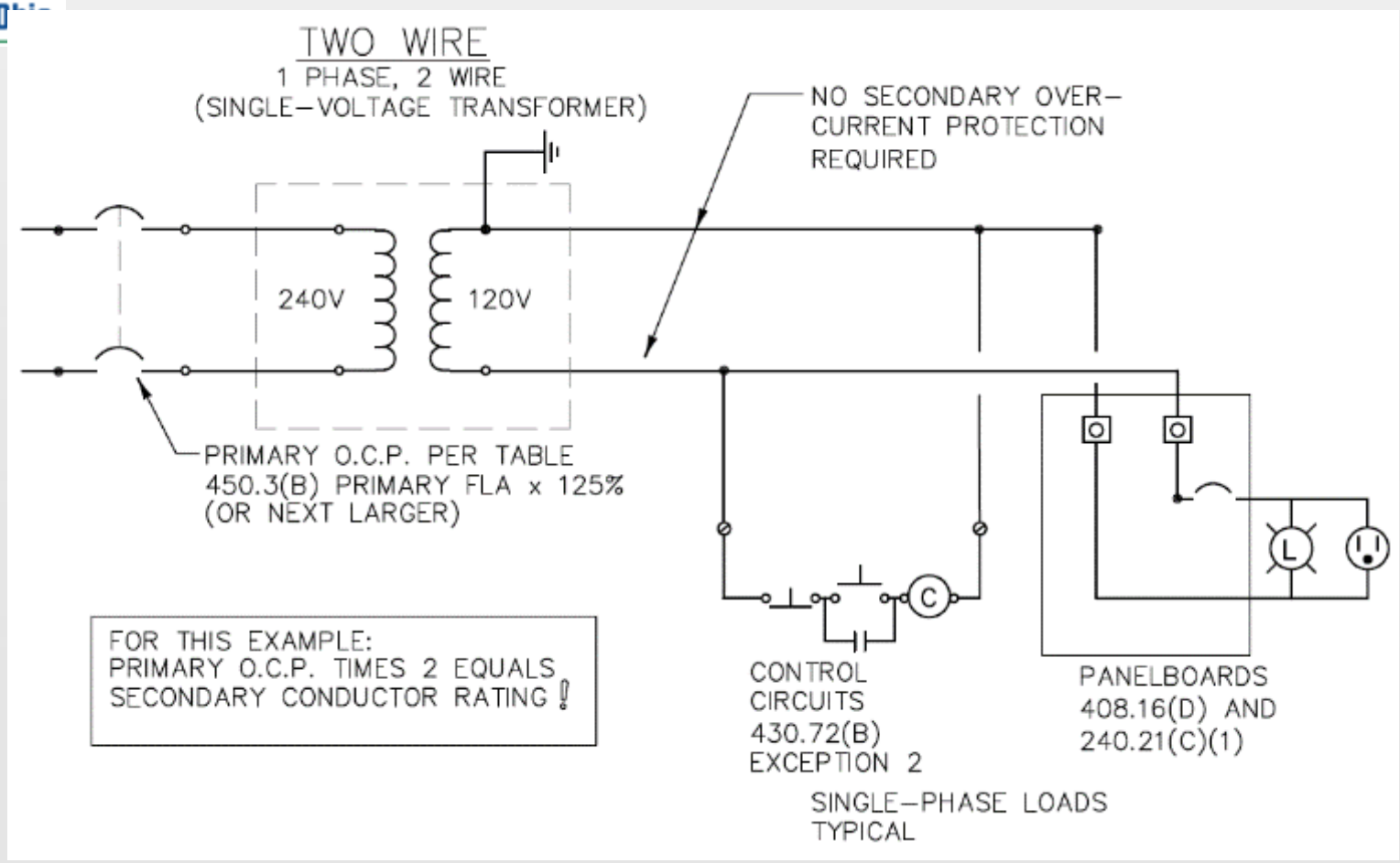
240.4 Protection of Conductors.

(F) Transformer Secondary Conductors. Single-phase (other than 2-wire) and multiphase (other than delta-delta, 3-wire) transformer secondary conductors shall not be considered to be protected by the primary overcurrent protective device.

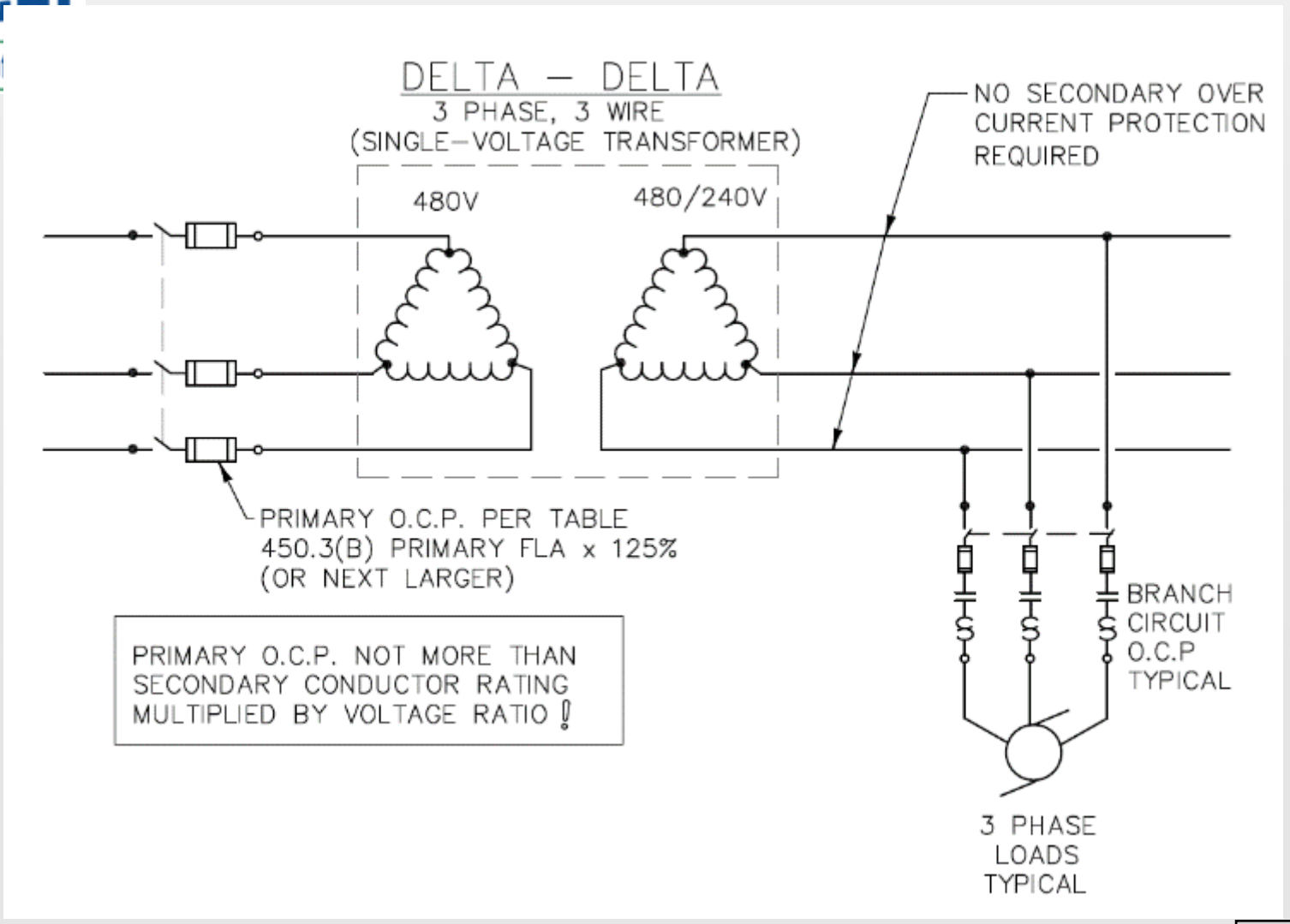
Be careful to read table 450.3(B) correctly!



Article 240.4(F) Overcurrent Protection



Article 240.4(F) Overcurrent Protection



RULE #23

Standard Ampere Ratings

Article 240.6 Overcurrent Protection

240.6 Standard Ampere Ratings.

(A) Fuses and Fixed-Trip Circuit Breakers. The standard ampere ratings for fuses and inverse time circuit breakers shall be considered 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600, 700, 800, 1000, 1200, 1600, 2000, 2500, 3000, 4000, 5000, and 6000 amperes.

RULE #24

Grounding and Bonding

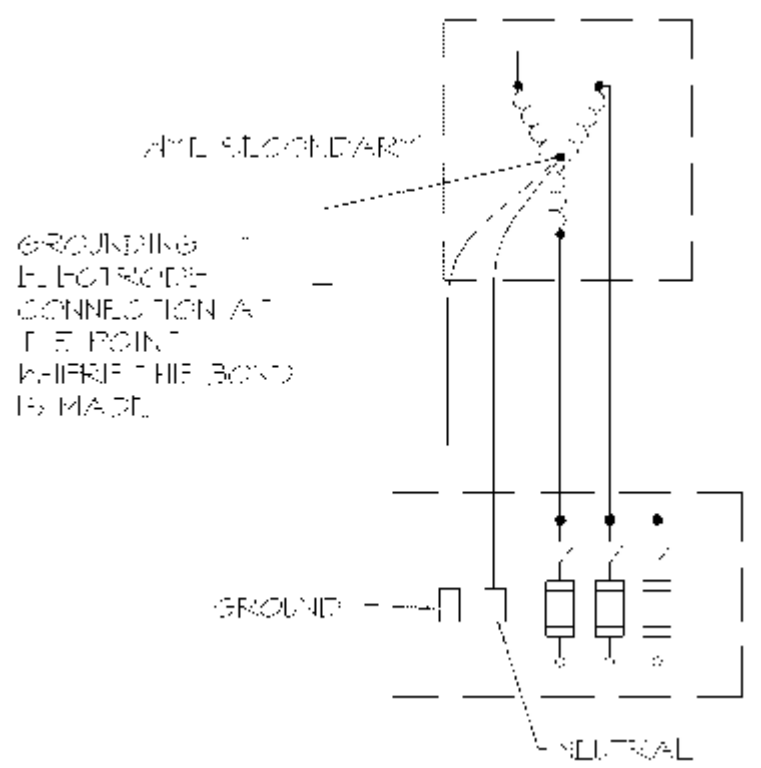
Article 250.20(D) Grounding and Bonding

250.20 Alternating-Current Systems to Be Grounded.

(D) Separately Derived Systems. Separately derived systems, as covered in 250.20(A) or (B), shall be grounded as specified in 250.30.

(250.30 (A)(7) structural steel or water line preferred as near as practical to the separately derived system. If these don't exist, create one)

Article 250.30(3) Grounding and Bonding



250.30 Grounding Separately Derived Alternating- Current Systems.

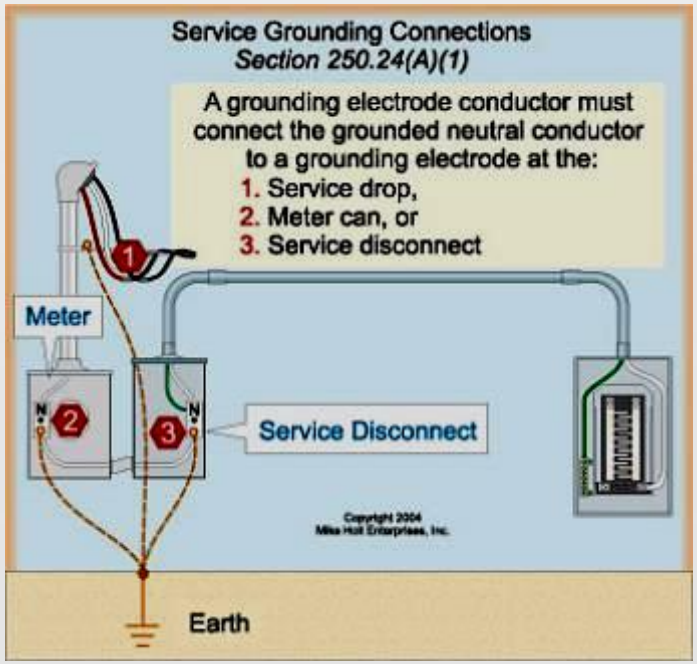
(3) Grounding Electrode Conductor, Single Separately Derived System.

A grounding electrode conductor for a single separately derived system shall be sized in accordance with 250.66 for the derived phase conductors and shall be used to connect the grounded conductor of the derived system to the grounding electrode.

RULE #25

Grounding Electrode System

Article 250.50 Grounding Electrode System

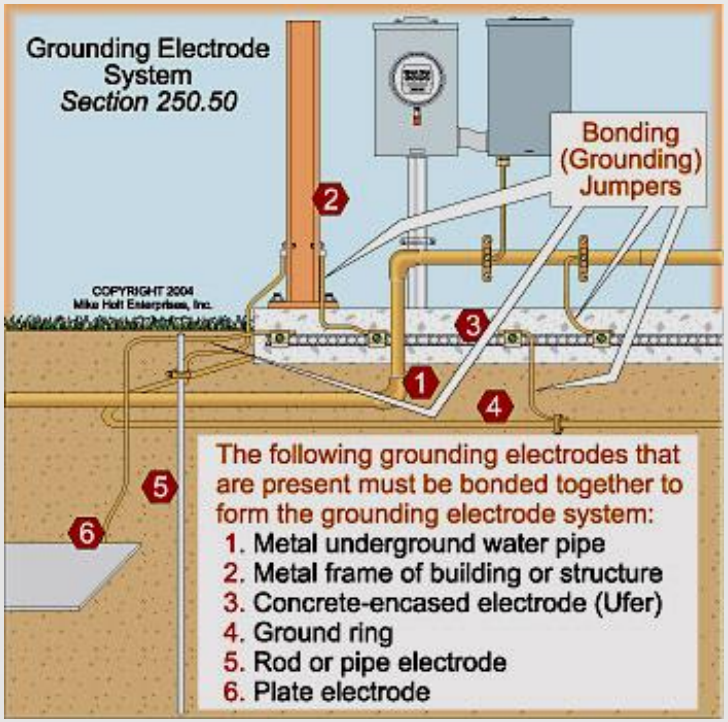


250.50 Grounding Electrode System.

All grounding electrodes as described in 250.52(A)(1) through (A)(7) that are present at each building or structure served shall be bonded together to form the grounding electrode system. Where none of these grounding electrodes exist, one or more of the grounding electrodes specified in 250.52(A)(4) though (A)(8) shall be installed and used.

Article 250.52 Grounding and Bonding

If (1) through (7) exist, you must use, otherwise install one or more of (4) through (8).



250.52 Grounding Electrodes.

(A) Electrodes Permitted for Grounding:

(1) Metal Underground Water Pipe.

(2) Metal Frame of the Building or Structure.

(3) Concrete-Encased Electrode.

(4) Ground Ring.

(5) Rod and Pipe Electrodes.

(6) Other Listed Electrodes

(7) Plate Electrodes.

(8) Other Local Metal Underground Systems or Structures.

Article 250.52(B) Grounding and Bonding

250.52 Grounding Electrodes.

(B) Electrodes Not Permitted for Grounding.

The following shall not be used as grounding electrodes:

(1) Metal underground gas piping system

(2) Aluminum electrodes

Article 250.66 Grounding and Bonding

Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

Size of Largest Ungrounded Service-Entrance Conductor or Equivalent Area for Parallel Conductors[a] (AWG/kcmil)		Size of Grounding Electrode Conductor (AWG/kcmil)	
Copper	Aluminum or Copper-Clad Aluminum	Copper	Aluminum or Copper-Clad Aluminum[b]
2 or smaller	1/0 or smaller	8	6
1 or 1/0	2/0 or 3/0	6	4
2/0 or 3/0	4/0 or 250	4	2
Over 3/0 through 350	Over 250 through 500	2	1/0
Over 350 through 600	Over 500 through 900	1/0	3/0
Over 600 through 1100	Over 900 through 1750	2/0	4/0
Over 1100	Over 1750	3/0	250

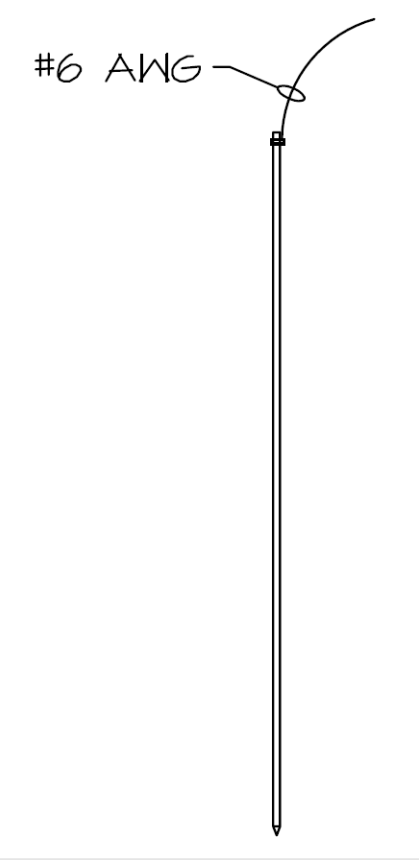
250.66 Size of Alternating-Current Grounding Electrode Conductor.

The size of the grounding electrode conductor of a grounded or ungrounded ac system shall not be less than given in Table 250.66.

RULE #26

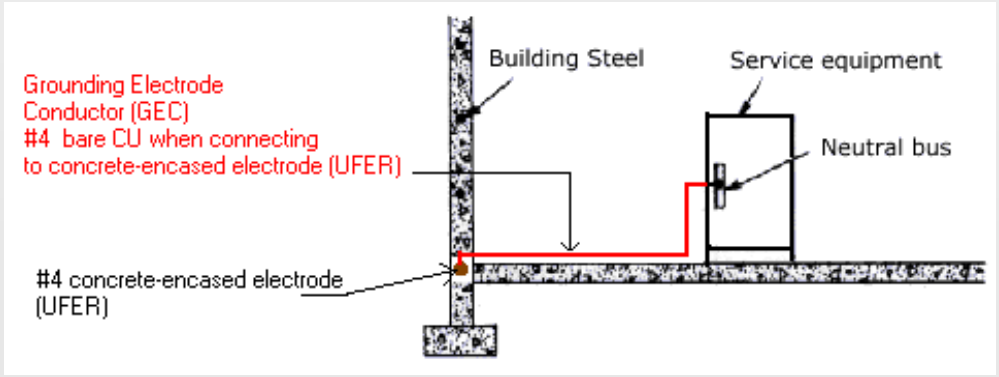
Connections to rod, pipe or plate electrodes

Article 250.66 Grounding and Bonding



(A) Connections to Rod, Pipe, or Plate Electrodes. Where the grounding electrode conductor is connected to rod, pipe, or plate electrodes as permitted in 250.52(A)(5) or (A)(6), that portion of the conductor that is the sole connection to the grounding electrode shall not be required to be larger than 6 AWG copper wire or 4 AWG aluminum wire.

Article 250.66 Grounding and Bonding



(B) Connections to Concrete-Encased Electrodes

…not required to be larger than 4 AWG copper

(C) Connections to Ground Rings

…not required to be larger than the ground ring conductor size.

RULE #27

Equipment Grounding Conductor Size

Article 250.122 Grounding and Bonding

Table 250.122 Minimum Size Equipment Grounding Conductors for Grounding Raceway and Equipment

Rating or Setting of Automatic Overcurrent Device in Circuit Ahead of Equipment, Conduit, etc., Not Exceeding (Amperes)	Size (AWG or kcmil)	
	Copper	Aluminum or Copper-Clad Aluminum*
15	14	12
20	12	10
30	10	8
40	10	8
60	10	8
100	8	6

250.122 Size of Equipment Grounding Conductors.

(A) General. Copper, aluminum, or copper-clad aluminum equipment grounding conductors of the wire type shall not be smaller than shown in Table 250.122 but shall not be required to be larger than the circuit conductors supplying the equipment.

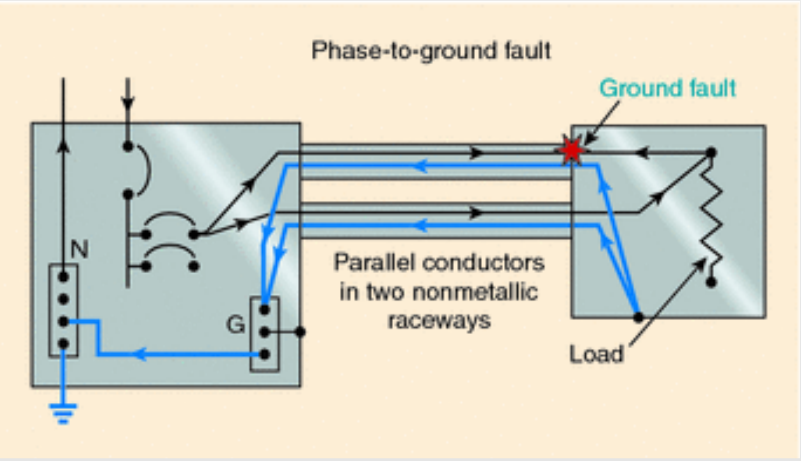
Article 250.122(B) Grounding and Bonding

250.122 (B) Increased in Size. Where ungrounded conductors are increased in size, equipment grounding conductors, where installed, shall be increased in size proportionately according to circular mil area of the ungrounded conductors.

RULE #29

Equipment Grounding Conductor run in Parallel

Article 250.122(F) Grounding and Bonding



250.122 (F) Conductors in Parallel. Where conductors are run in parallel in multiple raceways or cables as permitted in 310.4, the equipment grounding conductors, where used, shall be run in parallel in each raceway or cable.

Each parallel equipment grounding conductor shall be sized on the basis of the ampere rating of the overcurrent device protecting the circuit conductors in the raceway or cable in accordance with Table 250.122.

RULE #30

Conductors of Different Systems

Chapter 3 Wiring Methods and Materials

300.3 (C) Conductors of Different Systems.

(1) 600 Volts, Nominal, or Less. Conductors of circuits rated 600 volts, nominal, or less, ac circuits, and dc circuits shall be permitted to occupy the same equipment wiring enclosure, cable, or raceway. All conductors shall have an insulation rating equal to at least the maximum circuit voltage applied to any conductor within the enclosure, cable, or raceway.

RULE #31

Raceways exposed to different temperatures

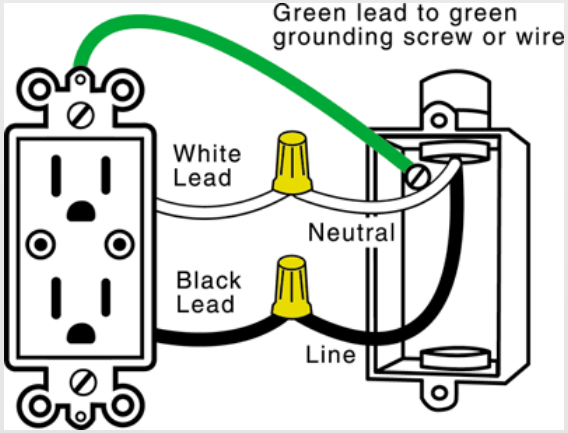
Chapter 3 – Article 300 Wiring Methods

300.7 Raceways Exposed to Different Temperatures. (A) Sealing. Where portions of a cable raceway or sleeve are known to be subjected to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway or sleeve shall be filled with an approved material to prevent the circulation of warm air to a colder section of the raceway or sleeve. An explosion proof seal shall not be required for this purpose.

RULE #32

Continuity of the grounded conductor

Chapter 3 – Article 300 Wiring Methods

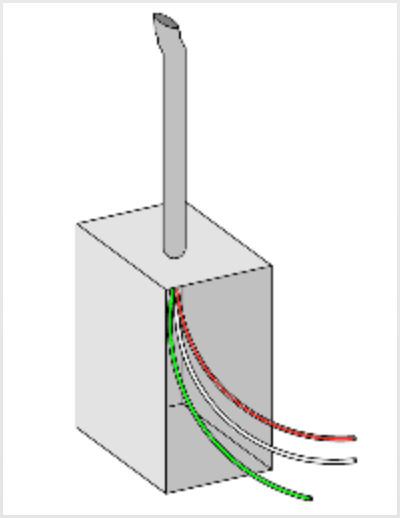


300.13 Mechanical and Electrical Continuity — Conductors.

(A) There shall be no splice or tap within a raceway.

(B) Device Removal. In multiwire branch circuits, the continuity of a grounded conductor shall not depend on device connections such as lampholders, receptacles, and so forth, where the removal of such devices would interrupt the continuity.

Chapter 3 – Article 300 Wiring Methods



300.14 Length of Free Conductors at Outlets, Junctions, and Switch Points. At least 150 mm (6 in.) of free conductor, measured from the point in the box where it emerges from its raceway or cable sheath, shall be left at each outlet, junction, and switch point for splices or the connection of luminaires (fixtures) or devices. Where the opening to an outlet, junction, or switch point is less than 200 mm (8 in.) in any dimension, each conductor shall be long enough to extend at least 75 mm (3 in.) outside the opening.

Chapter 3 – Article 300 Wiring Methods

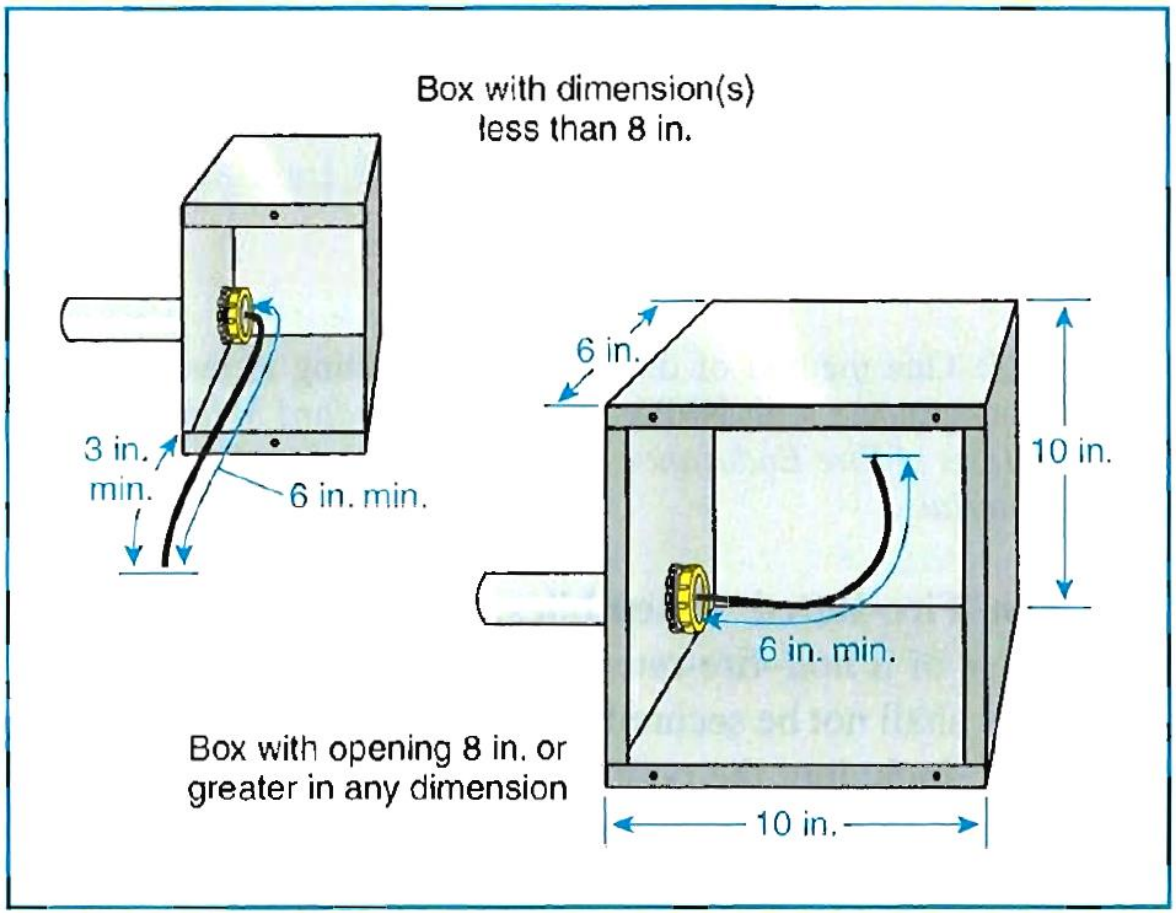
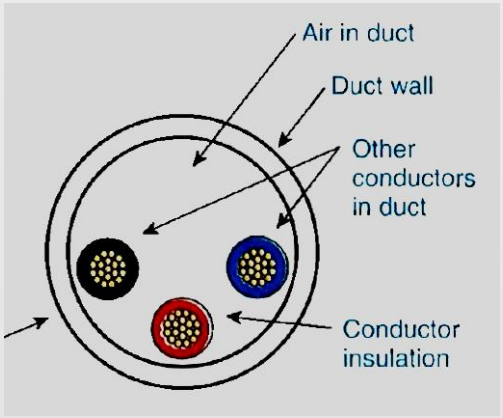


Exhibit 300.12 Two different boxes with free conductor lengths illustrated.

RULE #33

Induced Currents

Chapter 3 – Article 300 Wiring Methods



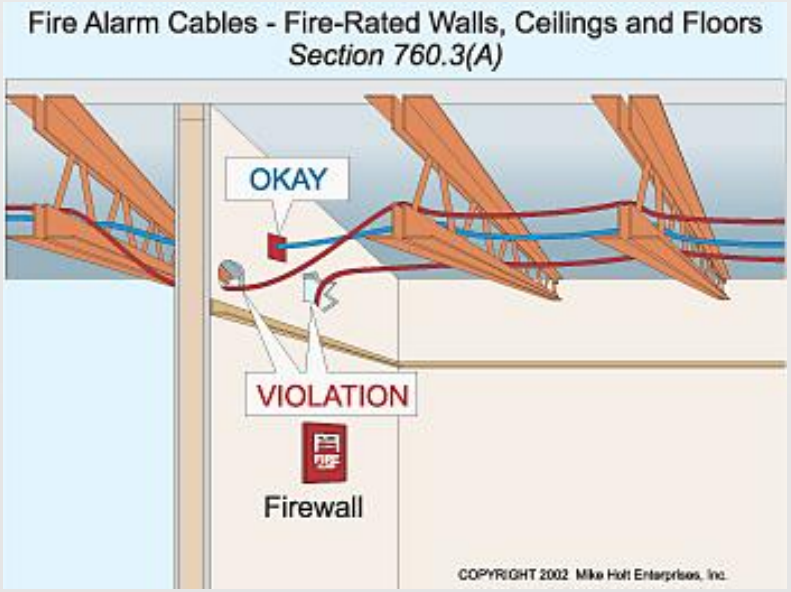
300.20 Induced Currents in Metal Enclosures or Metal Raceways.

(A) Conductors Grouped Together. Where conductors carrying alternating current are installed in metal enclosures or metal raceways, they shall be arranged so as to avoid heating the surrounding metal by induction. To accomplish this, all phase conductors and, where used, the grounded conductor and all equipment grounding conductors shall be grouped together.

RULE #34

Firestopping

Chapter 3 – Article 300 Wiring Methods



300.21 Spread of Fire or Products of Combustion. Electrical installations in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be made so that the possible spread of fire or products of combustion will not be substantially increased. Openings around electrical penetrations through fire-resistant–rated walls, partitions, floors, or ceilings shall be firestopped using approved methods to maintain the fire resistance rating.

RULE #35

Conductors in Parallel

Chapter 3 – Article 310 Conductors for General Wiring

310.4 Conductors in Parallel. Aluminum, copper-clad aluminum, or copper conductors of size 1/0 AWG and larger, comprising each phase, polarity, neutral, or grounded circuit conductor, shall be permitted to be connected in parallel (electrically joined at both ends).

Chapter 3 – Article 310 Conductors for General Wiring

310.4 Conductors in Parallel (Con't). The paralleled conductors in each phase, polarity, neutral, or grounded circuit conductor shall comply with all of the following:

(1) Be the same length

(2) Have the same conductor material

(3) Be the same size in circular mil area

(4) Have the same insulation type

(5) Be terminated in the same manner

RULE #36

Conductors exposed to sunlight

Article 310.15(B)(2)(c) Conduits Exposed to Sunlight on Rooftops

The 2008 code recognized that temperatures on rooftops where exposed to direct sunlight could be much higher than standard outdoor ambient temperatures.

The ambient temperature correction factors at the bottom of table 310.16 are taken where the ambient temperature is higher or lower than normal (78 –86 deg F).

An additional adjustment factor must now be added to the ambient temperature values based on the distance from the roof to the bottom of the conduit.

Article 310.15(B)(2)(c) Conduits Exposed to Sunlight on Rooftops

Table 310.15(B)(2)(c) Ambient Temperature Adjustment for Conduits Exposed to Sunlight On or Above Rooftops [ROP 6–51]

Distance Above Roof to Bottom of Conduit	Temperature Added °C	Temperature Added °F
0 – 13 mm (½ in.)	33	60
Above 13 mm (½ in.) – 90 mm (3½ in.)	22	40
Above 90 mm (3½ in.) – 300 mm (12 in.)	17	30
Above 300 mm (12 in.) – 900 mm (36 in.)	14	25

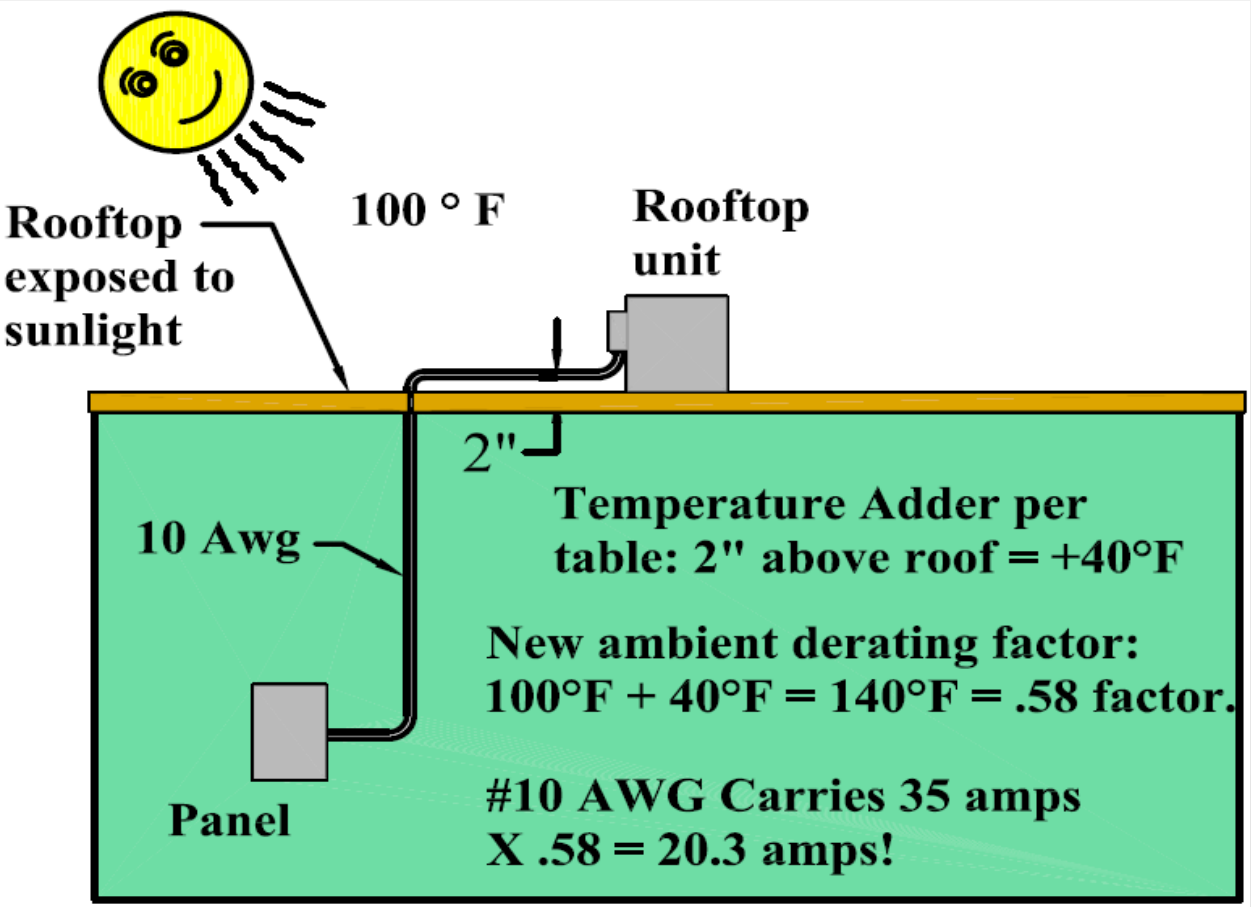
Article 310.15(B)(2)(c) Conduits Exposed to Sunlight on Rooftops

If the average summer ambient temperature is 90 degrees F and you are installing a conduit 3” above the roof, you must add 40 degrees F to the ambient temperature making the new ambient 130 degrees F.

Looking at the ambient temperature adjustment factors, a wire in 130 degree F ambient, 90 degree insulated temperature rated conductor now must be de-rated by .76.

(8 AWG: 55 amps x .76 = 41.8 amps max)

Table 310.15 Note 3 Figure



Article 315(B)(2)(c) Conduits Exposed to Sunlight on Rooftops

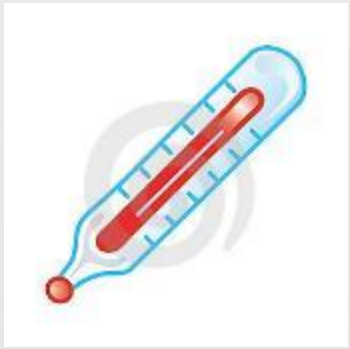
RULE #37

Conductors and derating

Chapter 3 – Article 310 Conductors for General Wiring

310.10 Temperature Limitation of Conductors. No conductor shall be used in such a manner that its operating temperature exceeds that designated for the type of insulated conductor involved. In no case shall conductors be associated together in such a way, with respect to type of circuit, the wiring method employed, or the number of conductors, that the limiting temperature of any conductor is exceeded.

Chapter 3 – Article 310 Conductors for General Wiring



The principal determinants of operating temperature are as follows:

(1) Ambient temperature — ambient temperature may vary along the conductor length as well as from time to time.

(2) Heat generated internally in the conductor as the result of load current flow, including fundamental and harmonic currents.

(3) The rate at which generated heat dissipates into the ambient medium. Thermal insulation that covers or surrounds conductors affects the rate of heat dissipation.

(4) Adjacent load-carrying conductors — adjacent conductors have the dual effect of raising the ambient temperature and impeding heat dissipation.

Chapter 3 – Article 310 Conductors for General Wiring

310.15 Ampacities for Conductors Rated 0–2000 Volts.

(B) Tables. Ampacities for conductors rated 0 to 2000 volts shall be as specified in the Allowable Ampacity Table 310.16 through Table 310.19.

Allowable ampacities result from consideration from the following:

(1) Temperature compatibility with connected equipment, especially the connection points.

Chapter 3 – Article 310 Conductors for General Wiring

310.15 Ampacities for Conductors Rated 0–2000 Volts.

(2) Adjustment Factors.

(a) Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multi-conductor cables are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing and are not installed in raceways, the allowable ampacity of each conductor shall be

reduced as shown in Table 310.15(B)(2)(a).

Chapter 3 – Article 310 Conductors for General Wiring

Table 310.15(B)(2)(a) Adjustment Factors for More Than Three Current-Carrying Conductors in a Raceway or Cable

Number of Current-Carrying Conductors	Percent of Values in Tables 310.16 through 310.19 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

Chapter 3 – Article 310 Conductors for General Wiring

310.15(4)(a) Neutral Conductor.

A neutral conductor that carries only the unbalanced current from other conductors of the same circuit shall not be required to be counted when applying the provisions of 310.15(B)(2)(a).

310.15(5) Grounding or Bonding Conductor.

A grounding or bonding conductor shall not be counted when applying the provisions of 310.15(B)(2)(a).

RULE #38

Conductors and ambient temperature

Chapter 3 – Article 310 Conductors for General Wiring

Size AWG or kcmil	Temperature Rating of Conductor			
	60°C (140°F)	75°C (167°F)	90°C (194°F)	(
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	T
	COPPER			A
18	—	—	14	
16	—	—	18	
14*	20	20	25	
12*	25	25	30	
10*	30	35	40	
8	40	50	55	
6	55	65	75	
4	70	85	95	
3	85	100	110	
2	95	115	130	
1	110	130	150	

Chapter 3 – Article 310 Conductors for General Wiring

Adjust the cable ampacity of the cables for ambient air temperatures greater than 30 degrees C (86 degrees F) by looking at the adjustment factors in the bottom of the ampacity tables:

Chapter 3 – Article 310 Conductors for General Wiring

Size AWG or kcmil	Temperature Rating of Conduct		
	60°C (140°F)	75°C (167°F)	90°C (194°F)
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2
	COPPER		
Ambient Temp. (°C)	For ambient temperatures other than 30°C (86°F), multiply the a factor shown bel		
21–25	1.08	1.05	1.04
26–30	1.00	1.00	1.00
31–35	0.91	0.94	0.96
36–40	0.82	0.88	0.91
41–45	0.71	0.82	0.87
46–50	0.58	0.75	0.82

RULE #39

Taping conductors in enclosures

Chapter 3 – ARTICLE 312
Cabinets, Cutout Boxes, and Meter Socket Enclosures

312.8 Enclosures for Switches or Overcurrent Devices. Enclosures for switches or overcurrent devices shall not be used as junction boxes, auxiliary gutters, or raceways for conductors feeding through or tapping off to other switches or overcurrent devices, unless adequate space for this purpose is provided.

RULE #40

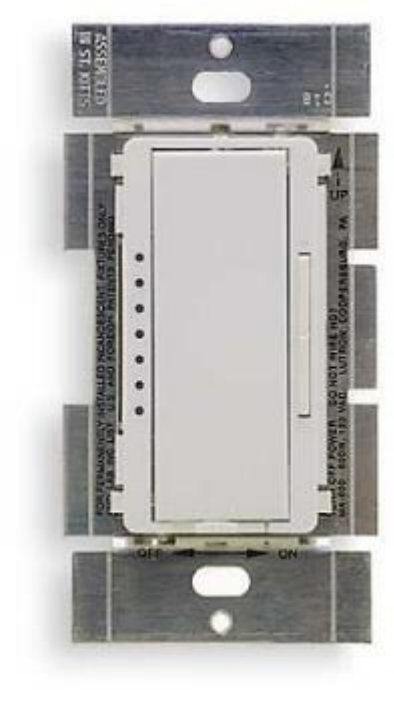
Device Box Depth

Article 314.24
Minimum Depth of Boxes for Outlets, Devices, and Utilization Equipment

This Article was expanded to cover various box depths for Outlets, devices and utilization equipment.

Although the minimum depths for outlet boxes (1/2”) and boxes with enclosed devices (15/16”) did not change, additional requirements for utilization equipment boxes was added.

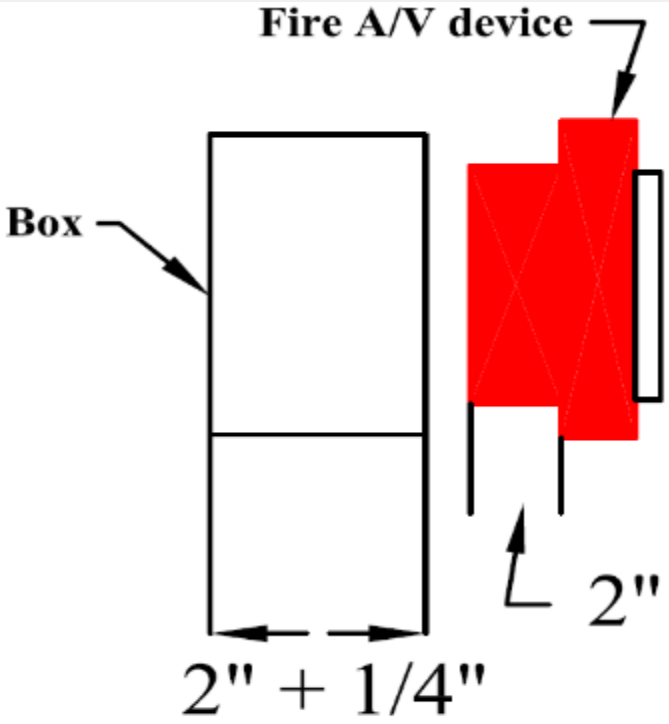
Article 314.24
Minimum Depth of Boxes for Outlets, Devices, and Utilization Equipment



Utilization equipment is by definition equipment that utilizes electric energy for electronic, electromechanical, chemical, heating, lighting or similar purposes.

Article 314.24(C) requires outlet boxes that enclose such equipment to have a minimum internal depth that accommodates the rearward projection of the equipment and the size conductor that it requires.

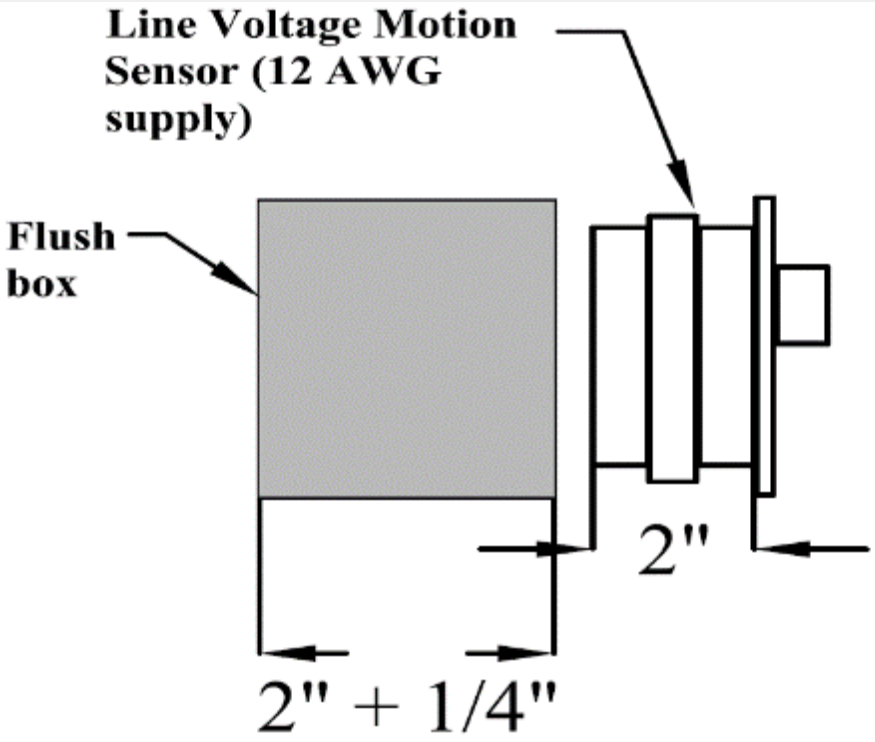
Article 314.24 (C) Figure



(C)(1) Large equipment (more than 1 7/8" rearward depth): box depth not less than the device depth plus 1/4".

Article 314.24(C)
Utilization Equipment Box Depths

Article 314.24 (C) Figure



(C)(4) Utilization Equipment fed by 12 or 10 AWG wire shall have a minimum depth of 1-3/16" or where the equipment projects rearward by more than 1", the box depth shall not be less than the equipment depth plus 1/4".

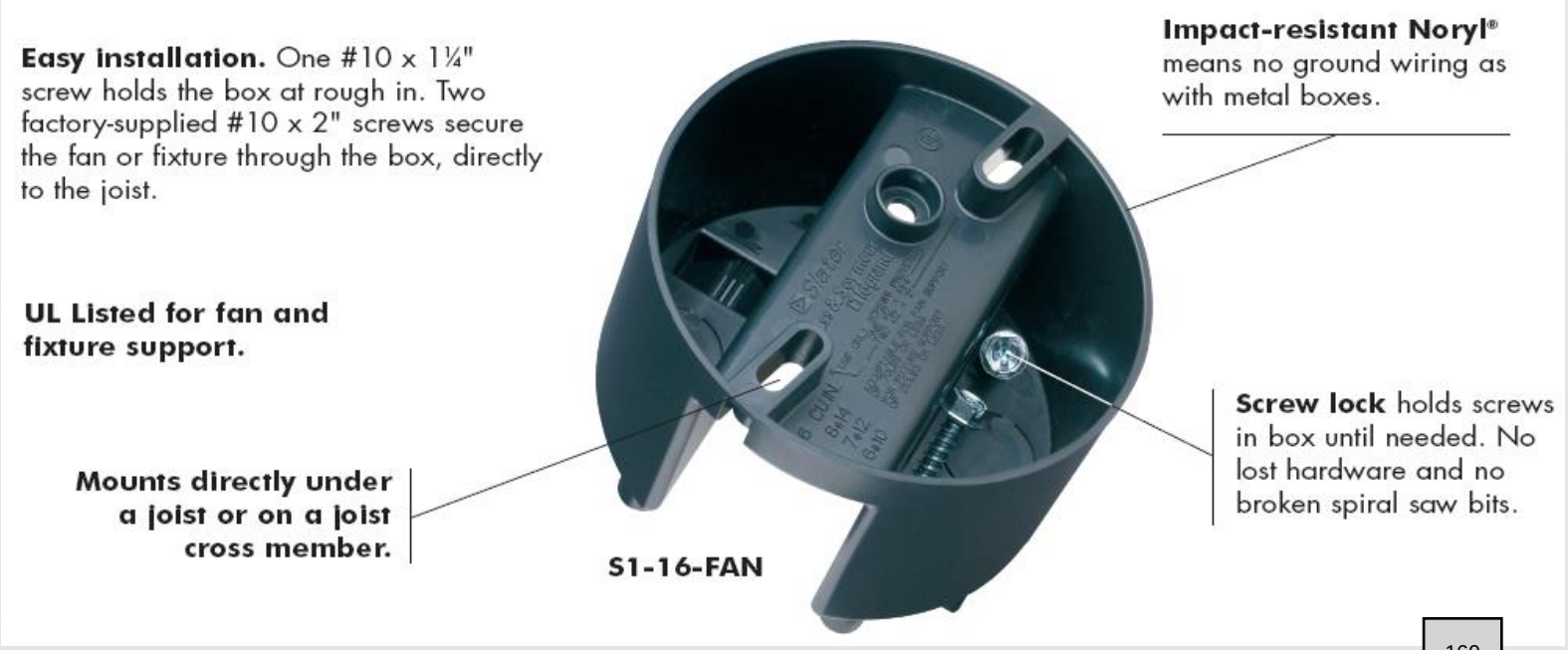
Article 314.24(C)(4)
Utilization Equipment Box Depths

RULE #41

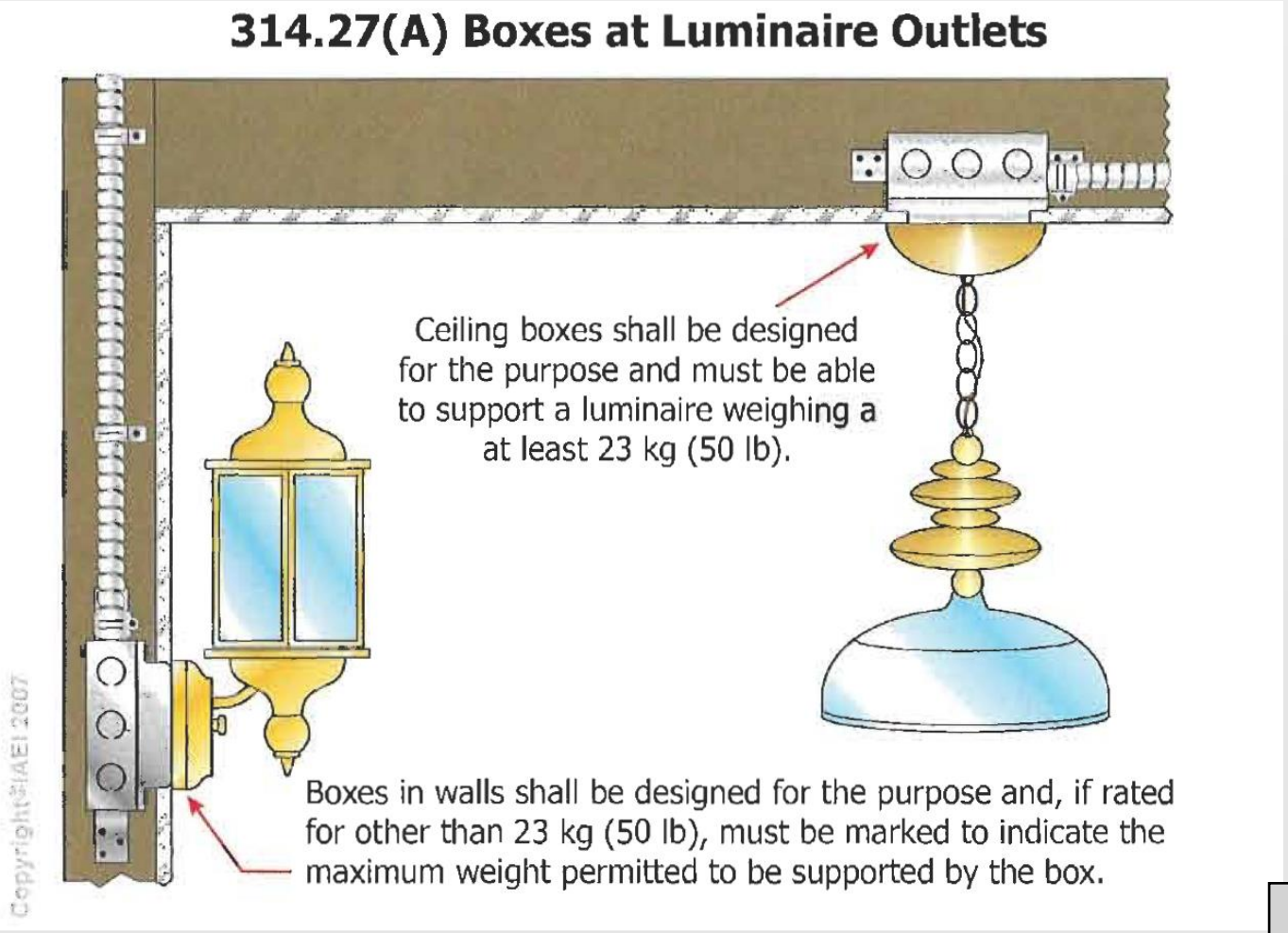
Boxes for the support of Luminaires

Article 314.27(A) and (B) Listed boxes Used for Luminaire Support

Boxes for luminaires are required to be listed for luminaire support and identified for the weight that must be supported.



Article 314.27(A) and (B) Listed boxes Used for Luminaire Support



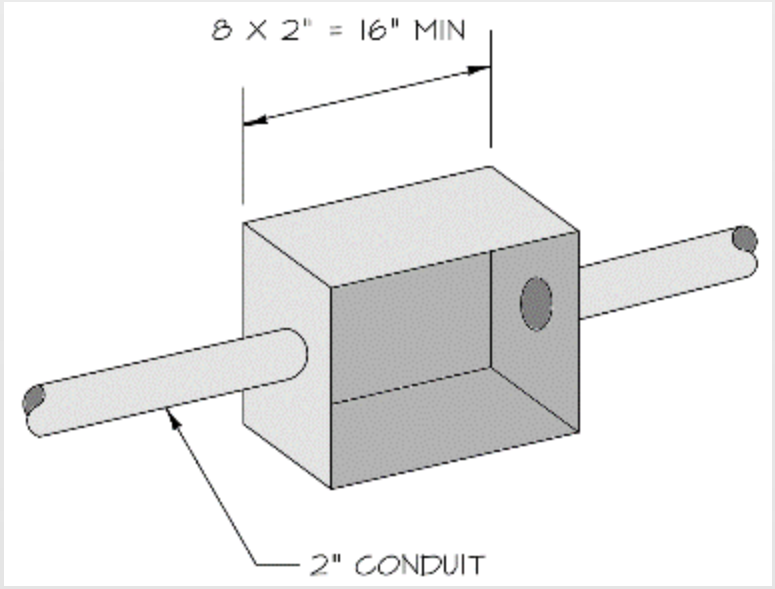
Article 314.27(A) and (B) Listed boxes Used for Luminaire Support

THIS LUMINAIRE WEIGHS 500 LBS AND IS MADE FROM THE ROOTS OF A TREE

RULE #42

Pullbox and Junction box Sizing

ARTICLE 314
Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures

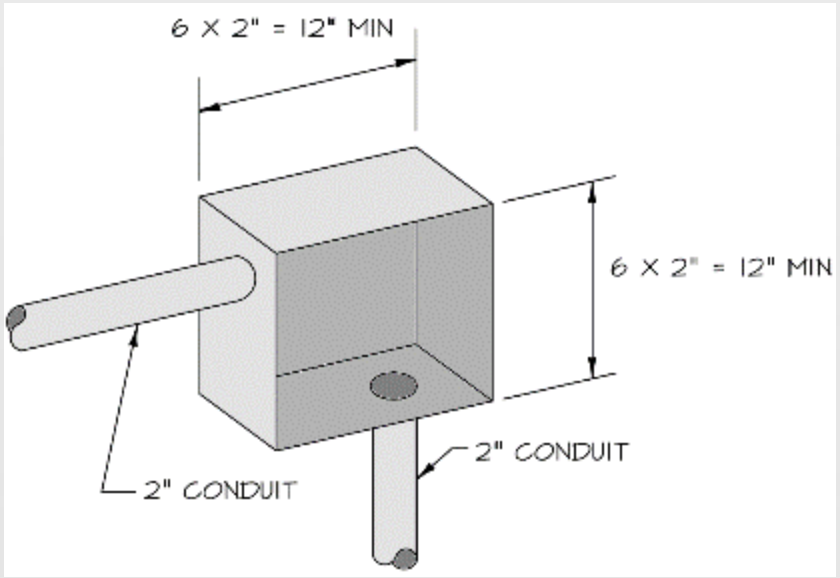


314.28 Pull and Junction Boxes and Conduit Bodies. Boxes and conduit bodies used as pull or junction boxes shall comply with the following:

(A) Minimum Size.

(1) Straight Pulls. In straight pulls, the length of the box shall not be less than eight times the metric designator (trade size) of the largest raceway.

ARTICLE 314
Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures



314.28 Pull and Junction Boxes and Conduit Bodies. (A)(2) Angle or U Pulls. Where splices or where angle or U pulls are made, the distance between each raceway entry inside the box and the opposite wall of the box shall not be less than six times the metric designator (trade size) of the largest raceway in a row.

ARTICLE 314
Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures

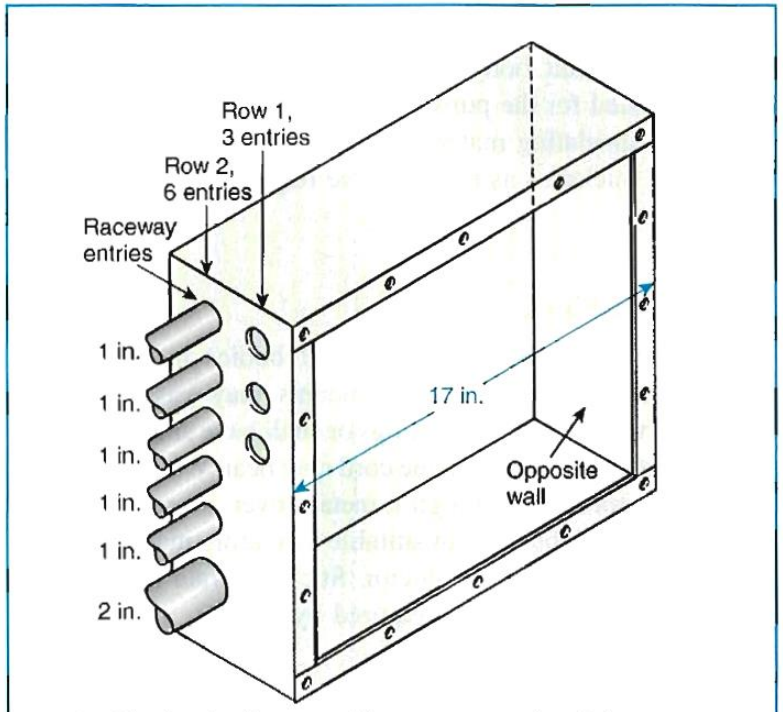


Exhibit 314.10 An example showing calculations required by 314.28(A)(2) for splices, angle pulls, or U pulls.

314.28 Pull and Junction Boxes and Conduit Bodies. This distance shall be increased for additional entries by the amount of the sum of the diameters of all other raceway entries in the same row on the same wall of the box. Each row shall be calculated individually, and the single row that provides the maximum distance shall be used.

ARTICLE 314
Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures

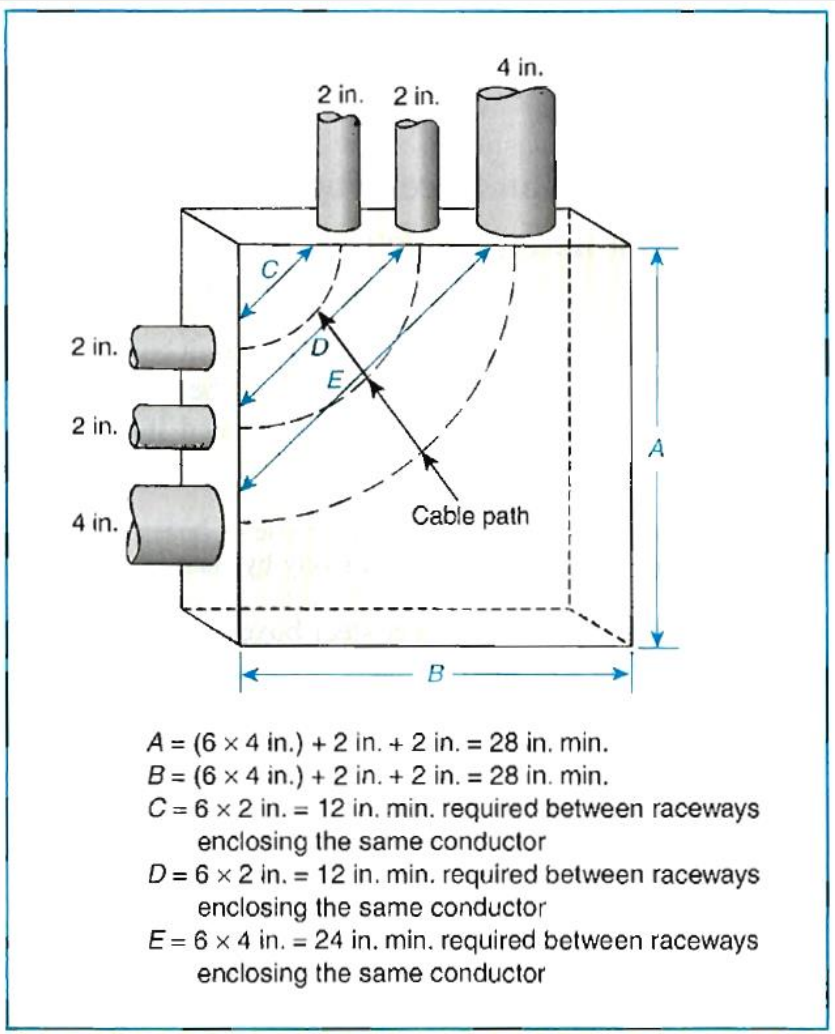


Exhibit 314.11 An example showing calculations required by 314.28(A)(2) for raceways enclosing the same conductor.

ARTICLE 314
Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures

314.28 Pull and Junction Boxes and Conduit Bodies. When transposing cable size into raceway size in 314.28(A)(1) and (A)(2), the minimum metric designator (trade size) raceway required for the number and size of conductors in the cable shall be used.

RULE #44

MC cable supporting

ARTICLE 330
Metal-Clad Cable: Type MC

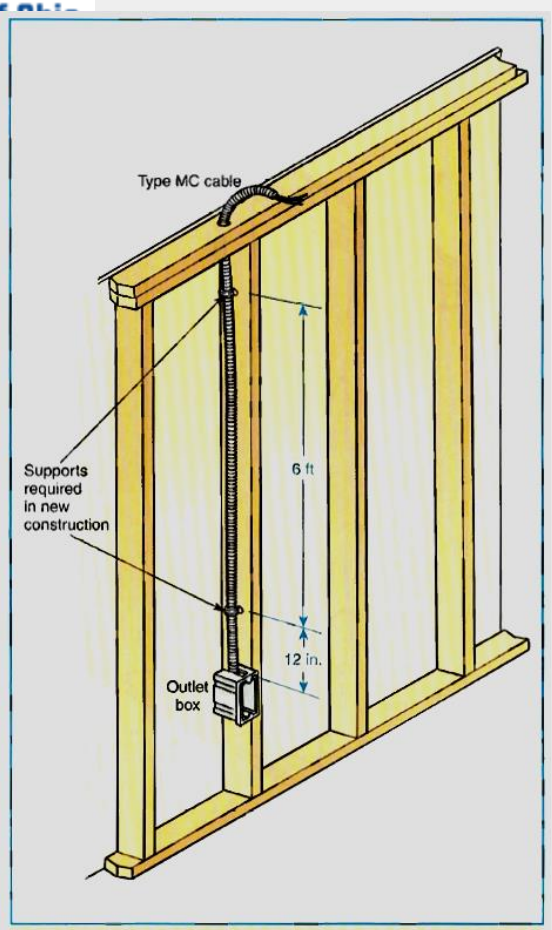


Exhibit 330.2 An application of 330.30(A) and (C), showing Type MC cable supported and secured at intervals not exceeding 6 ft and within 12 in. of the box.

330.30 Securing and Supporting.

(B) Securing. Unless otherwise provided, cables shall be secured at intervals not exceeding 1.8 m (6 ft). Cables containing four or fewer conductors sized no larger than 10 AWG shall be secured within 300 mm (12 in.) of every box, cabinet, fitting, or other cable termination.

ARTICLE 330
Metal-Clad Cable: Type MC

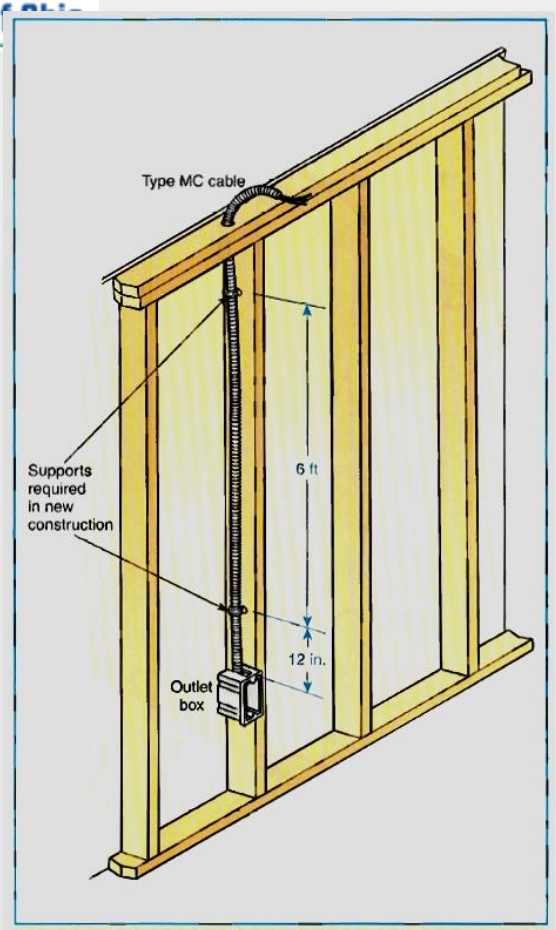


Exhibit 330.2 An application of 330.30(A) and (C), showing Type MC cable supported and secured at intervals not exceeding 6 ft and within 12 in. of the box.

330.30 Securing and Supporting.

(C) Supporting. Unless otherwise provided, cables shall be supported at intervals not exceeding 1.8-m (6-ft) Horizontal runs of Type MC cable installed in wooden or metal framing members or similar supporting means shall be considered supported and secured where such support does not exceed 1.8-m (6-ft) intervals.

ARTICLE 330
Metal-Clad Cable: Type MC

330.30 Securing and Supporting.

(D) Unsupported Cables. Type MC cable shall be permitted to be unsupported where the cable:

(1) Is fished between access points through concealed spaces in finished buildings or structures and supporting is impractical; or

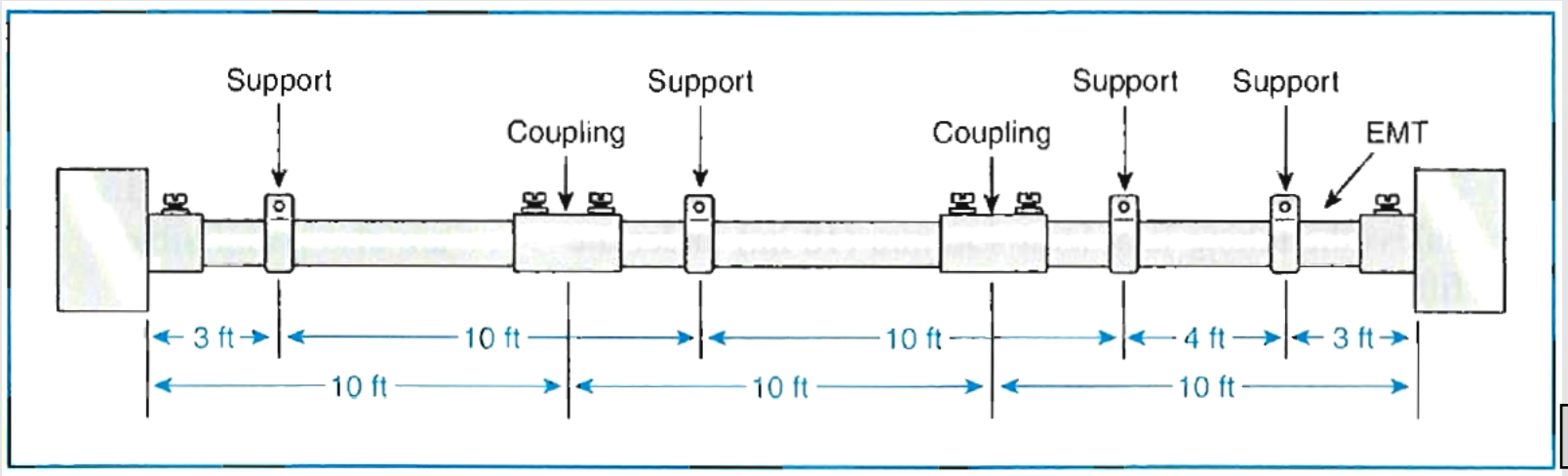
(2) Is not more than 1.8 m (6 ft) in length from the last point of cable support to the point of connection to a luminaire (lighting fixture) or other piece of electrical equipment and the cable and point of connection are within an accessible ceiling. For the purpose of this section, Type MC cable fittings shall be permitted as a means of cable support.

RULE #45

EMT conduit supporting

ARTICLE 358
Electrical Metallic Tubing: Type EMT

358.30(A) Securely Fastened. EMT shall be securely fastened in place at least every 3 m (10 ft). In addition, each EMT run between termination points shall be securely fastened within 900 mm (3 ft) of each outlet box, junction box, device box, cabinet, conduit body, or other tubing termination.



ARTICLE 358
Electrical Metallic Tubing: Type EMT

358.30(A) Securely Fastened.

Exception No. 2: For concealed work in finished buildings or prefinished wall panels where such securing is impracticable, unbroken lengths (without coupling) of EMT shall be permitted to be fished.

RULE #46

Flexible Cord

ARTICLE 400 - Flexible Cords and Cables

400.8 Uses Not Permitted. Unless specifically permitted in 400.7, flexible cords and cables shall not be used for the following:

(1) As a substitute for the fixed wiring of a structure

(2) Where run through holes in walls, structural ceilings, suspended ceilings, dropped ceilings, or floors

(3) Where run through doorways, windows, or similar openings

(4) Where attached to building surfaces

Exception to (4): Flexible cord and cable shall be permitted to be attached to building surfaces in accordance with the provisions of 368.56(B)

ARTICLE 400 - Flexible Cords and Cables

400.8 Uses Not Permitted. (con't)

(5) Where concealed by walls, floors, or ceilings or located above suspended or dropped ceilings

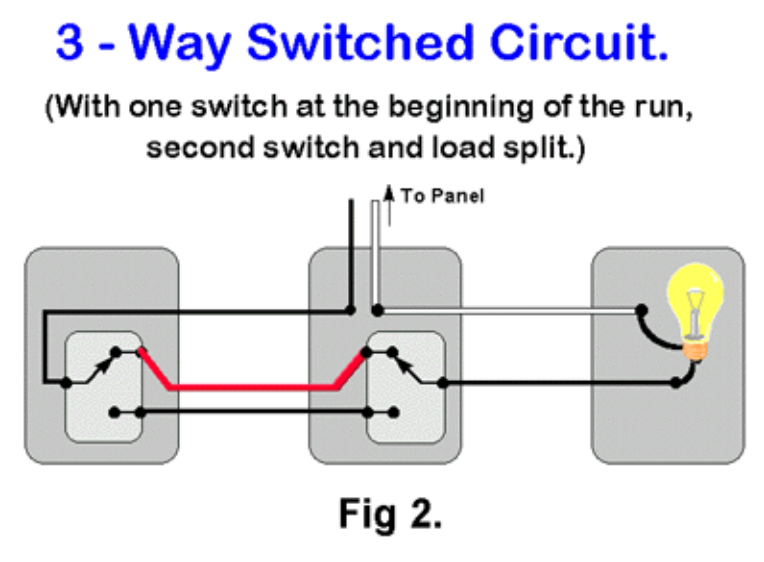
(6) Where installed in raceways, except as otherwise permitted in this *Code*

(7) Where subject to physical damage

RULE #47

Switch Connections

ARTICLE 404 Switches



404.2 Switch Connections.

(A) Three-Way and Four-Way Switches. Three-way and four-way switches shall be wired so that all switching is done only in the ungrounded circuit conductor.

Exception: Switch loops shall not require a grounded conductor.

(B) Grounded Conductors. Switches or circuit breakers shall not disconnect the grounded conductor of a circuit.

ARTICLE 404 Switches

Back on **Page 44 Article 200.7(C)(2)** permits a cable assembly with an insulated grounded conductor to be used to power the switch. The switched return leg is the black or red return conductor. The white or gray wire must be identified in the termination boxes.

RULE #48

Position of Switches

ARTICLE 404 Switches

404.6 Position and Connection of Switches.

(A) Single-Throw Knife Switches. Single-throw knife switches shall be placed so that gravity will not tend to close them. Single-throw knife switches, approved for use in the inverted position, shall be provided with an integral mechanical means that ensures that the blades remain in the open position when so set.

ARTICLE 404 Switches

404.8 Accessibility and Grouping.

(A) Location. All switches and circuit breakers used as switches shall be located so that they may be operated from a readily accessible place. They shall be installed such that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 2.0 m (6 ft 7 in.) above the floor or working platform.

ARTICLE 404 Switches

404.8 Accessibility and Grouping.

Exception No. 1: On busway installations, fused switches and circuit breakers shall be permitted to be located at the same level as the busway. Suitable means shall be provided to operate the handle of the device from the floor.

ARTICLE 404 Switches

404.8 Accessibility and Grouping.

Exception No. 2: Switches and circuit breakers installed adjacent to motors, appliances, or other equipment that they supply shall be permitted to be located higher than 2.0 m (6 ft 7 in.) and to be accessible by portable means.

Exception No. 3: Hookstick operable isolating switches shall be permitted at greater heights.

RULE #49

Damp vs. Wet Location

ARTICLE 406
Receptacles, Cord Connectors, and Attachment Plugs (Caps)

406.8 Receptacles in Damp or Wet Locations.

(A) Damp Locations. A receptacle installed outdoors in a location protected from the weather or in other damp locations shall have an enclosure for the receptacle that is weatherproof when the receptacle is covered (attachment plug cap not inserted and receptacle covers closed). An installation suitable for wet locations shall also be considered suitable for damp locations.

ARTICLE 406
Receptacles, Cord Connectors, and Attachment Plugs (Caps)

406.8 Receptacles in Damp or Wet Locations.

(A) Damp Locations. (Con't)

A receptacle shall be considered to be in a location protected from the weather where located under roofed open porches, canopies, marquees, and the like, and will not be subjected to a beating rain or water runoff.

ARTICLE 406
Receptacles, Cord Connectors, and Attachment Plugs (Caps)

406.8 Receptacles in Damp or Wet Locations.

(B) Wet Locations.

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

15- and 20-ampere, 125- and 250-volt receptacles installed in a wet location shall have an enclosure that is weatherproof whether or not the attachment plug cap is inserted.

RULE #50

Cables in switchboards

ARTICLE 408
Switchboards and Panelboards

408.3 Support and Arrangement of Busbars and Conductors.

(3) Same Vertical Section. Other than the required interconnections and control wiring, only those conductors that are intended for termination in a vertical section of a switchboard shall be located in that section.

Exception: Conductors shall be permitted to travel horizontally through vertical sections of switchboards where such conductors are isolated from busbars by barrier.

RULE #51

Panel Schedules

ARTICLE 408
Switchboards and Panelboards

408.4 Circuit Directory or Circuit Identification. Every circuit and circuit modification shall be legibly identified as to its clear, evident, and specific purpose or use. The identification shall include sufficient detail to allow each circuit to be distinguished from all others.

ARTICLE 408
Switchboards and Panelboards

408.7 Unused Openings. Unused openings for circuit breakers and switches shall be closed using identified closures, or other approved means that provide protection substantially equivalent to the wall of the enclosure.

RULE #52

Number of Overcurrent devices in a Panelboard

ARTICLE 408
Switchboards and Panelboards

III. Panelboards

408.35 Number of Overcurrent Devices on One Panelboard.

Not more than 42 overcurrent devices (other than those provided for in the mains) of a lighting and appliance branch-circuit panelboard shall be installed in any one cabinet or cutout box.

(A lighting and appliance branch-circuit panelboard is one having more than 10 percent of its overcurrent devices protecting lighting and appliance branch circuits.)

RULE #53

Luminaires in Bathrooms

ARTICLE 410
Luminaires (Lighting Fixtures), Lampholders, and Lamps

II. Luminaire (Fixture) Locations

410.4 Luminaires (Fixtures) in Specific Locations.

(D) Bathtub and Shower Areas. No parts of cord connected luminaires (fixtures), chain-, cable-, or cord suspended luminaires (fixtures), lighting track, pendants, or ceiling-suspended (paddle) fans shall be located within a zone measured 900 mm (3 ft) horizontally and 2.5 m (8 ft) vertically from the top of the bathtub rim or shower stall threshold. This zone is all encompassing and includes the zone directly over the tub or shower stall. Luminaires (lighting fixtures) located in this zone shall be listed for damp locations, or listed for wet locations where subject to shower spray.

ARTICLE 410
Luminaires (Lighting Fixtures), Lampholders, and Lamps

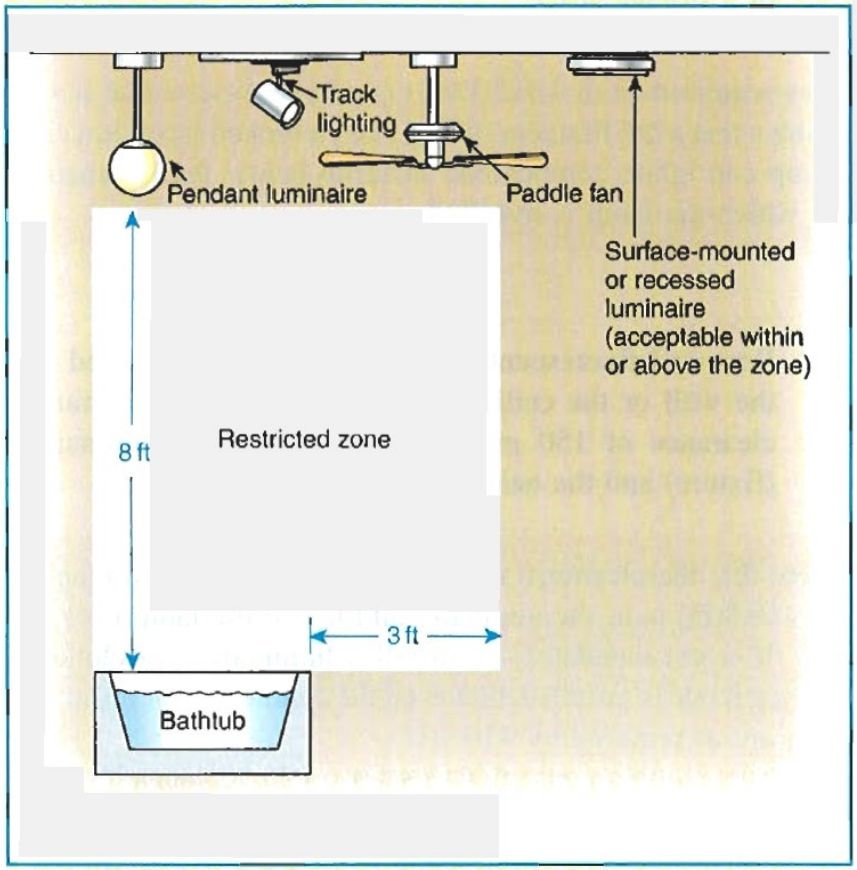


Exhibit 410.1 Luminaires, lighting track, and suspended (paddle) fan located near a bathtub.

RULE #54

Luminaires in Sports Areas

ARTICLE 410
Luminaires (Lighting Fixtures), Lampholders, and Lamps

II. Luminaire (Fixture) Locations

410.4 Luminaires (Fixtures) in Specific Locations.

(E) Luminaires (Fixtures) in Indoor Sports, Mixed-Use, and All-Purpose Facilities. Luminaires (fixtures) subject to physical damage, using a mercury vapor or metal halide lamp, installed in playing and spectator seating areas of indoor sports, mixed-use, or all-purpose facilities shall be of the type that protects the lamp with a glass or plastic lens.

RULE #55

Means of support for fixtures

ARTICLE 410
Luminaires (Lighting Fixtures), Lampholders, and Lamps

410.16 Means of Support.

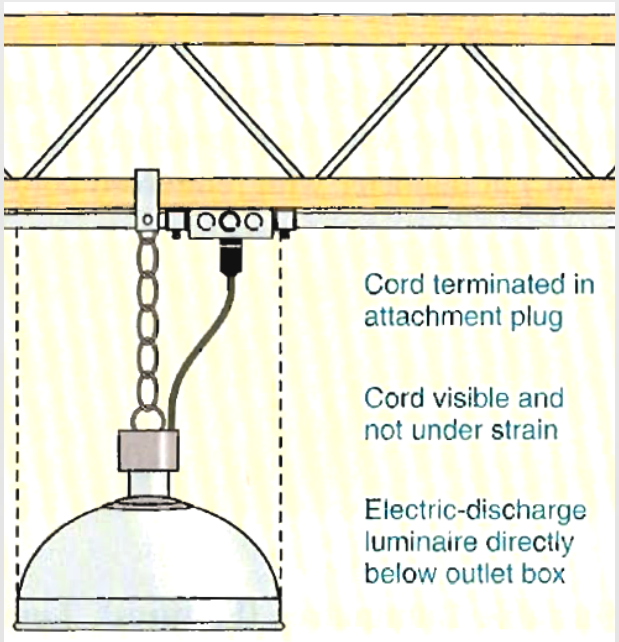
(C) Suspended Ceilings. Framing members of suspended ceiling systems used to support luminaires (fixtures) shall be securely fastened to each other and shall be securely attached to the building structure at appropriate intervals.

Luminaires (fixtures) shall be securely fastened to the ceiling framing member by mechanical means such as bolts, screws, or rivets. Listed clips identified for use with the type of ceiling framing member(s) and luminaire(s) [fixture(s)] shall also be permitted.

RULE #56

Cord and Plug Connected Light Fixture

ARTICLE 410
Luminaires (Lighting Fixtures), Lampholders, and Lamps



410.30 Cord-Connected Lampholders and Luminaires (Fixtures).

(C) Electric-Discharge Luminaires (Fixtures).

(1) Cord Connected Installation. A listed luminaire (fixture) or a listed assembly shall be permitted to be cord connected if the following conditions apply:

(1) The luminaire (fixture) is located directly below the outlet or busway.

(2) The flexible cord meets all the following: a. Is visible for its entire length outside the luminaire (fixture)

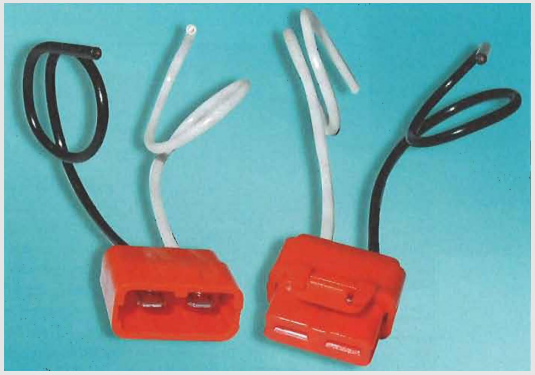
b. Is not subject to strain or physical damage

c. Is terminated in a grounding-type attachment plug cap or busway plug, or is a part of a listed assembly incorporating a manufactured wiring system connector in accordance with 604.6(C), or has a luminaire (fixture) assembly with a strain relief and canopy.

RULE #57

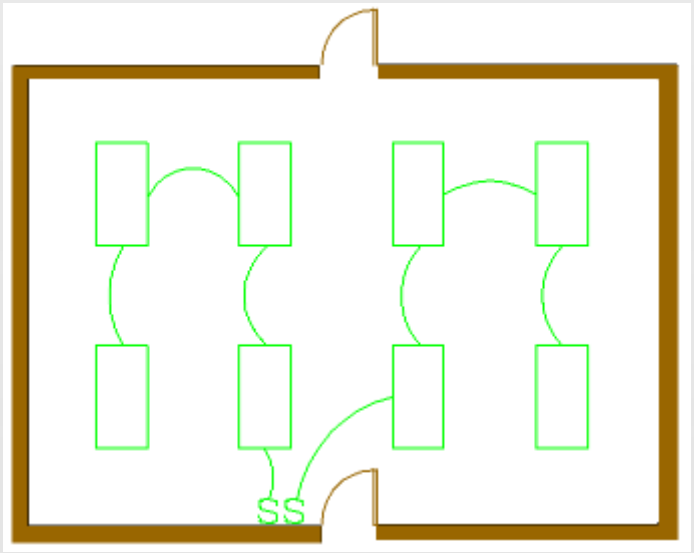
Light Fixture Disconnecting Means

ARTICLE 410
Luminaires (Lighting Fixtures), Lampholders, and Lamps



410.130(G)(1) Disconnecting Means. In indoor locations, other than dwellings and associated accessory structures, fluorescent luminaires that utilize double-ended lamps and contain ballast(s) that can be serviced in place shall have a disconnecting means either internal or external to each luminaire. The line side terminals of the disconnecting means shall be guarded.

ARTICLE 410
Luminaires (Lighting Fixtures), Lampholders, and Lamps



NO INDIVIDUAL DISCONNECTS

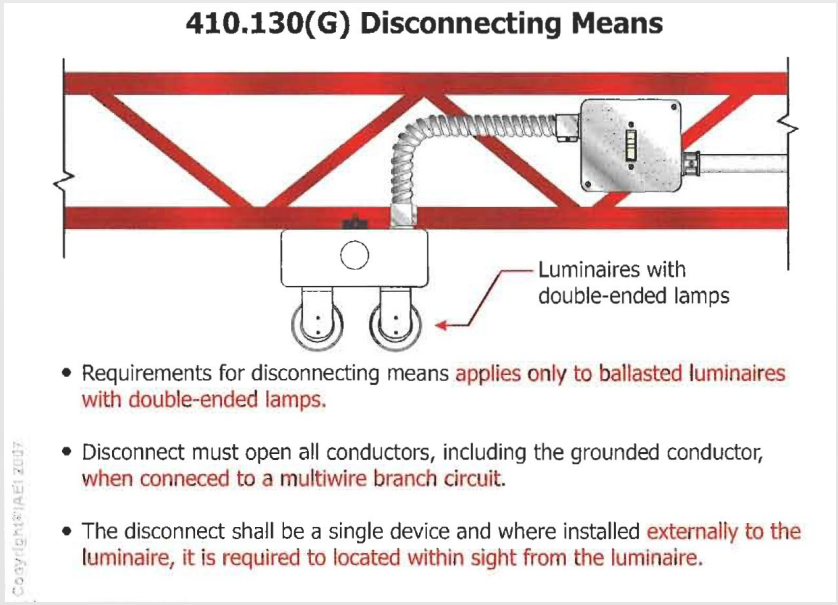
NO MULTIWIRE BRANCH CIRCUIT

410.130(G) Disconnecting Means. Exceptions for: hazardous locations, emergency illumination, Cord and plug connected, restricted public establishments, and where more than one luminaire in a space is supplied by other than a multiwire branch circuit, the space cannot be left in total darkness – otherwise provide disconnects on every fixture.

ARTICLE 410
Luminaires (Lighting Fixtures), Lampholders, and Lamps

410.130(G)(2) Multiwire Branch Circuits. When connected to multi-wire branch circuits, the disconnecting means shall simultaneously break all the supply conductors to the ballast, including the grounded conductor (neutral).

ARTICLE 410
Luminaires (Lighting Fixtures), Lampholders, and Lamps



410.130(G)(3) Location. The disconnecting means shall be located so as to be accessible to qualified persons before servicing or maintaining the ballast. Where the disconnecting means is external to the luminaire, it shall be a single device, and shall be attached to the luminaire of the luminaire shall be located within sight of the disconnecting means.

RULE #58

Vending Machine GFCI

ARTICLE 422
Appliances

422.51 Cord and plug connected Vending Machines. Cord-and-plug-connected vending machines manufactured or re-manufactured on or after January 1, 2005, shall include a ground-fault circuit interrupter as an integral part of the attachment plug or be located within 300 mm (12 in.) of the attachment plug. Older vending machines manufactured or remanufactured prior to January 1, 2005, shall be connected to a GFCI-protected outlet. For the purpose of this section, the term *vending machine* means any self-service device that dispenses products or merchandise without the necessity of replenishing the device between each vending operation and is designed to require insertion of a coin, paper currency, token, card, key, or receipt of payment by other means.

RULE #59

Electric Drinking Fountains

ARTICLE 422
Appliances

422.52 Electric Drinking Fountains.

Electric drinking fountains shall be protected with ground-fault circuit-interrupter protection.

RULE #60

Sizing Motor Wiring

ARTICLE 430
Motors, Motor Controls

430.6 Ampacity and Motor Rating Determination.

The size of conductors supplying equipment covered by Article 430 shall be selected from the allowable ampacity tables in accordance with 310.15(B) or shall be calculated in accordance with 310.15(C).

ARTICLE 430
Motors, Motor Controls

430.6 Ampacity and Motor Rating Determination.

(1) Table Values. Other than for motors built for low speeds (less than 1200 RPM) or high torques, and for multispeed motors, the values given in Table 430.247, Table 430.248, Table 430.249, and Table 430.250 shall be used to determine the ampacity of conductors or ampere ratings of switches, branch-circuit short-circuit and ground-fault protection, instead of the actual current rating marked on the motor nameplate.

ARTICLE 430
Motors, Motor Controls

Table 430.248

Table 430.248 Full-Load Currents in Amperes, Single-Phase Alternating-Current Motors

The following values of full-load currents are for motors running at usual speeds and motors with normal torque characteristics. The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120 and 220 to 240 volts.

Horsepower	115 Volts	200 Volts	208 Volts	230 Volts
1/6	4.4	2.5	2.4	2.2
1/4	5.8	3.3	3.2	2.9
1/3	7.2	4.1	4.0	3.6
1/2	9.8	5.6	5.4	4.9
3/4	13.8	7.9	7.6	6.9
1	16	9.2	8.8	8.0
1 1/2	20	11.5	11.0	10
2	24	13.8	13.2	12
3	34	19.6	18.7	17
5	56	32.2	30.8	28
7 1/2	80	46.0	44.0	40
10	100	57.5	55.0	50

ARTICLE 430
Motors, Motor Controls

Table 430.250

Table 430.250 Full-Load Current, Three-Phase Alternating-Current Motors

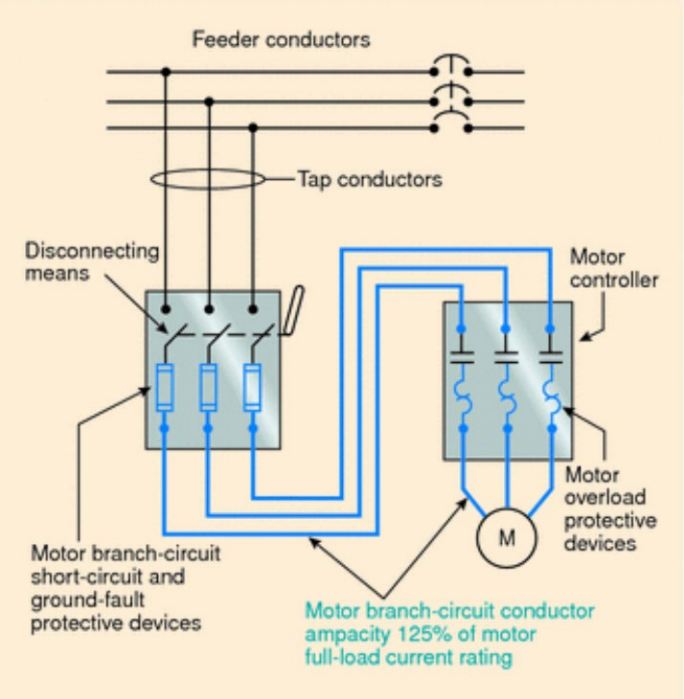
The following values of full-load currents are typical for motors running at speeds usual for belted motors and motors with normal torque characteristics.

The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480, and 550 to 600 volts.

	Induction-Type Squirrel Cage and Wound Rotor (Amperes)							Synchronous-Type Unity Power Factor* (Amperes)			
Horsepower	115 Volts	200 Volts	208 Volts	230 Volts	460 Volts	575 Volts	2300 Volts	230 Volts	460 Volts	575 Volts	2300 Volts
½	4.4	2.5	2.4	2.2	1.1	0.9	—	—	—	—	—
¾	6.4	3.7	3.5	3.2	1.6	1.3	—	—	—	—	—
1	8.4	4.8	4.6	4.2	2.1	1.7	—	—	—	—	—
1½	12.0	6.9	6.6	6.0	3.0	2.4	—	—	—	—	—
2	13.6	7.8	7.5	6.8	3.4	2.7	—	—	—	—	—
3	—	11.0	10.6	9.6	4.8	3.9	—	—	—	—	—
5	—	17.5	16.7	15.2	7.6	6.1	—	—	—	—	—
7½	—	25.3	24.2	22	11	9	—	—	—	—	—
10	—	32.2	30.8	28	14	11	—	—	—	—	—
15	—	48.3	46.2	42	21	17	—	—	—	—	—
20	—	62.1	59.4	54	27	22	—	—	—	—	—
25	—	78.2	74.8	68	34	27	—	53	26	21	—
30	—	92	88	80	40	32	—	63	32	26	—
40	—	120	114	104	52	41	—	83	41	33	—
50	—	150	143	130	65	52	—	104	52	42	—
60	—	177	169	154	77	62	16	123	61	49	12
75	—	221	211	192	96	77	20	155	78	62	15
100	—	285	273	248	124	99	26	202	101	81	20
125	—	359	343	312	156	125	31	253	126	101	25
150	—	414	396	360	180	144	37	302	151	121	30
200		552	528	480	240	192	49	400	201	161	40
250	—	—	—	—	302	242	60	—	—	—	—
300	—	—	—	—	361	289	72	—	—	—	—
350	—	—	—	—	414	336	83	—	—	—	—
400	—	—	—	—	477	382	95	—	—	—	—
450	—	—	—	—	515	412	103	—	—	—	—
500	—	—	—	—	590	472	118	—	—	—	—

*For 90 and 80 percent power factor, the figures shall be multiplied by 1.1 and 1.25, respectively.

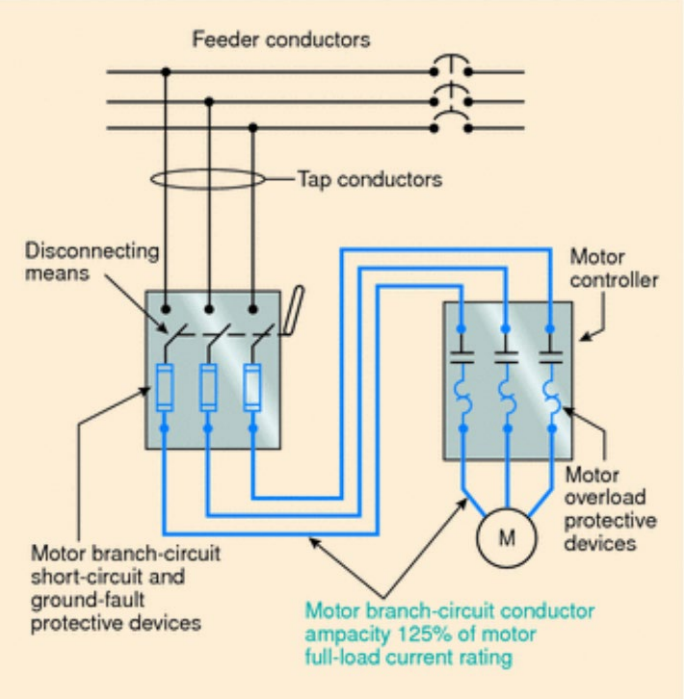
ARTICLE 430
Motors, Motor Controls



430.22 Single Motor.

(A) General. Conductors that supply a single motor used in a continuous duty application shall have an ampacity of not less than 125 percent of the motor's full-load current rating as determined by 430.6(A)(1).

ARTICLE 430
Motors, Motor Controls



430.24 Several Motors or a Motor(s) and Other Load(s).

Conductors supplying several motors, or a motor(s) and other load(s), shall have an ampacity not less than 125 percent of the full-load current rating of the highest rated motor plus the sum of the full-load current ratings of all the other motors in the group, as determined by 430.6(A), plus the ampacity required for the other loads.

RULE #61

Sizing Motor Overcurrent Protection

ARTICLE 430
Motors, Motor Controls

Table 430.52 Maximum Rating or Setting of Motor Branch-Circuit Short-Circuit and Ground-Fault Protective Devices

	Percentage of Full-Load Current			
Type of Motor	Nontime Delay Fuse[1]	Dual Element (Time-Delay) Fuse[1]	Instantaneous Trip Breaker	Inverse Time Breaker[2]
Single-phase motors	300	175	800	250
AC polyphase motors other than wound-rotor	300	175	800	250
Squirrel cage — other than Design B energy-efficient	300	175	800	250
Design B energy-efficient	300	175	1100	250
Synchronous[3]	300	175	800	250
Wound rotor	150	150	800	150
Direct current (constant voltage)	150	150	250	150

430.52 Rating or Setting for Individual Motor Circuit.

(C) Rating or Setting.

(1) In Accordance with Table 430.52. A protective device that has a rating or setting not exceeding the value calculated according to the values given in Table 430.52 shall be used.

RULE #62

Motor Disconnecting Means

ARTICLE 430
Motors, Motor Controls

430.102 Location.

(A) Controller. An individual disconnecting means shall be provided for each controller and shall disconnect the controller. The disconnecting means shall be located in sight from the controller location.

(3 Exceptions)

ARTICLE 430
Motors, Motor Controls

Exception for lock

430.102 Location.

(B) Motor. A disconnecting means shall be provided for a motor in accordance with (B)(1) or (B)(2).

(1) Separate Motor Disconnect. A disconnecting means for the motor shall be located in sight from the motor location and the driven machinery location.

(2) Controller Disconnect. The controller disconnecting means required in accordance with 430.102(A) shall be permitted to serve as the disconnecting means for the motor if it is in sight from the motor location and the driven machinery location.

RULE #63

Air Conditioning and Refrigeration Equipment Disconnect

ARTICLE 440
Air-Conditioning and Refrigerating Equipment

440.12 Rating and Interrupting Capacity.

(A) Hermetic Refrigerant Motor-Compressor. A disconnecting means serving a hermetic refrigerant motor-compressor shall be selected on the basis of the nameplate rated-load current or branch-circuit selection current, whichever is greater, and locked-rotor current, respectively, of the motor-compressor as follows.

(1) Ampere Rating. The ampere rating shall be at least 115 percent of the nameplate rated-load current or branch circuit selection current, whichever is greater. (Must be within sight)

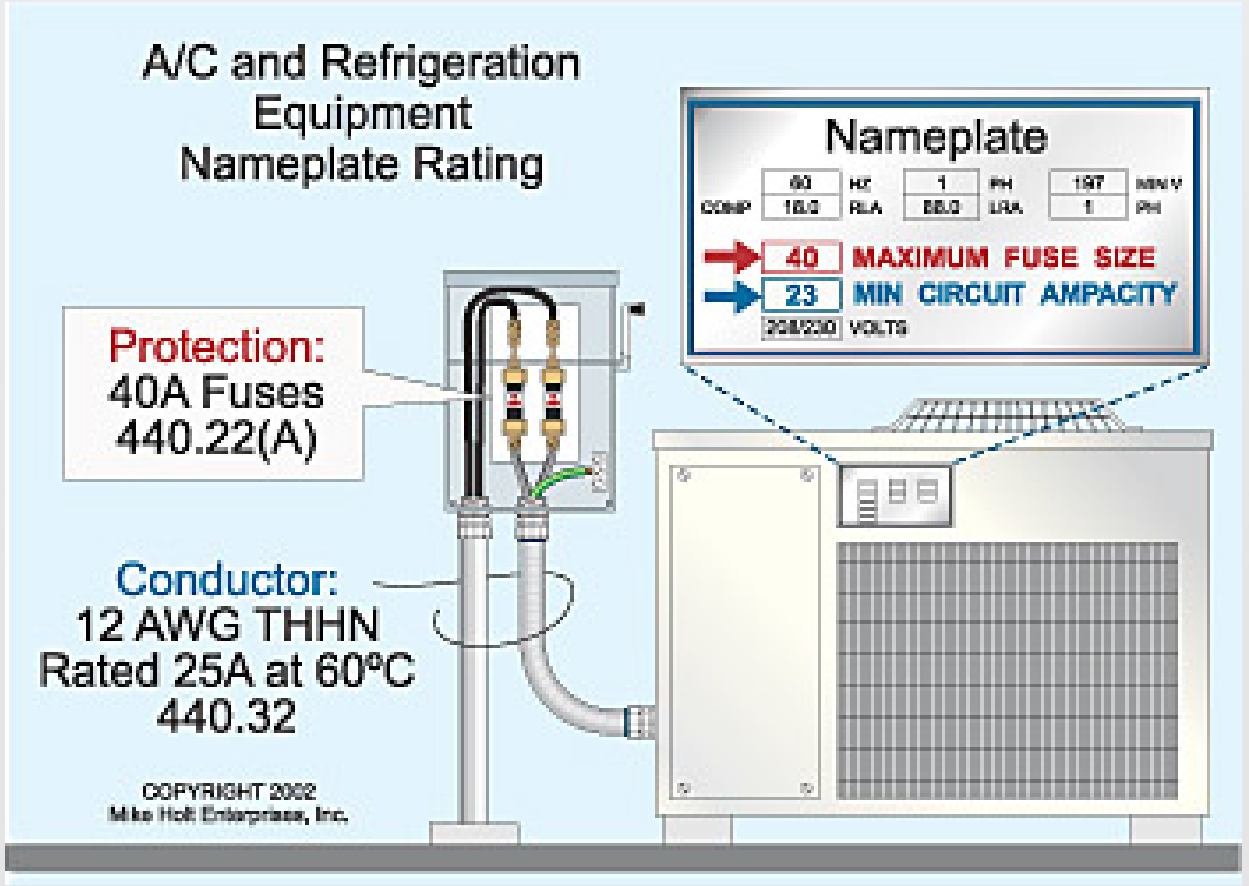
RULE #64

Air Conditioning and Refrigeration Equipment Wire Size

ARTICLE 440
Air-Conditioning and Refrigerating Equipment

440.22 (A) Application and Selection. Rating or Setting for Individual Motor-Compressor. The motor-compressor branch-circuit short-circuit and ground-fault protective device shall be capable of carrying the starting current of the motor. A protective device having a rating or setting not exceeding 175 percent of the motor-compressor rated-load current or branch-circuit selection current, whichever is greater, shall be permitted. Increase to 225 percent if necessary.

ARTICLE 440
Air-Conditioning and Refrigerating Equipment



RULE #65

Transformer Overcurrent Protection

Article 450
Transformers

450.3 Overcurrent Protection

(B) Transformers 600 Volts, Nominal, or Less. Overcurrent protection shall be provided in accordance with Table 450.3(B).

Article 450
Transformers

Table 450.3(B) Maximum Rating or Setting of Overcurrent Protection for Transformers 600 Volts and Less (as a Percentage of Transformer-Rated Current)

	Primary Protection			Secondary Protection (See Note 2.)	
Protection Method	Currents of 9 Amperes or More	Currents Less Than 9 Amperes	Currents Less Than 2 Amperes	Currents of 9 Amperes or More	Currents Less Than 9 Amperes
Primary only protection	125% (See Note 1.)	167%	300%	Not required	Not required
Primary and secondary protection	250% (See Note 3.)	250% (See Note 3.)	250% (See Note 3.)	125% (See Note 1.)	167%

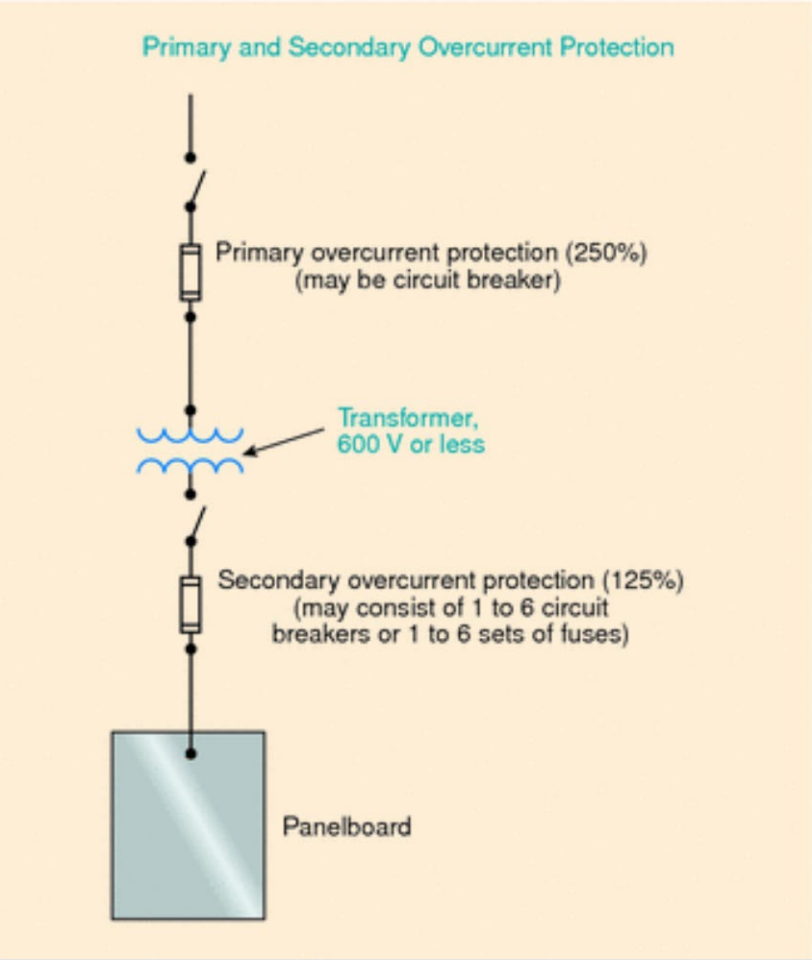
Article 450
Transformers

450.3 Overcurrent Protection

Table Notes:

1. Where 125 percent of this current does not correspond to a standard rating of a fuse or nonadjustable circuit breaker, a higher rating that does not exceed the next higher standard rating shall be permitted.

Article 450 Transformers



450.3 Overcurrent Protection

2. Where secondary overcurrent protection is required, the secondary overcurrent device shall be permitted to consist of not more than six circuit breakers or six sets of fuses grouped in one location. Where multiple overcurrent devices are utilized, the total of all the device ratings shall not exceed the allowed value of a single overcurrent device.

RULE #66

Explosion proof Protection Techniques

ARTICLE 500
Hazardous (Classified) Locations, Classes I, II, and III, Divisions 1 and 2

500.7 Protection Techniques. Section 500.7(A) through 500.7(L) shall be acceptable protection techniques for electrical and electronic equipment in hazardous (classified) locations.

(A) Explosionproof Apparatus. This protection technique shall be permitted for equipment in Class I, Division 1 or 2 locations.

ARTICLE 500
Hazardous (Classified) Locations, Classes I, II, and III, Divisions 1 and 2

500.7 Protection Techniques.

(B) Dust Ignition proof. This protection technique shall be permitted for equipment in Class II, Division 1 or 2 locations.

(C) Dusttight. This protection technique shall be permitted for equipment in Class II, Division 2 or Class III, Division 1 or 2 locations.

ARTICLE 500
Hazardous (Classified) Locations, Classes I, II, and III, Divisions 1 and 2

One of the Hoffman purging/pressurization products (see pages 10.08-10.11)

500.7 Protection Techniques.

(D) Purged and Pressurized. This protection technique shall be permitted for equipment in any hazardous (classified) location for which it is identified.

(E) Intrinsic Safety. This protection technique shall be permitted for equipment in Class I, Division 1 or 2; or Class II, Division 1 or 2; or Class III, Division 1 or 2 locations. The provisions of Articles 501 through 503 and Articles 510 through 516 shall not be considered applicable to such installations, except as required by Article 504, and installation of intrinsically safe apparatus and wiring shall be in accordance with the requirements of Article 504.

RULE #67

Wiring methods in Classified areas

ARTICLE 501
Class I Locations

II. Wiring

501.10 Wiring Methods. Wiring methods shall comply with 501.10(A) or 501.10(B).

(A) Class I, Division 1.

(1) General. In Class I, Division 1 locations, the wiring methods in (a) through (d) shall be permitted.

(a) Threaded rigid metal conduit or threaded steel intermediate metal conduit.

(b) Type MI cable with termination fittings listed for the location. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

ARTICLE 501
Class I Locations

501.10 Wiring Methods.

(A) Class I, Division 1.

(2) Flexible Connections. Where necessary to employ flexible connections, as at motor terminals, flexible fittings listed for Class I, Division 1 locations or flexible cord in accordance with the provisions of 501.140 shall be permitted.

ARTICLE 501
Class I Locations

501.115 Switches, Circuit Breakers, Motor Controllers, and Fuses.

(A) Class I, Division 1. In Class I, Division 1 locations, switches, circuit breakers, motor controllers, and fuses, including pushbuttons, relays, and similar devices, shall be provided with enclosures, and the enclosure in each case, together with the enclosed apparatus, shall be identified as a complete assembly for use in Class I locations.

RULE #68

Wiring methods in Class II Division 1 areas

ARTICLE 502
Class II Locations

II. Wiring

502.10 Wiring Methods. Wiring methods shall comply with 502.10(A) or 502.10(B).

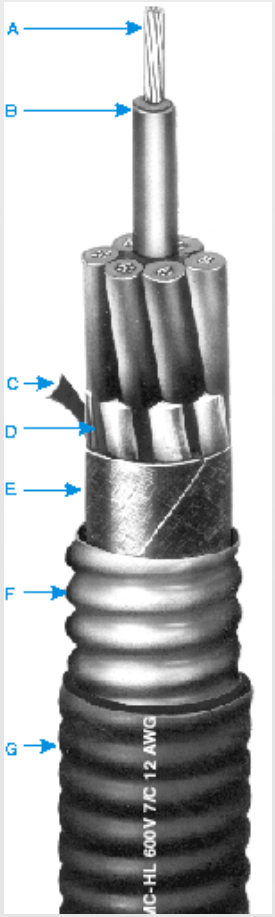
(A) Class II, Division 1.

(1) General. In Class II, Division 1 locations, the wiring methods in (1) through (4) shall be permitted.

(1) Threaded rigid metal conduit, or threaded steel intermediate metal conduit.

(2) Type MI cable with termination fittings listed for the location. Type MI cable shall be installed and supported in a manner to avoid tensile stress at the termination fittings.

ARTICLE 502
Class II Locations



502.10 Wiring Methods

(c) and (d) allow a hazardous location listed MC cable to be installed in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation.

Class II wiring allows flexible connections to equipment not permitted in Class I locations.

RULE #69

GFCI protected portable test equipment

ARTICLE 511
Commercial Garages, Repair and Storage

511.12 Ground-Fault Circuit-Interrupter Protection for Personnel. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in areas where electrical diagnostic equipment, electrical hand tools, or portable lighting equipment are to be used shall have ground-fault circuit interrupter protection for personnel.

RULE #70

Grounding in Health Care Facilities

ARTICLE 517
Health Care Facilities

517.13 Grounding of Receptacles and Fixed Electric Equipment in Patient Care Areas. Wiring in patient care areas shall comply with 517.13(A) and 517.13(B).

(A) Wiring Methods. All branch circuits serving patient care areas shall be provided with a ground path for fault current by installation in a metal raceway system, or a cable having a metallic armor or sheath assembly. The metal raceway system, or metallic cable armor, or sheath assembly shall itself qualify as an equipment grounding return path in accordance with 250.118.

ARTICLE 517
Health Care Facilities

517.13 Grounding of Receptacles and Fixed Electric Equipment in Patient Care Areas. Wiring in patient care areas shall comply with 517.13(A) and 517.13(B).

(B) Insulated Equipment Grounding Conductor. The grounding terminals of all receptacles and all non–current carrying conductive surfaces of fixed electric equipment likely to become energized that are subject to personal contact, operating at over 100 volts, shall be grounded by an insulated copper conductor. The equipment grounding conductor shall be sized in accordance with Table 250.122 and installed in metal raceways or as a part of listed cables having a metallic armor or sheath assembly with the branch-circuit conductors supplying these receptacles or fixed equipment.

RULE #71

Panelboard Grounding in Health Care Facilities

ARTICLE 517
Health Care Facilities

517.14 Panelboard Bonding. The equipment grounding terminal buses of the normal and essential branch-circuit panelboards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not smaller than 10AWG. Where two or more panelboards serving the same individual patient vicinity are served from separate transfer switches on the emergency system, the equipment grounding terminal buses of those panelboards shall be bonded together with an insulated continuous copper conductor not smaller than 10 AWG. This conductor shall be permitted to be broken in order to terminate on the equipment grounding terminal bus in each panelboard.

RULE #72

Temporary Installations

ARTICLE 590
Temporary Installations

590.3 Time Constraints.

(A) During the Period of Construction. Temporary electrical power and lighting installations shall be permitted during the period of construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities.

(B) 90 Days. Temporary electrical power and lighting installations shall be permitted for a period not to exceed 90 days for holiday decorative lighting and similar purposes.

ARTICLE 590
Temporary Installations

590.6 Ground-Fault Protection for Personnel. (A) Receptacle Outlets. All 125-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets that are not a part of the permanent wiring of the building or structure and that are in use by personnel shall have ground-fault circuit interrupter protection for personnel. If a receptacle(s) is installed or exists as part of the permanent wiring of the building or structure and is used for temporary electric power, ground-fault circuit-interrupter protection for personnel shall be provided. For the purposes of this section, cord sets or devices incorporating listed ground-fault circuit interrupter protection for personnel identified for portable use shall be permitted.

RULE #73

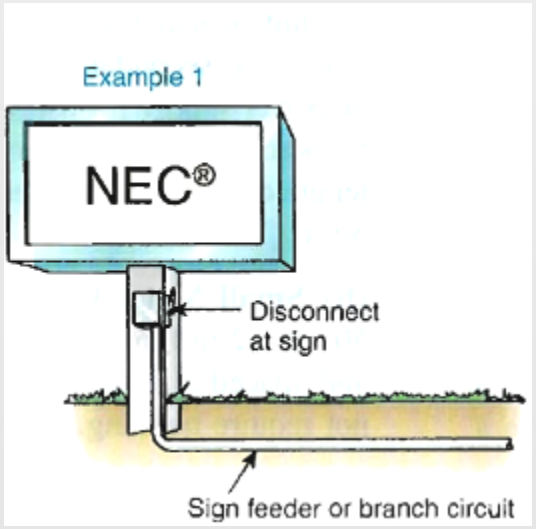
Disconnect at a sign

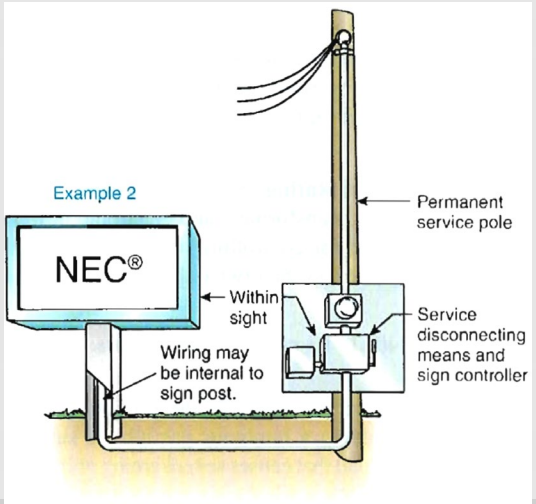
Article 600.6
Disconnects

600.6 Disconnects.

Each sign and outline lighting system, or feeder circuit or branch circuit supplying a sign or outline lighting system, shall be controlled by an externally operable switch or circuit breaker that will open all ungrounded conductors. Signs and outline lighting systems located within fountains shall have the disconnect located in accordance with 680.12.

Article 600.6 Disconnects

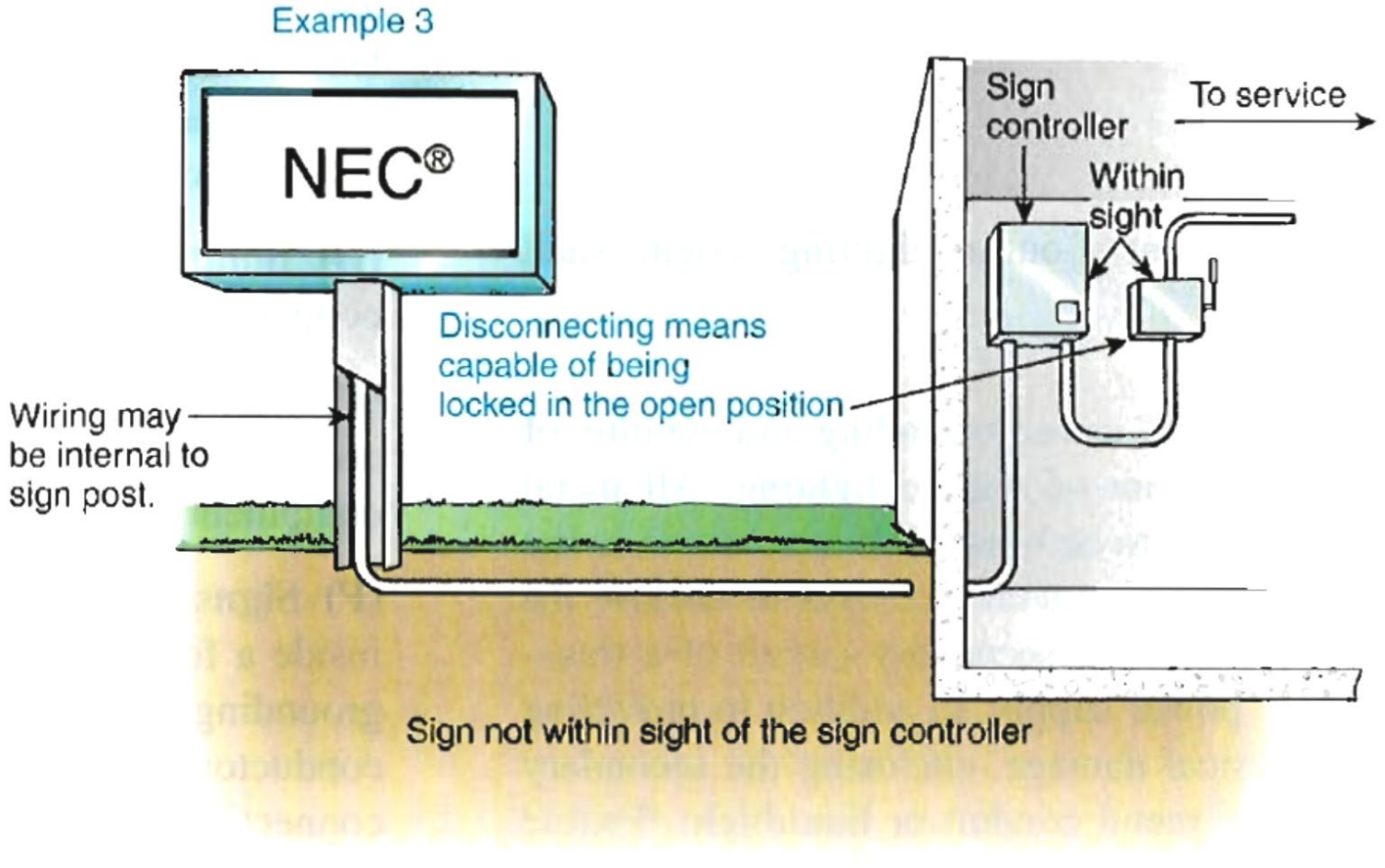




(A) Location.

(1) Within Sight of the Sign. The disconnecting means shall be within sight of the sign or outline lighting system that it controls. Where the disconnecting means is out of the line of sight from any section that is able to be energized, the disconnecting means shall be capable of being locked in the open position. The provision for locking or adding a lock to the disconnecting means must remain in place at the switch or circuit breaker whether the lock is installed or not. Portable means for adding a lock to the switch or circuit breaker shall not be permitted.

Article 600.6 Disconnects



Where the sign is controlled by an electronic or electromechanical means, the disconnect may be not located at the sign but within sight of the controller and lockable.

RULE #74

Sign grounding

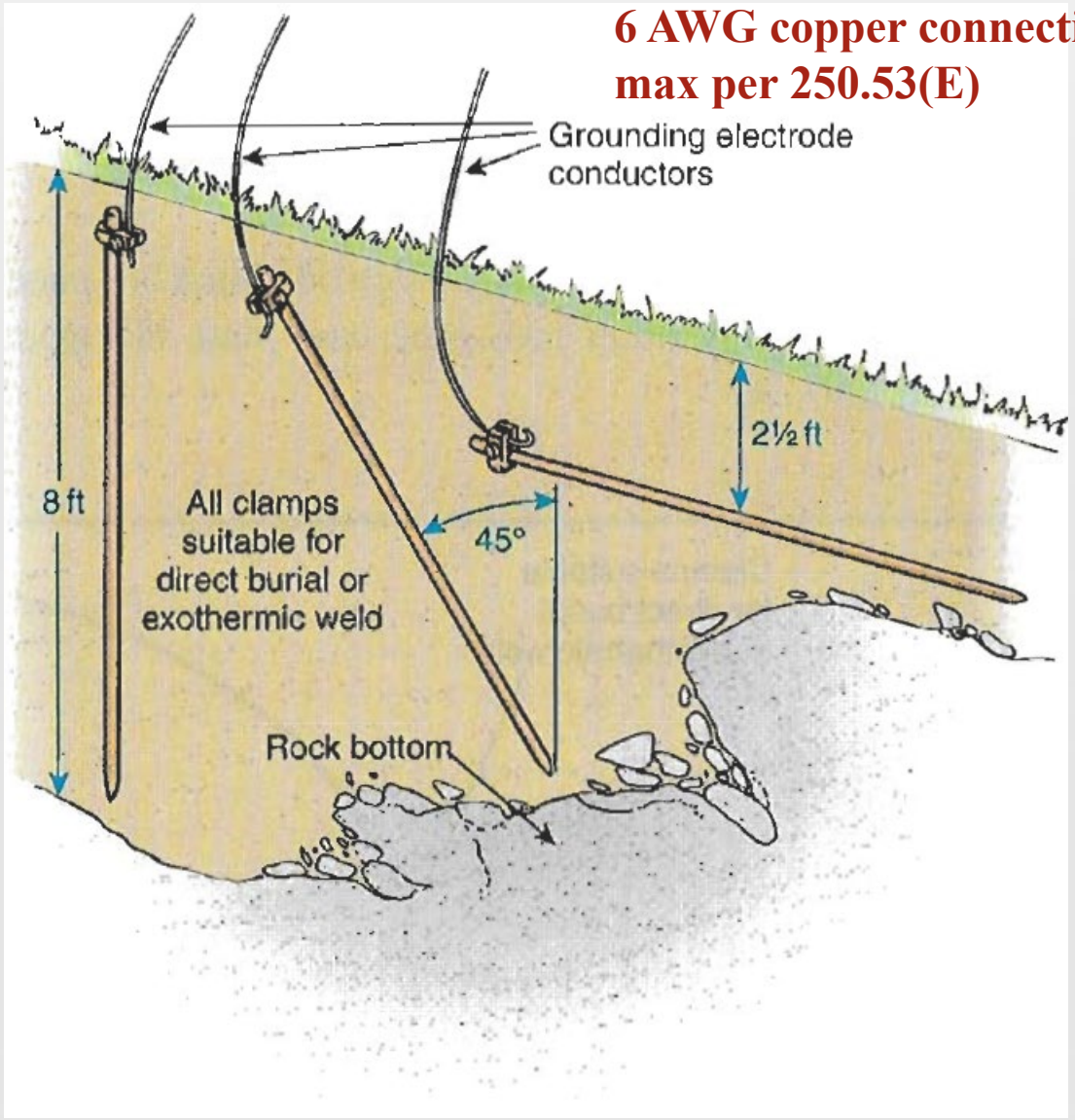
Article 600.7 Grounding

Signs shall be grounded by connection to the equipment grounding conductor (sized per 250.122).

An auxiliary grounding electrode shall be permitted and meet the requirements of 250.54. This take the form of a ground rod and is used to establish a reference to ground in the area of electrically operated equipment (lightning protection or earth reference). Not a substitute for a grounding wire.

Article 600.7 Grounding

6 AWG copper connection max per 250.53(E)



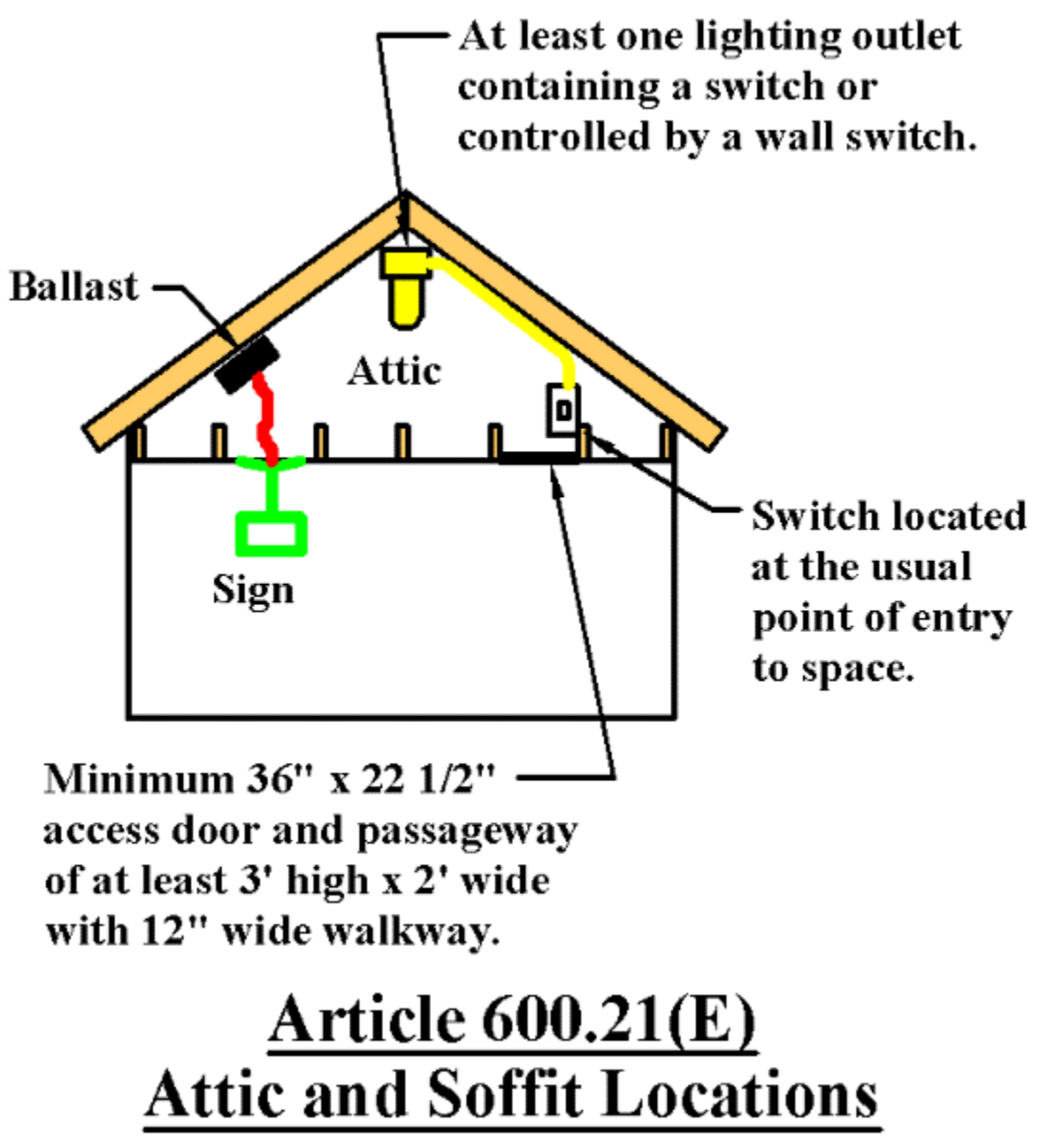
RULE #75

Attic and Soffit Lighting

Article 600.21(E) Attic and Soffit Locations

Similar to Article 210.70(C) which requires a lighting outlet and switch or light controlled by a switch in an attic area containing HVAC equipment which needs to be serviced, Article 621.E is new and requires the same in an attic or soffit where ballasts, transformers and electronic power supplies for signs are located.

Article 600.21(E) Figure



RULE #76

Furniture Branch Circuit Wiring

ARTICLE 605 Office Furnishings (Consisting of Lighting Accessories and Wired Partitions)

605.7 Freestanding-Type Partitions. Partitions of the freestanding type (not fixed) shall be permitted to be connected to the building electrical system by one of the wiring methods of Chapter 3. Multiwire branch circuits supplying power to permanently connected freestanding partitions shall be provided with a means to disconnect simultaneously all ungrounded conductors at the panelboard where the branch circuit originates.

RULE #77

Elevator Cab Lighting

620.22 Branch Circuits for Car Lighting, Receptacle(s), Ventilation, Heating, and Air Conditioning.

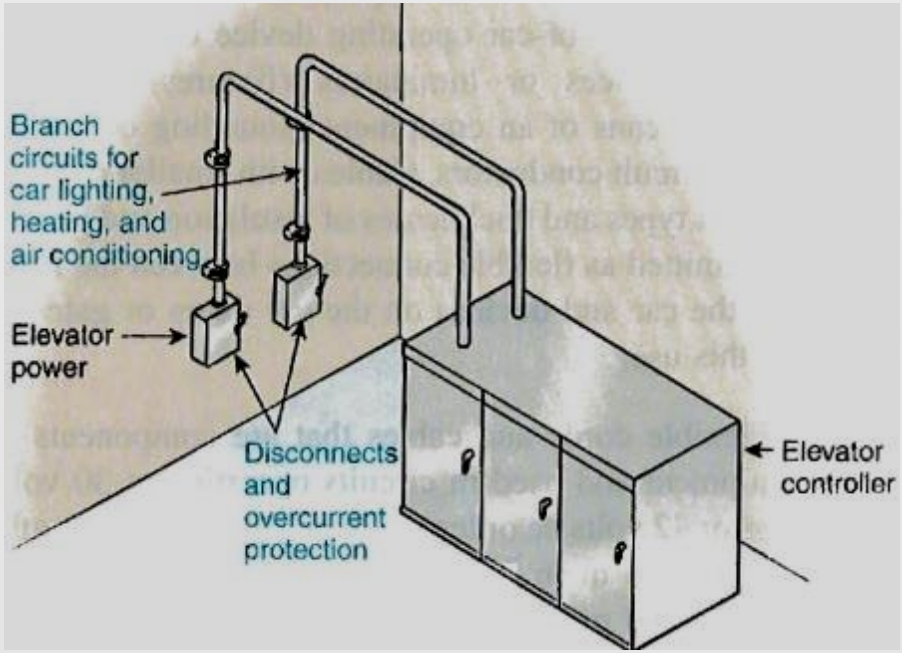
(A) Car Light Source. A separate branch circuit shall supply the car lights, receptacle(s), auxiliary lighting power source, and ventilation on each elevator car. The overcurrent device protecting the branch circuit shall be located in the elevator machine room or control room/machinery space or control space.

Required lighting shall not be connected to the load side of a ground-fault circuit interrupter.

RULE #78

Elevator Ventilation Circuits

620.22 Branch Circuits for Car Lighting, Receptacle(s), Ventilation, Heating, and Air Conditioning.



(B) Air-Conditioning and Heating Source. A dedicated branch circuit shall supply the air-conditioning and heating units on each elevator car. The overcurrent device protecting the branch circuit shall be located in the elevator machine room or control room/machinery space or control space.

620.53 Car Light, Receptacle(s), and Ventilation Disconnecting Means.

Elevators shall have a single means for disconnecting all ungrounded car light, receptacle(s), and ventilation power-supply conductors for that elevator car.

The disconnecting means shall be an enclosed externally operable fused motor circuit switch or circuit breaker capable of being locked in the open position and shall be located in the machine room or control room for that elevator car. Where there is no machine room or control room, the disconnecting means shall be located in the same space as the disconnecting means required by 620.51.

RULE #79

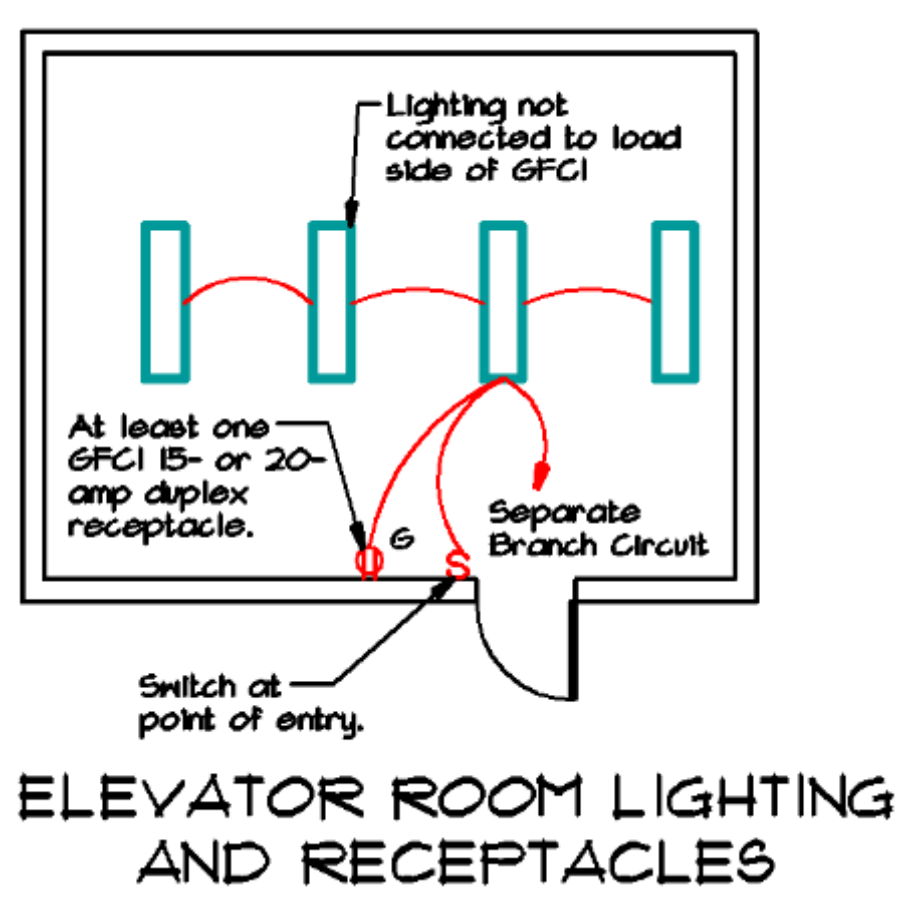
Elevator Room Lighting and Power Requirements

620.23 Branch Circuits for Machine Room or Control Room/Machinery Space or Control Space Lighting and Receptacle(s).

(A) Separate Branch Circuit. A separate branch circuit shall supply the machine room or control room/machinery space or control space lighting and receptacle(s). Required lighting shall not be connected to the load side of a ground-fault circuit interrupter.

(B) Lighting Switch. The machine room or control room/machinery space or control space lighting switch shall be located at the point of entry.

620.23 Branch Circuits for Machine Room or Control Room/Machinery Space or Control Space Lighting and Receptacle(s).



(C) Duplex Receptacle. At least one 125-volt, single-phase, duplex receptacle shall be provided in each machine room or control room and machinery space or control space.

(GFCI Req'd Per 620.85)

RULE #80

Completely new Electrified Truck Parking Space Article

Article 626 Electrified Truck Parking spaces

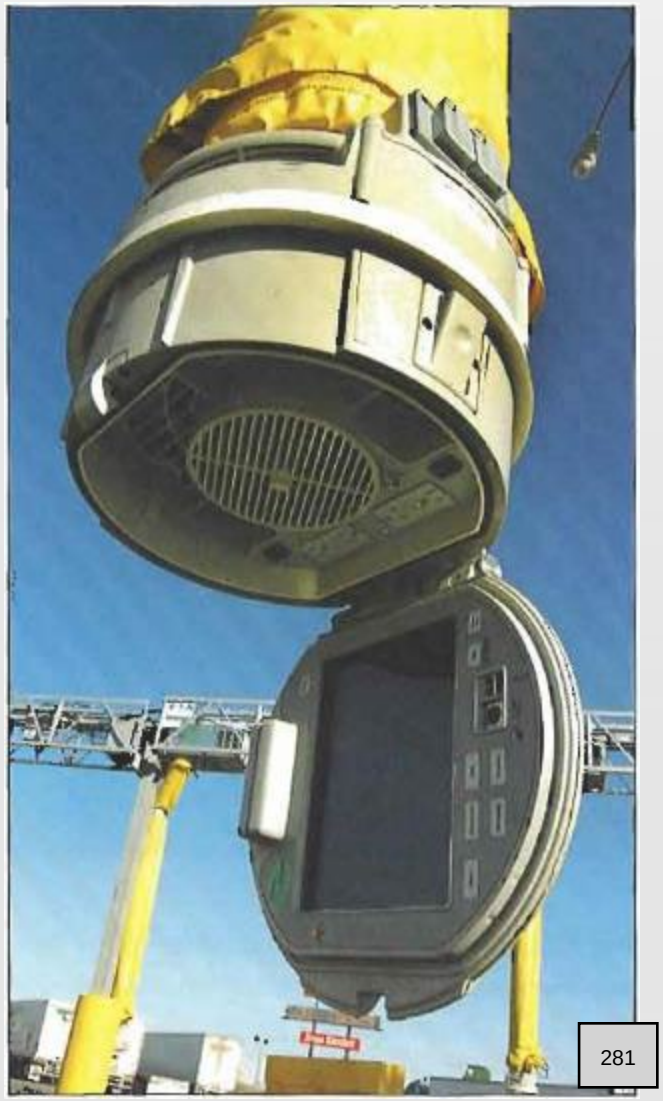
Photo 3. Example of Shorepower equipment

With the attention of regulatory agencies environmental groups focusing on reducing truck idling, article 626 was developed to cover Electrified Truck Parking Spaces.

Wiring methods, demand factors based on climatic temperature zone, and power supply cord and strain relief guidelines are included in this article.

Article 626 Electrified Truck Parking Figure

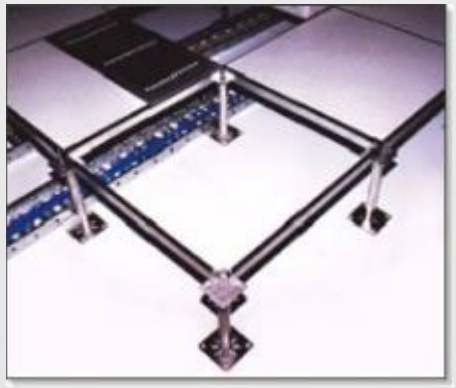
Figure 16. Electrified Truck Parking Space Equipment Photo courtesy of Georgia Power



RULE #81

Information Technology Room
Supply cable Ampacity

ARTICLE 645
Information Technology Equipment



645.5 Supply Circuits and Interconnecting Cables.

(A) Branch-Circuit Conductors. The branch-circuit conductors supplying one or more units of a data processing system shall have an ampacity not less than 125 percent of the total connected load.

ARTICLE 645
Information Technology Equipment

645.5 Supply Circuits and Interconnecting Cables.

(B) Cord-and-Plug Connections. The data processing system shall be permitted to be connected to a branch circuit by any of the following listed means:

(1) Flexible cord and attachment plug cap not to exceed 4.5 m (15 ft).

(2) Cord set assembly. Where run on the surface of the floor, they shall be protected against physical damage.

RULE #82

Information Technology Room
Supply cable Securing

ARTICLE 645
Information Technology Equipment

645.5 (E) Securing in Place. Power cables; communications cables; connecting cables; interconnecting cables; and associated boxes, connectors, plugs, and receptacles that are listed as part of, or for, information technology equipment shall not be required to be secured in place.

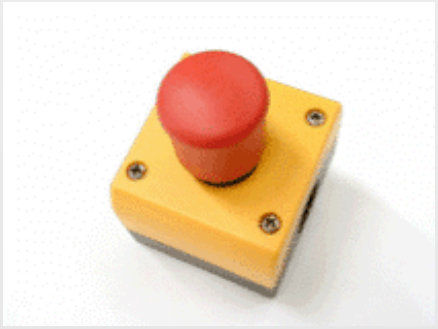
RULE #83

Information Technology Room
Disconnecting means

ARTICLE 645
Information Technology Equipment

645.10 Disconnecting Means. A means shall be provided to disconnect power to all electronic equipment in the information technology equipment room. There shall also be a similar means to disconnect the power to all dedicated HVAC systems serving the room and cause all required fire/smoke dampers to close.

ARTICLE 645
Information Technology Equipment



645.10 Disconnecting Means (Con't). The control for these disconnecting means shall be grouped and identified and shall be readily accessible at the principal exit doors. A single means to control both the electronic equipment and HVAC systems shall be permitted. Where a pushbutton is used as a means to disconnect power, pushing the button in shall disconnect the power.

Exception: Installations qualifying under the provisions of Article 685 (Integrated Electrical System – Industrial).

RULE #84

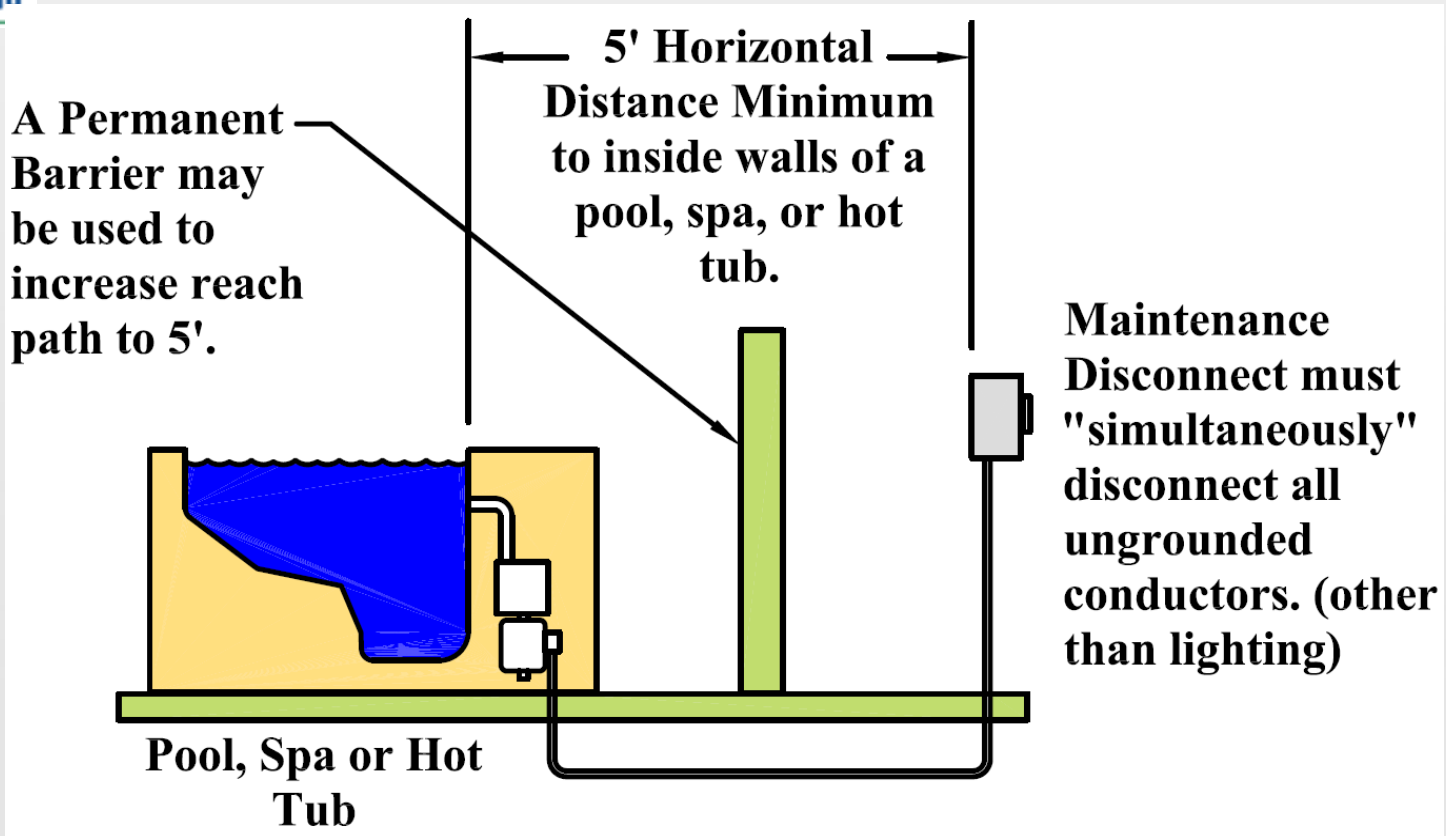
Pool Maintenance Disconnecting means

Article 680.12 Maintenance Disconnecting Means

Article 680.12 requires a maintenance disconnect to be installed to simultaneously disconnect power to all utilization equipment at a Swimming Pool, Fountain and Similar Installation. This disconnect does not need to disconnect the lighting.

This disconnect must be located at least 5' horizontally from the ***inside*** walls of the pool, spa or hot tub unless separated from open water by a permanently installed barrier that would require a reach of 5' or more.

Article 680.12 Maintenance Disconnecting Means Figure



Article 680.12
Maintenance Disconnecting Means

RULE #85

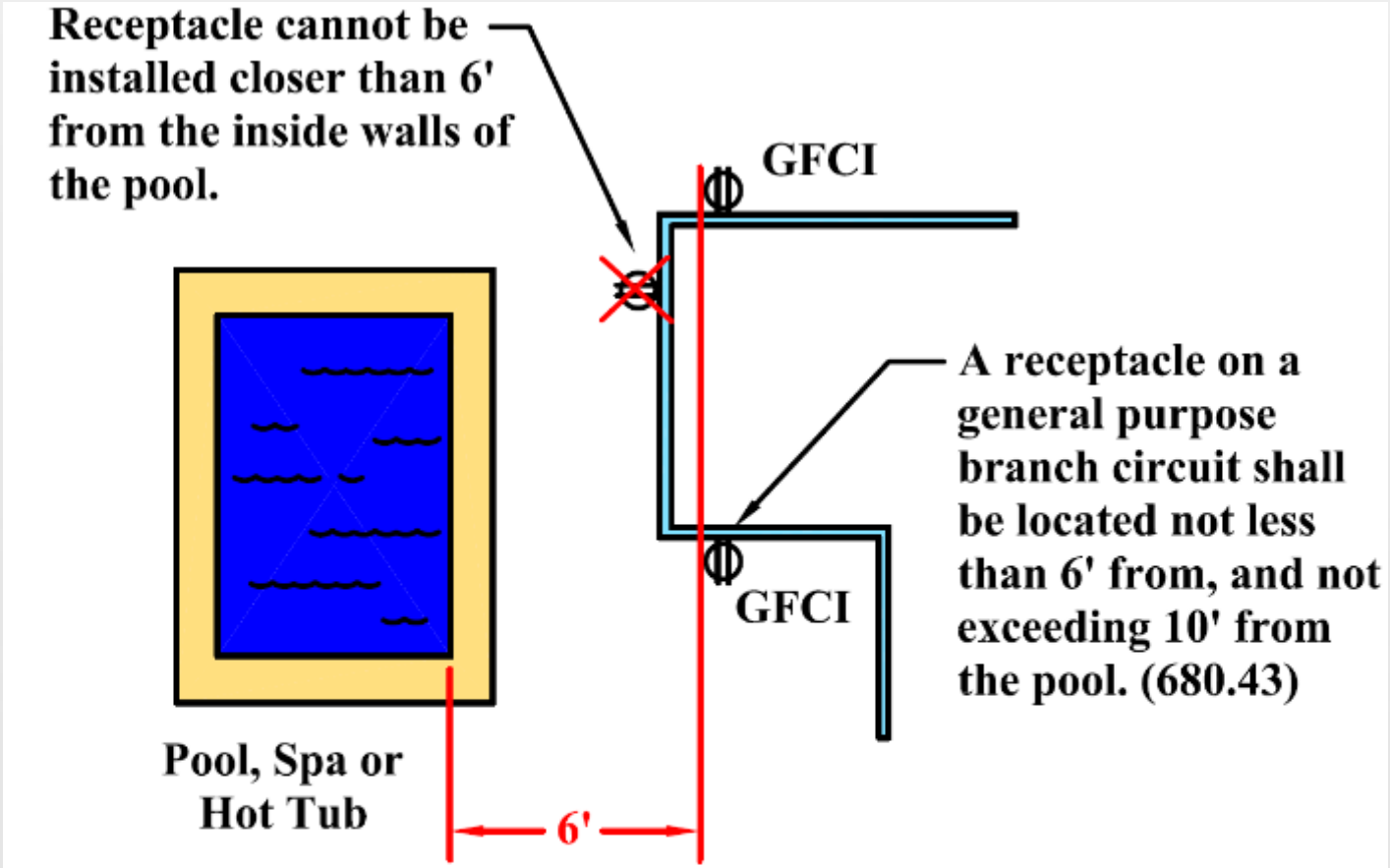
Pool Area Lighting and Receptacles

Article 680.22 Pool Area Lighting, Receptacles and Equipment

The inconsistent measurement of distances required for receptacles away from pools, spas and hot tubs in Articles 680.22, 680.34 and 680.42 was consistently changed to 6'.

This distance change is more consistent with other 6' away GFCI requirements in article 210.8 for sinks and similar.

Article 680.22 Pool Area Lighting, Receptacles and Equipment Figure



Article 680.22(A)
Receptacle Locations

RULE #86

Pool Grounding

Article 680.26(A) to (C) Equipotential Grounding

Article 680.26 has been reworded to clarify that conductive pool shells (concrete, concrete block and applied or sprayed concrete) are considered a conductive material due to water permeability and porosity and shall be grounded. Fiberglass and vinyl lined pools are not required to be grounded.

Bonding is accomplished through an 8 AWG solid copper - 12” x 12” grid structure (network of conductors) with a 4" tolerance which covers the contour of the pool and the pool decking extending 3’ horizontally from the inside walls of the pool.

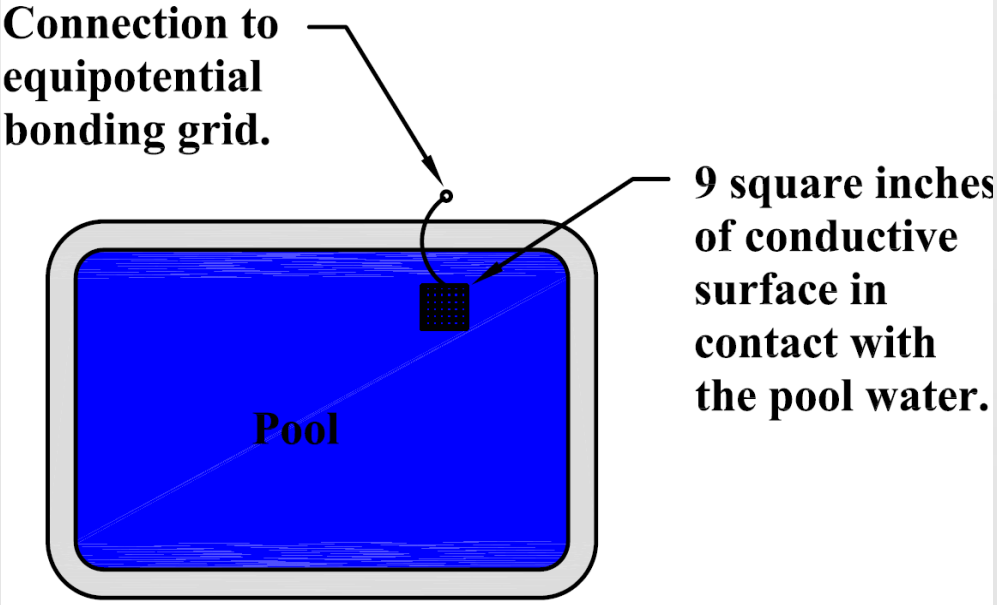
Article 680.26(A) to (C) Equipotential Grounding

In addition, equipotential bonding is done by bonding the perimeter surfaces of the pool with an 8 AWG solid copper conductor secured within or under the perimeter surface and installed within 18-24 inches from the inside walls of the pool.

Where installed beneath the final grade material, the bonding conductor shall be buried 6" - 8" below the subgrade.

Article 680.26(A) to (C) Equipotential Grounding

Finally, Article 680.26(C) requires an intentional bond with a minimum conductive surface area of 9 square inches shall be installed in contact with the pool water.



Article 680.26 (C)
Bonding of pool water

RULE #87

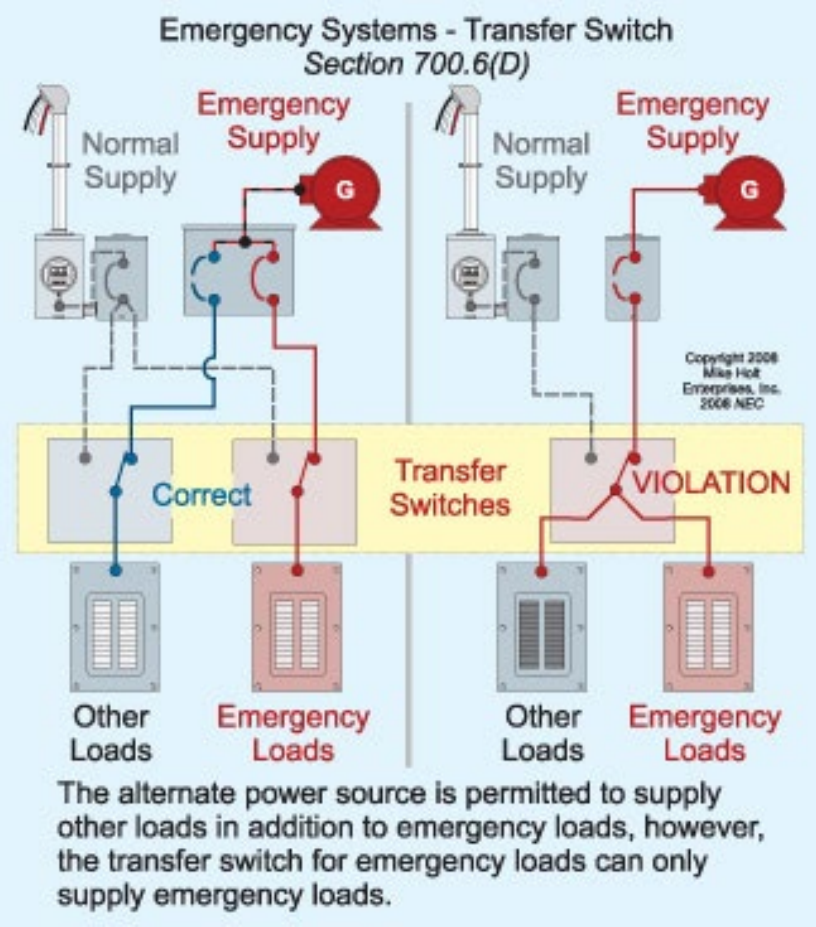
Emergency System Transfer switches

(Life Safety, Legally Required and Optional Standby)

Article 700.6 Transfer Equipment

(C) Automatic Transfer Switches. Automatic transfer switches shall be electrically operated and mechanically held. Automatic transfer switches, rated 600 VAC and below, shall be listed for emergency system use.

Article 700.6 Transfer Equipment



(D) Use. Transfer equipment shall supply only emergency loads.

One transfer switch per emergency system!

RULE #88

Emergency System Wiring

Article 700.9 Wiring, Emergency System

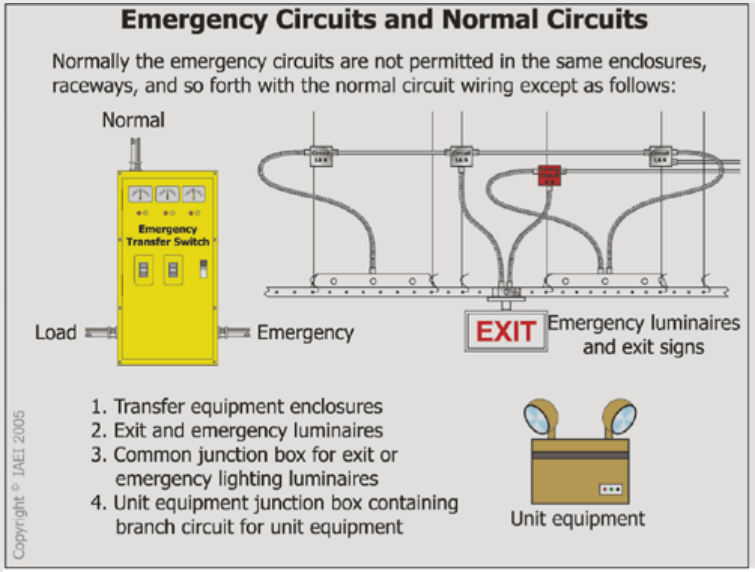


Figure 2. Locations where emergency circuits and normal circuits are permitted within the same enclosure

(B) Wiring. Wiring of two or more emergency circuits supplied from the same source shall be permitted in the same raceway, cable, box, or cabinet. Wiring from an emergency source or emergency source distribution overcurrent protection to emergency loads shall be kept entirely independent of all other wiring and equipment, unless otherwise permitted in (1) through (5):

(1) Wiring from the normal power source located in transfer equipment enclosures

(2) Wiring supplied from two sources in exit or emergency luminaires

Article 700.9 Wiring, Emergency System

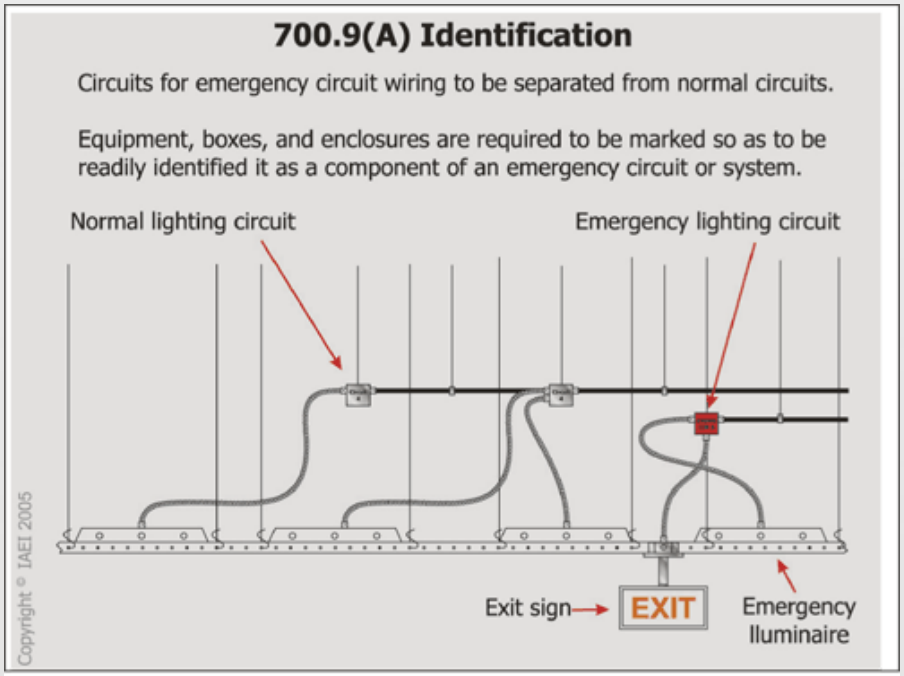


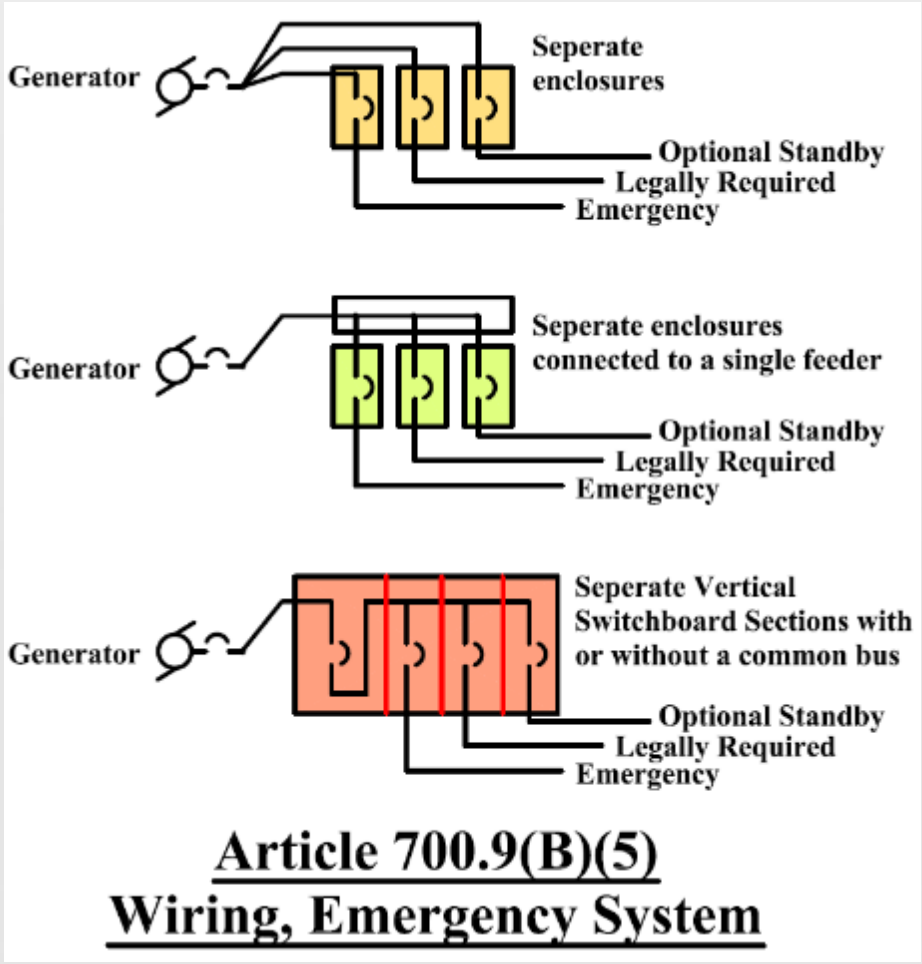
Figure 4. Equipment and enclosures are required to be readily identifiable as a component of an emergency system.

(3) Wiring from two sources in a common junction box, attached to exit or emergency luminaires

(4) Wiring within a common junction box attached to unit equipment, containing only the branch circuit supplying the unit equipment and the emergency circuit supplied by the unit equipment

(5) Wiring from an emergency source to supply any combination of emergency, legally required, or optional loads in accordance with (a), (b), and (c):

Article 700.9 Wiring, Emergency System



a. From separate vertical switchboard sections, with or without a common bus, or from individual disconnects mounted in separate enclosures.

b. The common bus or separate sections of the switchboard or the individual enclosures shall be permitted to be supplied by single or multiple feeders without overcurrent protection at the source.

c. Legally required and optional standby circuits shall not originate from the same vertical switchboard section, panelboard enclosure, or individual disconnect enclosu as emergency circuits.

RULE #88

Emergency Battery Light Wiring

Article 700.12 General Requirements

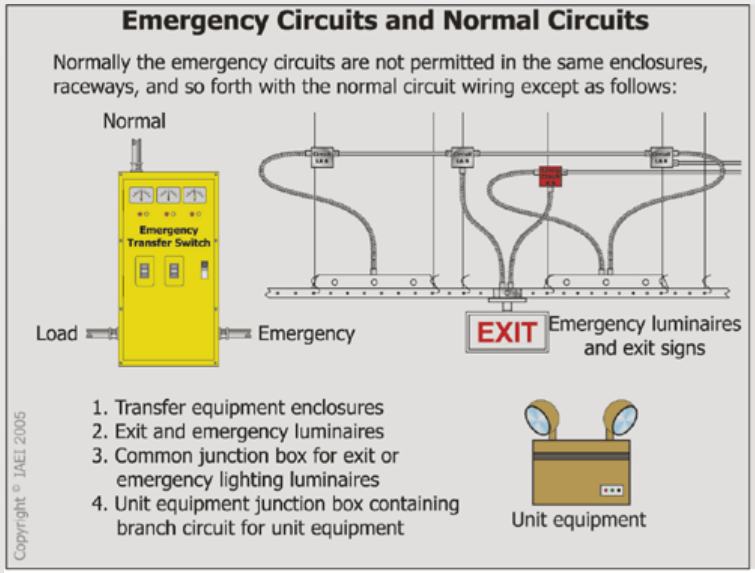


Figure 2. Locations where emergency circuits and normal circuits are permitted within the same enclosure

Emergency luminaires that obtain power from a unit equipment and are not part of the unit equipment shall be wired to the unit equipment as required by 700.9 and by one of the wiring methods of Chapter 3.

(Wired separately and ahead of local switching)

Article 700.12 General Requirements

Exception: In a separate and uninterrupted area supplied by a minimum of **three** normal lighting circuits, a separate branch circuit for unit equipment shall be permitted if it originates from the same panelboard as that of the normal lighting circuits and is provided with a lock-on feature.

RULE #89

Emergency Wiring

Article 700.15 Loads on Emergency Branch Circuits

No appliances and no lamps, other than those specified as required for emergency use, shall be supplied by emergency lighting circuits.

Emergency illumination shall include all required means of egress lighting, illuminated exit signs, and all other lights specified as necessary to provide required illumination.

RULE #90

Two Lamps

Article 700.16 Loads on Emergency Branch Circuits

Emergency lighting systems shall be designed and installed so that the failure of any individual lighting element, such as the burning out of a lamp, cannot leave in total darkness any space that requires emergency illumination.

Exterior door paths of egress are hit hard by this requirement!

RULE #91

Keeping the space illuminated

Article 700.16 Loads on Emergency Branch Circuits

Where high-intensity discharge lighting such as high- and low-pressure sodium, mercury vapor, and metal halide is used as the sole source of normal illumination, the emergency lighting system shall be required to operate until normal illumination has been restored.

Exception: Alternative means that ensure emergency lighting illumination level is maintained shall be permitted.

Time delay feature on emergency lights!

RULE #92

Wiring separation

Article 701.10 Wiring Legally Required Standby Systems.

The legally required standby system wiring shall be permitted to occupy the same raceways, cables, boxes, and cabinets with other general wiring.

Article 702.9 Wiring Optional Standby Systems.

The optional standby system wiring shall be permitted to occupy the same raceways, cables, boxes, and cabinets with other general wiring.

Life Safety emergency wiring is not, while Legally Required and Optional Standby Wiring is permitted to share raceways with normal power!

RULE #93

Be aware of the new COPS article

Article 708 Critical Operations Power Systems (COPS).

Figure 15. Critical Operations Power Systems

Scope. The provisions of this article apply to the installation, operation, monitoring, control, and maintenance of the portions of the premises wiring system intended to supply, distribute, and control electricity to designated critical operations areas (DCOA) in the event of disruption to elements of the normal system.

Article 708 Critical Operations Power Systems (COPS).

Scope. Critical operations power systems are those systems so classed by municipal, state, federal, or other codes by any governmental agency having jurisdiction or by facility engineering documentation establishing the necessity for such a system. These systems include but are not limited to power systems, HVAC, fire alarm, security, communications, and signaling for designated critical operations areas.

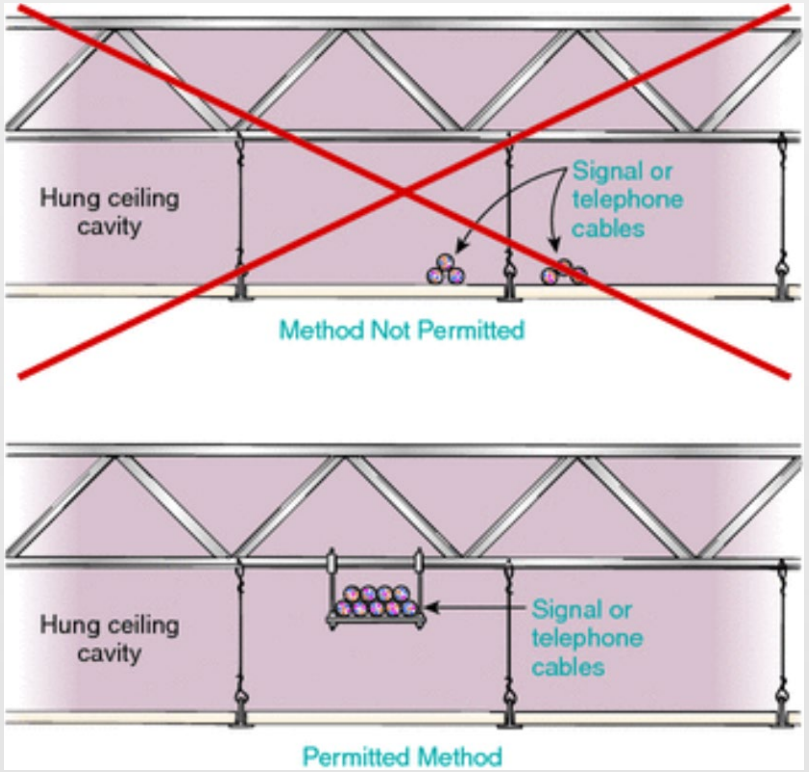
RULE #94

Cables laying on ceilings

Article 725.21 Access to Electrical Equipment Behind Panels Designed to Allow Access.

Access to electrical equipment shall not be denied by an accumulation of wires and cables that prevents removal of panels, including suspended ceiling panels.

Article 725.21 Access to Electrical Equipment Behind Panels



Incorrect installation of wires and cables (upper diagram), which can prevent access to equipment or cables. Correct method is shown in the lower diagram.

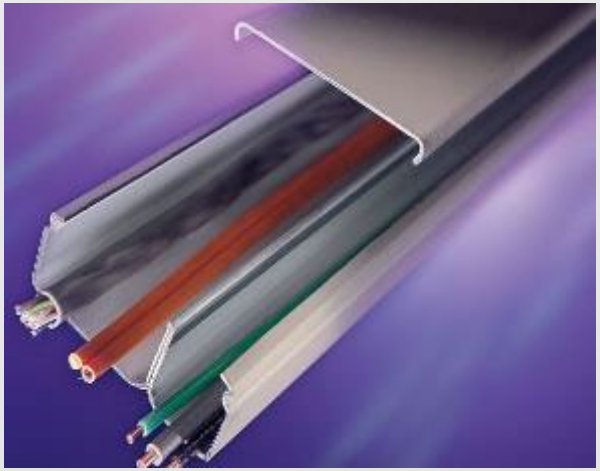
Article 725.24 Mechanical Execution of Work.

Class 1, Class 2, and Class 3 circuits shall be installed in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D).

RULE #95

Low voltage cable separation

Article 725.136 Separation from Electric Light, Power.



(A) General. Cables and conductors of Class 2 and Class 3 circuits shall not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm circuits, and medium-power network-powered broadband communications circuits unless permitted by 725.136(B) through (I).

(Barriers, separated within enclosures)

RULE #96

Fire Alarm Cable installation

Article 760.24 Mechanical Execution of Work.

Fire alarm circuits shall be installed in a neat workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D).

Article 760.25 Abandoned Cables.

The accessible portion of abandoned fire alarm cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

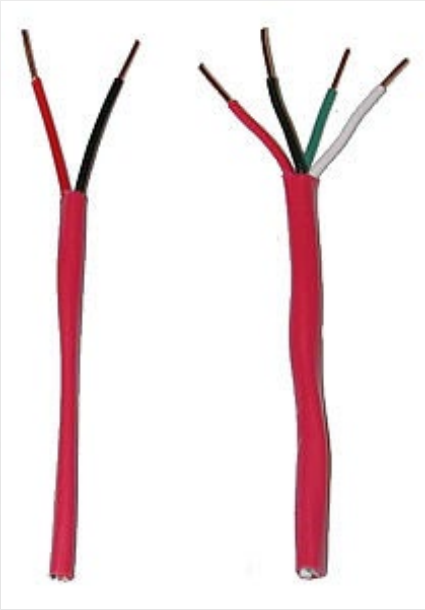
Article 760.30 Fire Alarm Circuit Identification.

Fire alarm circuits shall be identified at terminal and junction locations in a manner that helps to prevent unintentional signals on fire alarm system circuit(s) during testing and servicing of other systems.

RULE #97

Fire Alarm Cable Substitutions

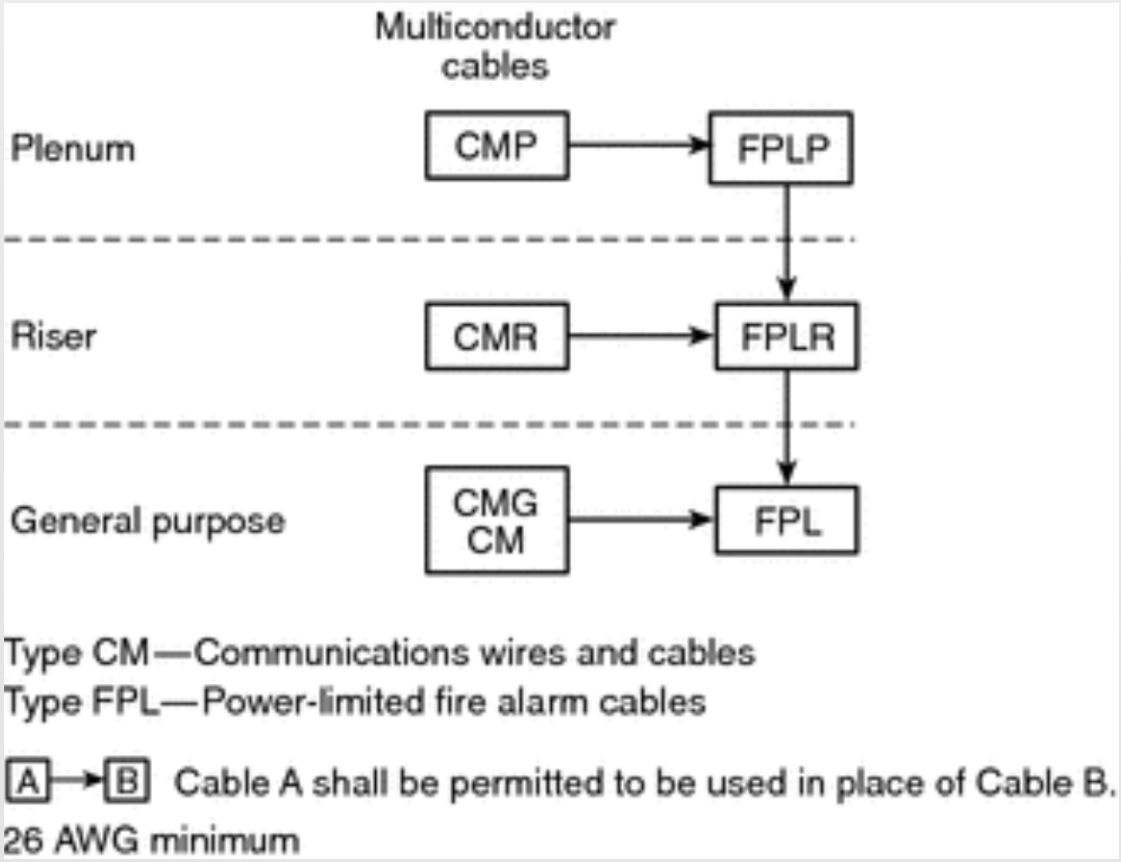
Article 760.154 Applications of Listed PLFA Cables.



(D) Fire Alarm Cable Substitutions. The substitutions for fire alarm cables listed in Table 760.154(D) and illustrated in Figure 760.154(D) shall be permitted. Where substitute cables are installed, the wiring requirements of Article 760, Parts I and III, shall apply.

FPN: For information on communications cables (CMP, CMR, CMG, CM), see 800.179.

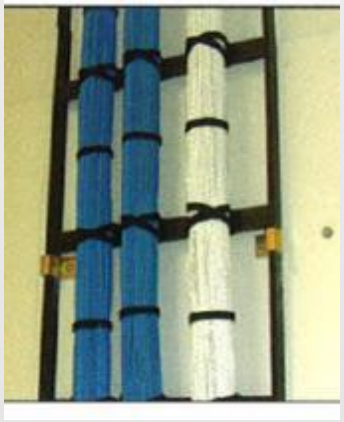
Figure 760.154(D) Cable Substitution Hierarchy.



RULE #98

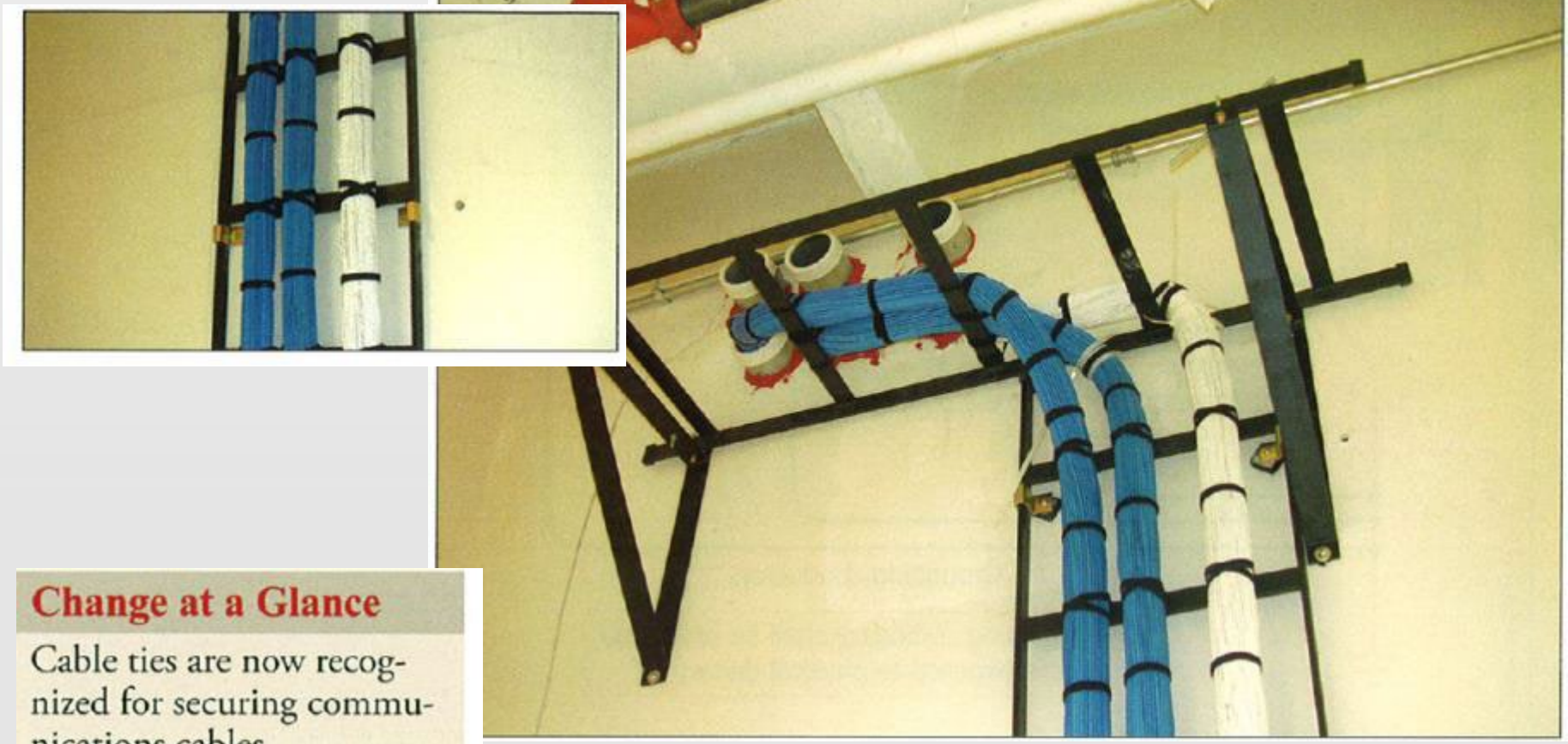
Communications Cable installations

Article 800.24 Mechanical Execution of Work.



Communications circuits and equipment shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables 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(D) and 300.11.

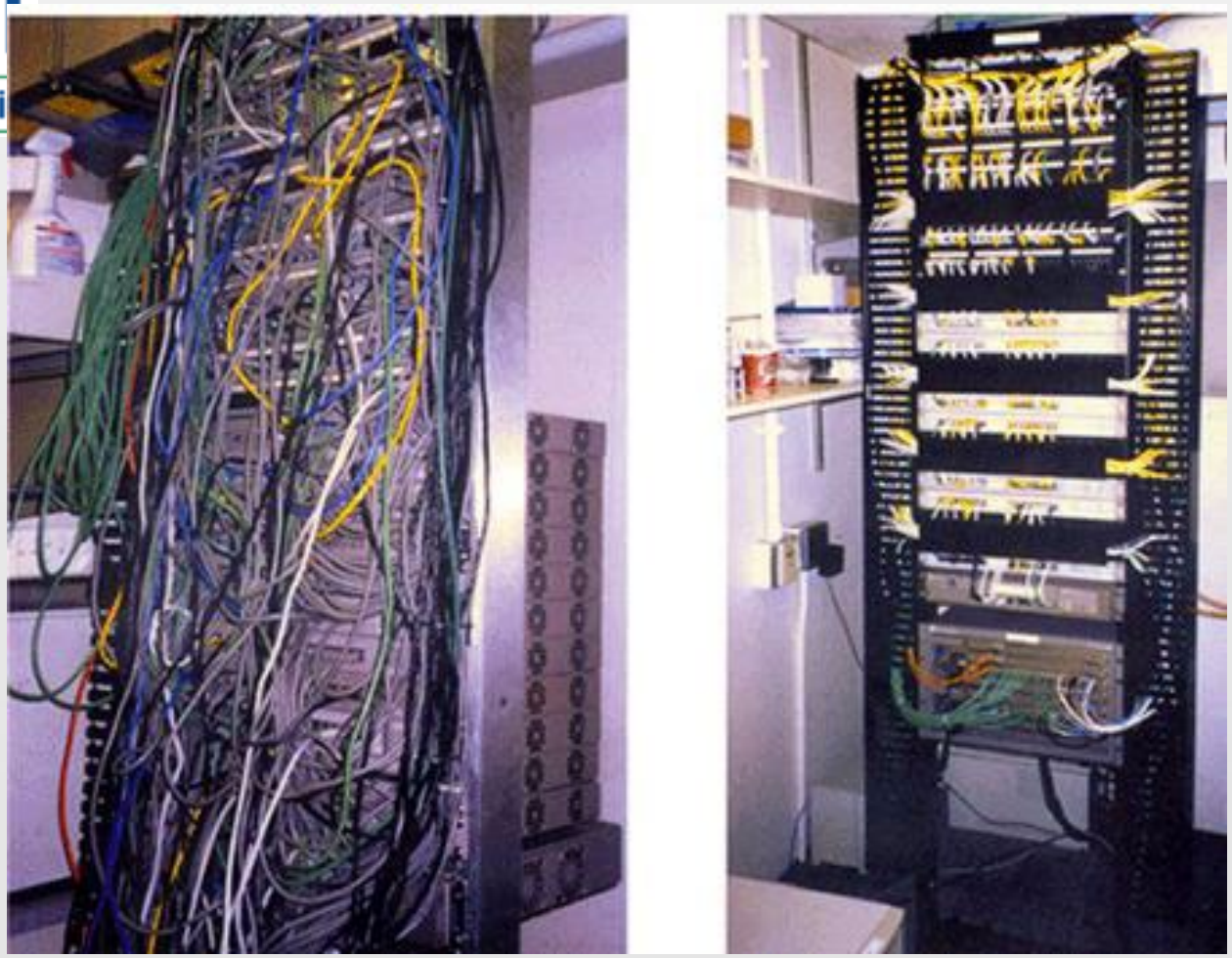
Figure 800.24 Mechanical Execution of Work



Change at a Glance

Cable ties are now recognized for securing communications cables.

Article 800.24 Mechanical Execution of Work.



Not installed in a neat and workmanlike manner.

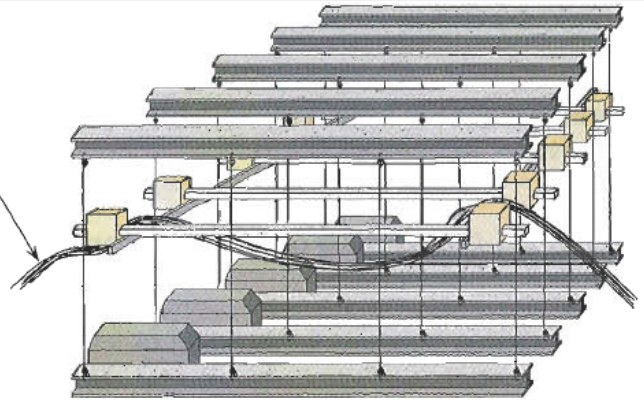
Article 800.25 Abandoned Cables.

The accessible portion of abandoned communications cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

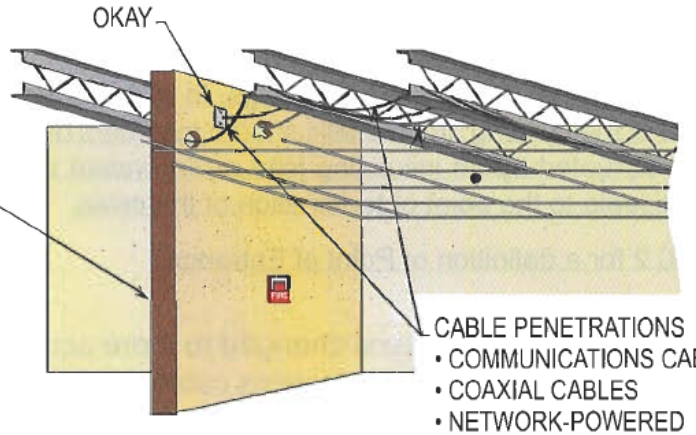
Wire installed in Conduits is considered Concealed and therefore not accessible!

Figure 800.25 Abandoned Cables

ABANDONED CABLES SHALL BE REMOVED
- COMMUNICATIONS CABLES
- COAXIAL CABLES
- NETWORK-POWERED BROADBAND CABLES
- **800.25**
- **820.25**
- **830.25**



FIREWALL PENETRATIONS
- OPENINGS SHALL BE FIRE STOPPED USING APPROVED METHODS TO MAINTAIN THE FIRE RESISTANCE RATING
- **800.26**
- **820.26**
- **830.26**



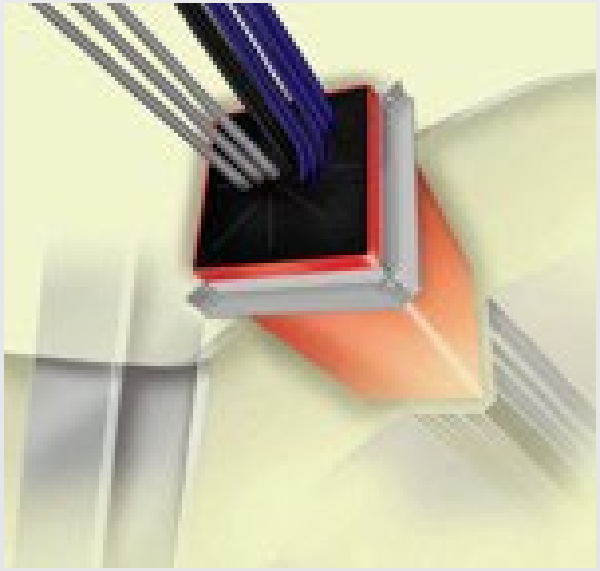
ABANDONED CABLES AND SPREAD OF FIRE OR PRODUCTS OF COMBUSTION
800.25
800.26

Purpose of Change: A new section has been added to address the requirements for the prevention of the spread of fire and one has been added dealing with abandoned cables.

RULE #98

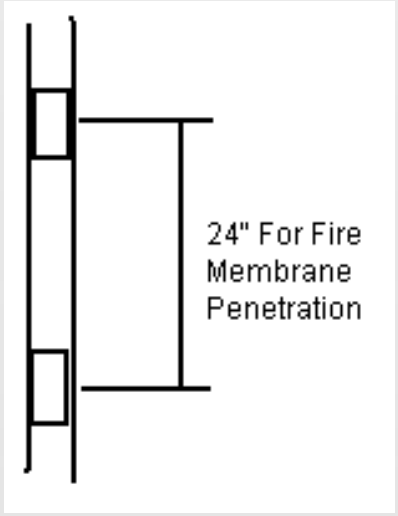
Communications Cable Fire Stopping

Article 800.26 Spread of Fire or Products of Combustion.



Installations of communications cables and communications raceways in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be made so that the possible spread of fire or products of combustion will not be substantially increased. Openings around penetrations of communications cables and communications raceways through fire-resistant-rated walls, partitions, floors, or ceilings shall be firestopped using approved methods to maintain the fire resistance rating.

Article 800.26 Spread of Fire or Products of Combustion.

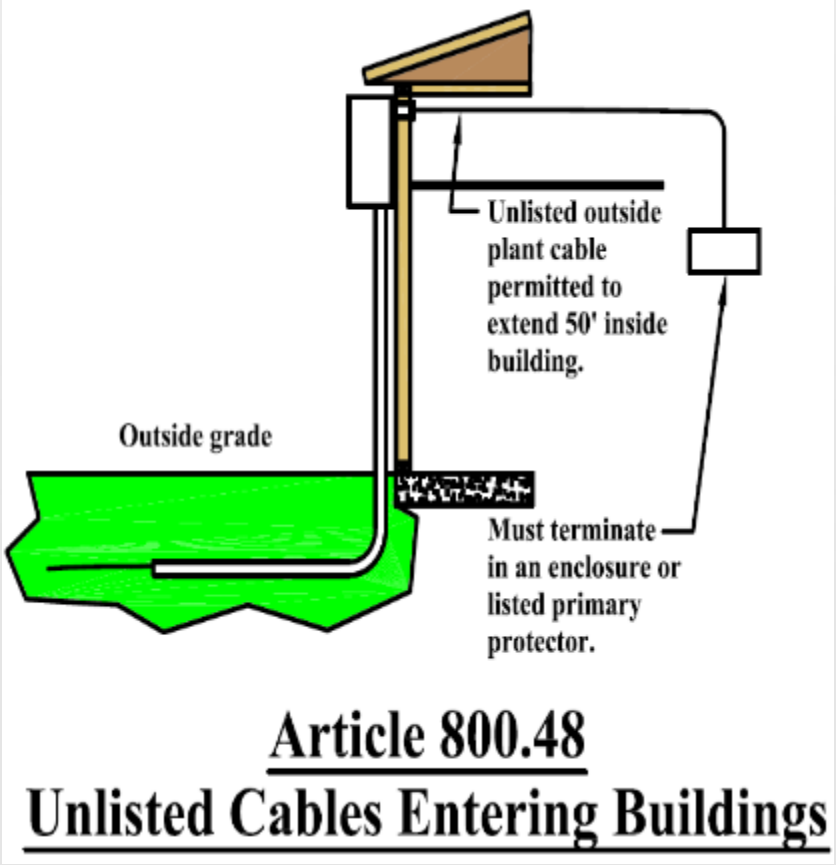


FPN: Directories of electrical construction materials published by qualified testing laboratories contain many listing installation restrictions necessary to maintain the fire-resistive rating of assemblies where penetrations or openings are made. Building codes also contain restrictions on membrane penetrations on opposite sides of a fire resistance–rated wall assembly. **An example is the 600 mm (24 in.) minimum horizontal separation that usually applies between boxes installed on opposite sides of the wall.** Assistance in complying with 800.26 can be found in building codes, fire resistance directories, and product listings.

RULE #99

Unlisted outside plant cables entering buildings

Article 800.48 Unlisted Cables Entering Buildings.



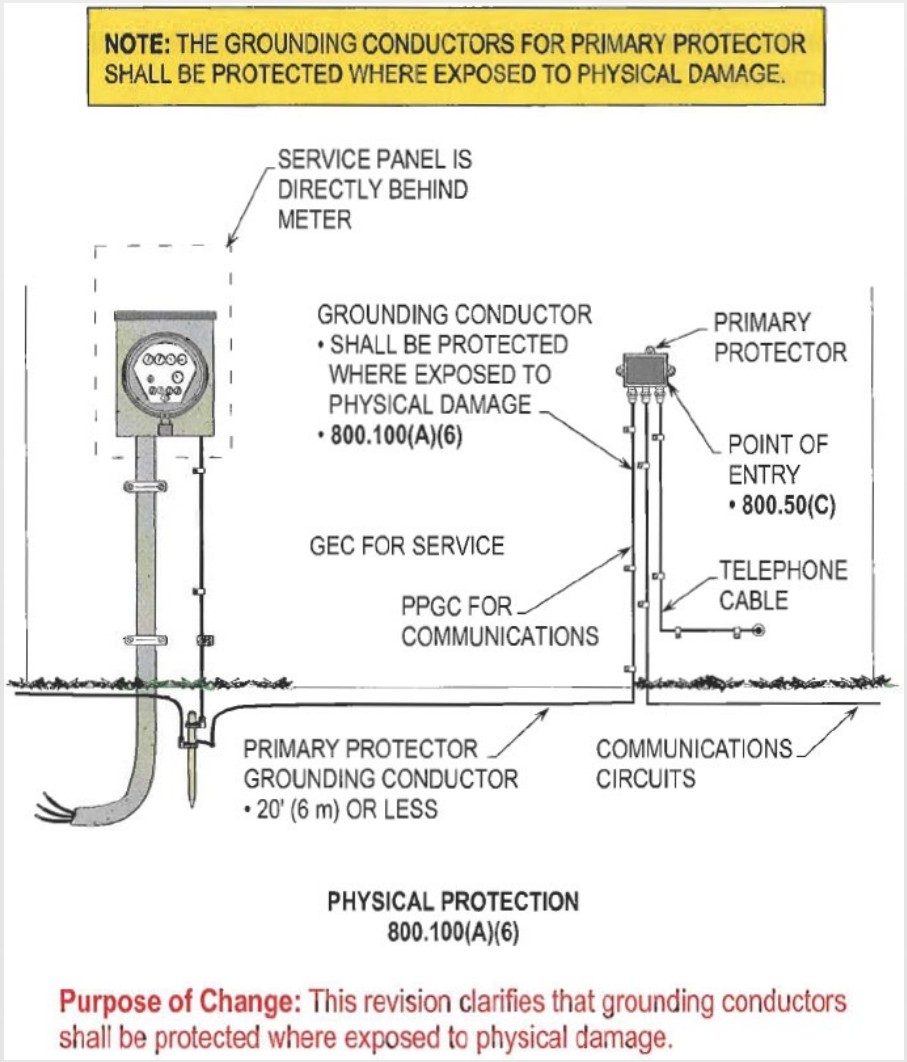
Unlisted outside plant communications cables shall be permitted to be installed in locations as described in 800.154(C) where the length of the cable within the building, measured from its point of entrance, **does not exceed 15 m (50 ft)** and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector.

FPN No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Article 800.53 Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between communications wires and cables on buildings and lightning conductors.

Article 800.100 Cable and Primary Protector Grounding.

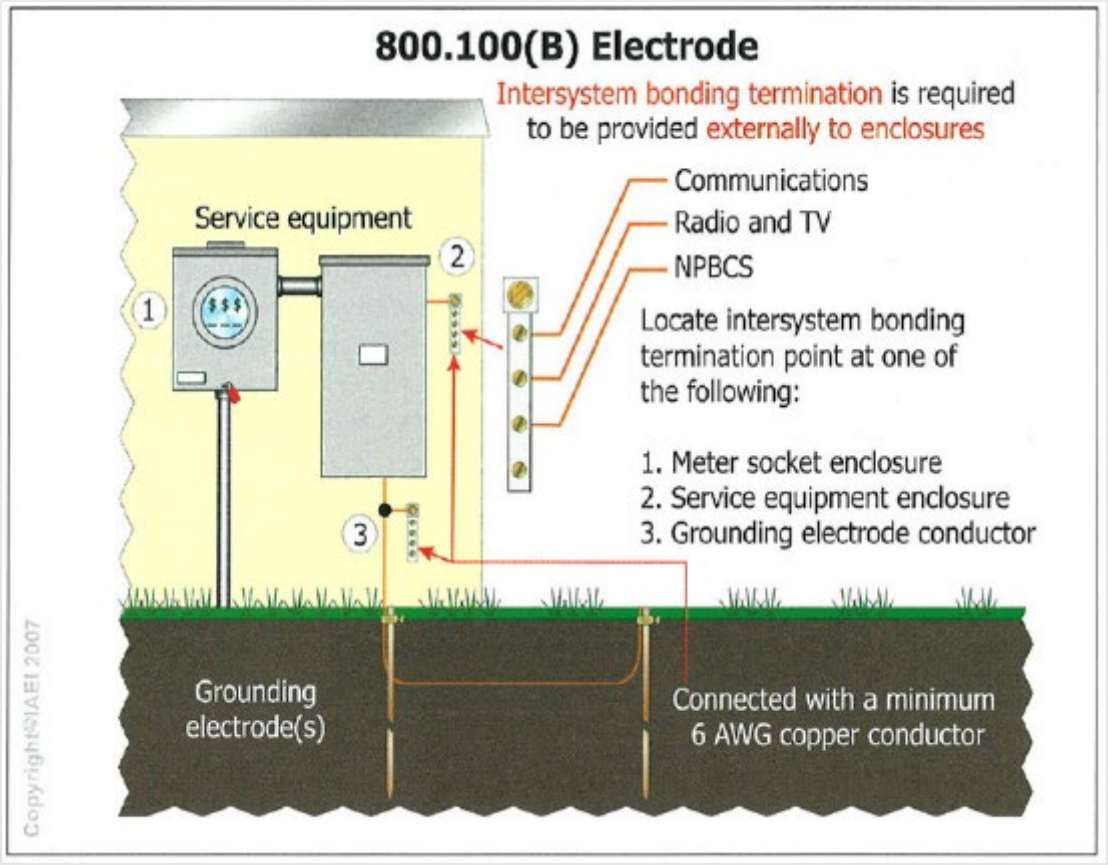


(6) Physical Protection. The grounding conductor shall be protected where exposed to physical damage. Where the grounding conductor is run in a metal raceway, both ends of the raceway shall be bonded to the grounding conductor or the same terminal or electrode to which the grounding

RULE #100

Grounding of Communications Services

Article 800.100 Cable and Primary Protector Grounding.



(B) Electrode.

(1) In Buildings or Structures with an Intersystem Bonding Termination. If the building or structure served has an intersystem bonding termination, the grounding conductor shall be connected to the intersystem bonding termination.

Article 800.100 Cable and Primary Protector Grounding.

(2) In Buildings or Structures with Grounding Means. If the building or structure served has no intersystem bonding termination, the grounding conductor shall be connected to the nearest accessible location on the following:

Article 800.100 Cable and Primary Protector Grounding.

(1) The building or structure grounding electrode system as covered in 250.50

(2) The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52

Article 800.100 Cable and Primary Protector Grounding.

(3) The power service accessible means external to enclosures as covered in 250.94

(4) The metallic power service raceway

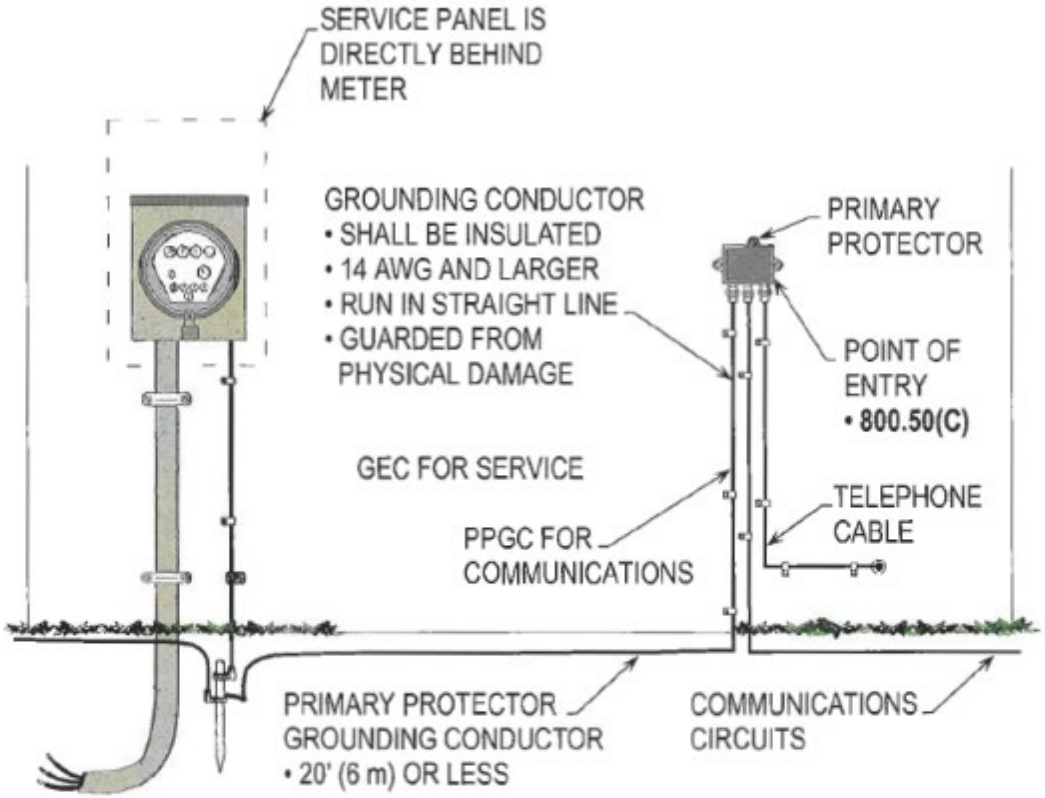
Article 800.100 Cable and Primary Protector Grounding.

(5) The service equipment enclosure

(6) The grounding electrode conductor or the grounding electrode conductor metal enclosure

(7) The grounding conductor or the grounding electrode of a building or structure disconnecting means that is grounded to an electrode as covered in 250.32

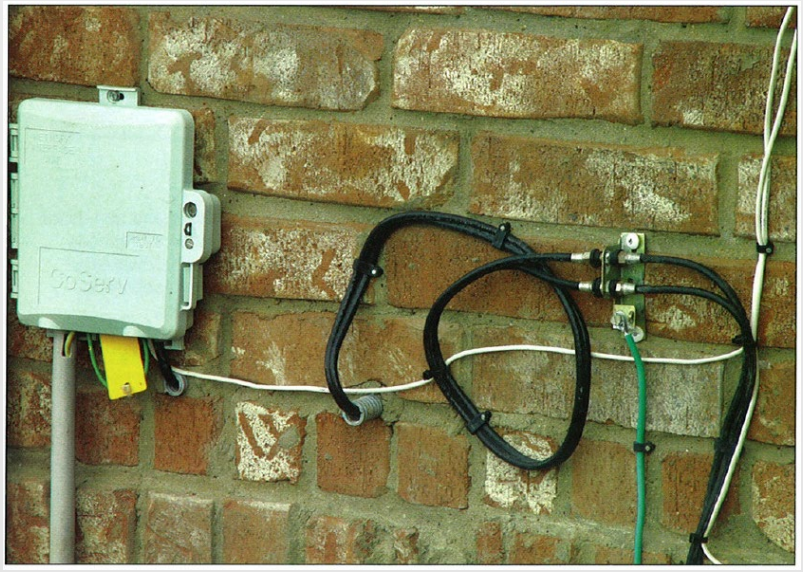
Figure 800.100 Cable and Primary Protector Grounding



GROUNDING OR INTERRUPTION OF METALLIC SHEATH MEMBERS OF COMMUNICATIONS CABLES 800.93(A) AND (B)

Purpose of Change: This revision clarifies the requirements for grounding or interruption of metallic sheath members of communications cables entering buildings or terminating on the outside of the building.

Article 800.100 Cable and Primary Protector Grounding.

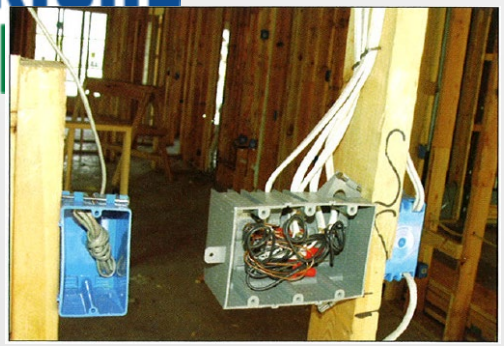


(D) Bonding of Electrodes. A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the communications grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

RULE #101

Communications outlet required

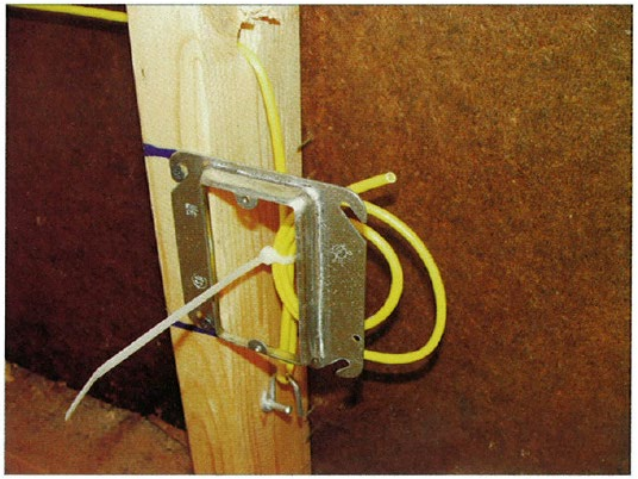
Article 800.156 Dwelling Unit Communications Outlet.



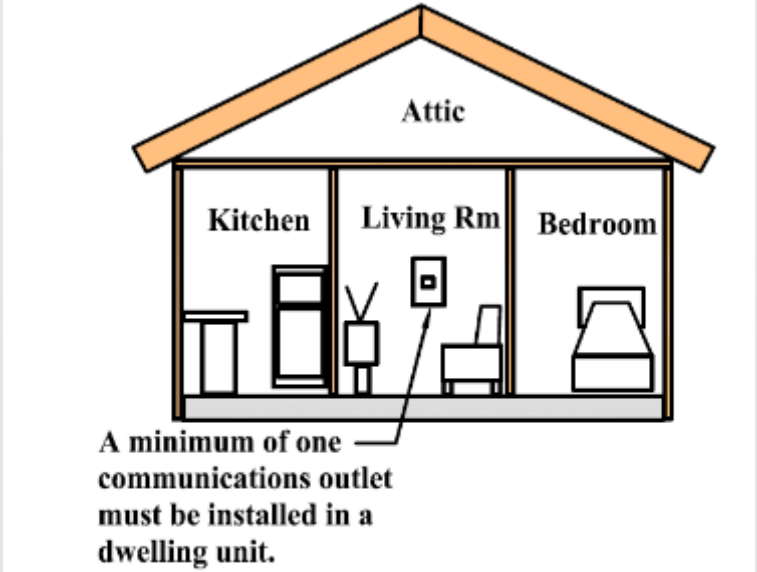
For new construction, a minimum of one communications outlet shall be installed within the dwelling and cabled to the service provider demarcation point.

800.156 Dwelling Unit Communications Outlet

At least one communications outlet shall be provided in all new dwelling unit construction.



The wiring for this communication outlet shall be routed to the service provider demarcation point of the dwelling unit.



Article 800.156

Dwelling unit Communications Out

File Attachments for Item:

ER-2 ERCES Bi-Directional Amplifier Systems (Radio Solutions)

BO, MPE, BPE, BI, FPI, RPE (1.5 hours)

Staff Notes: Recommend approval, include FPPE, RBO, RBI

Committee Recommendation:

DEREK A. CASE

derekacase@gmail.com | www.linkedin.com/in/derekacase | 143 Rocky Brook Road, New Canaan, CT 06840 | 203-434-5924

Global Director of Marketing & Business Development

Managing profitable growth through new product innovation, operational excellence & customer acquisition

KEY DIFFERENTIATORS:

- **Drove Breakthrough Initiatives** through Project Jump Start & Innovation Pipeline Projects, Fast-Track New Business Opportunities, developing disruptive solutions, business models & channels for our global customers.
- **Prioritized Strategic Adjacencies for business expansion,** including launching a new product line that will generate $20M Revenue & $5M Op. Income in 2020 in a market where Honeywell's competitors do not participate.
- **Identified companies for potential acquisition & led the M&A pursuit teams,** developing the long-term product roadmap, solution positioning, Channel differentiation plans, and modeling potential valuation scenarios.
- **Improved Value Price Realization by $18M in 2 years,** revising Executive Approval Levels, controlling Large Project Discounts, revising Rebate policies & reflecting segment-specific Value Pricing vs. next best alternatives.

Masters in Marketing | MBA in Finance & Marketing | Conversational German & Italian, beginner Japanese

PROFESSIONAL EXPERIENCE HIGHLIGHTS

RADIO SOLUTIONS, INC. (RSI) Dec 2019 - Present

Global Director of Marketing & Business Development, ERCES (Dec 2019 – Present)

Manage all Marketing & Sales activities for RSI's Emergency Responder Communications Enhancement Systems business. Responsibilities included Offering Management, Pricing, Customer Marketing, Channel Marketing, Technical Writing, Regulatory/Industry Affairs, Business Development, and Government Relations activities.

HONEYWELL FIRE SYSTEMS Aug 2015 – Dec 2019

Global General Manager, BDA Systems

Manage commercialization, GTM, and scaleup of next-generation fire safety systems business from the ground up to $7M. Lead matrix team across Offering Management, Customer Marketing, Technical Writing, Regulatory/Industry Affairs, Business Development, and Government Relations.

Product Launch: Set foundation for $20M revenue and $5M opportunity income in 2020, launching new product line in 9 months**,** negotiating contracts with 3rd-party solution providers, and collaborating on 5-year product roadmap creation.

- Increased profitability and sped market adoption by creating and refining value pricing levels and implementing value-selling training, and setting go-to-market strategy that added new channels of distribution.
- Realized $6M in 2019 by gaining industry-first safety accreditation, identifying customer need, working with regulators throughout product development and testing, and cultivating industry-wide adoption of accreditation.

International Expansion: Developed $120M pipeline and expanded to Canada, Europe, Middle East, and Oceania. Led pursuit teams for 3 M&A programs, prioritizing adjacent markets and creating business case for acquisition.

- Improved sales to 8X AOP revenue, tracking weekly revenue, margin, and operating income growth and adapting promotions and sales priorities. Coordinated trade shows/partner events and remote technology tour presentations.
- Drove fire code/standards development and enforcement to improve safety and grow sales, working with industry affairs, government relations, external lobbyists, AT&T FirstNet, and trade associations.

Global Director of Strategic Marketing & Business Development May 2015 – April 2019

Led team of 40 to translate strategy across strategic marketing, business development, strategic pricing, competitive/market intelligence, and industry affairs. Taught strategic marketing for high-potential leaders in leadership development program.

Business Strategy: Optimized global strategy of $4.3B global Life Safety & Security Solutions division, identifying high-opportunity verticals, adjacencies, and segments and bolstering plans for entrée and success.

- Developed partnerships with 3rd-party suppliers to fill solutions portfolio gaps with profitable niche solutions and designed ecosystem strategy with global marketing teams.

Profitability: Improved price realization $18M through structured pricing model and segment-based customer value analysis to target price increases, improving transactional and pass-through pricing.

- Optimized $70M OEM solutions business from 36 suppliers across Access Control, Video, Intrusion, and Fire portfolio.

NES WORLDWIDE 2009 – 2014

Director of Marketing & Business Development | Partner

Brought in to grow revenue, positioning $20M equipment manufacturer to gain competitive edge in mature market. Drove product development and portfolio management with R&D and technical groups. Optimized OEM relations, branding, marketing, sales, collateral, website, and media strategy. Held P&L & budget accountability. Co-managed 22 staff.

Business Growth: Turned around 3-year declining U.S. and European revenue to deliver business growth, winning long-term annual supply contracts with 3 major OEMs/dealers to ultimately position company for sale. Developed long-term diversification plan, identifying market opportunities and developing fully integrated marketing campaigns.

Product Development: Drove engineering to price point, conducting market and VOC research and leading launch execution including media communications, trade shows, artwork, content development, and collateral design.

IDEATION TO CREATION, Norwalk, CT 2008 – 2009

Founder & Principal

Consulted with clients in NA, Europe, and Asia on product line/market segment strategy, KPI tracking, website design, SEO, social media marketing, content marketing, direct marketing, CRM, lead generation, solution selling, and market launch.

New Media Marketing: Implemented B2B and B2C social media marketing programs, managing brand and engaging customers through Facebook, LinkedIn, YouTube, blogs, and e-newsletters.

- Secured 2nd round of venture capital funding for Israeli tech startup, developing global business Plan for launch.
- Won 2 profitable OEM contracts for NES Worldwide, prompting a partnership offer from the principals.

KODAK POLYCHROME GRAPHICS, Norwalk, CT 1998 – 2008

Worldwide Flexo Solutions Director & Packaging Segment Director (2002–2008)
European Packaging Segment Business Development Manager, Eschborn, Germany (2004–2005)

Advanced steadily within $6B joint venture to transform business from product-focus to full-solution approach, directing marketing strategy, value-based solution mapping, and sales analysis/plans for 5 global sales regions. Managed 8 staff.

Global Product Launch: Outpaced competitors by preparing sales leaders in America and creating plans for 4 global managers, partnering with OEM competitors and initiating organic R&D programs and strategic acquisitions.

Global Sales Leadership: Stepped in to gain traction in global market segment, leading product management, manufacturing, and European business development from regional headquarters in Germany.

Worldwide Product Manager, Chemistry & Equipment (1998–2001)

Promoted to lead total lifecycle management for 6 disparate portfolios with 185 products, reigning in suppliers worldwide.

Product Development: Increased profitability of $75M business 10% in 2 years through manufacturing consolidation, portfolio reduction, and regional pricing alignment. Standardized suppliers, training, inventory, and logistics.

EDUCATION

Data-Driven Marketing Certificate – Cornell University, Johnson Graduate School of Management (April 2016)
Marketing Strategy Certificate – Cornell University, Johnson Graduate School of Management (April 2014)
MBA, Finance & Marketing – Rochester Institute of Technology, Saunders College of Business
BA, Liberal Arts Concentration – Le Moyne College

CRITERIA FOR SUBMITTING CONTINUING EDUCATION COURSES FOR BOARD OF BUILDING STANDARDS CERTIFICATIONS

The Ohio Board of Building Standards approves Continuing Education Courses for building department personnel. The courses may be used for the attainment of goals that are connected with technical and professional development as they relate to enforcing and interpreting the Ohio State Building Codes. Board approval is granted only on course instruction pertaining to OBC, OMC, OPC, and RCO requirements and such other content areas directly related to the responsibilities of the certification for which credit is being requested.

Instructors: Anyone or any organization promoting an approved course, is required to make full and accurate disclosure regarding course title, course approval number, number of credit hours, certifications for which the BBS has approved the class, and fees in promotion materials and advertising. ***The Board does not grant retroactive approval. It is recommended that courses be submitted for approval well in advance of any scheduling of classes and advertising***. Advertising shall not disclose improper approval information to the public.

Course sponsors/co-sponsors: provide participants a certificate of completion containing the following information: name of participant, title of approved courses, BBS approval #, BBS approved certifications, date of the continuing education program, number of approved credit hours awarded and signature of authorized sponsor or instructor.

Anyone or any organization administering an approved course shall provide the Board with advanced written information on scheduling of the course(s) (date and place) and provide to the Board a legible list of participants who completed the course with the name of course, date, and location.

Participants: Must attend the complete course as presented by the instructor to receive credit hours approved by the Board. No partial credit shall be given to any participant who failed to complete the entire course as approved. The sponsor/co-sponsor or instructor shall formulate a method to verify the individual's attendance and completion of the course.

Board approval: Remains in effect through the calendar year of approval. The course may be renewed administratively by sponsor application in subsequent years so long as it references current codes and standards Upon the Board's adoption of a new edition of the codes, course sponsors must update their course and submit to the Board for approval. The Board does not grant retroactive approval for courses presented prior to approval date.

Facility/training area: Shall be capable of comfortably and safely seating at least the number of attendees with writing surfaces for each attendee; accessible to/and usable for people with disabilities; sized and provided with audio/visual equipment adequate so that each attendee can see the instructor(s) and overhead screen and hear the content of the training programs; illuminated for writing and that the content on an overhead screen can be seen easily by all attendees; non-smoking in the training room; sound controlled so that outside noise will not interfere with the training.

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER: Derek Case

Course Submitter: Derek Case (Contact Name)

Organization: Radio Solutions, Inc. (Organization/Company)

Address: 55 Accord Park Drive (Include Room Number, Suite, etc.)

City: Norwell State: MA Zip: 02061

E-Mail: derek.case@radiosolutionsinc.com

Telephone: 781-384-2910 Fax: _____

Course Sponsor: Jay Greene, Silco Fire & Security

COURSE INFORMATION:

Course Title: Emergency Responder Communications Enhancement Systems (ERCES) / Bi-Directional Amplifier (BDA) Systems for AHJs

New Course Submittal: ■ Update Course: ☐ Prior Approval Number: _____

Purpose and Objective: To educate AHJs and A&Es about code-requirements for ERCES / BDA Systems, how they solve radio signal "dead spots" in buildings, and how they provide code-required communications for First Responders in emergencies. The course also includes the process for AHJs to develop their own performance-based specifications for these systems, as well as the code-compliant process to inspect them once installed.

Number of Instructional Contact Hours that can be obtained upon completion: 1.5

If Multi-Session, Number of Instructional Contact Hours Per Session: n/a

Program Applicable for the Following Participants:

Building Official	■	Master Plans Examiner	■	Building Inspector	■	Fire Protection Inspector	■
		Building Plans Exam.	☐				
		Plumbing Plans Exam.	☐				
		Electrical Plans Exam.	☐				
		Mechanical Plans Exam.	☐				
		Fire Protect. Plans Exam.	✔				

Mechanical Inspector	☐	Plumbing Inspector	☐	Non-Res IU Inspector	☐				

Res Building Official	☐	Res Plans Examiner	■	Res Building Inspector	☐	Res Mechanical Inspector	☐	Res IU Inspector	☐

Electrical Safety Inspectors ☐

Location of ESI Course: _____ Date(s) of ESI Course(s): _____

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
	Organization sponsoring or requesting the program (if any)	x
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:		n/a
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

RSI™ + Silent FIRE & SECURITY

Emergency Responder Communication Enhancement Systems (ERCES) for

Southwest Ohio Fire Safety Council

Derek Case, Director of Marketing & Business Development

May 27th, 2022

ERCES & BDA Systems for Authorities Having Jurisdiction

1. Introduction to Emergency Responder Communications Enhancement Systems (ERCES)
2. ERCES Codes & Standards (including UL 2524 Listing)
3. ERCES Specification & Inspections
4. Impact of BDA Systems on your current radio infrastructure
5. Making life safety a priority with RSI ERCES
6. Question & Answer / Open Forum

1.) Introduction to E.R.C.E.S.

Terms and Definitions

- **ERCES: Emergency Responder Communications Enhancement System** is a term that most accurately describes the function and purpose of overall system.
- **BDA: Bi-Directional Amplifier, aka Signal Booster** is a powered, active device that boosts the signal level of the first responder radios (Uplink & Downlink). It is often referred to as the "head end."
- **DAS: Distributed Antenna System** is a network of passive or active antennas, cabling and other components installed with the purpose of distributing the signal throughout the structure.
- **BDA System**: a system that is comprised of a Donor Antenna, BDA and DAS

BDA Systems are the code-compliant, UL Listed technology of choice for ERCES.

Public Safety Radio

Reliable radio coverage is not a luxury.
It is a necessity. Lives depend on it!

The Problem: In-building Radio Signal Degradation.

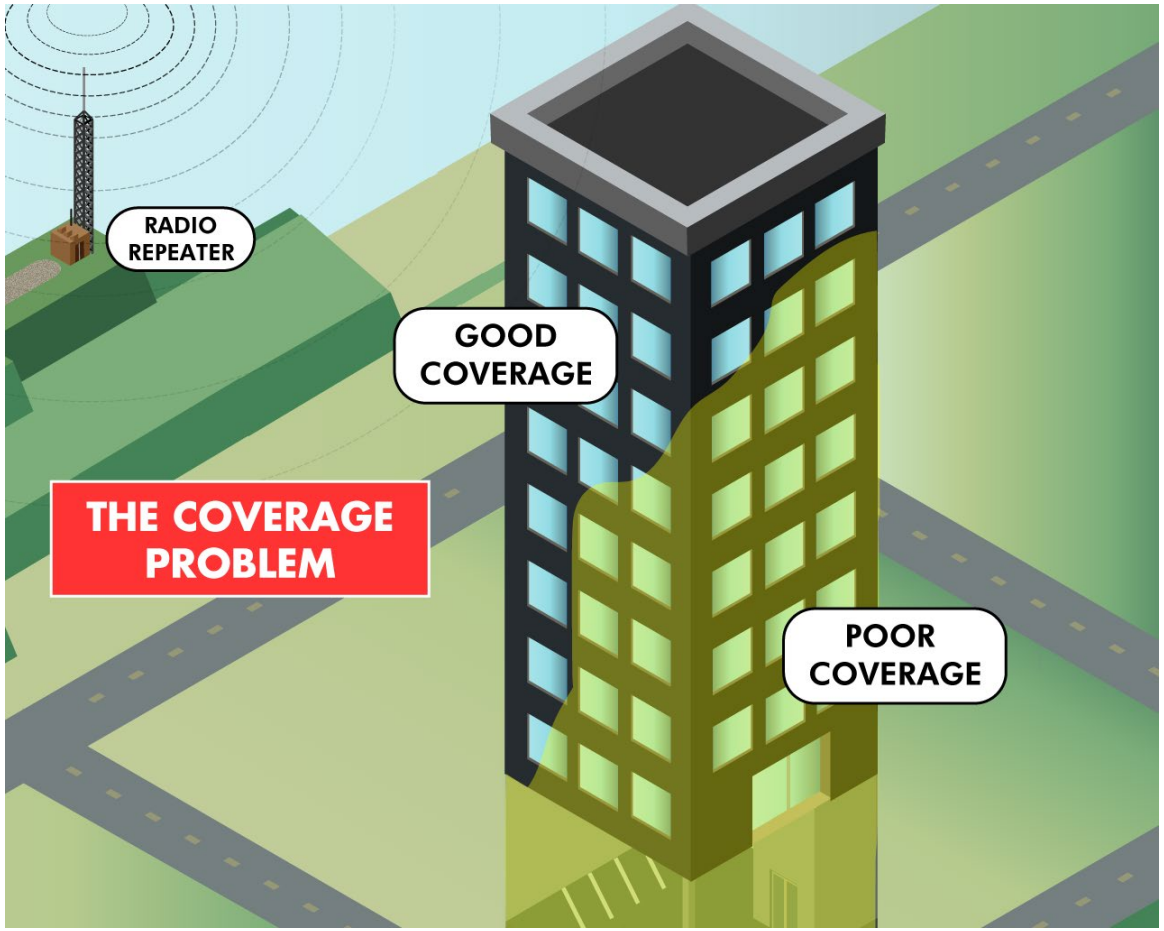
Radio signals are attenuated by:

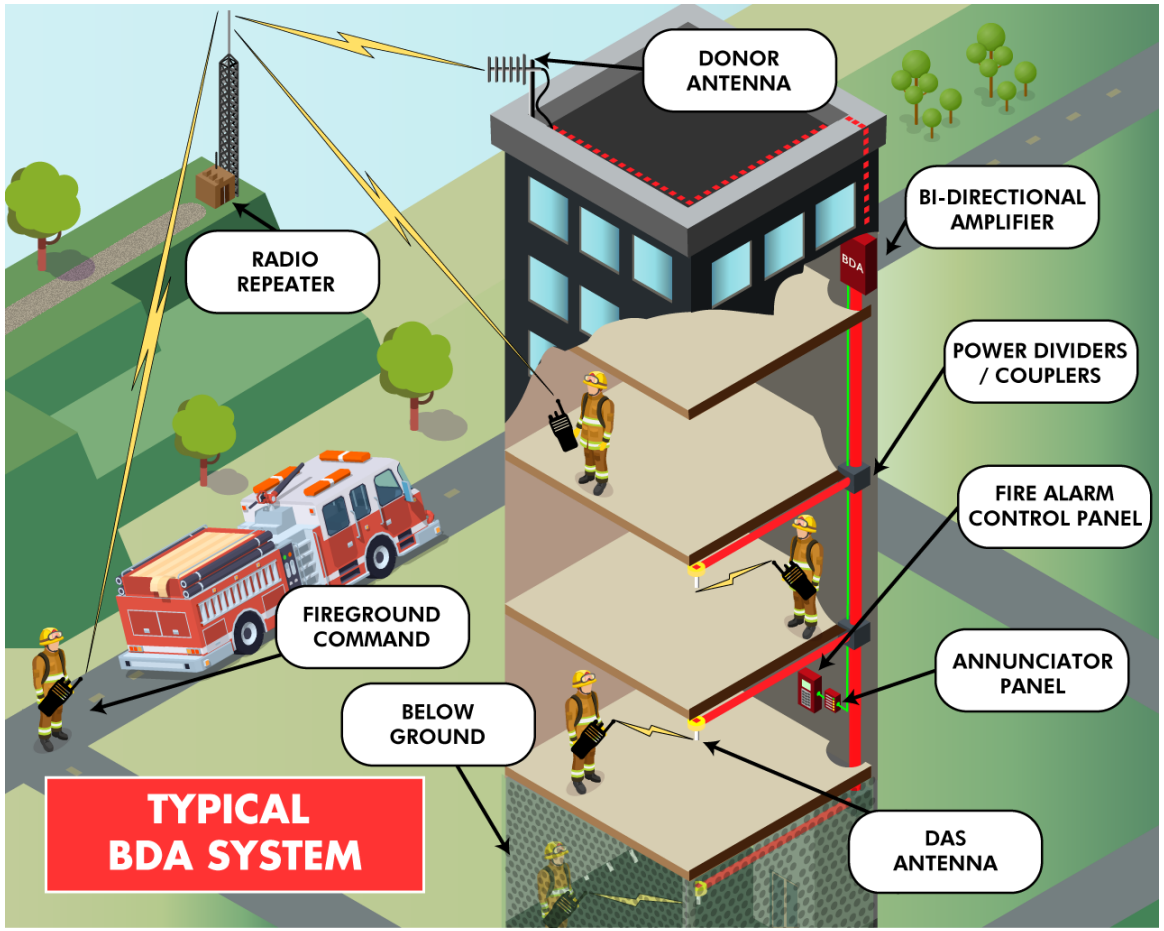
- Concrete, Metal and other building materials
- Low-E Glass
- Below-Ground Structures
- Other obstructions
- RF Interference

The consequence:

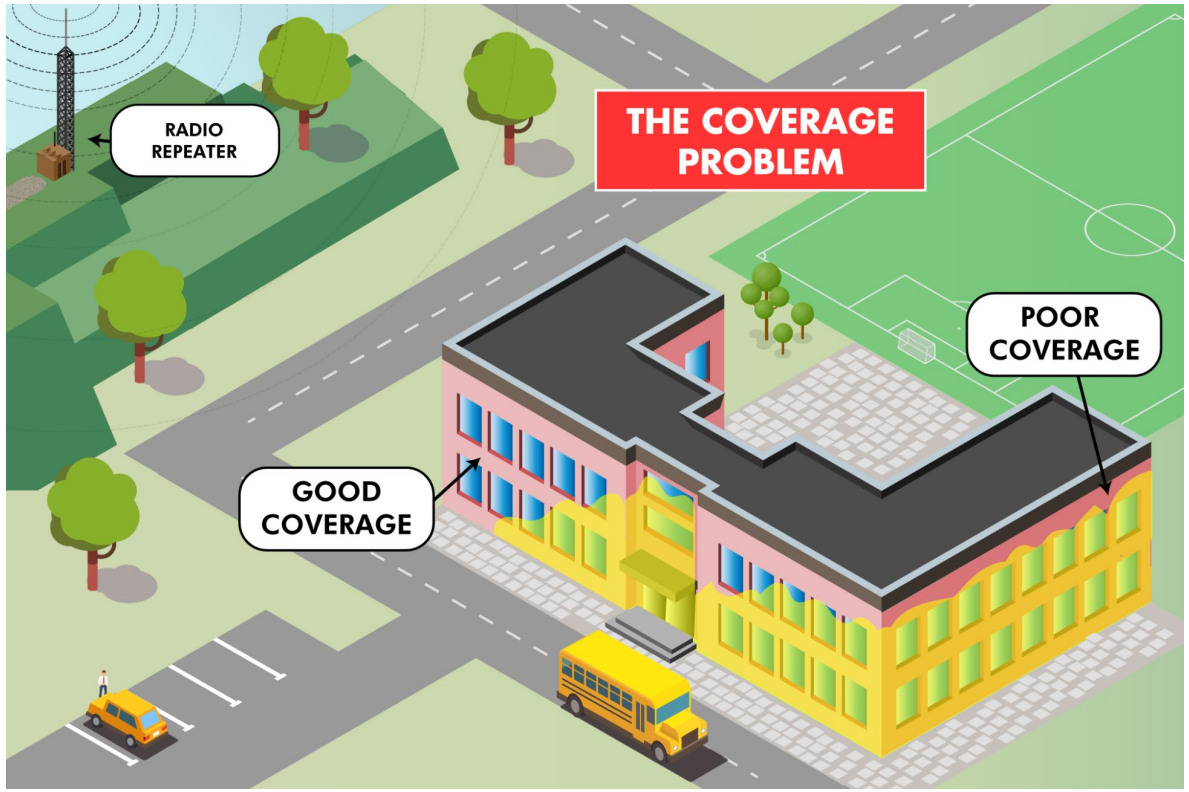
- Poor in-building radio signal coverage and RF "dead spots".
- Emergency responders lose communications.

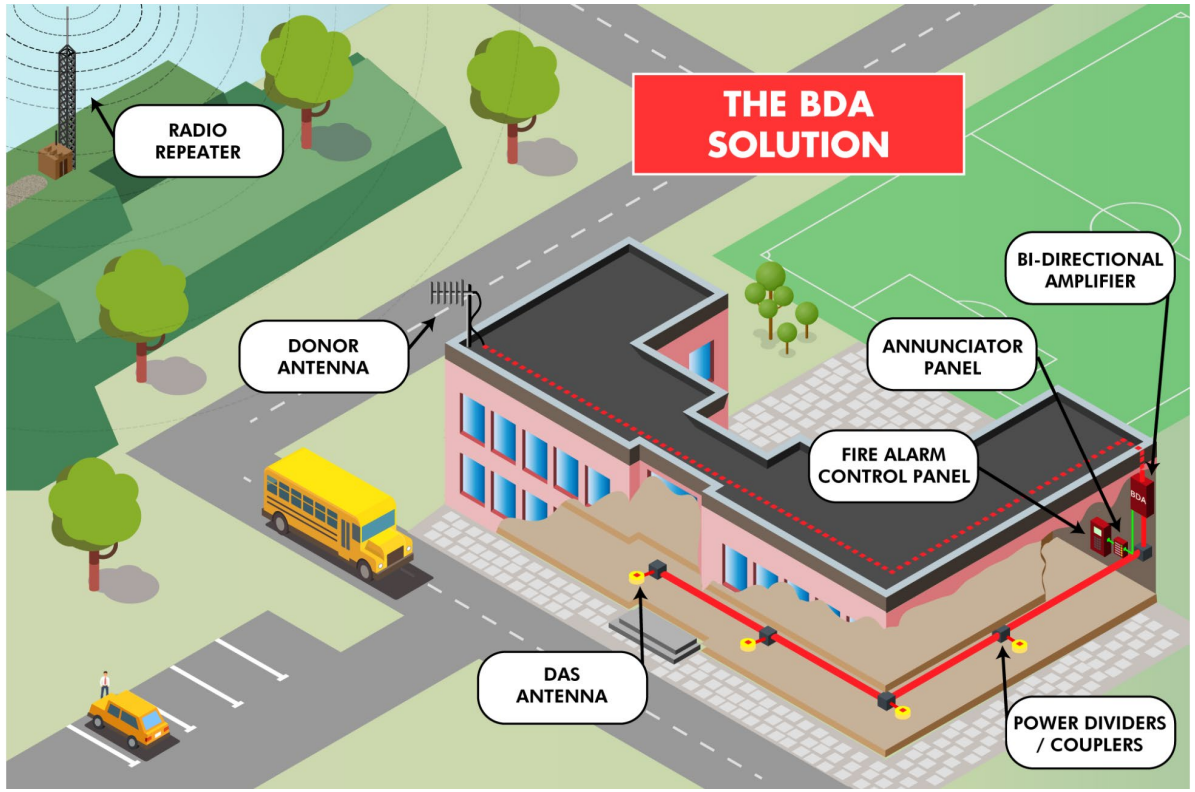
The Coverage Problem & BDA System Solution



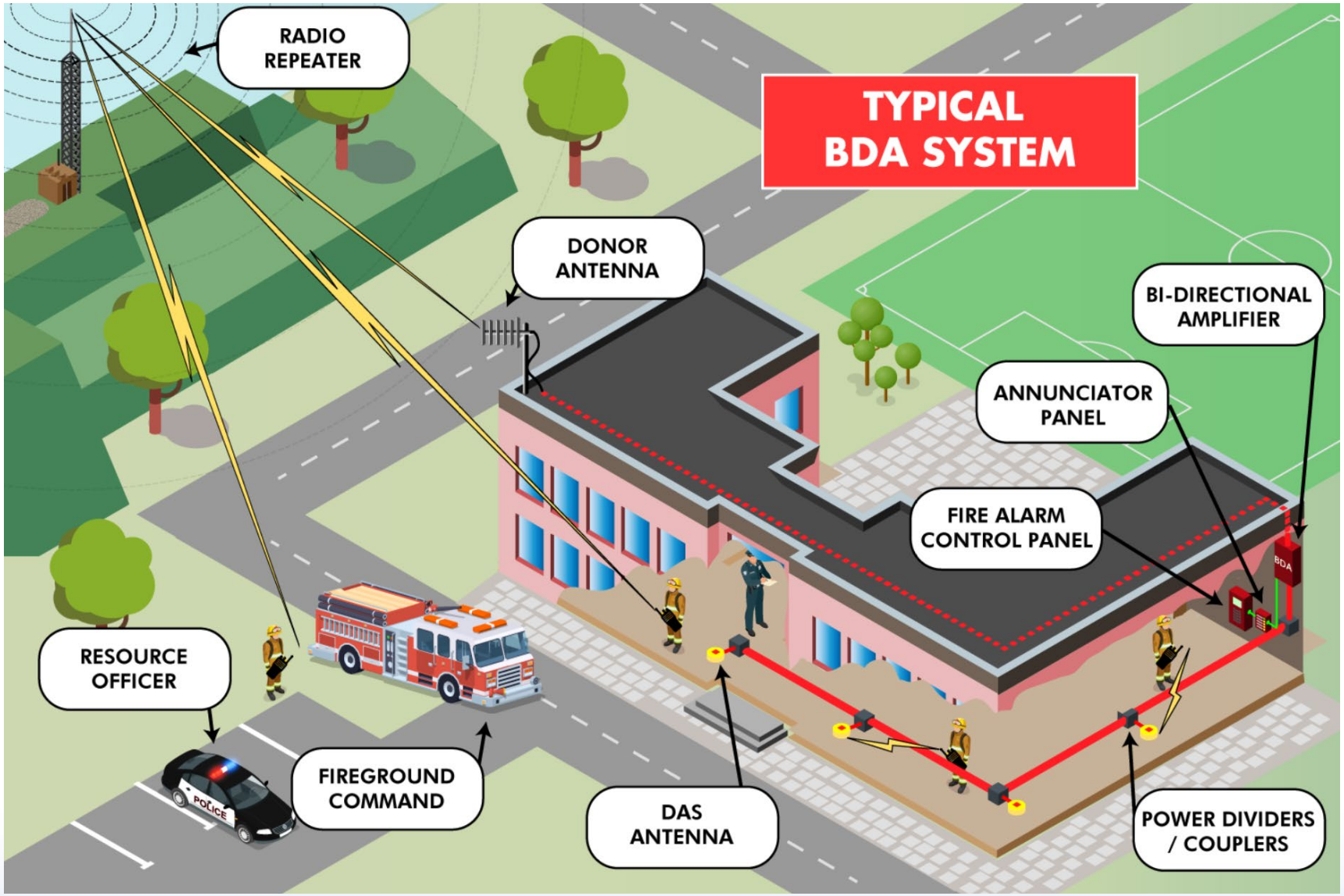


Coverage Problems are NOT Just in Highrise Buildings

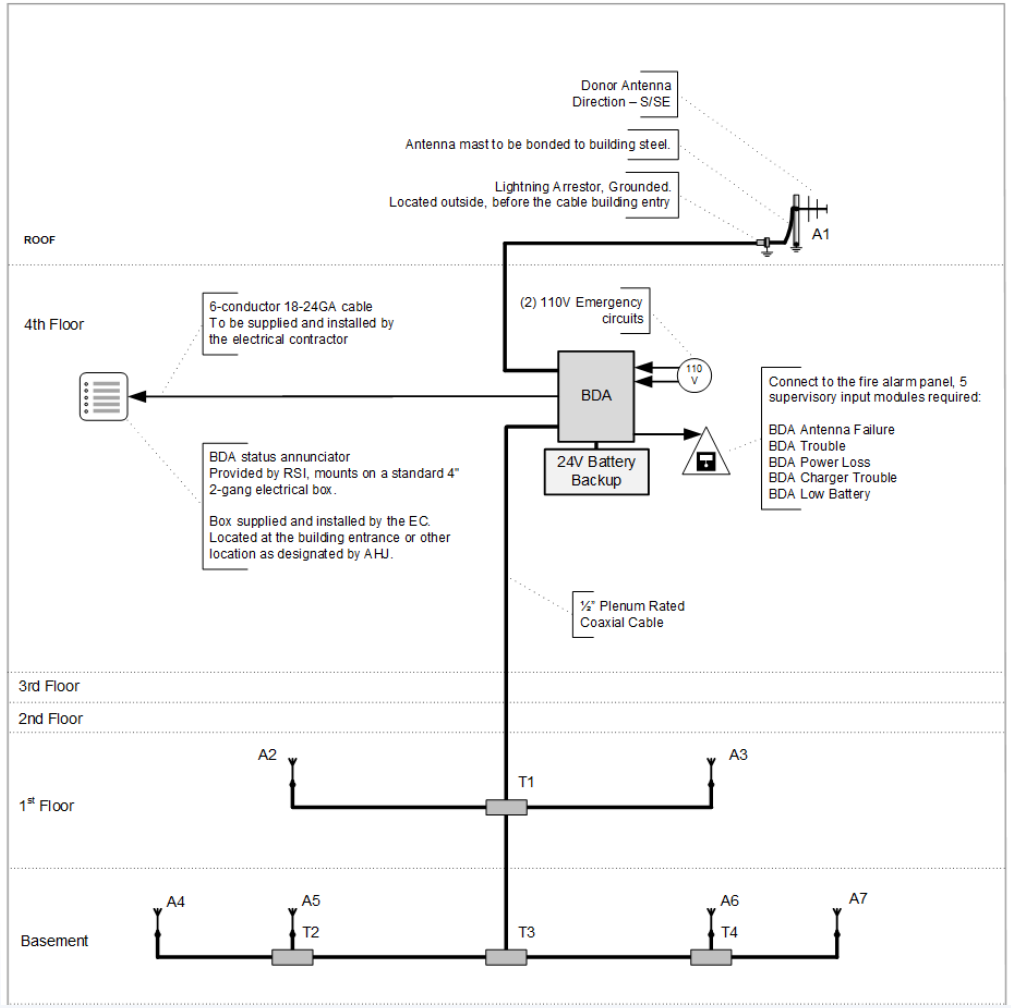




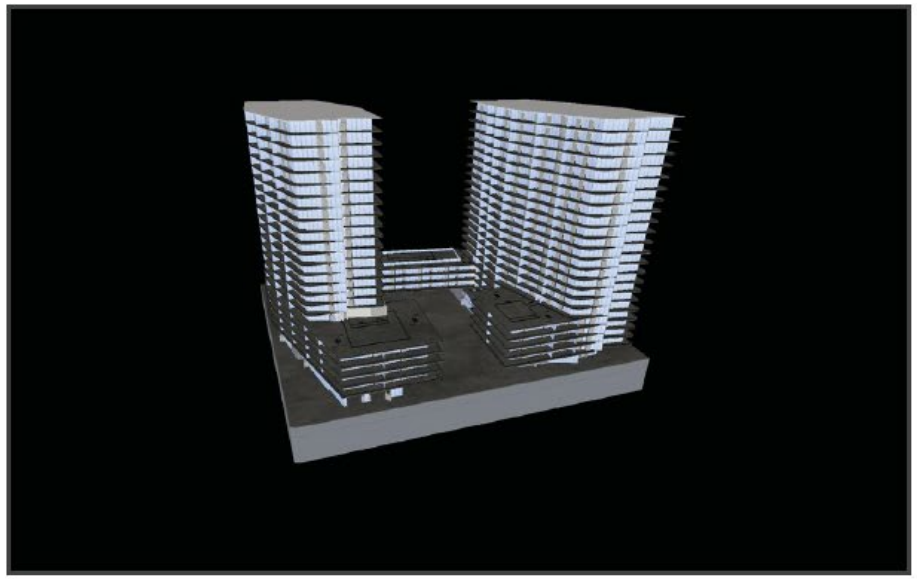
ERCES Are not Just for Fire – Also, Cover Police and EMS

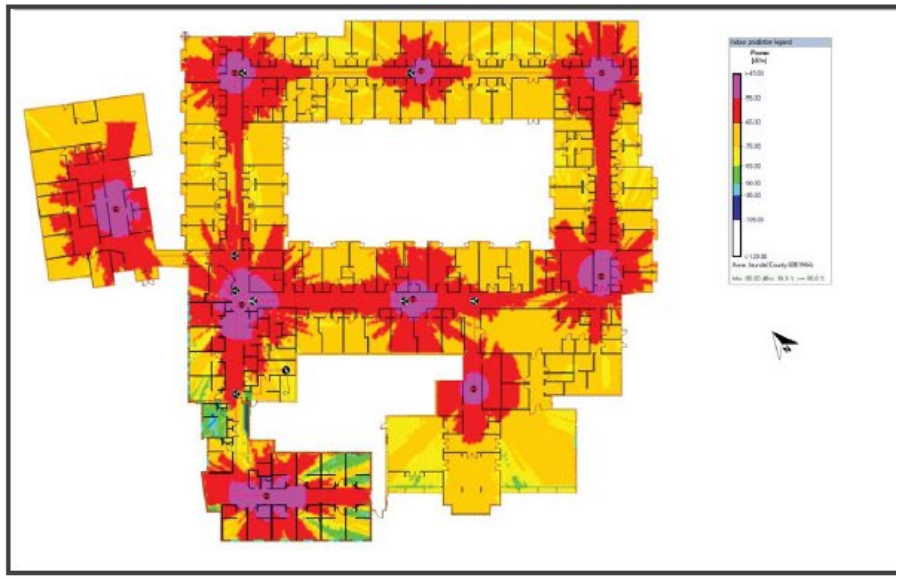


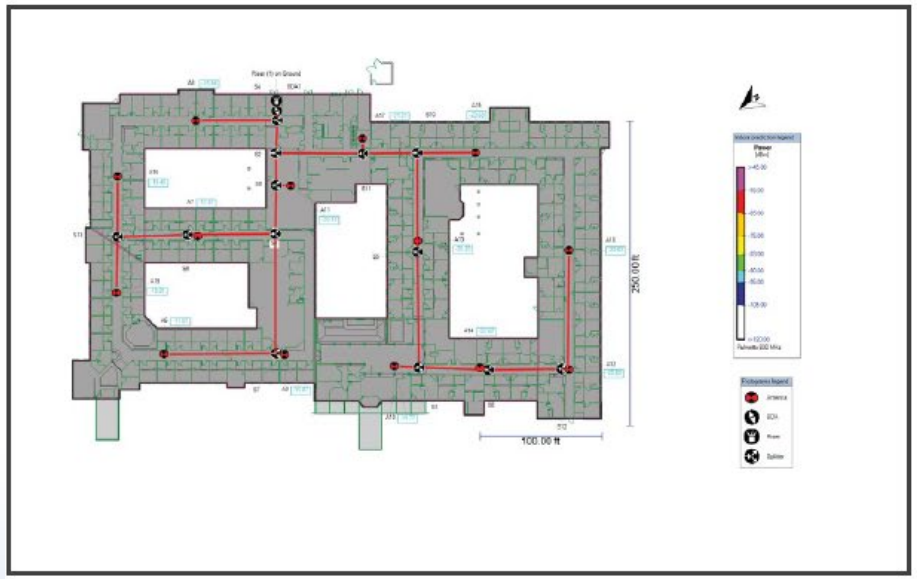
BDA System Components

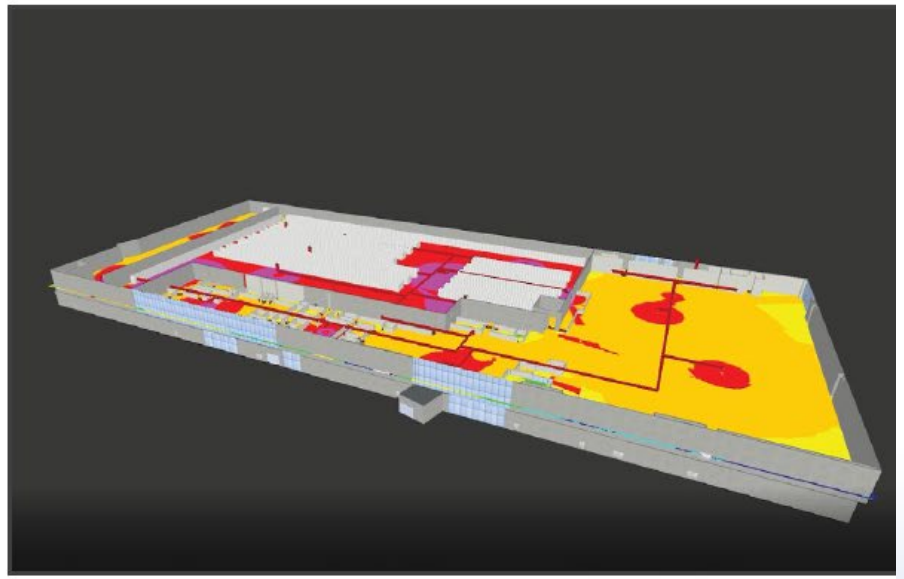


iBwave Designs by Radio Solutions

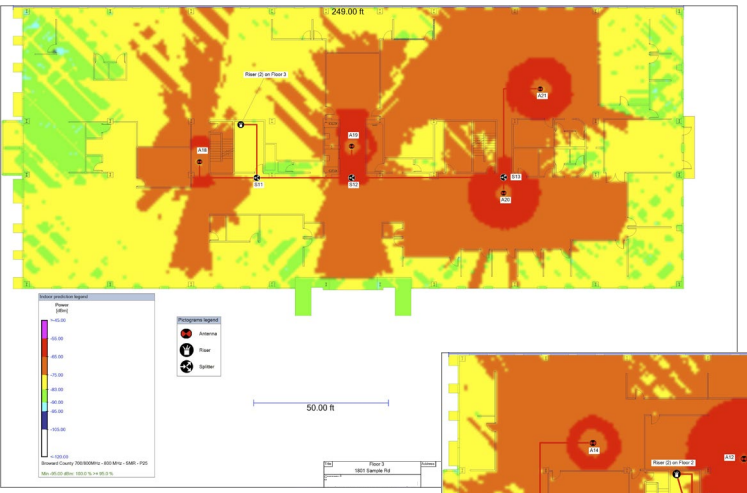


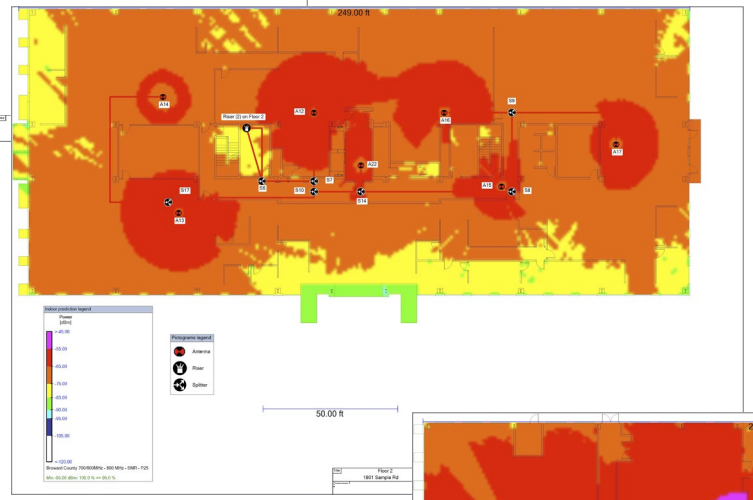


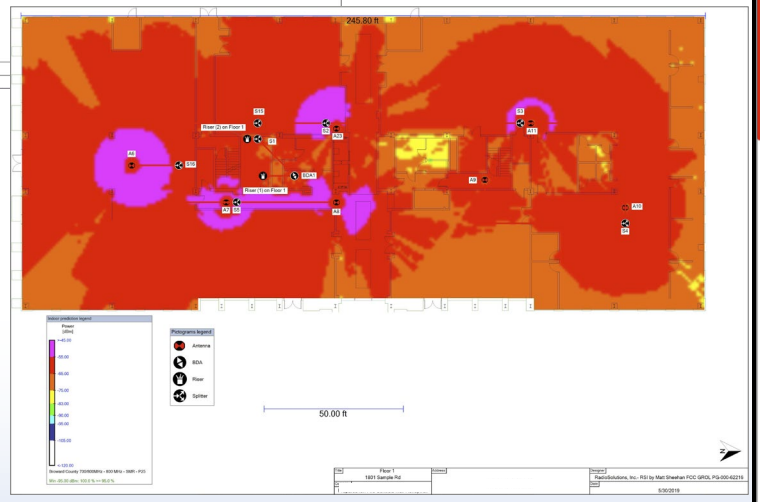


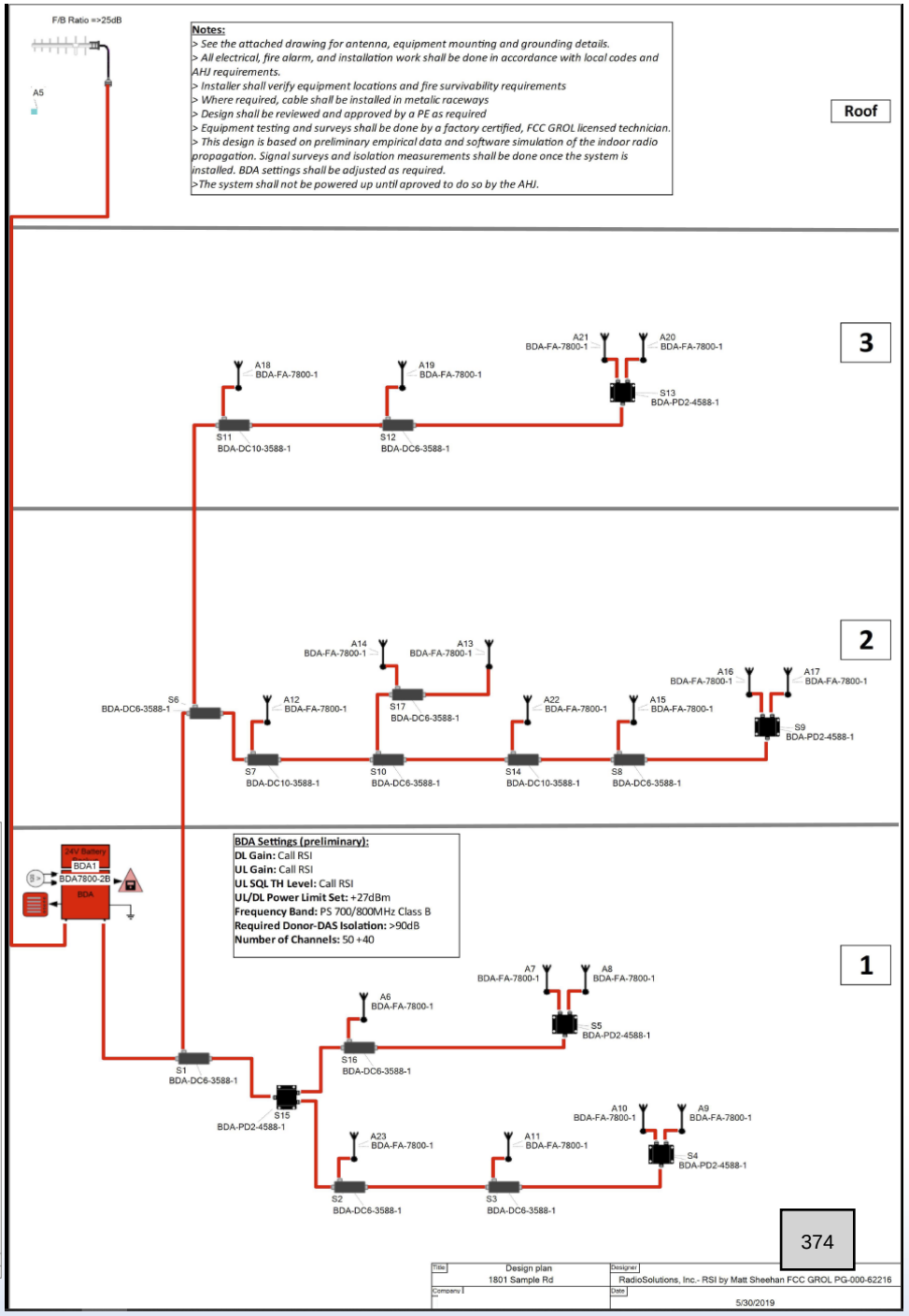


iBwave Design by Radio Solutions

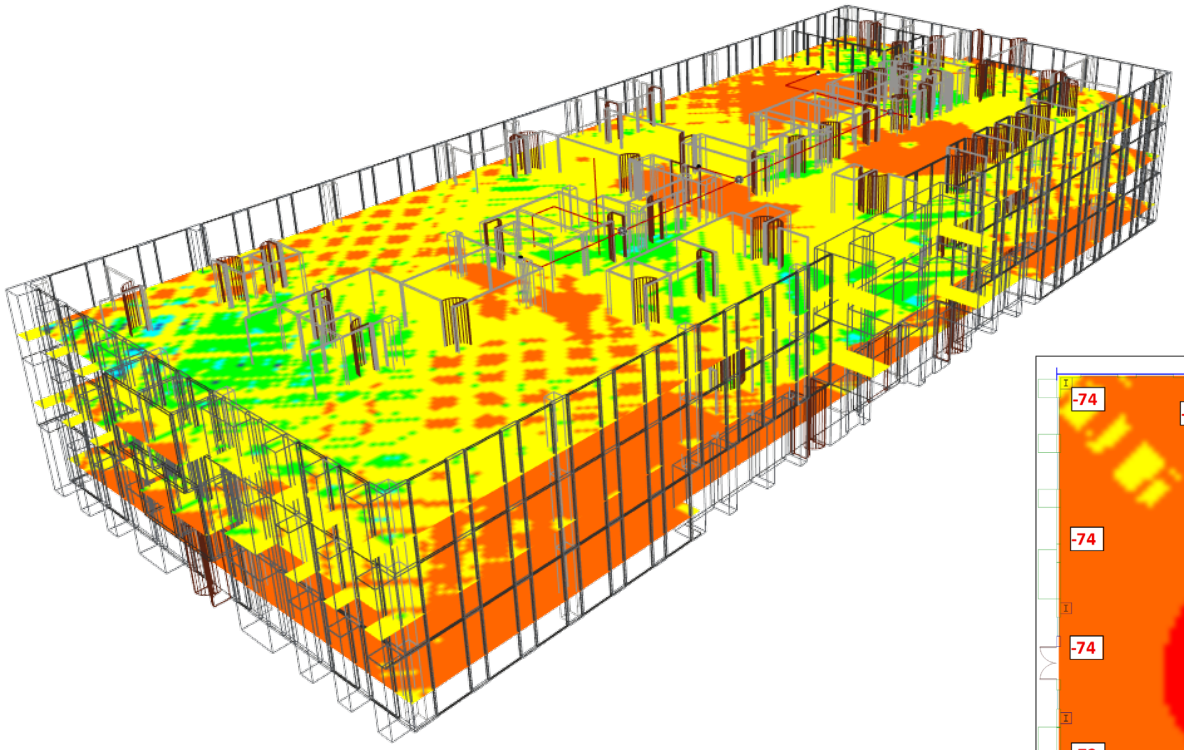


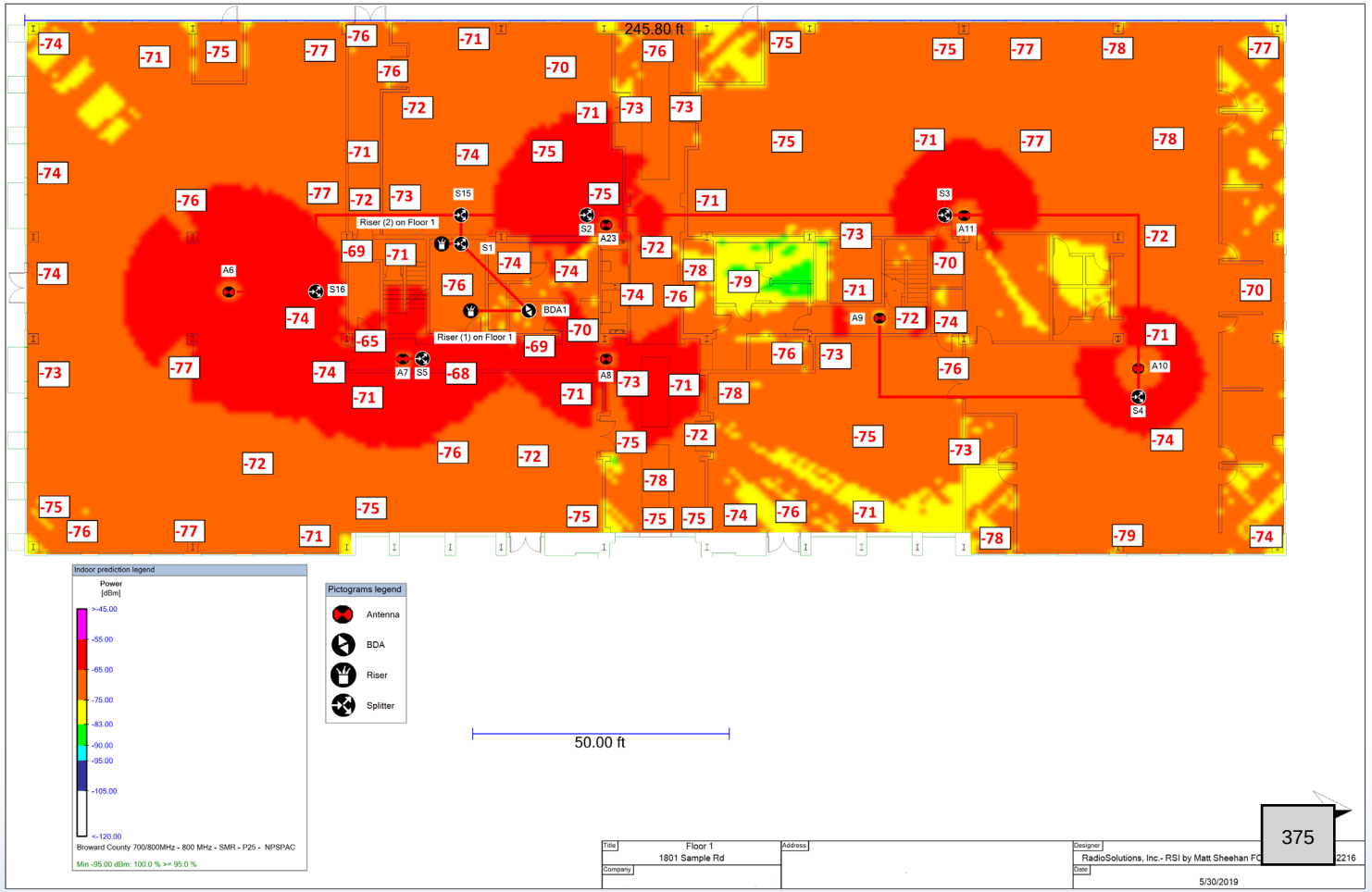






iBwave Design & Post RF Test





2.) ERCES Codes & Standards

ERCES Code Requirements

*IBC 916, 918**
IEBC

IFC 510
IFC 1103.2

NFPA 1, 101

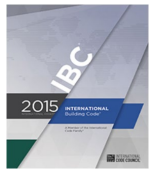
NFPA 72
NFPA 1221
*NFPA 1225**

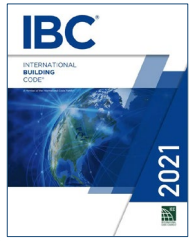
Federal

State & Local

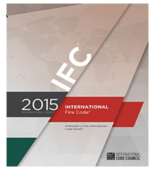
BDA – ERRC Requirements Summary

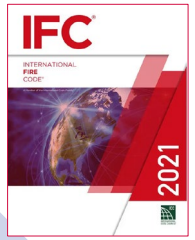
- Emergency responder radio coverage (ERRC) was introduced in 2006 International Building Code to address performance of emergency responders' portable radios inside buildings.
- Smaller buildings may already have sufficient radio signal coverage levels. In that case, property owner shall provide a signal survey report documenting the existing signal levels. Survey is performed and signed by a qualified, FCC - GROL Licensed vendor. Report is then submitted to AHJ for review and the coverage is verified by the AHJ.
- Buildings that do not have the required signal levels (-95 dBm) require amplification systems (i.e. signal boosters, BDA Bi-Directional Amplifiers or other as specified by the AHJ)
- Upon system completion, a final survey shall be performed as specified.
- All buildings shall therefore have a *certification of the approved in-building signal coverage* on record with the AHJ, regardless if they have a BDA or not.
- Signal coverage and the BDA system need to be inspected, tested, and serviced annually.
- Property owners are responsible for maintenance, surveys and upgrades of the in-building systems as required by the building code and as requested and specified by the AHJ.



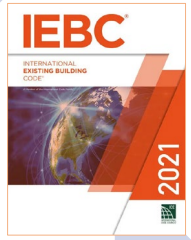


IBC 2006	IBC 2009	IBC 2012	IBC 2015	IBC 2018	IBC 2021
907.2.12.3	915.1	915.1	916.1	918.1	918.1

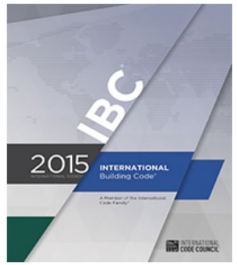




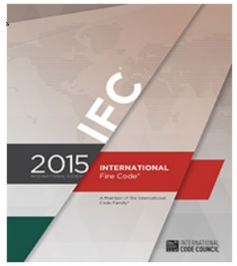
IFC 2009	IFC 2012:	IFC 2015:	IFC 2018:	IFC 2021:
510, 907.2.13.2	510, 907.2.13.2, 1103.2	510, 907.2.13.2, 1103.2	510, 907.2.12.2, 1103.2	510, 907.2.12.2, 1103.2



IEBC 2018	IEBC 2021
(no reference)	Refers to IFC 510

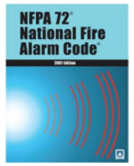


2015 IBC - 916.1 Emergency responder radio coverage shall be provided in all new buildings in accordance with Section 510 of the International Fire Code



2015 IFC – 510
510.1 Emergency responder radio coverage in new buildings
510.2 Emergency responder radio coverage in existing buildings Existing buildings shall be provided with approved radio coverage for emergency responders as required in Chapter 11
510.3 Permit required
510.4 Technical requirements
510.5 Installation requirements
510.6 Maintenance Requirements

1103.2 ERRC in existing buildings: Require coverage if existing wired system cannot be repaired, unless AHJ determines system is not needed



NFPA 72 2007
6.10.2

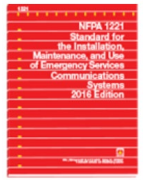
NFPA 72 2010
24.5.2

NFPA 72 2013
24.5.2

NFPA 72 2016
24.9 (moved to 1221)

NFPA 2019
24.9 (see NFPA 1221)

NFPA 1221 2013
9.3.1.2



NFPA 1221 2016
9.6

NFPA 1221 2019
9.6

NFPA 1225 2022
(ref UL 2524)

24.9 Two-Way Radio Communications Enhancement Systems.

24.9.1 General.

24.9.1.1 Non-Interference. No amplification system capable of operating on frequencies or causing interference on frequencies assigned to the jurisdiction by the FCC shall be installed without prior coordination and approval of the authority having jurisdiction. The building manager/owner shall suspend and correct other equipment installations that degrade the performance of the public safety radio system or public safety radio enhancement system.

24.9.1.2 Approval and Permit. Plans shall be submitted for approval prior to installation. At the conclusion of successful acceptance testing, a renewable permit shall be issued for the public safety radio enhancement system where required by the authority having jurisdiction.

24.9.2 Installation and Design. All in-building two-way radio communications enhancement systems shall be designed, installed, and maintained in accordance with NFPA 1221.

NFPA 72 2016

24.9 Two-Way Radio Communications Enhancement Systems.

24.9.1 General.

24.9.1.1 Non-Interference.

24.9.1.2 Approval and Permit.

24.9.2 Installation and Design. All in-building two-way radio communications enhancement systems shall be designed, *installed, and maintained in accordance with NFPA 1221*

Moved to NFPA 1221 in 2016

NFPA 1221 2016

9.6 Two-Way Radio Communications Enhancement Systems.

9.6.1 General

9.6.2 Pathway Survivability

9.6.3 Lightning Protection

9.6.4 Testing Requirements

9.6.5 Non-Interference and Non-Public Safety System Degradation

9.6.6 Approval and Permit

9.6.7 Radio Coverage (99% Critical Areas; 90% General Areas)

9.6.8 Signal Strength Inbound/Outbound DAQ >=3.0 analog or digital

9.6.9 Donor Antenna Isolation >20 dB above system gain

9.6.10 System Radio Frequencies

9.6.11 System Components

9.6.12 Power Supplies

9.6.13 System Monitoring

9.6.14 Technical Criteria

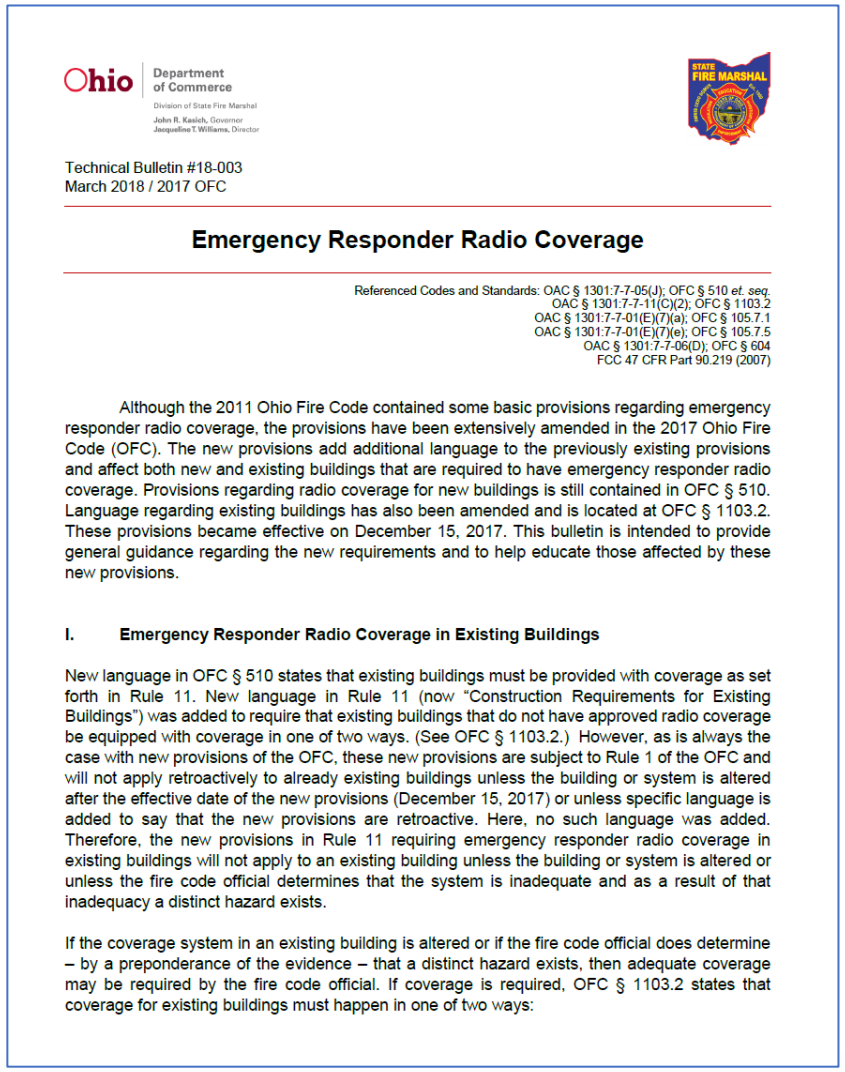
11.3.9 Operational Testing

ERCES / BDA System Codes & Standards

Code Requirements	NFPA*			IFC		
	NFPA 72 (2013)	NFPA 1221 (2016)	NFPA 1221 (2019)	IFC 510 (2015)	IFC 510 (2018)	IFC 510 (2021)
In-Building Solution Required	§ 24.5.2	**§ 9.6**	§ 9.6	§ **510.1**	§ 510.1	§ 510.1 510.4 Mandates UL 2524 Listing
Level 1, 2 or 3 Path Survivability	2 Hour for Riser Coaxial Cable § 24.3.6.8.1	**2-Hour for Riser Coaxial Cable § 9.6.2.1.1**	Enclosures for backbone & antenna cables match bldg. 9.6.2.3 & 9.6.2.4	**Not Addressed in § 510. Referenced in 24.3.6.8.1 of NFPA 72-2013**	Yes, § 510.4.2. Reference to NFPA 1221	Shall be approved by the AHJ § 510.4.2.1
Plenum Rated Coaxial Cable Required	Yes, Riser & Feeder Coaxial Cable § 24.3.6.8.1.1	**Yes, Riser & Feeder Coaxial Cable § 9.6.2.1.1.1**	Yes, Backbone, Antenna, Radiating or fiber optic cables § 9.6.2.1	**Not Addressed in § 510. Referenced in 24.3.6.8.1.1 of NFPA 72-2013**	Yes, § 510.4.2. Reference to NFPA 1221	Shall be approved by the AHJ § 510.4.2.1
Lightning Protection Required	Not addressed in § 24.5.2	**Yes, In accordance with NFPA 780 § 9.6.3**	Yes as per NFPA 780 9.6.3*	**Not Specifically Addressed in § 510**	Yes, Section 510.4.2 Per NFPA 780 as Referenced in NFPA 1221	Yes, § 510.5.1
Isolation of Donor Antenna Required	Yes, 15 dB § 24.5.2.3.3	**Yes, 20 dB § 9.6.9**	Yes, 20 dB § 9.6.9	**Not Specifically Addressed in § 510**	Yes, 20 dB - § 510.4.2.4 (4)	Yes, 20 dB - § 510.4.2.4 (4)
Secondary Power Source	12 Hours § 24.5.2.5.5.2	**12 Hours § 9.6.12.2**	12 Hours § 9.6.12.2	**24 Hours - § 510.4.2.3**	12 Hours - § 510.4.2.3 or 2-Hour Battery w/ Emergency Generator	12 Hours - § 510.4.2.3 or 2-Hour Battery w/ Emergency Generator
Signal Strength & Area Coverage Required	-95 dBm - § 24.5.2.3 90% General - § 24.5.2.2.2 99% Critical - § 24.5.2.2.1	**DAQ 3.0 - Section 9.6.8 90% General - § 9.6.7.5 99% Critical - § 9.6.7.4**	DAQ >=3.0 § 9.6.8.1.2 90% General § 9.6.7.4 99% Critical - § 9.6.7.3	**-95 dBm - § 510.4.1 95% General - § 510.4.1 99% Critical - Not Specifically Addressed in § 510**	DAQ 3.0 - § 510.4.1.1 95% General - § 510.4.1 99% Critical - § 510.4.2 (Ref. NFPA 1221)	-95 dBm – § 510.4.1.1 DAQ 3.0 - § 510.4.1.1 95% General - § 510.4.1 99% Critical - § 510.4.1
Monitoring By Fire Alarm Required	Yes - § 24.5.2.6	**Yes - § 9.6.13**	Yes - § 9.6.13	**Yes - § 24.5.2.6 NFPA 72 -2013**	Yes - § 9.6.13 NFPA 1221-2016	Yes - § 9.6.13 NFPA 1221-2016
Cabinets for Equipment & Battery Backup	Yes, NEMA 4/NEMA 4X – § 24.5.2.5.2	**Yes, NEMA 4/NEMA 4X - § 9.6.11.2**	Yes, NEMA 4/NEMA 4X - § 9.6.11.2	**Yes, NEMA 4 - § 510.4.2.4 (1) & (2)**	Yes, NEMA 4 / NEMA 3R – § 510.4.2.4 (1) & (2)	Yes, NEMA 4 / NEMA 3R – § 510.4.2.4 (1) & (2)
Monitor Antenna Malfunction Required	Yes, Donor Antenna – § 24.5.2.6(2)(a)	**Yes, Donor Antenna - § 9.6.13.1(2)(a)**	Yes, Donor Antenna – § 9.6.13.1(2)(a)	**Yes, § 24.5.2.6(2)(a) NFPA 72-2013**	Yes, Donor Antenna - § 510.4.2.5	Yes, Donor Antenna - § 510.4.2.5 (3)
System Acceptance / Testing	§ 24.5.2.1.2	**§ 9.6.4, 11.3.9 & 11.3.9.1**	§ 9.6.4, 11.3.9 & 11.3.9.1	**§ 510.5.3**	§ 510.5.3	§ 510.5.4 510.4 Mandates UL 2524 Listing

RSI™ Radio Solutions, Inc. BDA SYSTEMS

*** NFPA 1 § 11.10:** In all new and existing buildings, minimum radio signal strength for fire department communications shall be maintained at a level determine[illegible]e AHJ. Where required by the AHJ, two-way radio communication enhancement systems shall comply with NFPA 1221. *(Safer Buildings Coalition, 2019)*



Ohio Department of Commerce
Division of State Fire Marshal
John R. Kasich, Governor
Jacqueline T. Williams, Director

Technical Bulletin #18-003
March 2018 / 2017 OFC

Emergency Responder Radio Coverage

Referenced Codes and Standards: OAC § 1301:7-7-05(J); OFC § 510 *et. seq.*
OAC § 1301:7-7-11(C)(2); OFC § 1103.2
OAC § 1301:7-7-01(E)(7)(a); OFC § 105.7.1
OAC § 1301:7-7-01(E)(7)(e); OFC § 105.7.5
OAC § 1301:7-7-06(D); OFC § 604
FCC 47 CFR Part 90.219 (2007)

Although the 2011 Ohio Fire Code contained some basic provisions regarding emergency responder radio coverage, the provisions have been extensively amended in the 2017 Ohio Fire Code (OFC). The new provisions add additional language to the previously existing provisions and affect both new and existing buildings that are required to have emergency responder radio coverage. Provisions regarding radio coverage for new buildings is still contained in OFC § 510. Language regarding existing buildings has also been amended and is located at OFC § 1103.2. These provisions became effective on December 15, 2017. This bulletin is intended to provide general guidance regarding the new requirements and to help educate those affected by these new provisions.

I. Emergency Responder Radio Coverage in Existing Buildings

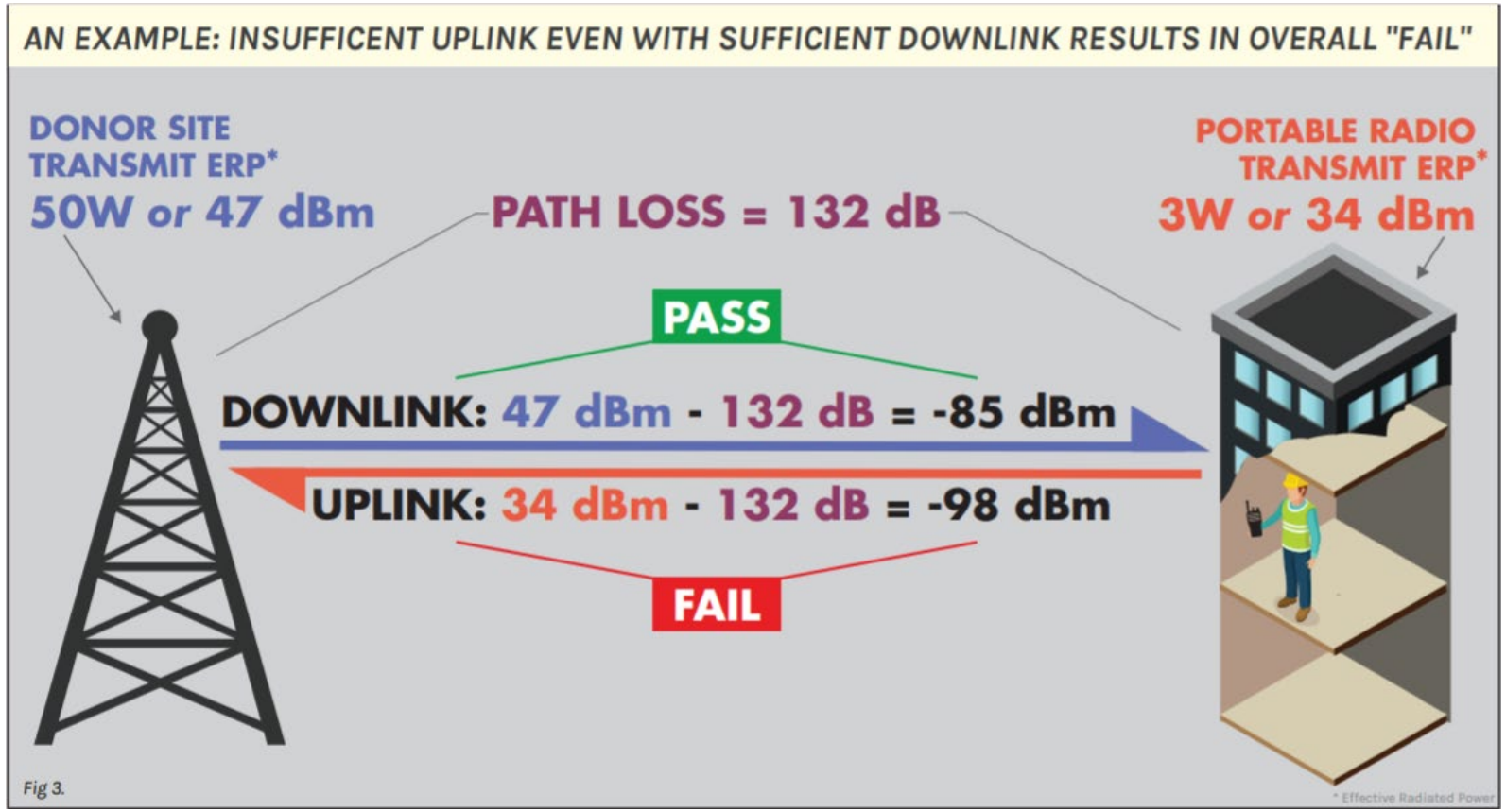
New language in OFC § 510 states that existing buildings must be provided with coverage as set forth in Rule 11. New language in Rule 11 (now "Construction Requirements for Existing Buildings") was added to require that existing buildings that do not have approved radio coverage be equipped with coverage in one of two ways. (See OFC § 1103.2.) However, as is always the case with new provisions of the OFC, these new provisions are subject to Rule 1 of the OFC and will not apply retroactively to already existing buildings unless the building or system is altered after the effective date of the new provisions (December 15, 2017) or unless specific language is added to say that the new provisions are retroactive. Here, no such language was added. Therefore, the new provisions in Rule 11 requiring emergency responder radio coverage in existing buildings will not apply to an existing building unless the building or system is altered or unless the fire code official determines that the system is inadequate and as a result of that inadequacy a distinct hazard exists.

If the coverage system in an existing building is altered or if the fire code official does determine – by a preponderance of the evidence – that a distinct hazard exists, then adequate coverage may be required by the fire code official. If coverage is required, OFC § 1103.2 states that coverage for existing buildings must happen in one of two ways:

Mar 2018: Ohio Fire Code §510 New Buildings; O F C §1103.2 Existing Buildings

- Doesn't apply retroactively unless building is altered
- Permit Required OFC §105.7.5
- -95 dBm signal strength *into and out of the building*
- 95% floor area coverage in all areas on each floor
- 24-hour standby power
- NEMA 4 enclosures
- Signal Booster & Battery Backup must be constantly monitored
- FCC certification of the amplifier (FCC 47 CFR Part 90.219 2007)
- FCC GROL license for ERCES system designer & lead installation personnel
- Manufacturer's Certification or nationally-recognized organization or school
- 20 equally-sized grids / floor; calibrated radios same model used by agency
- Verify two-way communication to and from the outside of the building
- Use spectrum analyzer for acceptance testing, measure gain, compare annually
- Annual test & inspection (coverage, gain, batteries, DAS), send report to AHJ
- If frequency changes occur, the building owner must modify or expand system

Minimum Inbound / Outbound Signal Strength



-**85dBm is the inbound signal strength**, and *13 dB is the signal strength difference* (47 dBm – 34 dBm)

The **outbound signal strength**, *in this example*, would only be **-98 dBm** (-85 dBm – 13 dB), *which does not meet code.*

Delivered Audio Quality / 'Signal to Noise' Ratio

NFPA 1221 2016 Edition

Delivered Audio Quality Metrics (*DAQ*):

DAQ 1 Unusable. Speech present but not understandable.

DAQ 2 Speech understandable with considerable effort. Requires frequent repetition due to noise/distortion.

DAQ 3 Speech understandable with slight effort. Requires occasional repetition due to noise/distortion.

DAQ 3.4 Speech understandable without repetition. Some noise/distortion present.

DAQ 4 Speech easily understood. Occasional noise/distortion present.

DAQ 5 Speech easily understood.

What is the Signal-to-Interference-Plus-Noise-Ratio (SINR)?

Ratio between useful **signal** (**signal** with user information) and undesirable components disturbing it (**noise** and **interference**).

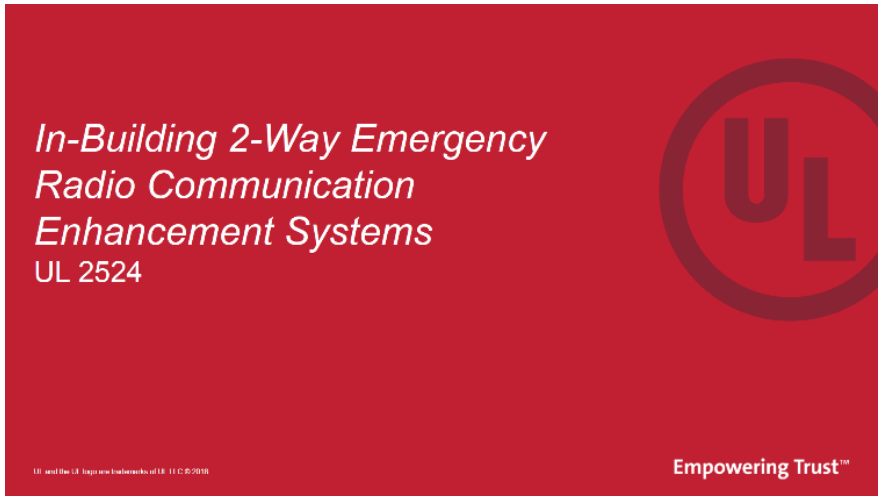
$$SINR = \frac{\text{Signal Power}}{\text{Noise + Interference Power}}$$

DAQ 3.0 = SINR 17.4

DAQ 3.4 = SINR 19

In-Building 2-Way Emergency Radio Communication Enhancement Systems UL 2524

- Includes UL 60950 Basic Safety, IFC-2018, NFPA1221 - 2016
- Creates a Performance Standard for ALL BDA Manufacturers
- Ensures Life Safety Systems Perform the First Time & Every Time
- IFC, NFPA 1, NFPA 101 will ***all require*** ERCES to comply with UL 2524 & be LISTED by an OSHA-accredited Nationally Recognized Testing Lab (NRTL)



"Independent 3rd Party Verification NFPA 1221 & IFC 510 Requirements *Are Met*"

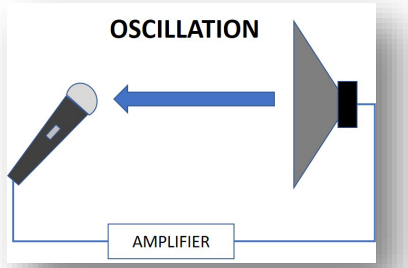
Are ERCES / BDA Systems Regulated?

- FCC-Certification Requirements:
- Signal Boosters must be FCC certified
- Manufacturer product brochures and product labels must include FCC ID number
- The end-user must ensure that all equipment is FCC-certified
- BDA systems shall be designed & installed by factory trained, FCC GROL Licensed Personnel
- The FCC Licensee is the *only* authority that can grant permission to re-transmit its licensed frequencies: FCC 47 CFR §90.219 b (1) (i)

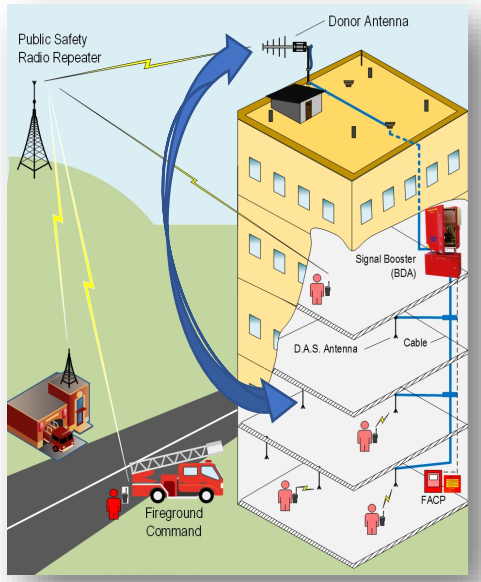
AHJ Concerns About Non-Compliant BDA Systems

#1 – OSCILLATION Interference:

Improper installation or a failure could lead to Oscillation (donor antenna signal feeds back into the DAS), creating harmful interference to Public Safety Radio System.



OSCILLATION



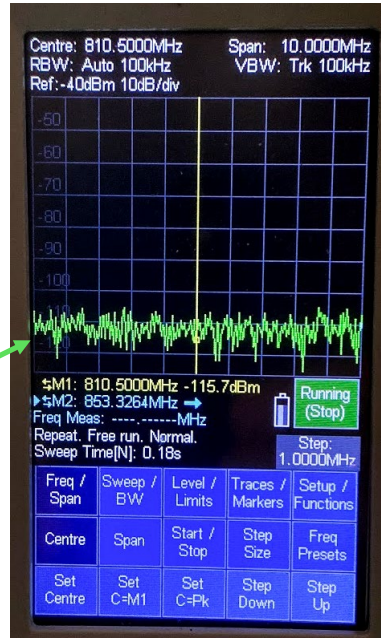
THE SOLUTION - Oscillation Suppression (Included in UL 2524 Standard):

1. BDA Detects Oscillation & Reduces Gain until the oscillation is neutralized
2. BDA Sends Trouble Signal to Fire Alarm Control Panel
3. BDA Indicates Trouble on Remote Annunciator / Monitor
4. BDA Continues normal operation with the maximum allowable gain

AHJ Concerns About Non-Compliant BDA Systems

#2 - NOISE Interference:

Noise on uplink can potentially add up & cause signal degradation for fire radio systems.



THE SOLUTION- Noise Suppression Feature:

1. Most BDAs normally generate a small amount of noise when idle.
2. The cumulative effect of multiple BDAs raises the “noise floor” on a frequency.
3. RSI’s BDAs operate in “stand-by mode” & do not transmit any noise while idle.

AHJ Concerns About Non-Compliant BDA Systems

#3 - SUPERVISION:

Failure of A System Component may go unnoticed without proper monitoring & supervision (required by NFPA 1221), resulting in the system NOT being available when you need it the most.

THE SOLUTION – UL-Certified Supervision and Monitoring:

Supervision as required by IBC/IFC and NFPA

SUPERVISED Dedicated Monitoring Annunciator Panel

Dedicated connections for Fire Alarm Panel Supervisory

Monitoring Of:

- Battery
- Power Supplies (Primary & Secondary)
- Antenna
- BDA Diagnostics

Industry-Leading Product

- Simple to Install & Deploy
- Proven & Reliable
- Turnkey System; All-Inclusive, NFPA-compliant
- First BDAs LISTED by UL to 2524 Standard in June 2018
- Full compliance with FCC, NFPA, IBC, IFC, CSFM
- Built in supervisory circuits
- Built in charger and battery monitoring
- Uplink Noise Squelch
- Automatic Oscillation Detection & Prevention
- Made in Norwell, Massachusetts, USA!

DESIGNED AND BUILT U. S. A.

UL 2524

RSI™ Radio Solutions, Inc. BDA SYSTEMS

3.) ERCES Specification & Inspections

A.) AHJ Spec / Model BDA Ordinance

Includes Specific Fire Code References

Approval & Permit

Fire Fighter Communication System Specifications

1. General
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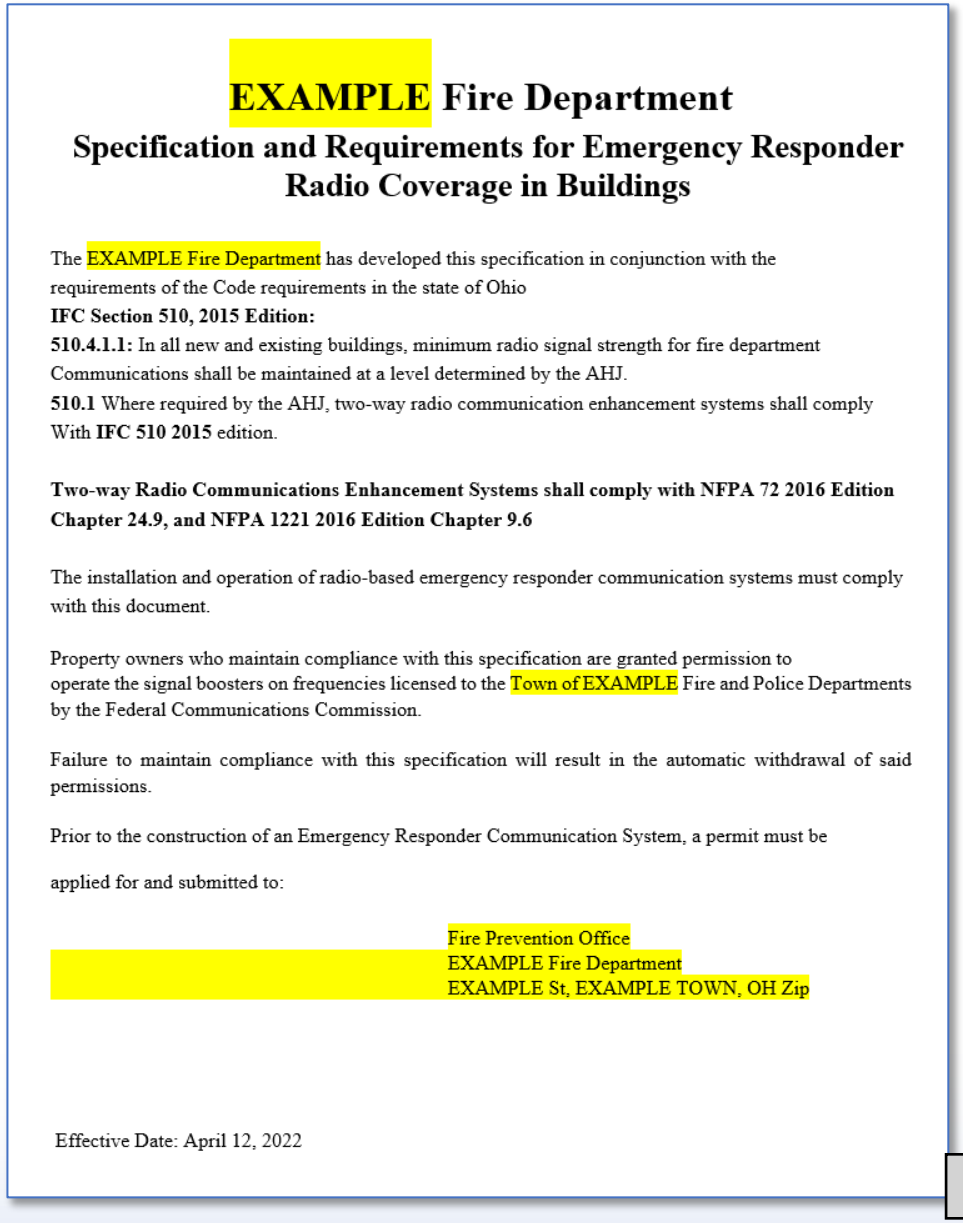

EXAMPLE Fire Department

Specification and Requirements for Emergency Responder Radio Coverage in Buildings

The EXAMPLE Fire Department has developed this specification in conjunction with the requirements of the Code requirements in the state of Ohio

IFC Section 510, 2015 Edition:

510.4.1.1: In all new and existing buildings, minimum radio signal strength for fire department Communications shall be maintained at a level determined by the AHJ.

510.1 Where required by the AHJ, two-way radio communication enhancement systems shall comply With **IFC 510 2015** edition.

Two-way Radio Communications Enhancement Systems shall comply with NFPA 72 2016 Edition Chapter 24.9, and NFPA 1221 2016 Edition Chapter 9.6

The installation and operation of radio-based emergency responder communication systems must comply with this document.

Property owners who maintain compliance with this specification are granted permission to operate the signal boosters on frequencies licensed to the Town of EXAMPLE Fire and Police Departments by the Federal Communications Commission.

Failure to maintain compliance with this specification will result in the automatic withdrawal of said permissions.

Prior to the construction of an Emergency Responder Communication System, a permit must be

applied for and submitted to:

Fire Prevention Office
EXAMPLE Fire Department
EXAMPLE St, EXAMPLE TOWN, OH Zip

Effective Date: April 12, 2022

A.) AHJ Spec / Model BDA Ordinance

Includes Specific Fire Code References

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Approval and Permit

1. Prior to the installation of a fire fighter Communication system, a permit for the Installation of a signal booster must be summitted to:

   Fire Prevention Office
   Example Fire Department
   Example St, Example Town, OH Zip

2. The permit application shall include:

   a. Detailed Drawings showing the location of the amplification equipment and associated antenna systems which include a view showing building access to the equipment.

   b. Schematic drawings of the electrical system, backup power, antenna system and any other associated equipment relative to the amplification equipment including Panel Lactations and labeling.

   c. Manufacturer's data sheets on all equipment to be installed.

3. Upon approval, a permit for the installation of a signal booster will be issued. Any field changes that occur during construction shall be incorporated into a new As-Built plans, including any manufacturer's data sheets for any equipment changes not submitted in the original submittal. As- Built plans, if required due to system changes, shall be submitted for approval.

4. The EXAMPLE Fire Department assumes the responsibility of registering approved Signal Boosters with the FCC.

5. Property Owners who maintain compliance with this document are granted permission to operate a signal booster on frequencies licensed to the EXAMPLE Fire Department by the Federal communications commission. The failure to maintain compliance with this specification will result in the automatic withdrawal of said permissions.

A.) AHJ Spec / Model BDA Ordinance

Includes Specific Fire Code References

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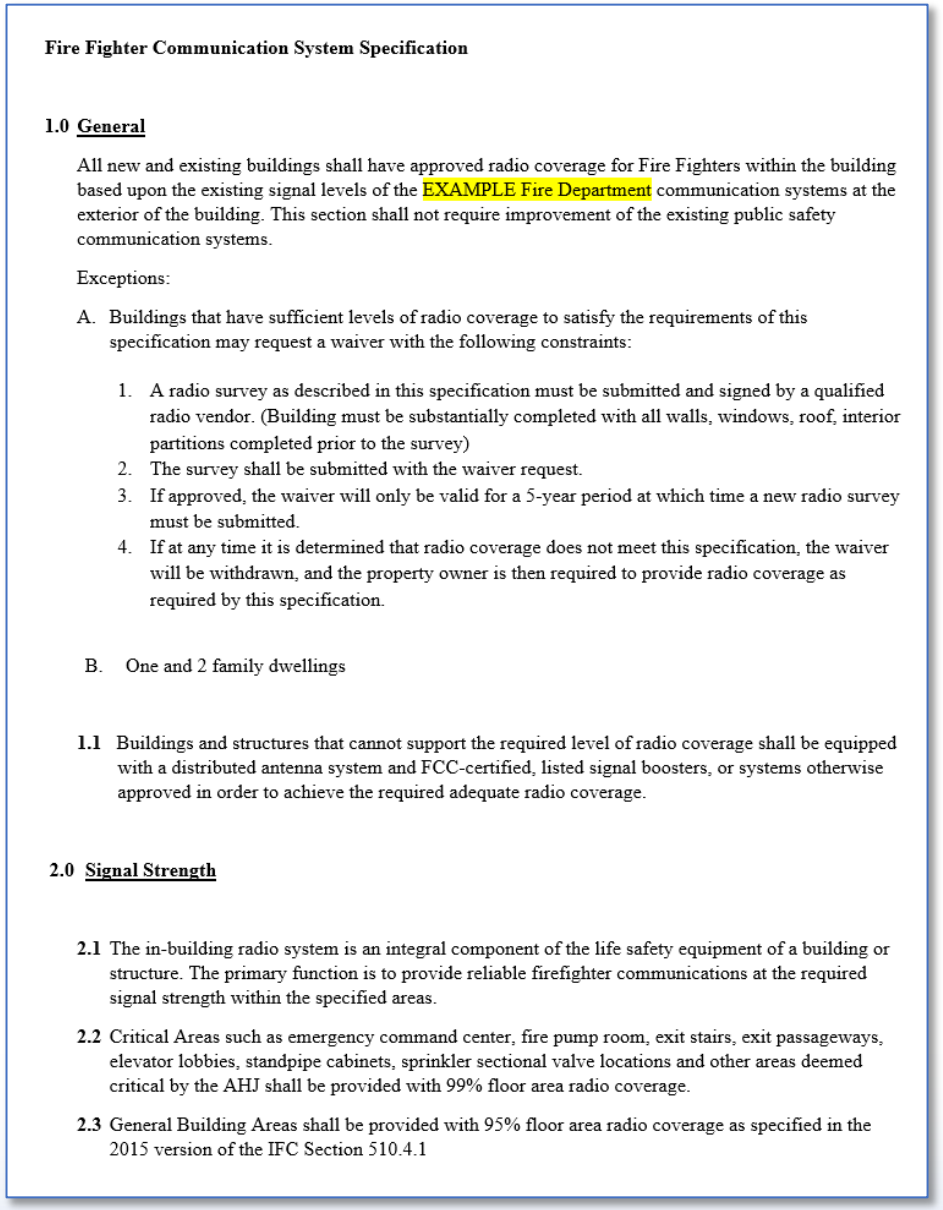

Fire Fighter Communication System Specification

1.0 General

All new and existing buildings shall have approved radio coverage for Fire Fighters within the building based upon the existing signal levels of the EXAMPLE Fire Department communication systems at the exterior of the building. This section shall not require improvement of the existing public safety communication systems.

Exceptions:

A. Buildings that have sufficient levels of radio coverage to satisfy the requirements of this specification may request a waiver with the following constraints:

1. A radio survey as described in this specification must be submitted and signed by a qualified radio vendor. (Building must be substantially completed with all walls, windows, roof, interior partitions completed prior to the survey)
2. The survey shall be submitted with the waiver request.
3. If approved, the waiver will only be valid for a 5-year period at which time a new radio survey must be submitted.
4. If at any time it is determined that radio coverage does not meet this specification, the waiver will be withdrawn, and the property owner is then required to provide radio coverage as required by this specification.

B. One and 2 family dwellings

1.1 Buildings and structures that cannot support the required level of radio coverage shall be equipped with a distributed antenna system and FCC-certified, listed signal boosters, or systems otherwise approved in order to achieve the required adequate radio coverage.

2.0 Signal Strength

2.1 The in-building radio system is an integral component of the life safety equipment of a building or structure. The primary function is to provide reliable firefighter communications at the required signal strength within the specified areas.

2.2 Critical Areas such as emergency command center, fire pump room, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations and other areas deemed critical by the AHJ shall be provided with 99% floor area radio coverage.

2.3 General Building Areas shall be provided with 95% floor area radio coverage as specified in the 2015 version of the IFC Section 510.4.1

A.) AHJ Spec / Model BDA Ordinance

Includes Specific Fire Code References

Approval & Permit

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2.4 In-building radio systems required by this ordinance must provide the following signal strengths:

Downlink - Minimum signal strength of -95 dBm throughout the coverage area, as per §510.4.1.

Uplink - Minimum signal strength of -95 dBm received at the FD Radio System, as per §510.4.1.

3.0 Radio Survey:

3.1 Acceptance test procedure. Where an emergency responder radio coverage system is required, and upon completion of installation, the building owner shall have the radio system tested to verify that two-way coverage on each floor of the building is not less than 90 percent. The test procedure shall be conducted as follows:

1. Each floor of the building shall be divided into a grid of 20 approximately equal test areas.
2. The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency' s radio communications systems.
3. Failure of not more than two nonadjacent test areas shall not result in failure of the test.
4. In the event that three of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of not more than four nonadjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 90-percent coverage requirement.
5. A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the public agency's radio communication system. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered failure of that test area. Additional test locations shall not be permitted.
6. The gain values of all amplifiers shall be measured, and the test measurement results shall be kept on file with the building owner so that the measurements can be verified during annual tests. In the event that the measurement results become lost, the building owner shall be required to rerun the acceptance test to reestablish the gain values.
7. As part of the installation a spectrum analyzer or other suitable test equipment shall be utilized to ensure spurious oscillations are not being generated by the subject signal booster. This test shall be conducted at the time of installation and subsequent annual inspections.

3.2 RF plots indicating the enhanced coverage shall be submitted at the time of acceptance testing.

3.3 The FD is to be notified prior to any testing.

3.4 Unattended operation of the in-building radio system is not permitted until the completion of acceptance testing.

A.) AHJ Spec / Model BDA Ordinance

Includes Specific Fire Code References

Approval & Permit

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4.0 Technical Specifications and Component Installation:

4.1 Assembly and installation of all components of the Fire Fighter Communication System shall comply with all applicable sections of the National Electrical Code.

4.2 Signal boosters and other active components of the system shall be listed for the intended purpose.

4.3 Pathway Survivability levels shall be as described in NFPA 1221 § 9.6.2.1.1

4.4 The system must comply with all applicable sections of FCC rules. Signal booster shall have FCC certification prior to installation.

4.5 Aftermarket add-on filters, attachments or other modifications of the original equipment shall not be permitted.

4.6 All signal booster components, power supplies and chargers shall be contained in a NEMA4 type approved waterproof cabinet. All enclosures shall be painted red and shall include a locking mechanism.

4.7 The signal booster system shall include built-in automatic alarming of malfunctions of the signal booster and battery system as per §24.5.2.6.1 NFPA 1221 version 2016. Aftermarket equipment add-ons and field modifications of the OEM equipment to achieve compliance with this specification will not be accepted.

4.8 Maximum Propagation delay of the signal booster system is 14us (microseconds)

4.9 Antenna isolation shall be maintained between the donor antenna and all inside antennas (D.A.S.) to a minimum of 20dB under all operating conditions.

4.10 Frequencies:

The systems shall be capable of supporting simultaneous transmissions of the following frequencies:

Downlink frequency (mobile receive) Fire Channel 1: 159.300 MHz
Downlink frequency (mobile receive) Fire Channel 2: 159.300 MHz
Downlink frequency (mobile receive) Police: 155.5275 MHz

Uplink frequency (mobile transmit) Fire Channel 1: 151.385 MHz
Uplink frequency (mobile transmit) Fire Channel 2: 159.0675 MHz
Uplink frequency (mobile transmit) Police: 159.0675 MHz

Signal surveys shall include all the specified frequencies.

A.) AHJ Spec / Model BDA Ordinance

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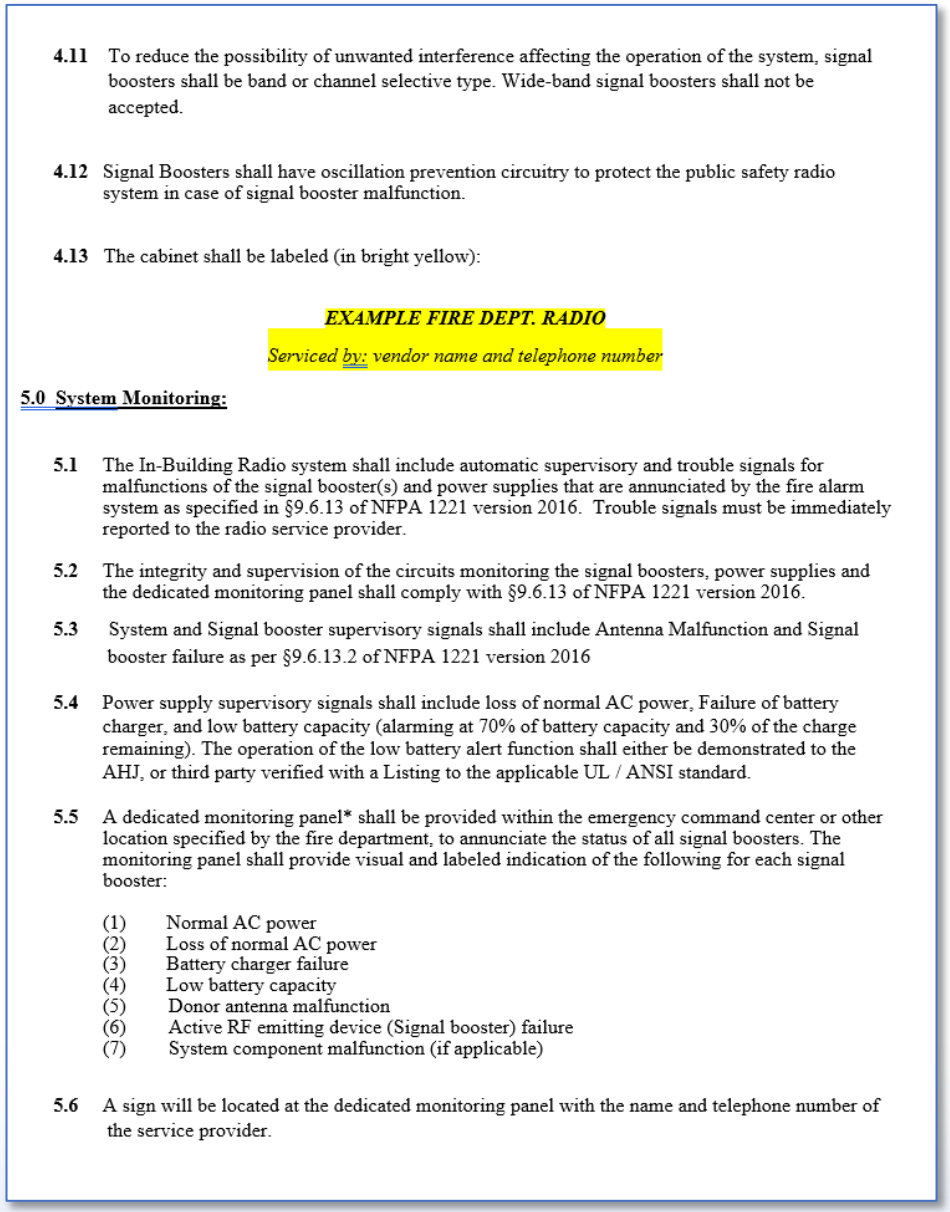

4.11 To reduce the possibility of unwanted interference affecting the operation of the system, signal boosters shall be band or channel selective type. Wide-band signal boosters shall not be accepted.

4.12 Signal Boosters shall have oscillation prevention circuitry to protect the public safety radio system in case of signal booster malfunction.

4.13 The cabinet shall be labeled (in bright yellow):

EXAMPLE FIRE DEPT. RADIO

Serviced by: vendor name and telephone number

5.0 System Monitoring:

5.1 The In-Building Radio system shall include automatic supervisory and trouble signals for malfunctions of the signal booster(s) and power supplies that are annunciated by the fire alarm system as specified in §9.6.13 of NFPA 1221 version 2016. Trouble signals must be immediately reported to the radio service provider.

5.2 The integrity and supervision of the circuits monitoring the signal boosters, power supplies and the dedicated monitoring panel shall comply with §9.6.13 of NFPA 1221 version 2016.

5.3 System and Signal booster supervisory signals shall include Antenna Malfunction and Signal booster failure as per §9.6.13.2 of NFPA 1221 version 2016

5.4 Power supply supervisory signals shall include loss of normal AC power, Failure of battery charger, and low battery capacity (alarming at 70% of battery capacity and 30% of the charge remaining). The operation of the low battery alert function shall either be demonstrated to the AHJ, or third party verified with a Listing to the applicable UL / ANSI standard.

5.5 A dedicated monitoring panel* shall be provided within the emergency command center or other location specified by the fire department, to annunciate the status of all signal boosters. The monitoring panel shall provide visual and labeled indication of the following for each signal booster:

(1) Normal AC power
(2) Loss of normal AC power
(3) Battery charger failure
(4) Low battery capacity
(5) Donor antenna malfunction
(6) Active RF emitting device (Signal booster) failure
(7) System component malfunction (if applicable)

5.6 A sign will be located at the dedicated monitoring panel with the name and telephone number of the service provider.

A.) AHJ Spec / Model BDA Ordinance

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6.0 Distributed Antenna System:

6.1 The distributed antenna system may utilize a radiating cable, conventional cable, fixed antennas or a Combination of all three.

6.2 Notice will be made to the EXAMPLE Fire Department as part of the permit application if the DAS will have frequencies other than those specified in section 4.9. All secondary users of the distributed antenna system (DAS) must comply with all requirements of the EXAMPLE Fire Department so as not to degrade the operational standards of the system.

7.0 Power Supply:

7.1 At least 2 independent and reliable power supplies shall be provided (§510.4.2.3 of IFC 2015)

7.2 The primary power source shall be supplied from a dedicated branch circuit and comply with (§510.4.2.3 of IFC 2015)

7.3 The emergency responder radio coverage system shall be equipped with a secondary source of power. The secondary source of power shall be a battery system with a listed dedicated battery charger. The secondary power supply shall automatically switch over and power the device when the primary power source is lost. The secondary source of power shall be capable of operating the emergency responder radio coverage system for a period of at least 12 hours. The battery charging system shall automatically charge in the presence of external power input. Battery charger and all other electronic components must be fully enclosed in a non-vented NEMA4 enclosure. Batteries shall be enclosed either in a separate, vented NEMA3R or sealed NEMA4 type approved enclosure of appropriate size. (§510.4.2.4 (1) & (2) IFC 2015)

8.0 Acceptance Testing:

8.1 Delivered audio quality (DAQ) testing will be conducted by FD radio personnel to ensure that two-way radio coverage, on each floor of the building, meets the minimum coverage requirements of Section 2 above.

8.2 The radio service vendor shall certify that the in-building radio system was installed and tested in accordance with the requirements of the current In-Building Radio Coverage Specification.

8.3 A radio service company shall certify that a maintenance contract is in effect that provides 24-hour by 7-day response within 2 hours of notification of a problem. This contract must be for a period of at least 1 year.

8.4 RF plotting (grid tests) results, gain values of all amplifiers, as built drawings which include BDA Manufacturer, Model #, Serial #, FCC Certification #, Listing Certificate and a link budget must be submitted.

A.) AHJ Spec / Model BDA Ordinance

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9.0 Annual Test:

9.1 The owner shall check all active components of the in-building radio system, including but not limited to amplifier, power supplies, and back-up batteries, a minimum of once every twelve (12) months.

9.2 Amplifiers shall be tested to ensure that the gain is the same as it was upon initial installation and acceptance. The original gain shall be noted and any change in gain shall be documented.

9.3 Back-up batteries and power supplies shall be tested under load to verify that they will operate during an actual power outage.

9.4 Active components shall be checked to determine that they are operating within the manufacturer's specifications for their intended purpose.

9.5 Documentation of the test shall be maintained on site and a copy forwarded by the radio service company to the EXAMPLE Fire Department upon completion of the test.

9.6 Radio coverage test shall be conducted a minimum of once every year to ensure that the radio system continues to meet the requirements of this ordinance. The procedure set forth in Section 3 shall apply to such tests. Any gaps in coverage shall be promptly remedied or reported to the fire department.

10. Service Provider Responsibilities:

10.1 All tests shall be conducted, documented, and signed by a person in possession of FCC General General Radio Telephone Operators License.

10.2 All testing personnel shall be certified and authorized by the BDA manufacturer in the installation and operation of their equipment.

10.3 Submit annual testing report to the fire department.

10.4 Fire department shall be promptly notified of any system failures that have not been rectified during the initial service call.

10.5 FD shall be notified in writing at least thirty (30) days prior to cancellation of a maintenance contract.

10.6 FD shall be notified in writing upon the procurement of contractual agreements relating to in-building radios covered by this specification.

11. Modifications:

11.1 Any modification of an existing BDA System will require a written request to FD.

11.2 After completion of any modification to a BDA a full acceptance test as required in this specification will be conducted and submitted for review.

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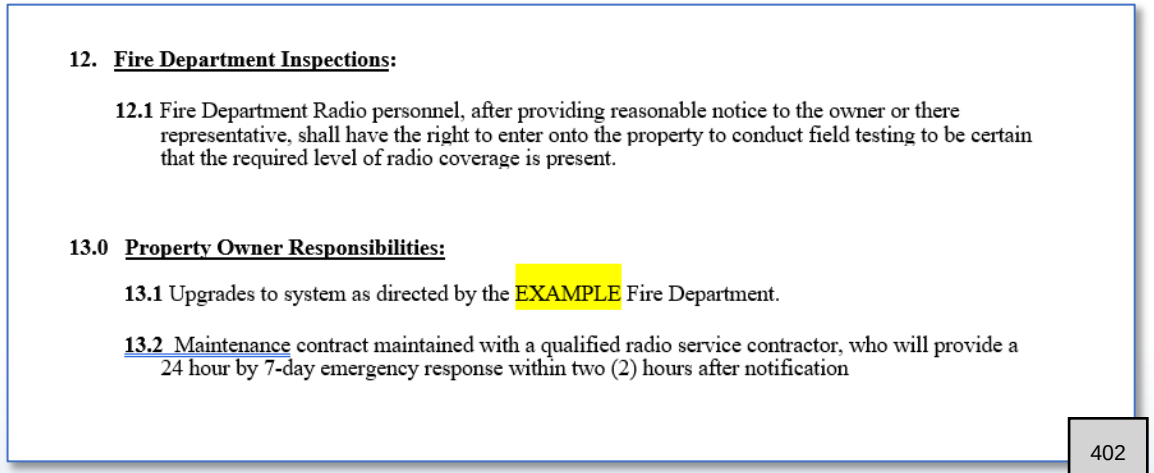


12. Fire Department Inspections:

12.1 Fire Department Radio personnel, after providing reasonable notice to the owner or there representative, shall have the right to enter onto the property to conduct field testing to be certain that the required level of radio coverage is present.

13.0 Property Owner Responsibilities:

13.1 Upgrades to system as directed by the EXAMPLE Fire Department.

13.2 Maintenance contract maintained with a qualified radio service contractor, who will provide a 24 hour by 7-day emergency response within two (2) hours after notification

B.) BDA Permit

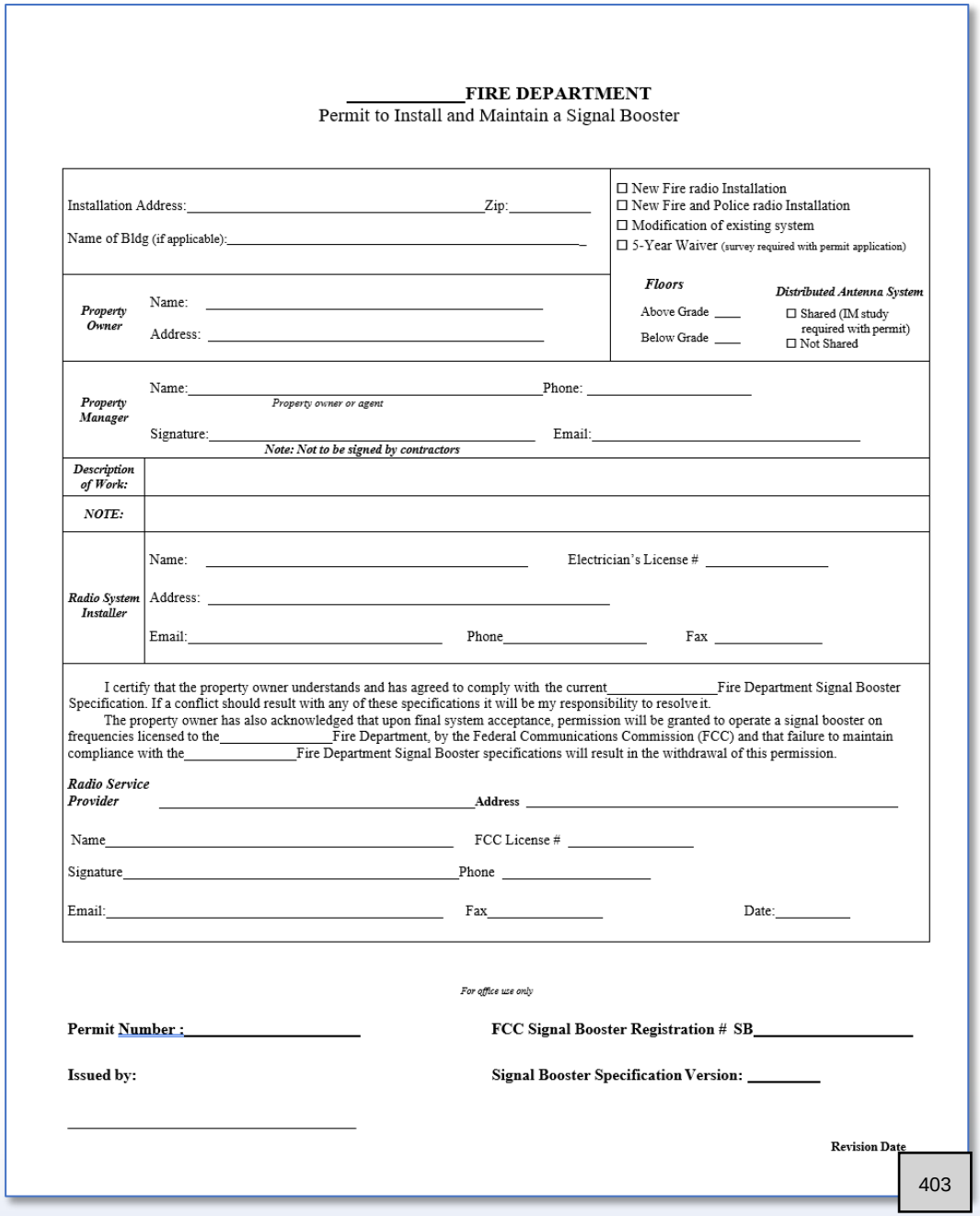
Permit is part of the Project Submittal Package for the AHJ
(with Plans, Equipment Specifications, etc.)

Permit to Install a BDA System Signed by:

- **Property Manager**
- **BDA System Installer**

"Property Owner *understands* and *has agreed to comply* with the current _____ Fire Department Signal Booster Specification"

Note whether Fire AND Police Frequencies are included



_____FIRE DEPARTMENT
Permit to Install and Maintain a Signal Booster

Installation Address:_____Zip:_____
Name of Bldg (if applicable):_____

☐ New Fire radio Installation
☐ New Fire and Police radio Installation
☐ Modification of existing system
☐ 5-Year Waiver (survey required with permit application)

Property Owner Name: _____ Address: _____

Floors Above Grade ____ Below Grade ____

Distributed Antenna System ☐ Shared (IM study required with permit) ☐ Not Shared

Property Manager Name:_____Phone: _____
Property owner or agent
Signature:_____ Email:_____
Note: Not to be signed by contractors

Description of Work:

NOTE:

Radio System Installer Name: _____ Electrician's License # _____
Address: _____
Email:_____ Phone_____ Fax _____

I certify that the property owner understands and has agreed to comply with the current_____Fire Department Signal Booster Specification. If a conflict should result with any of these specifications it will be my responsibility to resolve it.
The property owner has also acknowledged that upon final system acceptance, permission will be granted to operate a signal booster on frequencies licensed to the_____Fire Department, by the Federal Communications Commission (FCC) and that failure to maintain compliance with the_____Fire Department Signal Booster specifications will result in the withdrawal of this permission.

Radio Service Provider _____**Address** _____
Name_____ FCC License # _____
Signature_____Phone _____
Email:_____ Fax_____ Date:_____

For office use only

Permit Number :_____ **FCC Signal Booster Registration # SB**_____
Issued by: **Signal Booster Specification Version:** _____
_____
Revision Date

C.) Acceptance Checklist

Must be Customized to the Municipality:

A.) Plans & Permits

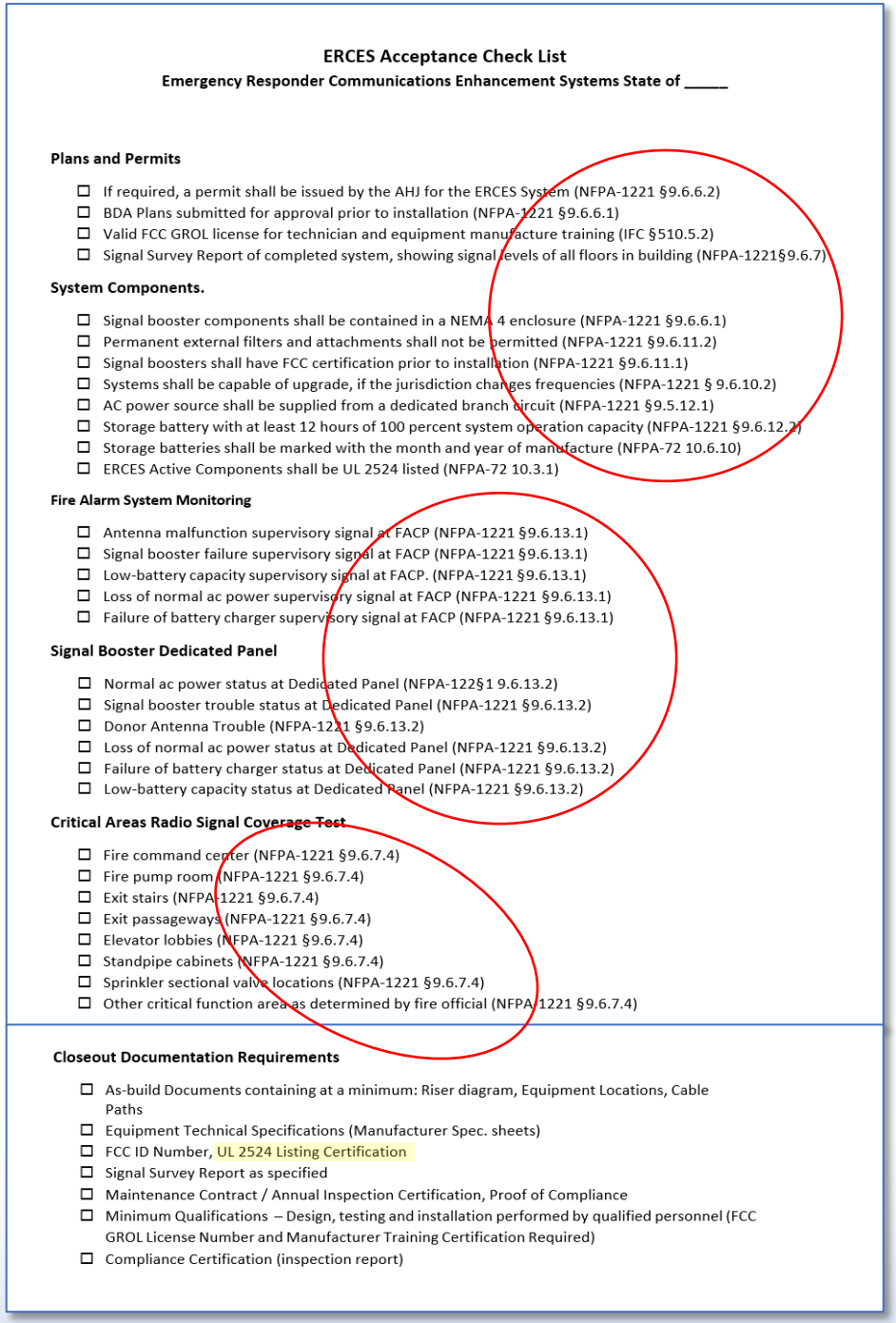
B.) System Components

C.) Fire Alarm System Monitoring

D.) Signal Booster Dedicated Panel

E.) Critical Areas Radio Signal Coverage Test

F.) Closeout Documentation Requirements



ERCES Acceptance Check List
Emergency Responder Communications Enhancement Systems State of _____

Plans and Permits

- ☐ If required, a permit shall be issued by the AHJ for the ERCES System (NFPA-1221 §9.6.6.2)
- ☐ BDA Plans submitted for approval prior to installation (NFPA-1221 §9.6.6.1)
- ☐ Valid FCC GROL license for technician and equipment manufacture training (IFC §510.5.2)
- ☐ Signal Survey Report of completed system, showing signal levels of all floors in building (NFPA-1221§9.6.7)

System Components.

- ☐ Signal booster components shall be contained in a NEMA 4 enclosure (NFPA-1221 §9.6.6.1)
- ☐ Permanent external filters and attachments shall not be permitted (NFPA-1221 §9.6.11.2)
- ☐ Signal boosters shall have FCC certification prior to installation (NFPA-1221 §9.6.11.1)
- ☐ Systems shall be capable of upgrade, if the jurisdiction changes frequencies (NFPA-1221 § 9.6.10.2)
- ☐ AC power source shall be supplied from a dedicated branch circuit (NFPA-1221 §9.5.12.1)
- ☐ Storage battery with at least 12 hours of 100 percent system operation capacity (NFPA-1221 §9.6.12.2)
- ☐ Storage batteries shall be marked with the month and year of manufacture (NFPA-72 10.6.10)
- ☐ ERCES Active Components shall be UL 2524 listed (NFPA-72 10.3.1)

Fire Alarm System Monitoring

- ☐ Antenna malfunction supervisory signal at FACP (NFPA-1221 §9.6.13.1)
- ☐ Signal booster failure supervisory signal at FACP (NFPA-1221 §9.6.13.1)
- ☐ Low-battery capacity supervisory signal at FACP. (NFPA-1221 §9.6.13.1)
- ☐ Loss of normal ac power supervisory signal at FACP (NFPA-1221 §9.6.13.1)
- ☐ Failure of battery charger supervisory signal at FACP (NFPA-1221 §9.6.13.1)

Signal Booster Dedicated Panel

- ☐ Normal ac power status at Dedicated Panel (NFPA-122§1 9.6.13.2)
- ☐ Signal booster trouble status at Dedicated Panel (NFPA-1221 §9.6.13.2)
- ☐ Donor Antenna Trouble (NFPA-1221 §9.6.13.2)
- ☐ Loss of normal ac power status at Dedicated Panel (NFPA-1221 §9.6.13.2)
- ☐ Failure of battery charger status at Dedicated Panel (NFPA-1221 §9.6.13.2)
- ☐ Low-battery capacity status at Dedicated Panel (NFPA-1221 §9.6.13.2)

Critical Areas Radio Signal Coverage Test

- ☐ Fire command center (NFPA-1221 §9.6.7.4)
- ☐ Fire pump room (NFPA-1221 §9.6.7.4)
- ☐ Exit stairs (NFPA-1221 §9.6.7.4)
- ☐ Exit passageways (NFPA-1221 §9.6.7.4)
- ☐ Elevator lobbies (NFPA-1221 §9.6.7.4)
- ☐ Standpipe cabinets (NFPA-1221 §9.6.7.4)
- ☐ Sprinkler sectional valve locations (NFPA-1221 §9.6.7.4)
- ☐ Other critical function area as determined by fire official (NFPA-1221 §9.6.7.4)

Closeout Documentation Requirements

- ☐ As-build Documents containing at a minimum: Riser diagram, Equipment Locations, Cable Paths
- ☐ Equipment Technical Specifications (Manufacturer Spec. sheets)
- ☐ FCC ID Number, UL 2524 Listing Certification
- ☐ Signal Survey Report as specified
- ☐ Maintenance Contract / Annual Inspection Certification, Proof of Compliance
- ☐ Minimum Qualifications – Design, testing and installation performed by qualified personnel (FCC GROL License Number and Manufacturer Training Certification Required)
- ☐ Compliance Certification (inspection report)

D.) Registering the BDA with the FCC

A.) AHJ inputs FCC Registration # & Password

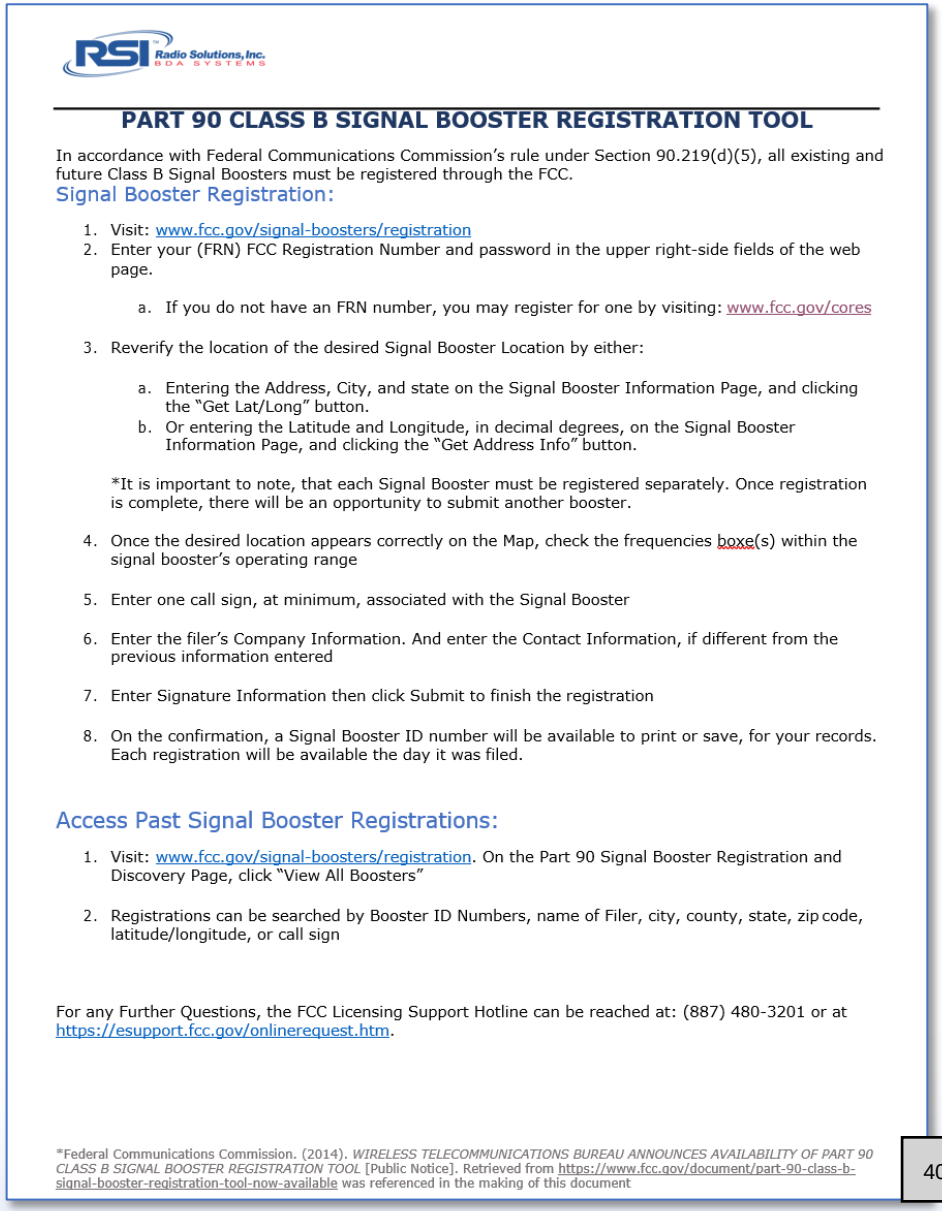
B.) Location of the Signal Booster

C.) Frequencies Included

D.) Call Sign

E.) Filer's Company Info. & Contact Info.
Usually the Licensee (AHJ Responsibility)

F.) Signature



RSI Radio Solutions, Inc. BDA SYSTEMS

PART 90 CLASS B SIGNAL BOOSTER REGISTRATION TOOL

In accordance with Federal Communications Commission's rule under Section 90.219(d)(5), all existing and future Class B Signal Boosters must be registered through the FCC.

Signal Booster Registration:

1. Visit: www.fcc.gov/signal-boosters/registration
2. Enter your (FRN) FCC Registration Number and password in the upper right-side fields of the web page.
   a. If you do not have an FRN number, you may register for one by visiting: www.fcc.gov/cores
3. Reverify the location of the desired Signal Booster Location by either:
   a. Entering the Address, City, and state on the Signal Booster Information Page, and clicking the "Get Lat/Long" button.
   b. Or entering the Latitude and Longitude, in decimal degrees, on the Signal Booster Information Page, and clicking the "Get Address Info" button.

   *It is important to note, that each Signal Booster must be registered separately. Once registration is complete, there will be an opportunity to submit another booster.
4. Once the desired location appears correctly on the Map, check the frequencies boxe(s) within the signal booster's operating range
5. Enter one call sign, at minimum, associated with the Signal Booster
6. Enter the filer's Company Information. And enter the Contact Information, if different from the previous information entered
7. Enter Signature Information then click Submit to finish the registration
8. On the confirmation, a Signal Booster ID number will be available to print or save, for your records. Each registration will be available the day it was filed.

Access Past Signal Booster Registrations:

1. Visit: www.fcc.gov/signal-boosters/registration. On the Part 90 Signal Booster Registration and Discovery Page, click "View All Boosters"
2. Registrations can be searched by Booster ID Numbers, name of Filer, city, county, state, zip code, latitude/longitude, or call sign

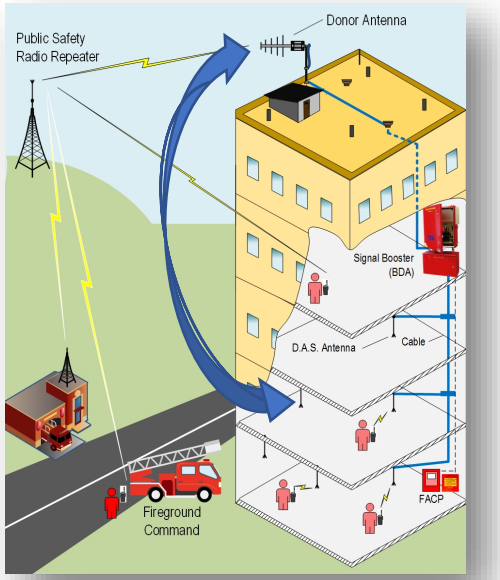
For any Further Questions, the FCC Licensing Support Hotline can be reached at: (887) 480-3201 or at https://esupport.fcc.gov/onlinerequest.htm.

*Federal Communications Commission. (2014). *WIRELESS TELECOMMUNICATIONS BUREAU ANNOUNCES AVAILABILITY OF PART 90 CLASS B SIGNAL BOOSTER REGISTRATION TOOL* [Public Notice]. Retrieved from https://www.fcc.gov/document/part-90-class-b-signal-booster-registration-tool-now-available was referenced in the making of this document

4.) BDA Impact on Infrastructure

Assurance

OSCILLATION PREVENTION

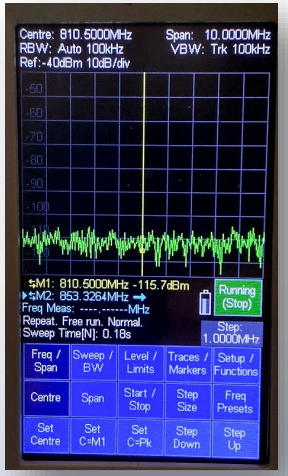


CODE-REQUIRED SUPERVISION

FCC-LICENSED TECHNICIANS

FCC GROL

NON-INTERFERENCE



RSI™ Radio Solutions, Inc. BDA SYSTEMS

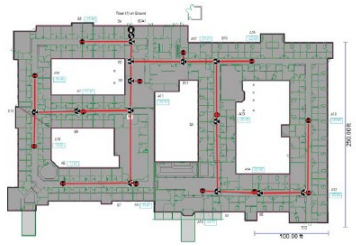
5.) ERCES = Life Safety as a Priority

"What makes the RSI - Silco Fire & Security Partnership Unique?"

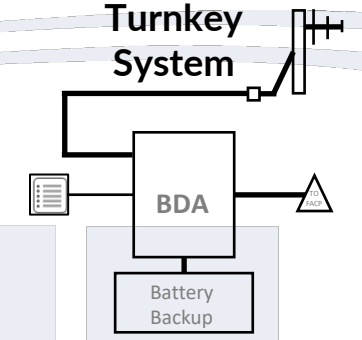
RSIs Model for ERCES Quality Assurance with Silco Fire & Security

Standardized ERCES Technical Training

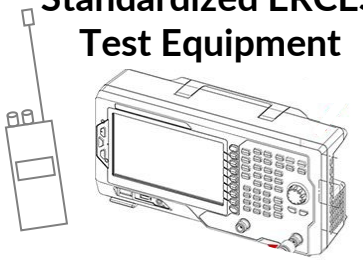
Manufacturer System Designs in iBwave



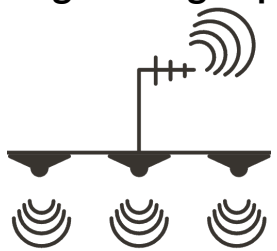
Turnkey System



Standardized ERCES Test Equipment



Project Management & Engineering Support



FCC GROL-Licensed Technicians

Life Safety Codes & Standards Expertise

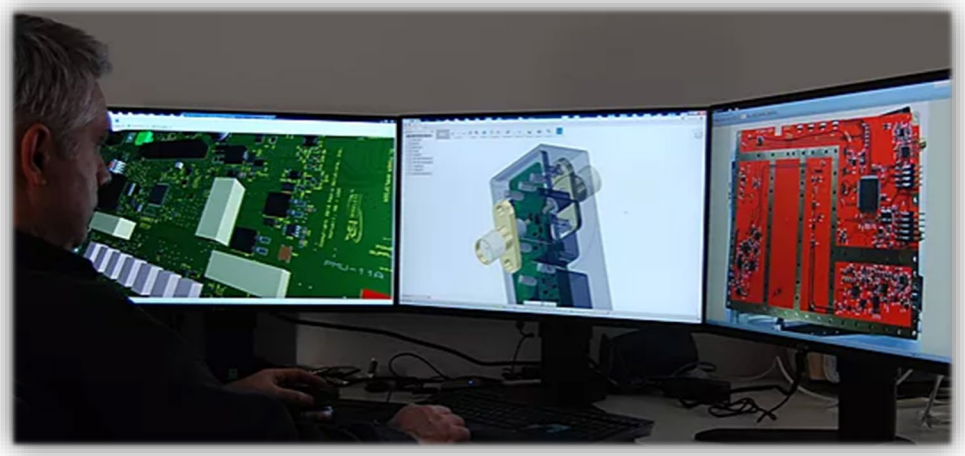
QUESTIONS & ANSWERS

Jay Greene
Fire & Security Consultant
Cell:513.620.1392

Silco
FIRE & SECURITY

Derek Case
Global Director of Marketing & Business Development
Radio Solutions, Inc.
55 Accord Park Drive
Norwell, MA 02061
office (781) 384-2910
Derek.Case@RadioSolutionsInc.com

RSI™ Radio Solutions, Inc. BDA SYSTEMS



Thank You!

RSI™ Radio Solutions, Inc.
BDA SYSTEMS

Thanks again for considering RSI's ERCES presentation for Authorities Having Jurisdiction in Ohio.

Here is a brief outline of the course:

1. Introduction to Emergency Responder Communications Enhancement Systems (ERCES)
2. ERCES Codes & Standards (including UL 2524 Listing)
3. ERCES Specification & Inspections
4. Impact of BDA Systems on your current radio infrastructure
5. Making life safety a priority with code-compliant ERCES
6. Question & Answer / Open Forum

I've also attached a PDF of the presentation that I gave to the Southwest Ohio Fire Safety Council three weeks ago. Please let me know if you have any questions. Thank you.

Have a GREAT Weekend!

Best,

Derek Case
Global Director Marketing & Business Development
Radio Solutions Inc. | ERCES / BDA Systems
direct: 781-384-2910 | main: 781-561-3000
www.radiosolutionsinc.com

File Attachments for Item:

ER-3 How to E-Learn and Study Skills (Building and Fire Code Academy)

All certifications (6 hours)

Staff Notes: Soft skills course on maximizing impact of online learning and study for work and exams. Recommend approval.

Committee Recommendation:

2420 Vantage Drive
Elgin, IL 60124
Website www.bfcacademy.com

BFCA®
Building & Fire Code Academy

Phone (847) 428-2951
Fax (847) 428-2911
Toll-Free (800) 488-7057
E-mail info@bfcacademy.com

How to E-Learn and Study Skills

6 CEUs
Soft Skills – Focus is on being an Active Participant during class and Study Skills, though code is used, it is only a tool for practicing study skills.

9:00 – 4:00 – Includes two 15 minute breaks, and 1 hour lunch

Morning Session:
9:00 – 12:00 w/1 break

Covers how to be an active participant with an overview of how we learn best. Students will explore their own learning styles and learn why some study strategies work, and why some do not. Students will do one short (15 minutes) activity to practice a reading method that will allow students to cover a large amount of material without having to necessarily read every word and try to commit that to memory.

Power point: Slides 1-58 approx. Handout: Class Exercise No. 1

Afternoon session:
1:00 – 4:00 w/1 break

Covers Study Strategies, with demonstrations and discussion on how or why some of these skills work for some students but not for others. Focus is to have students start to think about how they learn best and what study skills in the past has worked, or not worked for them. The afternoon session is more interactive and will conclude with another practice section of the Survey Reading method with a longer reading section.

Power point: Slides 58-End Handout: Class Exercise No. 2

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: Teresa Wawro
(Contact Name)
Organization: Buiilding & Fire Code Academy
(Organization/Company)
Address: 2420 Vantage Drive
(Include Room Number, Suite, etc.)
City: Elgin State: IL Zip: 60124
E-Mail: twawro@bfcacademy.com
Telephone: 847-428-2951 Fax: 847-428-2911
Course Sponsor:

COURSE INFORMATION:

Course Title: How to E-Learn and Study Skills

New Course Submittal: ■ Update Course: ☐ Prior Approval Number:

Purpose and Objective: A training course structured for individuals needing to take an e-learning course. Students will be able to: Identify their unique characeristics of how to learn best and apply them to the e-learning classroom; Identify the ideal environment in which to partiicpate in e-learning courses and in which to further their study; Analyze their reasons for taking an e-learning course and will understand and apply those reasons to the goals of attending the course successfully; Determine which study skills to utilize and apply to their goals for taking an e-learning course

Number of Instructional Contact Hours that can be obtained upon completion: 6

If Multi-Session, Number of Instructional Contact Hours Per Session: N/A

Program Applicable for the Following Participants:

Building Official ■ Master Plans Examiner ■ Plumbing Plans Exam. ■ Electrical Plans Exam. ■ Mechanical Plans Exam. ■ Building Inspector ■ Fire Protection Inspector ■ Mechanical Inspector ■ Plumbing Inspector ■ Non-Res IU Inspector ■

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ■ Res IU Inspector ■

Electrical Safety Inspectors [X]
Location of ESI Course: Date(s) of ESI Course(s):

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	X
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	X
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	X
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	X
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	N/A
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	X
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	X
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	X
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

Teresa Wawro

Pingree Grove, Illinois 60140
twawro@gmail.com

Education and Certificate

- Trinity International University, Deerfield, Illinois - Bachelor of Arts - Education, 2008
- Professional Educators License, Elementary Education, K-9 SCGE, Language Arts 5-8 and Social Science 5-8

Teaching Experience

Teacher - Parkview Christian Academy, Yorkville, Illinois - 2014 ~ 2019

- Two years classroom experience at Fourth grade level. Taught all required curriculum including Reading, Writing, Grammar, Math, Science and History
- Three years at the Middle School level teaching Social Studies encompassing U.S. History, Cultural Geography, and World History. Taught three years of Math through Pre-Algebra. One year of Science. One year of Language Arts at the 6th grade level. One year of Algebra 2 with a high school student that needed one to one instruction
- Responsible for lesson planning, pacing and scope of courses. Differentiation of material as necessary for students both below and above grade level. Integrated research and writing into all subjects across all grade levels
- Member of the curriculum committee responsible for selection of new Social Studies and Math texts. Assisted with design of math and social studies course offerings at both the Middle School and High School levels
- Resided on committee for the hiring of both teachers and administrators

Resource Teacher - Westminster Christian School, Elgin, Illinois - 2009 ~ 2014

- Program instruction in Reading for elementary and middle school students utilizing SLANT, an Orton-Gillingham based system
- Math instruction for middle and high school level students in grade level and Pre-Algebra, Algebra and Algebra 2, responsible for lesson planning, pacing and scope of course. Goal was to provide one to one instruction that parallels the general education classroom
- Provide instructional support for students. Focus on organization, study skills and accountability. Able to differentiate instruction and support classroom teachers in order to provide focused instruction for their students
- Obtained training and certification in SLANT System. SLANT is a tier 2 and 3 intervention using multi-sensory instructional techniques with a focus on the structure of the English language

Related Experience

Long-term Substitute - Cary Junior High School, Cary, Illinois - 2019 ~ 2020

- Covered three long-term positions. Taught 8th grade Language Arts, 7th Grade Language Arts and Social Studies and Drama for 6th through 8th grades
- For both the 8th grade and 7th grade Language Arts positions and the 7th Grade Social Studies position was responsible for all lesson planning and grading. Provided differentiated instruction for multi-level learners and worked closely with and co-taught with a special education teacher
- Differentiated instruction for the all grade levels in the Drama course
- Provided Remote Learning instruction during the Drama course

Teacher Resource Specialist (Paraprofessional) - Westfield Middle School, Bloomington, Illinois - 2008 ~ 2009

- Co-taught with Reading Specialist/Literacy Coach by conferencing with students, establishing reading strategies and reinforcing necessary skills for students to become fluent readers
- Assisted with the running of Instructional Media Center on a daily basis by providing library services to teachers and students
- Substitute teacher across grade levels and curricular classes; following lesson plans established by instructor
- Attended content team meetings, and in-service workshops provided by the district and established ideas for instructional activities such as differentiation and behavior management
- Aided in administration of MAP testing, established schedule of students for testing

Experience

Operations Manager - Unified Barcode & RFID, Inc. - 2005 - 2006

- Responsible for Accounts Payable/Receivable, HR and Payroll, using Quickbooks
- Responsible for handling customer service calls to maintain 100% customer satisfaction
- Maintained accurate inventory
- Handled shipping and receiving as necessary
- Worked with Accountant to make tax payments and produce financial reports and statements

Retail Associate, Assistant Manager - Gymboree - 2002 – 2005

- Met daily sales goals as a retail associate. Aided team members to ensure that they met their goals, so that the store could consistently meet sales goals.
- As Assistant Manager responsible for ensuring that cash balanced, and that sales figures were reported as required
- Ensured that customers were satisfied with their shopping experience
- Helped to reset store as needed with new inventory

Administrative Assistant - Bisco, Inc. - 2000 – 2001

- Acted as personal secretary to Vice President/Co-owner of the firm. Kept appointment calendar, expense reports as needed
- Kept accurate records of investments and other financial records as needed
- Helped with the travel arrangements for sales representatives to industry trade shows. Ensured that trade show booth was shipped and delivered/set-up for each show on time, meeting all requirements

Operations Manager - Vision Technology - 1999 – 2000

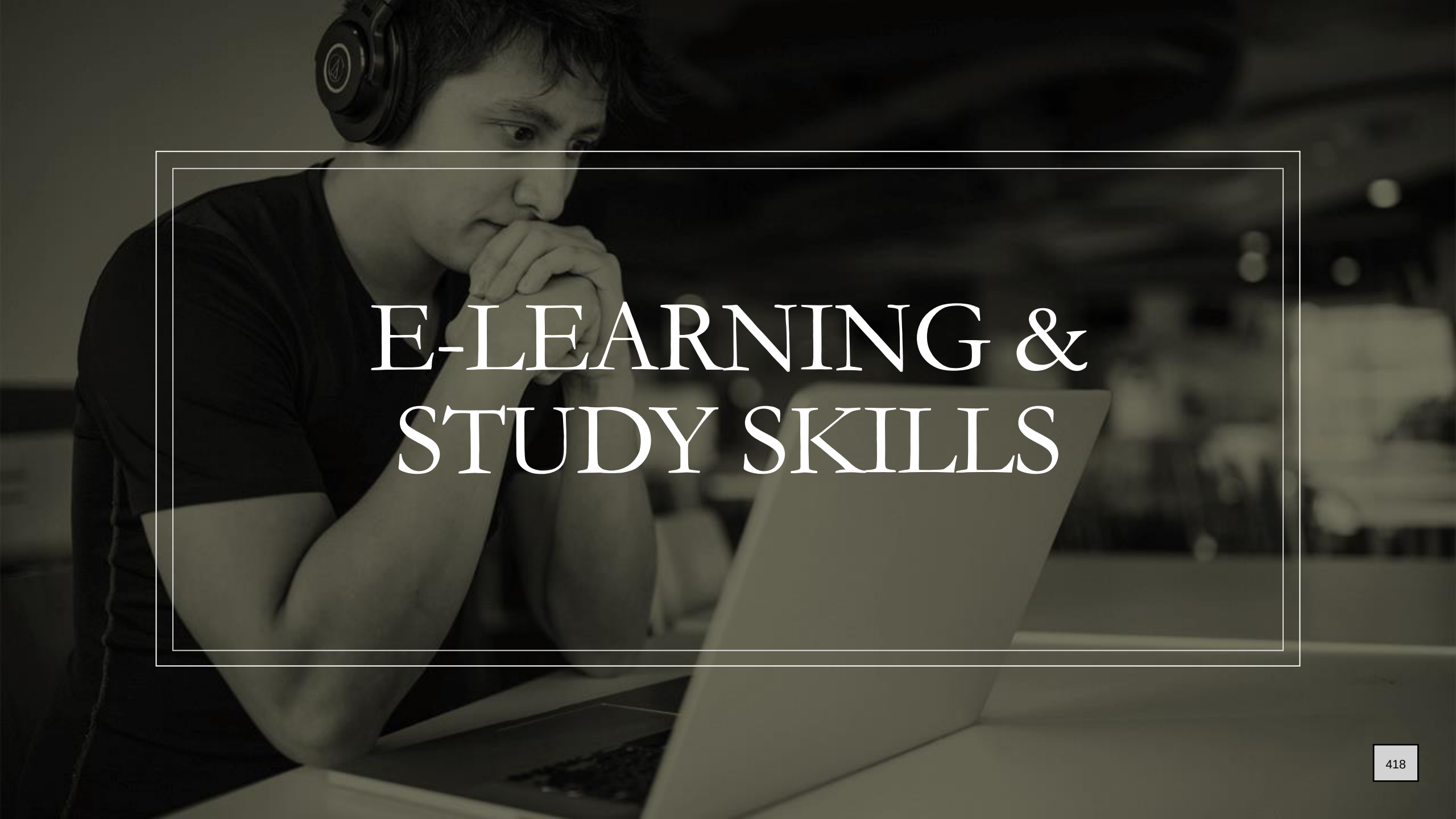
- Responsible for Accounts Payable/Receivable, HR and Payroll, using Quickbooks
- Responsible for handling customer service calls ensuring customer satisfaction
- Worked with Accountant to make tax payments and produce financial reports and statements
- Worked with Recruiters to maintain a database of consultants
- Produced documents, contracts and presentations as required

Manager - Main Street True Value - 1996 – 1999

- Daily operations of a retail store, including cash handling, scheduling
- Worked with Sales Representative to produce presentations for commercial accounts
- Reconciled goods delivered versus goods invoiced
- Reported daily, weekly sales to owner
- Helped to identify areas of improvement, additional revenue
- Oversaw expansion of retail space

Receptionist, Administrative Assistant - Cargill Investor Services, Inc. - 1989 – 1995

- As a Receptionist responsible for handling 2500 phone calls per day on average, and greeted visitors to company
- Accepted packages and deliveries. Completed paperwork necessary to have packages/documents delivered, especially overnight
- As an Administrative Assistant, reported to Chief Financial Officer, and worked with supporting staff and departments
- Acted as Corporate Secretary for Corporation
- Maintained all banking agreements for firm
- General clerical as needed such as typing of documents, filing, expense reports and travel arrangements
- Worked with staff and team members to produce presentations as needed



E-LEARNING & STUDY SKILLS

Introduction - Disclaimer

- This workbook, including all illustrations, is designed to enhance general knowledge and understanding of How to E-Learn and Study Skills.
- The text, including illustrations and course content, represent the opinion of the author and instructor based on accepted industry practices, formal interpretations, research and analysis as to the application, intent and rationale.
-

****

Course Description

A training course structured for individuals needing to take an e-learning course. This course will focus on the reasons and motivation for taking an e-learning course. Students will learn how to gain the most benefit from any course that they will take. Additionally, Instruction will focus on how to use best practices for further studying of material as it pertains to taking certification exams.

Learning Objectives and Outcomes – Students will be able to . . .

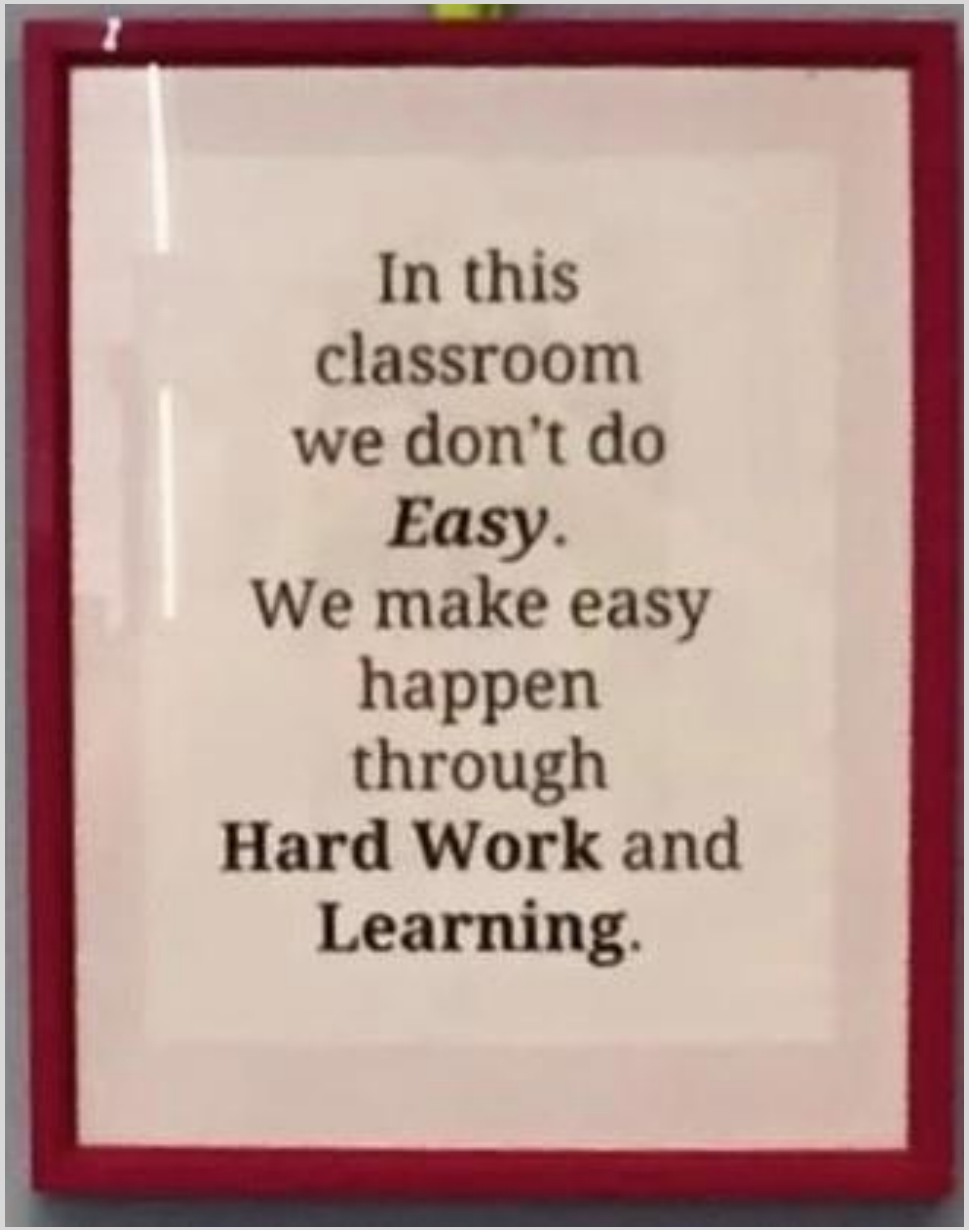
1. Identify their unique characteristics of how they learn best and apply them to the e-learning classroom.

2. Identify the ideal environment in which to participate in e-learning courses and in which to further their study

3. Analyze their reasons for taking an e-learning course and will understand and apply those reasons to the goal of attending the course successfully

4. Determine which study skills to utilize and apply to their goals for taking an e-learning course

Background and Expectations


In this
classroom
we don't do
Easy.
We make easy
happen
through
Hard Work and
Learning.

Who Am I?

- I am a Certified Teacher, licensed in the State of Illinois, K-9th grade, though teaching was not my first career
- Endorsed to work in a Self-contained Classroom, Middle School, Language Arts and Social Studies
  - Several class hours away from also being endorsed in Maths and Science
- Prior to having my own classroom, I worked as a Resource Teacher
  - Worked with students to support what was happening in the classroom, 2nd – 12th grade
  - Identified students that needed additional support either in the classroom, or more specialized teaching
  - Taught one-on-one and small group
  - Received additional extensive training to teach children that have Dyslexia how to read
  - Taught a Study Skills class each year, sometimes several times a year
- Once I moved to my own classroom, taught 4th grade for a couple of years, then Middle School where I taught Maths, Science, Language Arts, Social Studies
  - Often wrote all of my own curriculum to align with Standards

While in This Class

- Be Comfortable
  - Take a break when you need one, even if we are not currently taking one as a whole class
  - Being uncomfortable will make it more difficult to learn the material – This is true for any class you taken, on-line or in-person
- Feel Free to Move About Your Space
  - Some people think better standing, or rocking back and forth, keeps the blood flowing to the brain
- Use a Fidget or Two
  - As long as the fidget is not distracting yourself, or someone else

Fidgets. . .

The bunny is a little loud when used, but the spinner is a good example of a fidget that would be appropriate while in a class.

Just remember that the fidget is to be used as a focusing tool NOT as a distraction.

- PLEASE PARTICIPATE!
  - Participation is Active Learning, and we will discuss that in more detail in a bit
  - Use the Chat Function, or Unmute your microphone and ask. Just remember to mute again after you are done speaking
    - Be polite – "If you can't say something nice . . ."
    - In Chat – try to use complete(ish) sentences; avoid using slang terms, acronyms or abbreviations as these might not be familiar to everyone

"Tell me and I forget, teach me and I may remember, involve me and I learn."

Benjamin Franklin

Preface

- Research and Our Own Experience
- Learning Happens Naturally

Learning – Happens Naturally

- Life
  - Think of a Baby
    - Learning to Walk
      - As long as they have developed the muscles and their framework, walking can develop
    - Learning to Talk
      - A baby is able to produce sound (not language), from the moment it is born
      - Language development happens over time, and when the child is ready, they will be able to speak words that we will be able to understand and recognize as language

Steps to Muscle Contraction

1. A nerve impulse travels to the **neuromuscular junction** on a muscle cell. *The **neuromuscular junction** is the point where the axons of the nerve meet with the muscle cell.*
2. Ach is released from the axon to receptors located on the sarcolemma
3. The binding Ach causes **depolarization** of the sarcolemma by opening ion channels and allowing Na+ ions into the muscle cell.
4. Na+ ions diffuse into the muscle fiber and depolarization occurs.
5. Depolarization creates a wave of **action potential** (electrical current) across the sarcolemma
6. Action potential travels across the sarcolemma and down the **T-tubules** which triggers the **sarcoplasmic reticulum SR** to release Ca+
7. As Ca+ levels rise, Ca+ ions bind with **Troponin** which removes the blocking action of **Tropomyosin** from the **Actin binding sites.**
8. Myosin is now ready to bind with the actin and form **cross bridges** which begins the contraction process
9. In order to contract, ATP binds to the Myosin
10. ATP is then hydrolyzed (broken down) to ADP and Pi, which gives the myosin the energy to "cock" its head to the high-energy position.
11. Actin and myosin bind together to form a cross bridge
12. The myosin heads then pull the actin filaments inward and release the ADP and Pi and return to a low energy position.

The myosin is now ready for more ATP to bind and repeat the cycle. This process will continue for as long as there are Ca+ ions and ATP available.

RED = the E-C coupling stage

Learning . . .

- Play time
  - Humans learn most when an activity has elements of fun and exploration
    - Hide and Seek
      - Don't stand behind a really thin tree, you will get found quickly
    - Climbing on Monkey Bars
      - Keep contact with the bars at all times, prevents falling
- Memorable Class or Teacher
  - If what is being taught is of high interest to you – you are excited, and learn more
  - Shared activities, or Group Activities
  - Hands-on

Two Schools of Thought - Most Classrooms Follow One or Both

- **Behaviorism**
  - All learning always produces a change in behavior
  - Behaviorism is attractive as an Educator because there are demonstrable results and the outcomes is clear:
    - I teach you how to solve an equation
      - Student solves the equation, and obtains the correct answer, repeat these steps
  - As an educator, start with the desired outcome, and plan backwards to the activities and materials that will lead students to that desired outcome

- **Socio-cultural**
  - Learning is always social, and embedded in our culture and our values
  - Communities of Practice
    - You learn from being with, observing and working along side the “Experts”
    - Gradually become expert yourself, and the cycle continues

It is Easy to Teach When Teaching the Same Thing, But Not Everyone Gets the Same Thing Out of It

- Student Expectations
- Classroom Teacher Perspective
- E-Learning is Here to Stay

Student Expectations

- We just want to know – have the knowledge readily available to us
  - Place the Code Book under my pillow at night, and when I wake up . . . *Voila!*
    - Instant Expert and I can pass any Certification Exam

- Let's get back to reality!

Classroom Teacher Perspective

- In-Person Teaching is Easier
  - Feedback is immediate
    - Observation of students informs the teacher how to structure lesson, or reteach
      - What are they doing, On task?
      - How are they reacting to material?
      - Frustration? Boredom? Or Focused?
  - Ability to change lesson on the "Fly" so to speak is easier
    - Materials are often more readily available

Classroom Teacher Perspective

- On-line Teaching is Tricky
  - Limited Feedback
  - Difficult to know if lesson is being received as intended
- However, teaching is teaching
  - Must continue to use best practices, adapted to On-line

E-Learning is Here to Stay

- Convenience
  - Some courses are available on-demand
  - You get to pick the time and the place
- Teaching On-line
  - Use best practices
    - Know the material and your audience
    - Set Expectations
    - Know your students – How do they learn best
    - Vary the delivery of information – Use activities
- Learning On-Line
  - Set expectations of yourself and the course
    - What do you want to get out of the class; What is your goal?

We Have to **Inspect** *What We Expect*

Take 5 minutes and think about how you learn the best and what is your goal for taking an e-learning course. There is room in your workbook to write it down.

How Does Having A Goal Help?

- Is this enrichment of knowledge already learned, or a new concept(s)?
- Why did you take the course?
- What is the purpose of sitting in front of a computer or in a classroom for 6+ hours?

Fully Commit to the Class

- Participate – Learning is Active, not passive
  - Ask at least one question, each session, or each section
  - Take notes, get clarification
  - If using on-line Chat to communicate, be polite and respectful
  - Add your own insight to the class discussion

- Multi-tasking may be the norm during your work day
- Being able to switch from one task to another is a sought after skill
  - But, you need to know how to prioritize and have a brain that allows for Fast Switching between tasks

Try Not to Multi-Task

- Brain can only focus on one thing at a time at 100%

Make the E-Learning Course a Priority

- A study done by the APA (American Psychological Association) found that switching between different tasks can cause a 40% loss of productivity
  - You are only getting 60% of the material presented
  - Multi-tasking can disrupt your Short-term or Working memory
    - Which means that whatever was in your short-term memory can NOT be wired into your long-term memory
  - Multi-tasking can actually lower your IQ in the short-term
  - Windshield Wiper affect

Know How to Use the Technology

- Make sure your internet is working
- Know how to navigate in the platform
  - Join class a few minutes early and try out the different tools

Have a Quiet Area to Participate

- Close your door (if in an office), or a quiet corner
- Turn off cell phones and other distractions
  - Email notifications, etc.
- Have camera on (if allowed), be aware of what is happening in the background

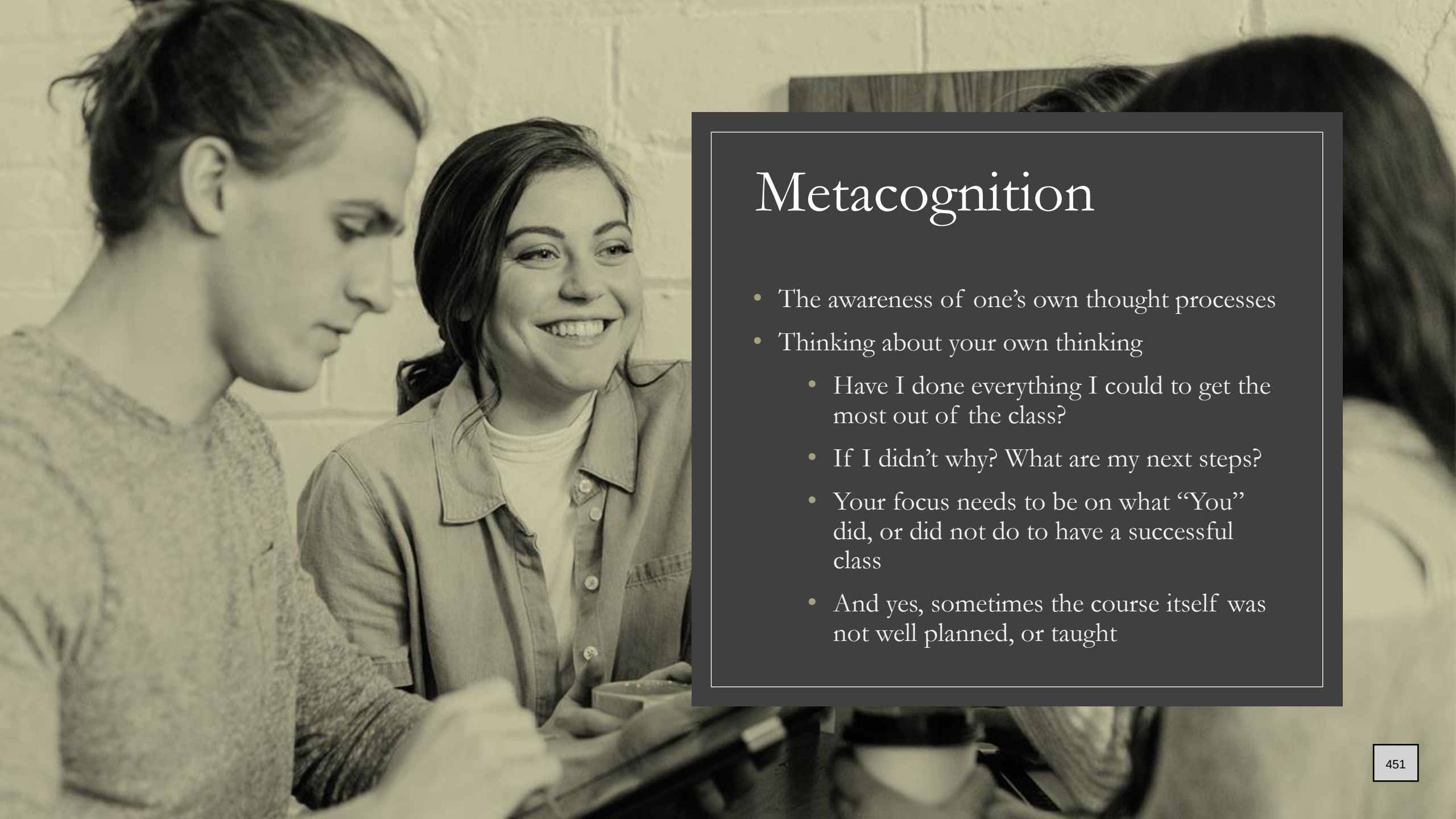
Ask Questions for Understanding and Clarification

- If you think you understand, apply it to a situation and ask if that is a correct understanding or application of the code / material

Be Motivated

- What is your goal and expectations?
- If class is not meeting your expectations

You have to **Inspect** what you Expect



Metacognition

- The awareness of one's own thought processes
- Thinking about your own thinking
  - Have I done everything I could to get the most out of the class?
  - If I didn't why? What are my next steps?
  - Your focus needs to be on what "You" did, or did not do to have a successful class
  - And yes, sometimes the course itself was not well planned, or taught

Class is Over, Now What?

- Depends on the reason (goal) you took the class
  - If for CEUs, send them in, and your done, But . . .
    - Take something from the course and try to use it
    - Share something your learned, or thought was important to your position with someone that couldn't attend
  - If for New Education or Position,
    - Make it a goal to develop good work habits using the material that you learned from the course
    - Seek out others with more experience, look for a mentor

Class is over . . .

- If to pass a Certification Exam
  - Develop a plan
  - Decide when to take the test
  - Plan your study

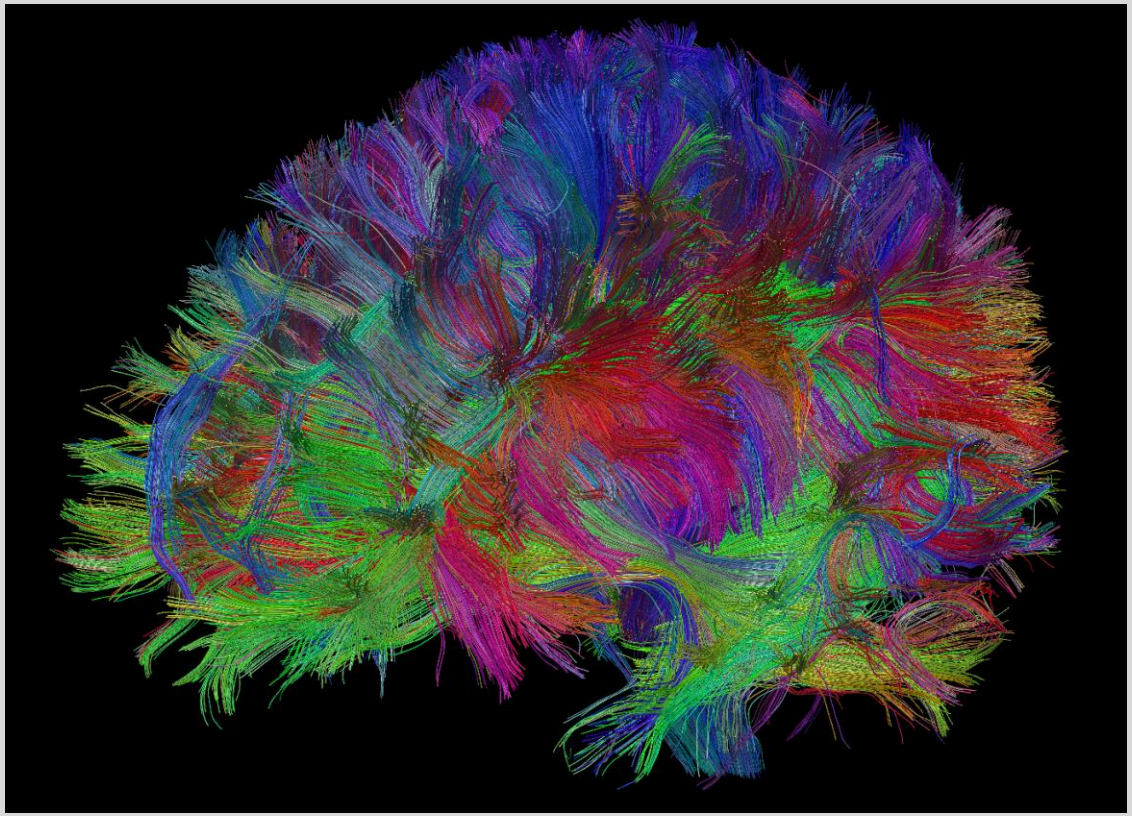
Study Skills – Why Needed?

Your brain learns best using vivid, visual or descriptive imagery; it involves your senses.

It takes time to learn anything new. It works best when new knowledge can be connected to prior knowledge already learned.

Think Foundation and Framing

Say Hello to Your Brain



Difficult to Learn Large Amounts of Material in a Short Amount of Time

- Human Brains need processing time, to build pathways to prior knowledge
  - Think of it as a U-Store It facility
  - It is physically impossible for the brain to grow neural pathways that are strong enough (permanent connections) in one day to achieve complete retention

- Cramming DOES NOT work!
  - You might be able to pass the exam the next day, but can you remember enough of what you crammed in after a few weeks?

- Not enough time spent studying creates added stress
- More stress means memory is weakened
  - Ever stare at a test and think, “I never learned this” or “This isn’t what they said would be on the test” or my favorite, “You never taught us this”.
  - “Information is there, but I do not have the Key to unlock it”.

Active Learning versus Passive Learning

An Active Learner

- Reads to understand and remember
- Makes connections between what they already know and new information in texts, lectures, and from studying with peers
- is engaged during lectures and takes organized notes
- Puts in quality study time
- Realizes when they need help and seeks it out early
- Understands they are responsible for their own learning, analyzes weak performance if it occurs, and changes the way they study accordingly
- Questions new information that doesn't "fit in" with what they already know.

A Passive Learner

- Reads but may not understand or remember
- Doesn't think about and process information that they read and hear
- Does not pay attention during lecture and takes unorganized or incomplete notes
- May put in a lot of study time but it isn't quality time
- Seeks too little help too late
- Blames others for poor performance, approaches every course in the same way and fails to learn from their mistakes
- Accepts what they read and hear in lectures as true and doesn't question

"The best tip that I can recommend is to take an "active" or "engaged" approach to studying. Instead of simply reading the text over and over, it helps to take notes, highlight, look up terms, etc. Using several methods of studying instead of simply reading will help you retain the information because your brain is using the information in multiple ways. I recommend looking up practice tests and other exercises from the internet to help increase your knowledge, and also using the ICC website. Assigning specific time to study also helps, you need to force yourself to do it, but cramming for hours and hours never works."

Ian Burgin, B&FCCS Inspector
Passed 64 exam on 1st try

Make a Plan

- Reasonable
  - Account for obligations, outside of studying
- Allow time to Miss or Skip study days – Life Happens
- Know your strengths and weaknesses
- Know how you learn best

Group Studying Works

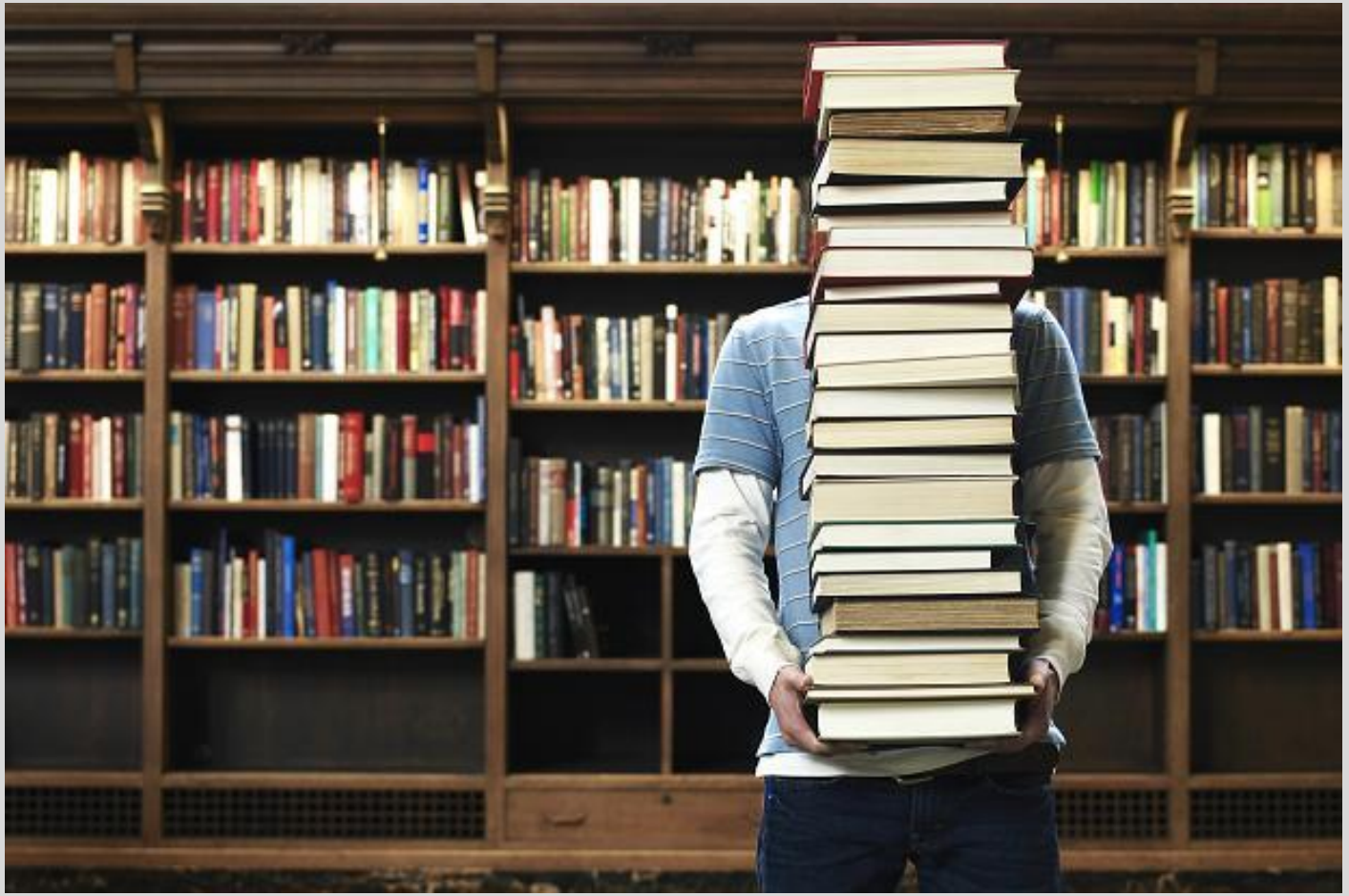
- Helps to hold each other, and yourself, accountable
- Use each Member's strengths to teach each other
- This is Active Learning at its Best

Stay Organized

Use a Calendar or Planner

- Make it easy to Use and KEEP IT UP TO DATE!
  - Make sure you refer to it often
    - Use it as the background on your phone, or computer desktop
    - Tape it to your bathroom mirror, or refrigerator
  - Remember to account for outside obligations
- Use **Color** or imagery to help stay organized
- Have all supplies needed in a handy spot
  - Pens, pencils, notebooks, highlighters, charger(s), headphones, index cards

I Have a Plan, a Goal . . . Now What?



Now What . . .

- No one is telling you that you have to MEMORIZE every word in every Code Book – Just Not Possible!
- Reading is to become familiar with the Code and where the Information you may need is found within the Code itself
  - Reading and thinking about what you have read
  - What are the connections within the Code and/or to other Codes and where can we find these connections within the Code and the Field

Surveying – Reading Skill

Surveying

- Read a Section of Code utilizing the following Steps
  1. Highlight only the critical or important information that IS NOT already **bolded**, *italicized*, put in a box or otherwise emphasized
     - Highlighting and using pen in code books is allowed; DO NOT use pencils, or post-it notes
  2. Do not Highlight anything that is the topic sentence or main idea. Usually, this is the first sentence of each paragraph

Surveying . . .

3. Don't forget to read Tables, especially the footnotes if any; Appendices are another critical read as are the Table of Contents and the Index
4. Remember to also highlight the information that supports the main idea or topic AND any information that points you to another section of code, or another Code entirely.

Surveying . . .

- Take notes while reading
  - Formulas / Calculations – this is important if doing these types of equations is challenging
- Again, Think about what you are reading
  - The main ideas and items that are emphasized fit together. How?
    - Apply this to a real-life scene – Something you may have encountered – or Speak with a Mentor
    - **Method of Loci**
    - **Mind Mapping**
- Using the Survey method will reduce the time that you are reading and make it less daunting

Class Exercise – 15 Minutes

- Use the handout labeled Class Exercise #1. Survey Read the page, and Highlight or underline that material that you think is important for understanding what that Section and specifically that page is conveying.
- Use the back of the page to make any notes, etc. to aid in your survey
- Be forewarned: I will be calling on a few individuals to share that they highlighted and why

Spacing

Spacing

- Remember – Repeated short-exposures
  - Read a chapter or section of Code (Survey Method) then give it time, do not study, or re-read it again for at least a day – You can however read a different chapter or section of code – preferably one connected to what you just read. Or, don't read at all
- On days when not reading, What should I do?
  - Did you take notes while reading?
    - Practice the formulas / calculations
      - Write down the steps – from Memory
      - Color Code or make a Mind Map
    - Work on Definitions or Terms in the Section
      - Flash cards
    - Try to connect the terms – categorize by topic, code, section of code

Spacing . . .

- Repeated exposure with spacing, allows time to build on prior knowledge already stored in long-term memory
  - Your Brain needs the time to build connections, the stronger the connection the better and easier it is to recall

Study Strategies to Try – Once Class is Over

They All Work – But Not All Work for Everyone

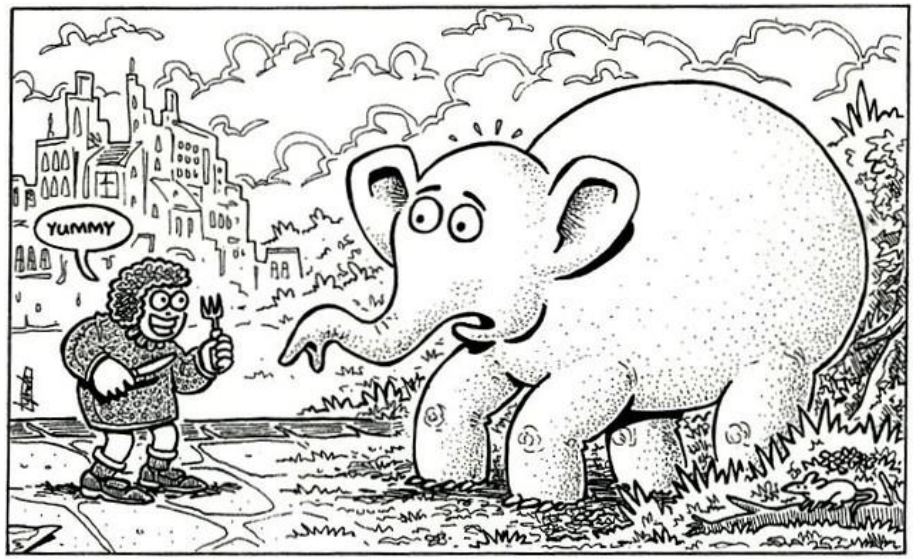
- Try and see which one works best for you.
  - Google study strategies and find additional ones to try – keep searching until you find one or two or three that will work.
- Best Study Strategy – Work alone, AND Use the Power of the Collaborative Group
  - Make sure everyone in the group is dedicated
    - Not everyone has to study the same thing at the same time
    - Use the group to stay motivated and on track, and do the same for others in the group

- Discuss and Actively LISTEN
  - Don't just read aloud from the book – The point is to restate in your own words – Hear and understand the connections you have made
  - Hearing others will help make connections – different understanding or point of view
  - Engages more of everyone's brain
- Stories are a Chain maker
  - The more fun, or ridiculous the better – absurdity makes it more memorable
  - Story Telling
  - Make it Visual – Associate the information with a picture

Chaining Technique

Study Aloud during Group Sessions

- Stops Procrastination
  - You can do anything for a short period of time
  - Strengthens your Determination to get through large amounts of material
    - How do you eat an elephant?
  - Ability to study at a higher intensity
  - Limits Distractions
  - Breaks help you refresh energy and focus



Pomodoro Method or Technique

Simple and Effective

Pomodoro . . .

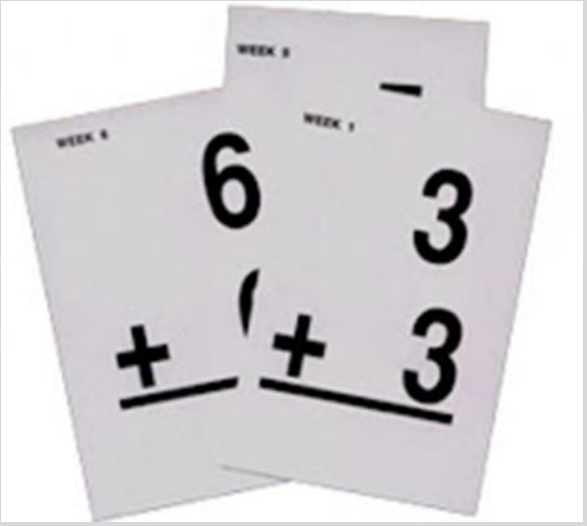
1. Set a timer and work for 25 minutes
    a. The length of time isn't as important – if you can work longer, go for it!
    b. Time can be adjusted during the study session – if the timer goes off, and you want to keep working that is okay
2. When timer goes off take a 5 minute break
    a. Do something else
    b. Leave your study space
    c. Take a walk
    d. Get a snack
    e. Play a game, especially if it is a physical game
    f. Again, time is not etched in stone, but don't get distracted and forget about studying
3. Repeat Steps 1 and 2 – 3 more times
4. At the end of the 4th study session take a longer break – You Deserve It!

Memorizing Information

- DO NOT attempt to memorize every word of each code book
  - It won't help you on the exam – if you haven't made connections with or understood the material memorized
- Memorization should focus on making those connections – the Central Idea(s)
  - Will help you know where to find the answer in the Code Book

Memorizing . . .

- Flashcards
  - Make your own – using decks created by someone else is passive learning at the start, but can be useful if in a time crunch
    - Could be done in Group Study Sessions – All about making those connections
  - Include the Right amount of Information
    - Don't write paragraphs
    - Use bullet points – No more than 3 per card
    - Try to connect concepts on the flashcards



Waterfall Method

- Confidence based repetition
  - Focus is on cards you don't know – not wasting time on cards you do
- On-line study Sites
  - Quizlet
  - Kahoot – Great for Study Groups – Competition
  - Chegg

1. Begin with a stack of 30-50 cards
2. Go through entire stack
    a. If you know the answer right away – put it in the KNOW pile
    b. If you struggled to remember the answer place it in a STRUGGLED pile
3. Pick up the STRUGGLED pile and Repeat
    a. If you know the answer right away – put it in a New KNOW pile
    b. If you are still struggling, place it in a New STRUGGLED pile
4. Repeat the process until you only 1-5 cards left in your last STRUGGLED pile

Waterfall Method

Used with Flashcards – Retrieval Practice

Now, go back up the Waterfall

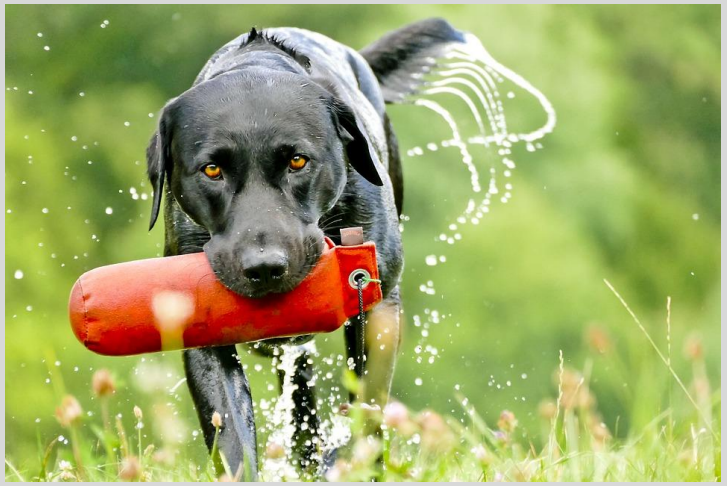
1. Combine the last STRUGGLED pile with your last KNOW Pile
   a. Go through the deck, if you answer any cards incorrectly go through ALL of them – Yes, that means start over
   b. IF you answered all of them correctly in the last two piles, then combine with the next pile and do it again, until you are back to having only one pile

Waterfall Method

Used with Flashcards – Retrieval Practice

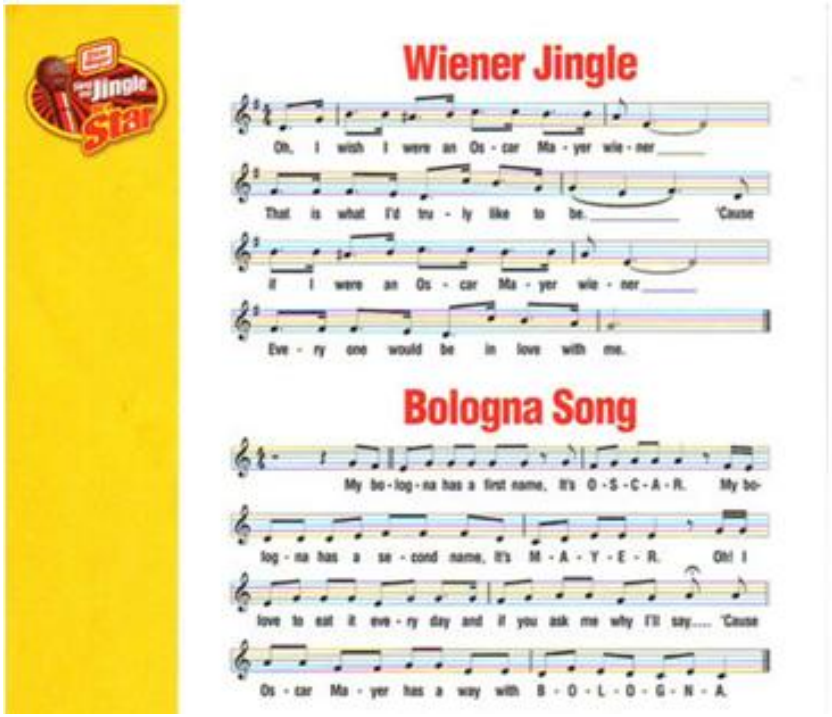
Retrieval Practice

- Bringing information to mind from your memory
  - It can be simple – such as closing your eyes and recalling a key word or definition that you learned earlier in the day
- Start using Retrieval Practice as soon as possible
  - Retrieval Practice is HOW you build the memorization and then the Recall
  - Use Retrieval Practice with your study group
- It is going to feel like you are working hard if you doing it right
- All Retrieval Practice is beneficial – Even if you didn't recall the information correctly



- Mnemonics are great for memorizing and RECALLING information
  - Especially the Order of Things
  - Can be combined with the Chaining Technique
    - Retrieval Practice
- Mnemonics are:
  - Songs
  - Rhymes
  - Acronyms
  - Images
  - Phrases
  - Sentences

Please Excuse My Dear Aunt Sally



Mnemonics

Roy G Biv

- Another form of Retrieval Practice
  - Sights, sounds, smells and touch can aid in the recall of information
- Use a treat such as a milkshake, while you study – Associate that treat with the information you are learning
- Method of Loci relies on the emotional response triggered by sight
- Chaining Technique can elicit an emotional response if you use a favorite song, or story or activity

Emotional Response

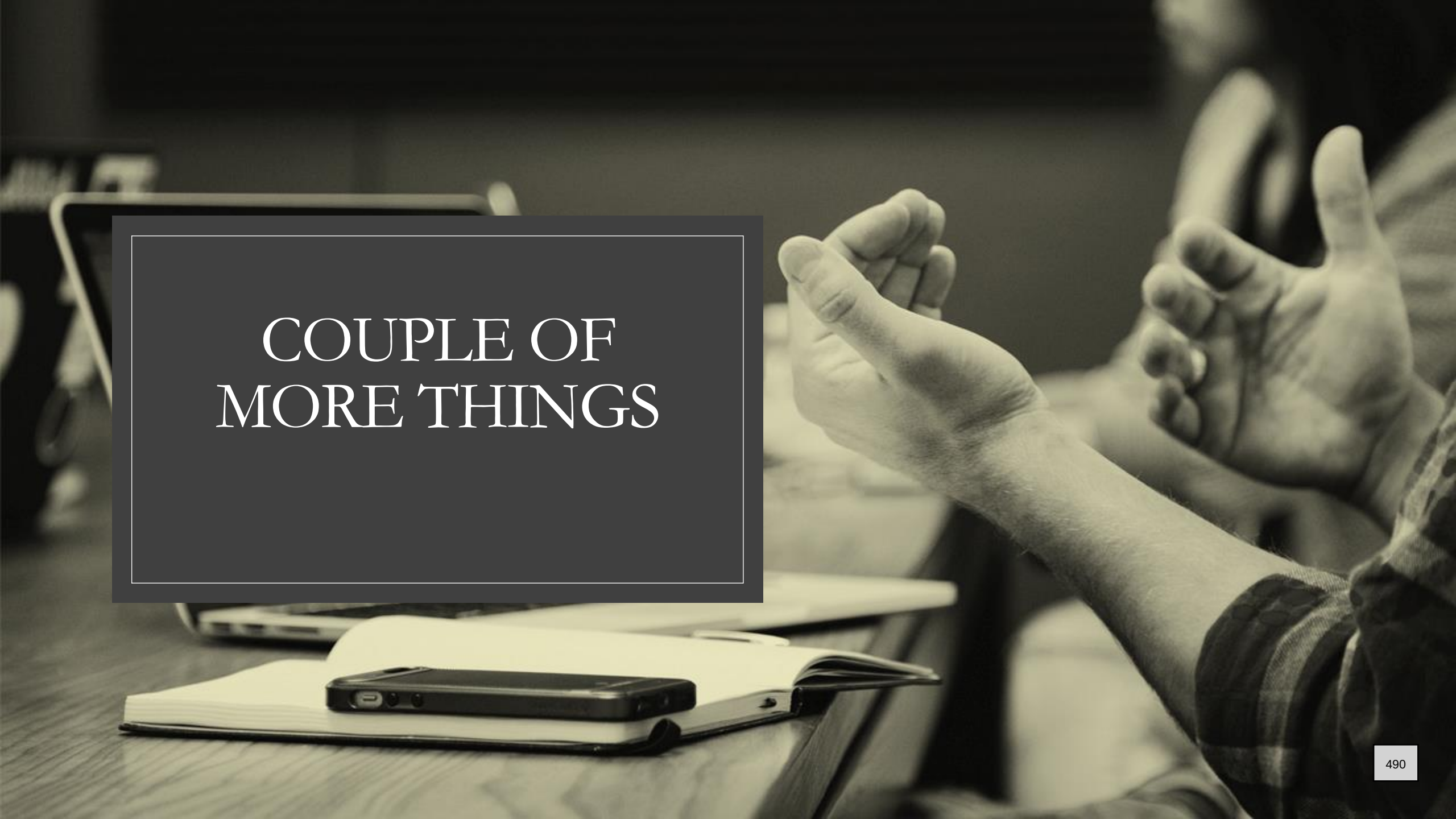
Sights, Sounds, Smells or Touch

What is the Take Away from all of this?

- Learning Material Takes Time and Effort
- Having a Plan, and utilizing study skills and strategies makes the task easier to manage
- No Work, No Reward

What is the Take Away . . .

- What if I have always struggled with learning new things and especially on Tests?
  - ICC does allow for accommodations as per the ADA
  - For PRONTO (proctored on-line) – you must fill out a 3 part form
    - Part 1 is filled out by you
      - Be very specific as to the accommodation you need
    - Part 2 and 3 is filled out by a Medical Professional
      - They should also be specific as to the accommodation needed
      - Part 3 is a letter – that can be written on a Script


COUPLE OF
MORE THINGS

- Think of a route or place you know really well
  - When you close your eyes you can recall every detail of it
  - Bedrooms are a great place to start
- Visualize each part of the information that you want to memorize in a different area of the room or along the route
  - Start with placing flash cards around the room on Objects in the room
  - Stand at the door and memorize where those words are, and on what object they are located on

Method of Loci

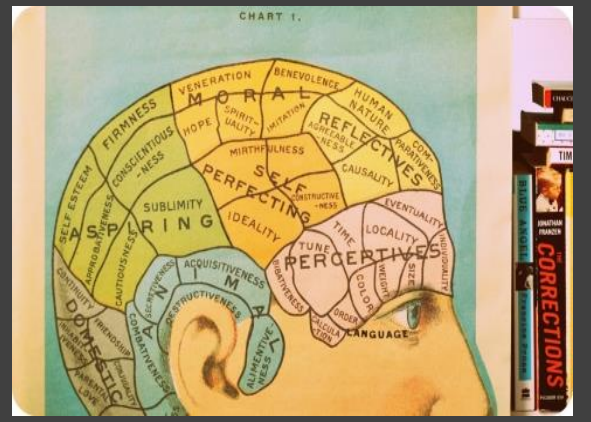
- Mentally place each item (words, idea, code section) on each object on your route, or in your room
- When it comes time to recall, visualize (minds eye) your route or room and it should call up the memories of the information you placed there

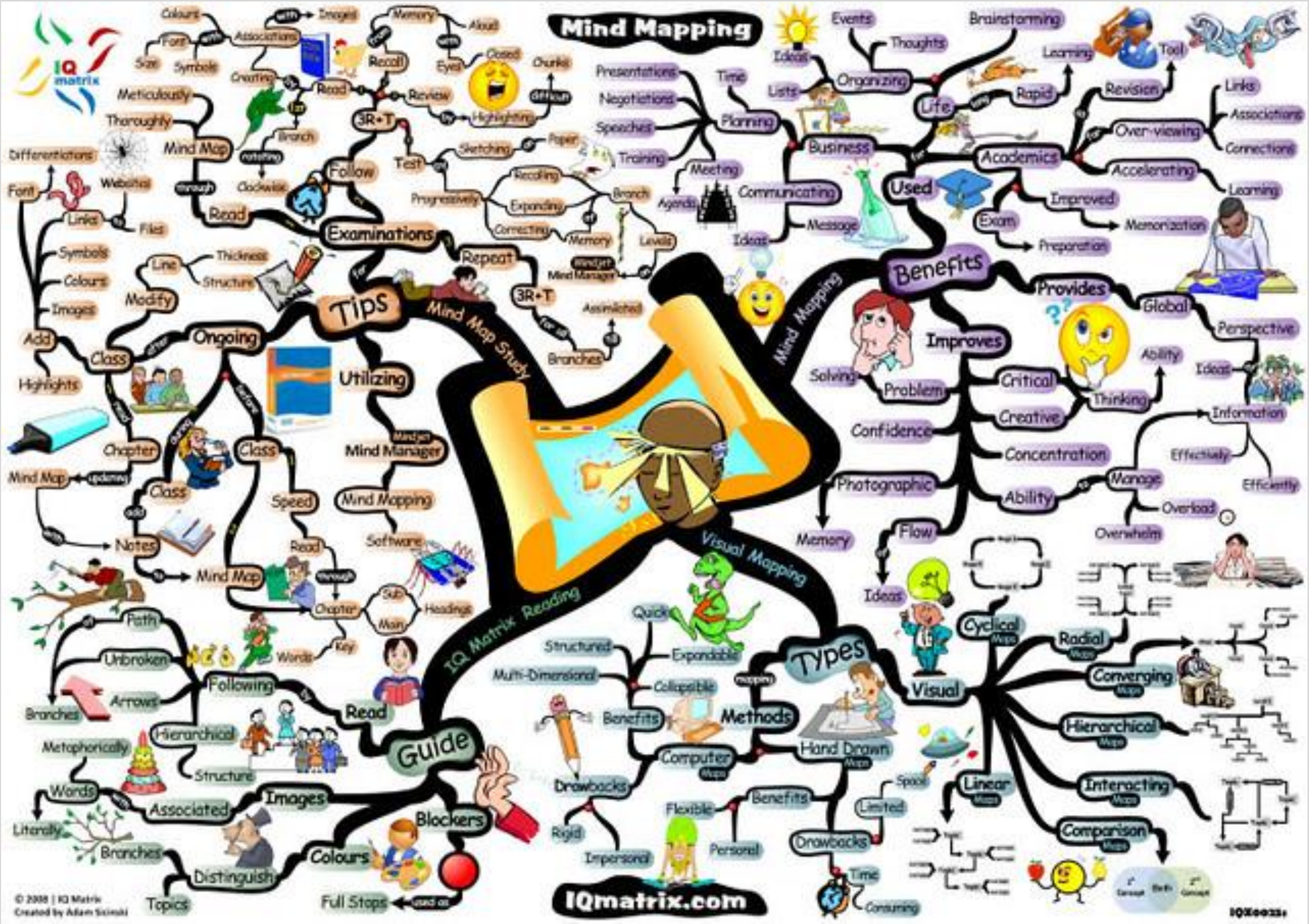
Method of Loci can be the **KEY** to unlocking a memory stored

Method of Loci

- Uses your brains "Language" to recall seemingly disparate pieces of information
- Builds on Foundation memories to make a cohesive whole
- Mind Maps can be:
  - Hand-drawn, various mediums (pencil, pens, markers, crayons)
  - Computer generated – software, or on-line apps
  - Thinking – mind and brain (Method of Loci)

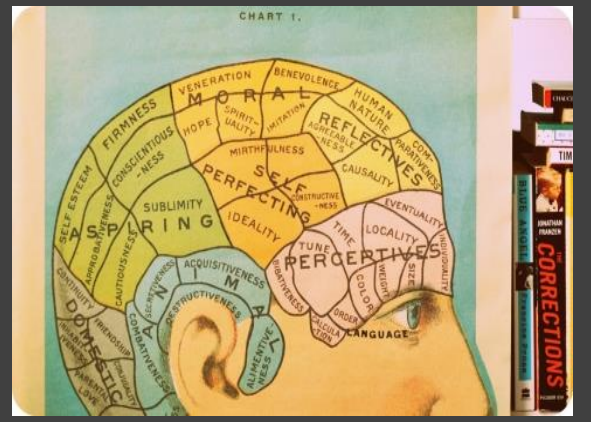
Mind Mapping

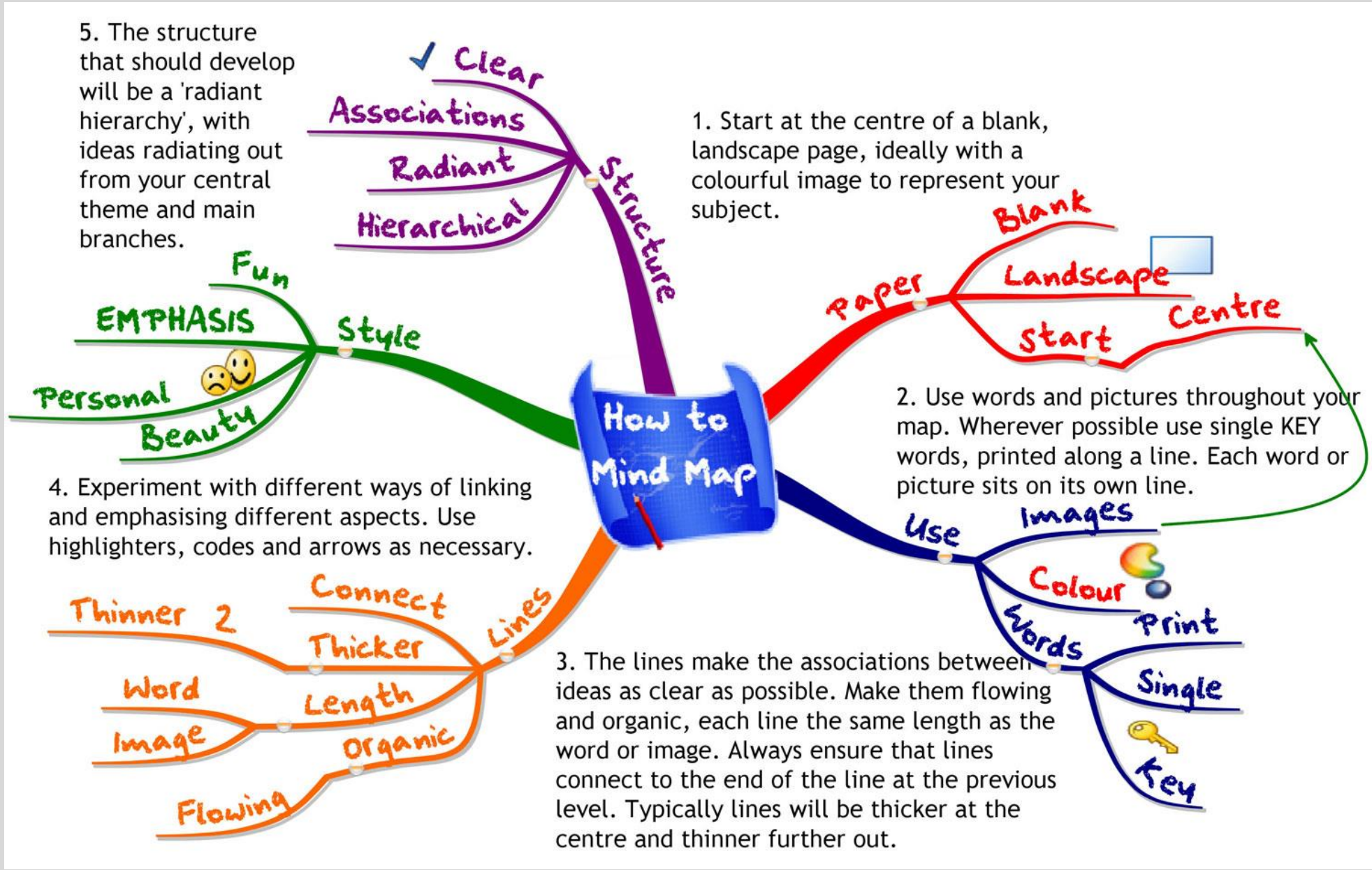



Mind Mapping
Mind Map Study
IQ Matrix Reading
Visual Mapping
Mind Mapping
Tips
Examinations
Follow
Read
Repeat
3R+T
Recall
Review
Test
Memory
Ongoing
Utilizing
Mind Manager
Mind Mapping
Software
Class
Notes
Chapter
Mind Map
Guide
Following
Read
Images
Associated
Blockers
Colours
Full Stops
Distinguish
Topics
Branches
Words
Literally
Metaphorically
Hierarchical
Structure
Arrows
Unbroken
Path
Benefits
Used
Academics
Business
Life
Organizing
Planning
Communicating
Presentations
Negotiations
Speeches
Training
Meeting
Brainstorming
Events
Thoughts
Ideas
Lists
Learning
Rapid
Revision
Over-viewing
Accelerating
Links
Associations
Connections
Exam
Improved
Memorization
Preparation
Provides
Global
Perspective
Improves
Problem
Solving
Critical
Creative
Thinking
Confidence
Concentration
Ability
Manage
Information
Effectively
Efficiently
Overload
Overwhelm
Photographic
Memory
Flow
Ideas
Types
Visual
Cyclical
Radial
Converging
Hierarchical
Interacting
Comparison
Linear
Methods
Hand Drawn
Computer
Benefits
Drawbacks
Quick
Structured
Expandable
Multi-Dimensional
Collapsible
Flexible
Personal
Rigid
Impersonal
Limited
Space
Time
Consuming
IQmatrix.com
© 2008 | IQ Matrix
Created by Adam Sicinski

- There really is not right or wrong way to make mind maps
- There are a few general guidelines:
  - Lines should have a curve to them – this is an Organic process
    - Life is rarely carried out in a straight line
    - Curves represent that there are other pieces of the concept, that are not easily straight line connected
  - Mind Maps do not have to be elaborate
    - Add imagery if it works for you, if not, don't
    - Color works to help organize, but not if it distracts
  - Great tool to use for Retrieval Practice

Mind Mapping




5. The structure that should develop will be a 'radiant hierarchy', with ideas radiating out from your central theme and main branches.
Clear
Associations
Radiant
Hierarchical
Structure
1. Start at the centre of a blank, landscape page, ideally with a colourful image to represent your subject.
Blank
Paper
Landscape
Start
Centre
Fun
EMPHASIS
Style
Personal
Beauty
How to Mind Map
2. Use words and pictures throughout your map. Wherever possible use single KEY words, printed along a line. Each word or picture sits on its own line.
Use
Images
Colour
Print
Words
Single
Key
4. Experiment with different ways of linking and emphasising different aspects. Use highlighters, codes and arrows as necessary.
Connect
Thinner 2
Thicker
Lines
Word
Length
Image
Organic
Flowing
3. The lines make the associations between ideas as clear as possible. Make them flowing and organic, each line the same length as the word or image. Always ensure that lines connect to the end of the line at the previous level. Typically lines will be thicker at the centre and thinner further out.


QUESTIONS?

Class Exercise #2 - ?? Minutes

- Materials Needed
  - Handout – Labeled Class Exercise #2
- Rules:
  - You can work alone, or connect with others in the class – No more than 3 in a group
  - At the end of work time – Your group will present, 1 or more of you may speak, but no more than 10 minutes in length
- What to Accomplish
  - Use what you have learned today to learn the Chapter given to you in the Handout
  - Yes, if you have other study skills or strategies you like to use – USE them!
    - Just be prepared to share and teach the skill
  - You must include
    - 1 Mnemonic – Try to Make one Up!
    - 1 Method of Loci or Mind Map
    - Flash cards – No more than 10-15

Before You Go

- When the Go To Training is Ended before you CLOSE that Prompt that asks for Feedback
- PLEASE Leave your Feedback! It is really helpful to know how this class was received and what can be improved, or what types of classes your are looking for


THANK YOU!

File Attachments for Item:

ER-4 Water-Based Fire Protection Inspection Process (Fire Code Academy)

BO, MPE, BPE, PPE, FPPE, BI, FPI, NRIUI, RBO, RBI, RIUI (3 hours)

Staff Notes: Recommend approval, include PI, RPE

Committee Recommendation:

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER: FIre Code Academy

Course Submitter: Randall L. Hormann (Contact Name)

Organization: Fire Code Academy (Organization/Company)

Address: 81 MIll Street - Suite 300 (Include Room Number, Suite, etc.)

City: Gahanna State: Ohio Zip: 43230

E-Mail: RandyH@FireCodeAcademy.com

Telephone: 614-416-8077 Fax: _____

Course Sponsor: Fire Code Academy

COURSE INFORMATION:

Course Title: Water-Based Fire Protection: Inspection Process for New Inspectors and AHJ's

New Course Submittal: ■ Update Course: ☐ Prior Approval Number: _____

Purpose and Objective: This 3-hour program will focus on two primary questions that all AHJs and Fire Inspectors are concerned with when it comes to water-based fire protection systems; "will it work" and "how do I know"?. Referencing sections of NFPA 13 & 25, and through interactive discussion, we will provide students with the understanding of various water based fire protection systems, how to verify proper installation, and discuss the acceptance testing procedures.

Number of Instructional Contact Hours that can be obtained upon completion: 3

If Multi-Session, Number of Instructional Contact Hours Per Session: _____

Program Applicable for the Following Participants:

Building Official ■	Master Plans Examiner ■	Building Inspector ■	Fire Protection Inspector ■	Mechanical Inspector ☐	
	Building Plans Exam. ✔			Plumbing Inspector ☐	
	Plumbing Plans Exam. ■			Non-Res IU Inspector ☐	
	Electrical Plans Exam. ☐				
	Mechanical Plans Exam. ☐				
	Fire Protect. Plans Exam. ✔				
Res Building Official ■	Res Plans Examiner ☐	Res Building Inspector ■	Res Mechanical Inspector ☐	Res IU Inspector ☐	

Electrical Safety Inspectors ☐

Location of ESI Course: _____ Date(s) of ESI Course(s): _____

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
	Organization sponsoring or requesting the program (if any)	x
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:		NA
Completed Application:		x

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

Water-Based Fire Protection:
Inspection Process for New Inspectors and AHJ's

This 3 hour CEU program will focus on two primary questions that all AHJ's are concern when it comes to water based fire protection systems, "will the system work?" and "how do I know".

With power point presentations and interactive discussion, the program will cover the following: Basic understanding of a Sprinkler Plan – Design – Sprinkler Components - All required testing.

Specific References:

NFPA 13 – 16 / NFPA 25 – 2017 OBC (9) and OFC (9)

The Design and Layout of Fire Sprinkler Systems – 2nd Edition – Mark Broman.

Principles of Fire Prevention – David Diamantes:
Chapter 5 – Plan Review
Chapter 7 – Fire Protection Systems Testing

Learning Objectives:

At the conclusion of this program the student will be able to and understand:

1. Understand the basic principles of plan review of a sprinkler system.
2. Understand the design approach.
3. Identify a wet and dry sprinkler system.
4. Identify the components of a wet and dry systems.
5. Understand a visual inspection.
6. Understand the process – approval and testing of a fire sprinkler systems

Course Objective:

To eliminate the failure of automatic sprinkler systems

Note:

Each student will receive a full set of plans to use as reference to follow along during the presentation.

Water-Based Fire Protection:
Inspection Process for New Inspectors and AHJ's

Curriculum Outline

00:00 - 0030	Opening and Introduction
00:50 - 01:00	Power Points Slides 5-10
00:50 - 01:00	Break
01:00 - 01:50	Power Points Slides 11-23
01:50 - 02:00	Break
02:00 - 02:50	Power Points Slides 24-37
02:50 - 03:00	Break
03:00 - 03:30	Power Points Slides 38-47

Total credit hours for this course - 3.0 Hours

Date: 2/20/2022

INSTRUCTOR:
Mark Walsh
Vice President, Fire Code Academy, Gahanna, Ohio
Captain, Colerain Township Fire Department, Cincinnati Ohio
Address: 81 Mill Street, Suite 300, Gahanna, Ohio 43230
Phone: Cell: 513-324-0031
E-mail: MarkW@FireCodeAcademy.com

Qualifications:

- Vice President, Training and Program Development for the Fire Code Academy, Fire Code Consulted, Program instructor for: Fire Code Continue Education Programs, IFSTA Fire Safety Inspector Certifications, Sprinkler Design and Plan Review, Fire Safety Inspector Certifications,
- Ohio Board of Building Standards Certified FPI Fire Protection Inspector and Plans Examiner.
- Ohio Fire Academy Training Instructor, Program Coordinator for; Certified Fire Safety Inspector, Intro to Sprinkler Systems, Sprinkler Design, Sprinkler Hydraulics, Sprinkler Plan Review, Building Plan Review, and Continue Education Classes.
- Southwest Ohio Fire Safety Council, member of the fire code update committees; voting and committee member for fire code development and adoption process, committee member for the Southwest Fire Code Appeals Board,
- Colerain Fire Department Training Division, Fire instructor and Fire Safety Inspector Instructor, responsibilities include, developing training programs for firefighting, fire safety inspectors, continue education programs, fire sprinkler and fire alarm programs.
- Fire safety inspector instructor for the Hamilton County Fire Chief Association program coordinator and development for the plan review course, legal aspect course, fire sprinkler classes, smoke detector education classes, and fire code education training.
- Ohio Fire Official Association prior; training director and code development committing coordinator.

Firefighter, Fire Safety Inspector, Fire Investigator, and EMT:

- 33 plus years in the fire service, 25 years serving as the departments building plan reviewer, reviewing building and fire protection plan's to ensure building and fire code compliance.
- 25 plus years in a supervision role. Currently, The Bureau Director of the Colerain Township Fire and Life Safety Division, supervision of the fire safety inspectors, fire investigations, pre-plans, and hazard material permits. Responsible for over 2,200 occupancy inspections, fire alarm inspections and testing, fix suppression systems, private fire service mains, and sprinkler systems.

Education

- Cincinnati State – Associate degree in Safety Mgmt.
- Seneca College of Applied Science, Fire Sprinkler Design. (2 year certificate)
- University of Cincinnati – ASSSSOCIATES in Fire Safety Admin
- Ohio Fire Academy.
- National Fire Academy

Inspection Process for New Inspectors / AHJ's

Fire Sprinkler Systems

FIRE CODE ACADEMY

Introduction

STUDENT INTRODUCTIONS

- Name
- Title
- Organization
- Years as an AHJ
- One thing you want to take away from this class?

PLEASE TURN OFF OR SILENCE YOUR CELL PHONE

Inspection Process for New Inspectors / AHJ's

Where do I Start ?

What I am Looking For ?

How do to conduct Acceptance Test.

- Objectives

Describe an automatic fire sprinkler system (Types)

Plan Review

Visual Inspection

Acceptance testing

CODES AND STANDARDS

The Information in this presentation comes from the following References :

NFPA 13 – 16 NFPA 25

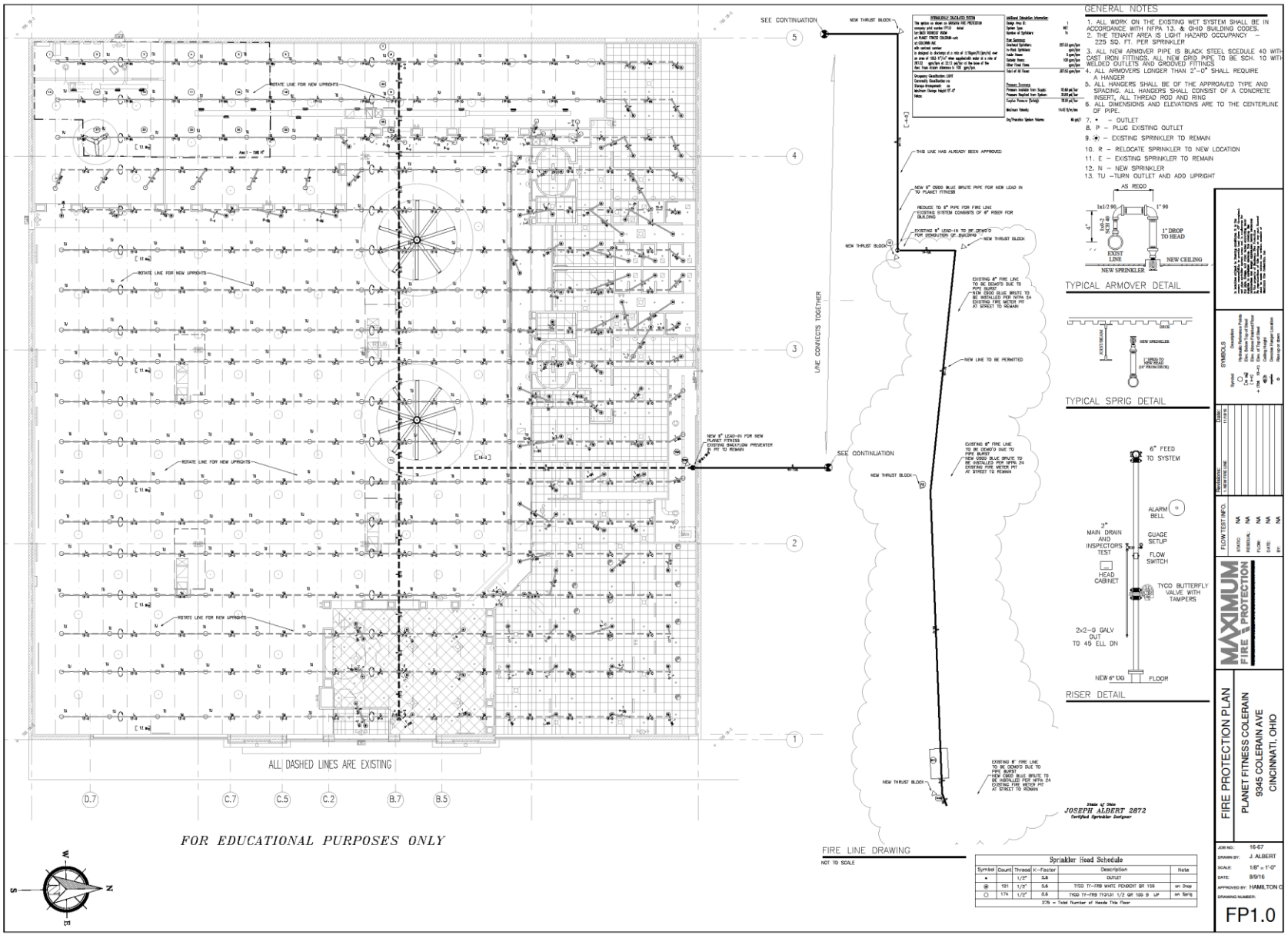
The Design and Layout of Fire Sprinkler Systems – 2nd Edition – Mark Broman

Principles of Fire Prevention – David Diamantes

Chapter 5 – Plan review

Chapter 7 – Fire Protection Systems Testing

WHERE DO I START ?



Sprinkler Head Schedule					
Symbol	Count	Thread	K-Factor	Description	Note
•		1/2"	5.6	OUTLET	
◉	101	1/2"	5.6	TYCO TY-FRB WHITE PENDENT QR 155	on Drop
○	174	1/2"	5.6	TYCO TY-FRB TY3131 1/2 QR 155 @ UP	on Sprig
				275 = Total Number of Heads This Floor	

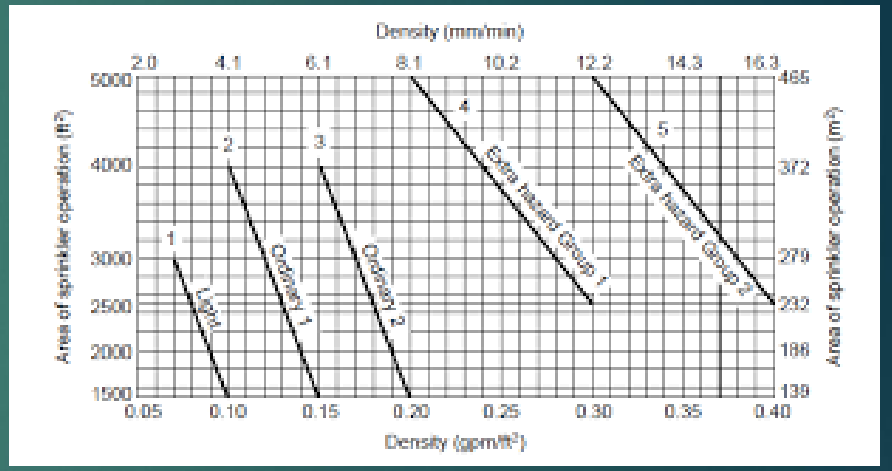
FOR EDUCATIONAL PURPOSES ONLY

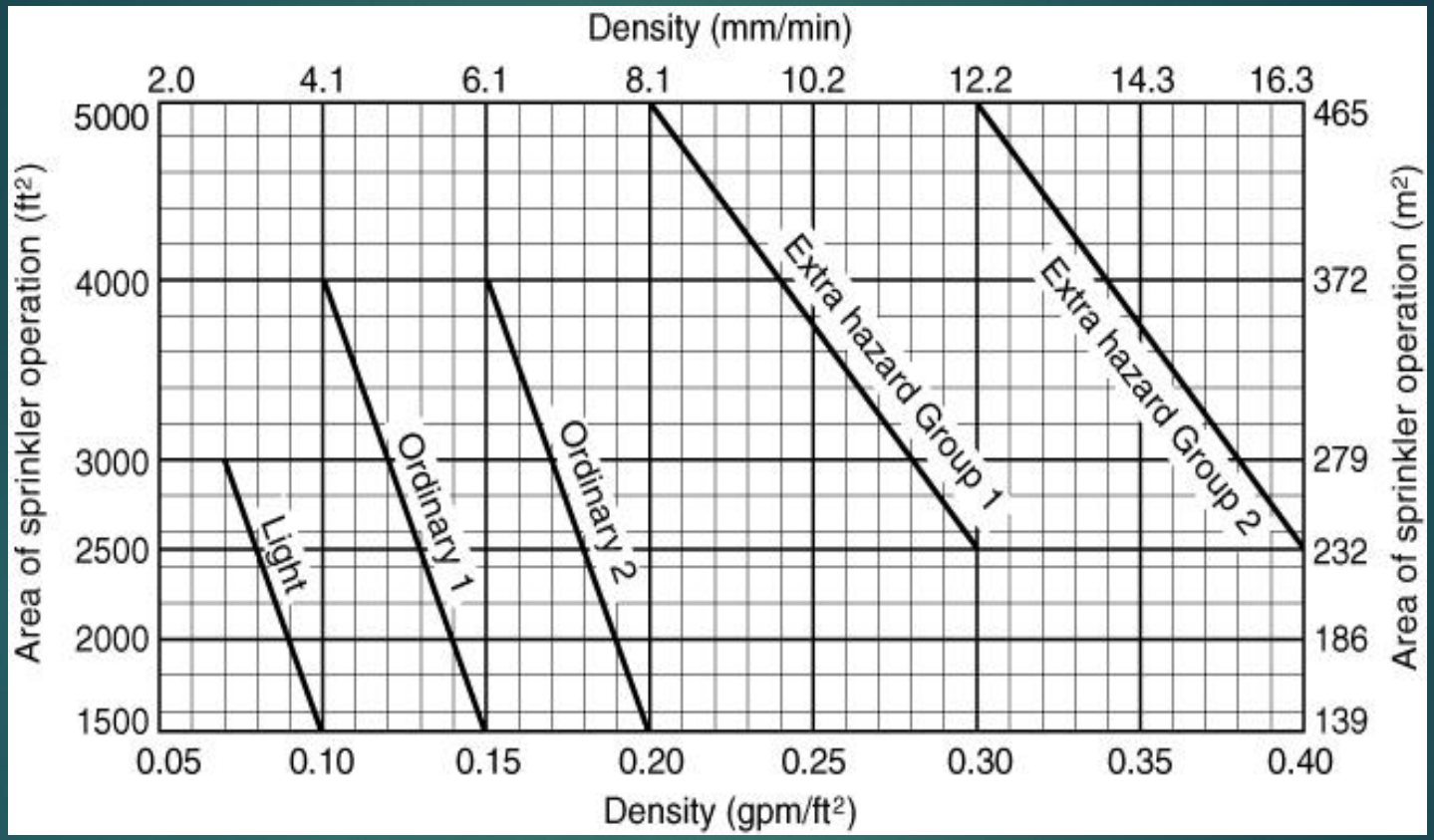
Classification of Occupancies

Light Hazard

Ordinary Hazard 1 - 2

Extra Hazard 1-2

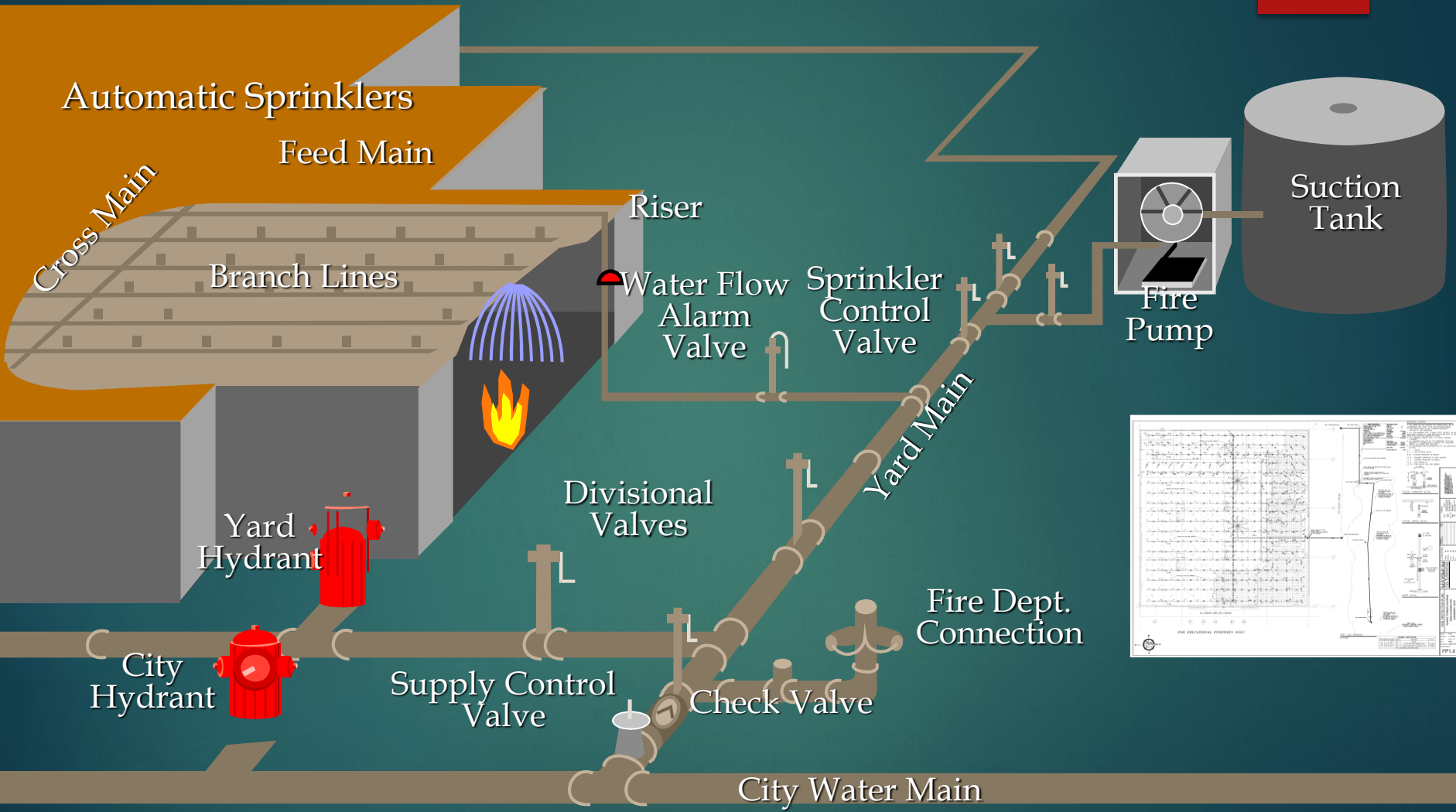




NFPA – 13 Chapter 5

Overall view of a typical fire protection sprinkler system

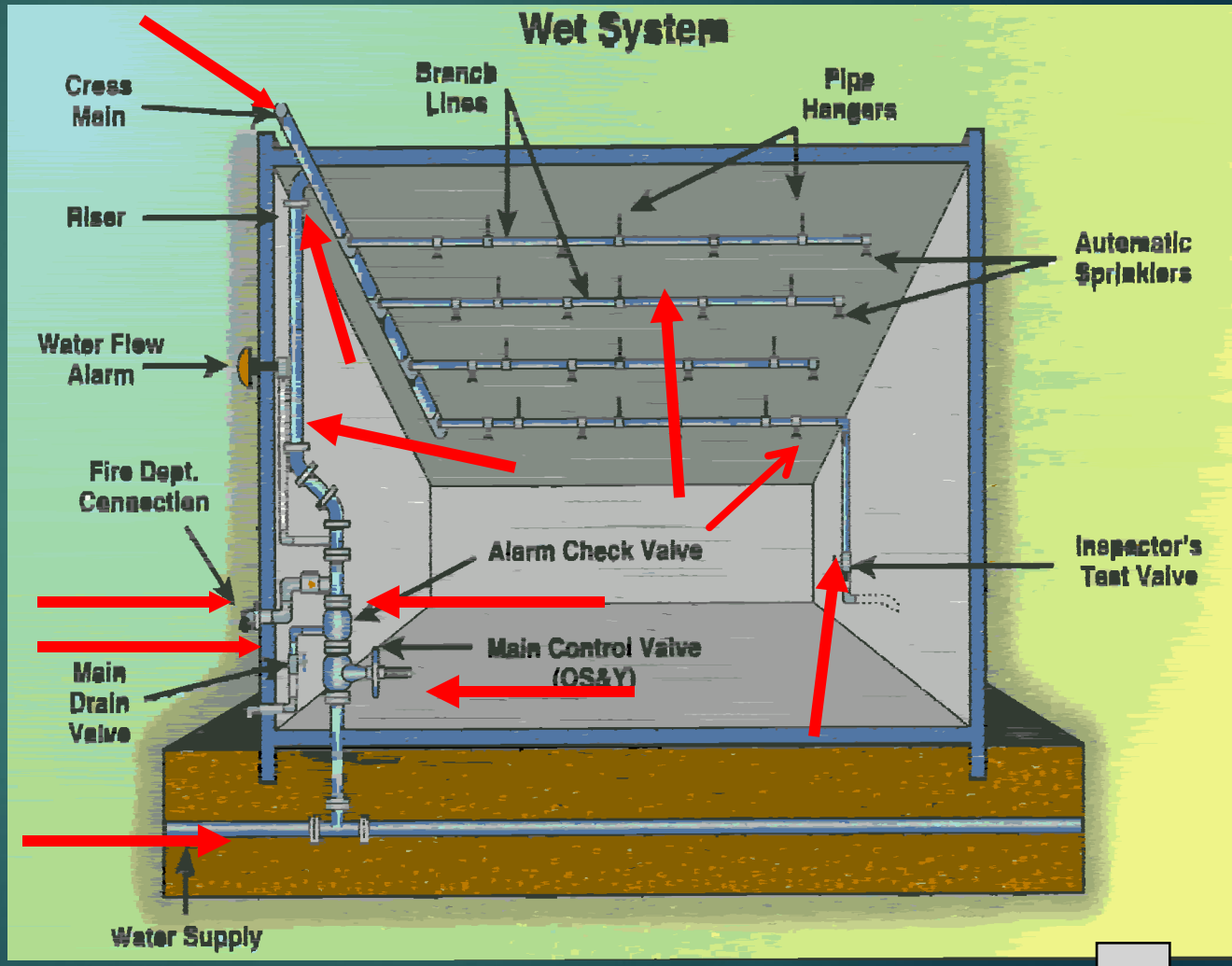
The Components



ITEMS WE WILL REVIEW IN THIS CLASS.

BASIC SYSTEM FUNDAMENTALS

- Starts at main
- FDC
- Control Valve
- Alarm Valve
- Main Drain
- Riser
- Cross Main
- Branch lines
- Sprinkler Heads
- Inspectors Test Valve

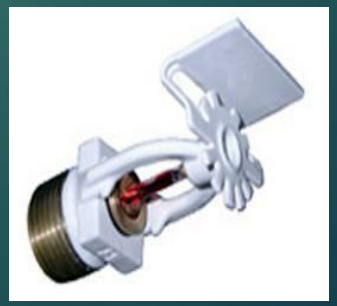


Common Sprinklers

- Upright

- Pendent

- Side Wall



Other Types

Concealed Head

Quick Response

Early Suppression Fast Response (ESFR)

Large drop

Dry Pendent

Residential

Piping


BlazeMaster
BlazeMaster

Fittings


SPRINKLER
CONTROL
VALVE


Mueller Co.
OPEN

OS&Y Valve
Outside Stem and Yoke

Valve Supervision

Control Valve Safeguarding Techniques NFPA® standards require that each control valve contained within an automatic fire sprinkler system be secured. Each of the following methods can effectively secure valves from accidental or intentional closure.

Each normally open valve shall be secured by means of a seal or a lock or shall be electrically supervised.

Fire Department Connection

Fire Department Connection (6.7)

- FDC shall be secure/supported
- Each FDC is required to have signage
- FDC shall not be connected to the suction side of a fire pump

5 Types of systems

Wet Pipe
Dry Pipe
Pre-Action System
Deluge System

Most common is the Wet System
Second is the Dry System

Most Common Type is: Wet System

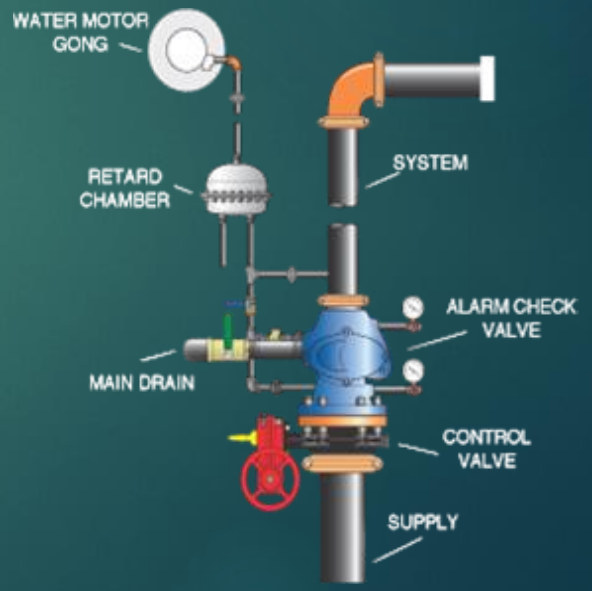
Most common; Why ?

Simplest !

Most Reliable

Most Economical

Requires Least Maintenance

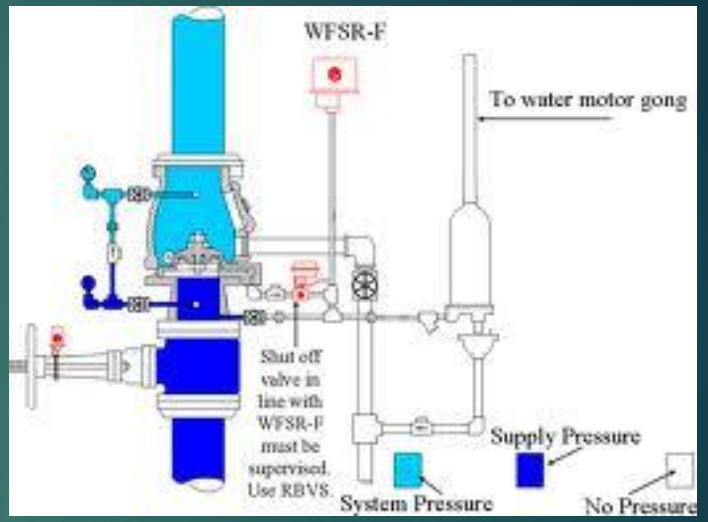


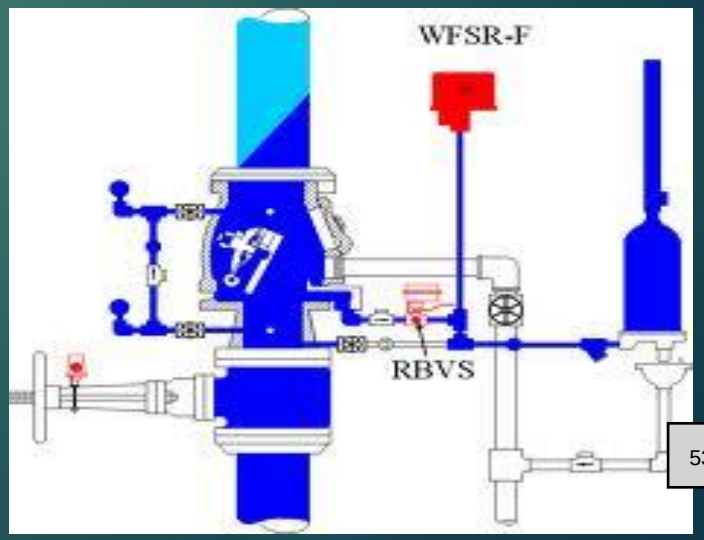
Wet Pipe System

Sequence of Operations

- System is filled with water
- Fire Starts
- Sprinkler Activation
- Discharge of water
- Alarm activation

Alarm Check Valve System

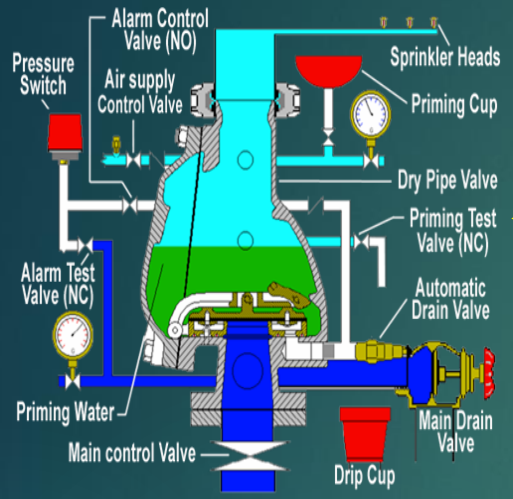




Dry Systems

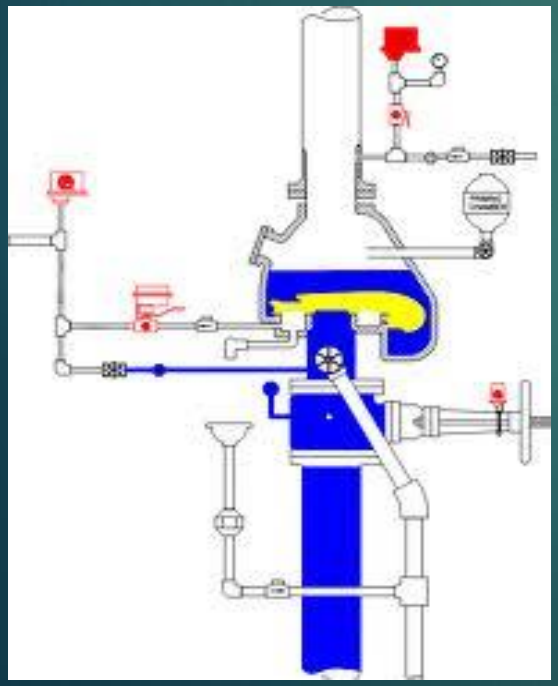
- Use where wet system can't - unheated areas.
- More costly to maintain
- More costly to operate and installed

Operation



Dry valve held closed by air..6-1 ratio or more

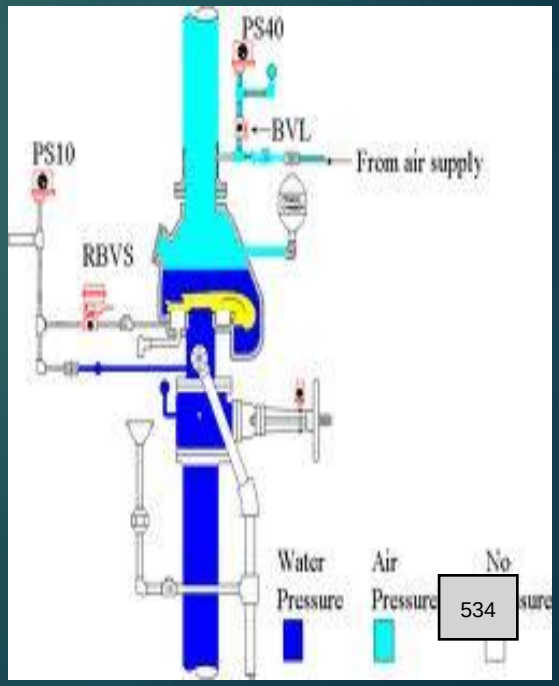
1 pound of air can hold back 6 pounds or more of water



Fire ..sprinkler head activated
Air Pressure is reduce

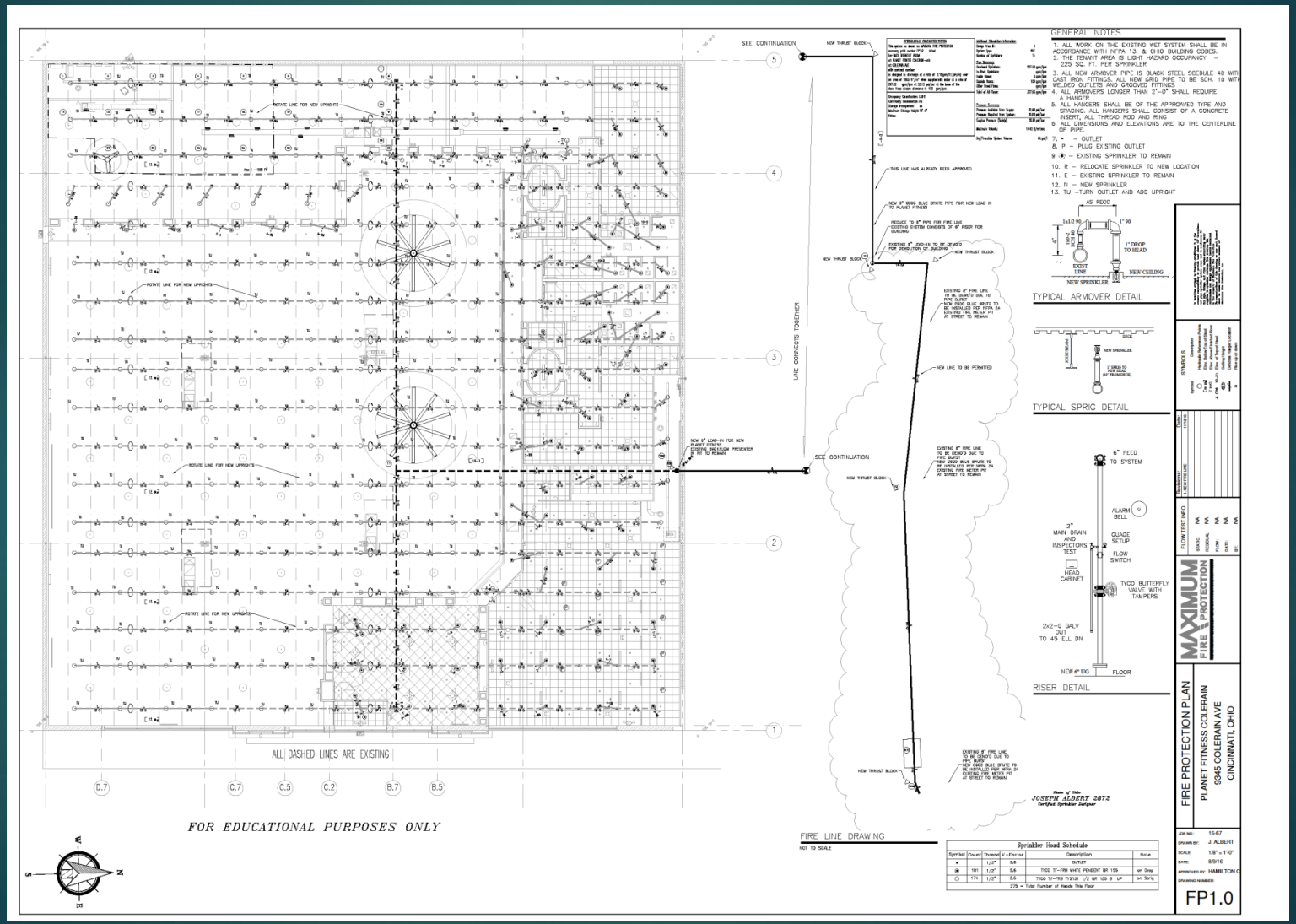
Dry pipe valve trips

Water enters the system



Plan Review: is a proactive approach. This approach ensures that the appropriate codes and standards are applied in the design and construction phases of a buildings development in order to provide an acceptable degree of public safety from fire and other hazards and risk before the structure is completed.

Installation Requirements NFPA – 13 Chapter 8



System Protection Area Limitations

- Light Hazard - 52,000 sqft
- Ordinary - 52,000 sqft
- Extra Hazard – Hydraulically – 40,000 Sqft

Next – what temperature head is need – this is all based

Distance from heat source

Ceiling Temperatures

Hazard --

The Application – Type of Sprinkler and Coverage

K – FACTOR

A unique orifice coefficient that is calculated for a specific sprinkler.

Describes water flow through orifice

Higher K-factor = more water

Flow can vary even with same orifice size

The sprinkler is rated a 5.6 K factor

The Minimum K factor for any head

Sprinkler Hydraulics and Design

Determining the **Minimum Pressure** at the most remote sprinkler head.

$$Q = K \times \sqrt{P}$$

Q = Flow GPM 17 Q/GPM Example .

K = K-Factor or Orifice Coefficient

P = Pressure

The Solution then is:

$$P = \left[\frac{Q}{K}\right]^2 \qquad \left[\frac{17}{5.6}\right] = (3.025)^2 \qquad = 9.21 \text{ psi}$$

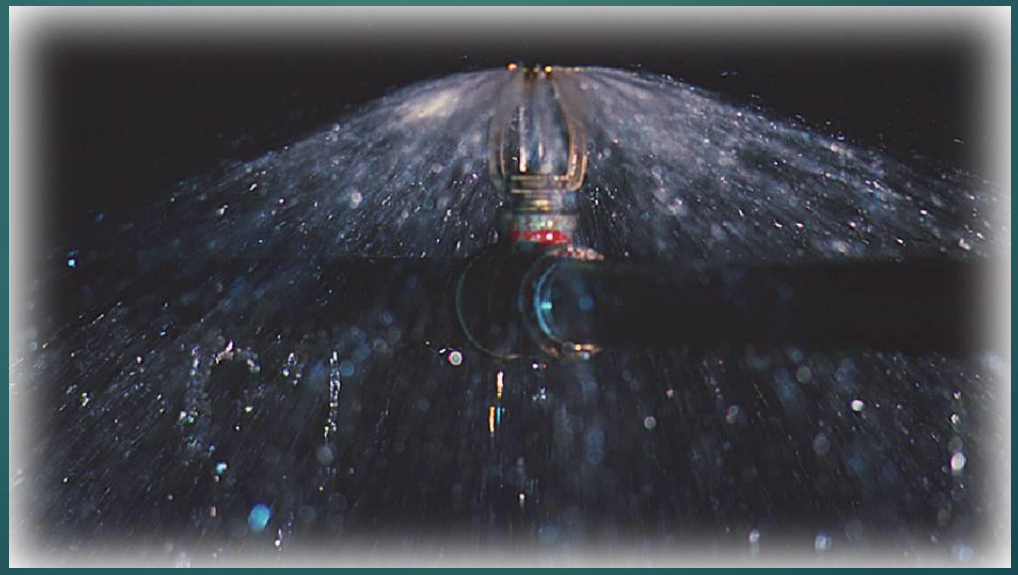
5.6 is the K-Factor of the Sprinkler Factor

Sprinkler Hydraulics and Design

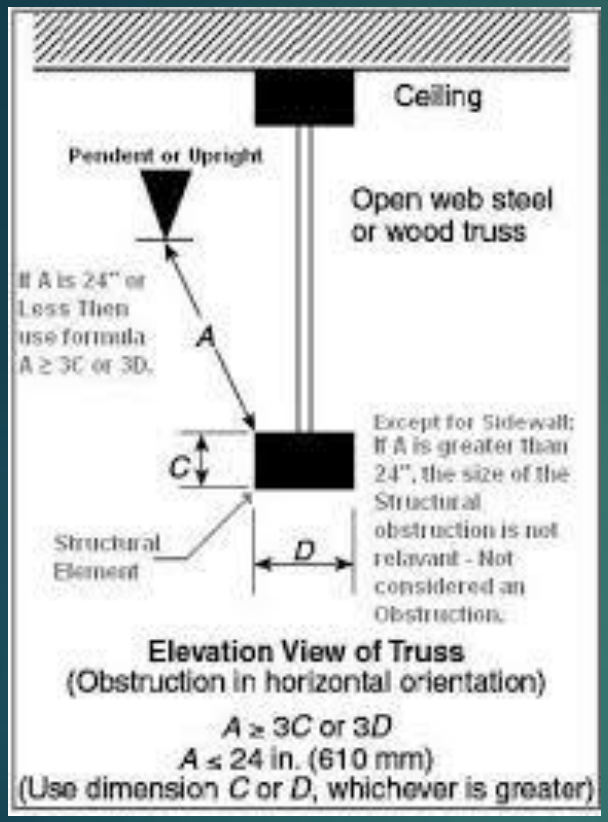
FYI

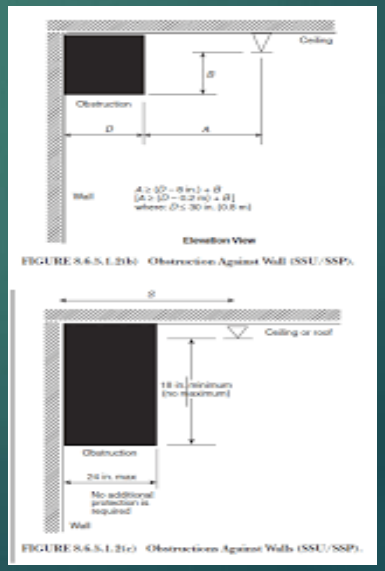
$$Q = (5.6) \times \sqrt{9.21\ psi} = 16.99 \text{ or } 17\ GPM$$

The minimum psi for any sprinkler head is 7 psi



Obstructions

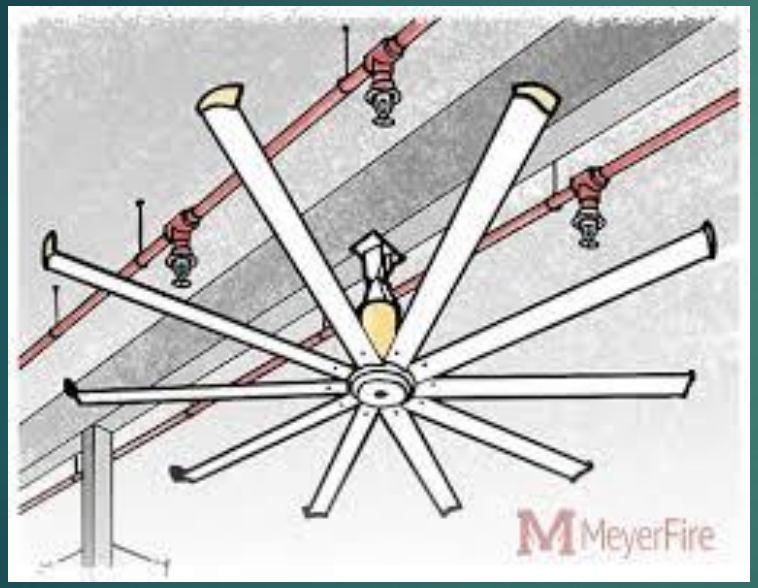




Just a few example

Obstruction to Sprinkler Discharge

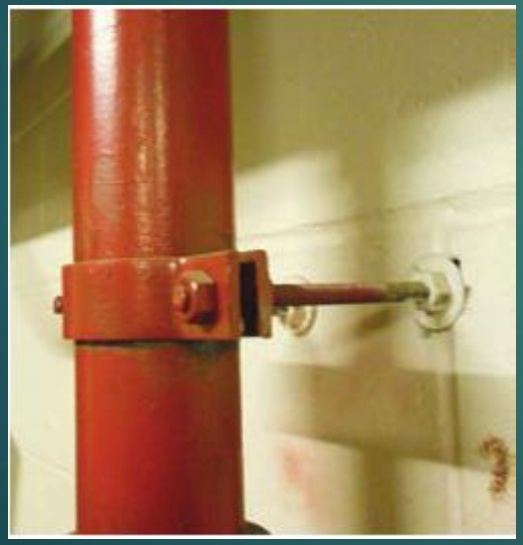
Obstructions



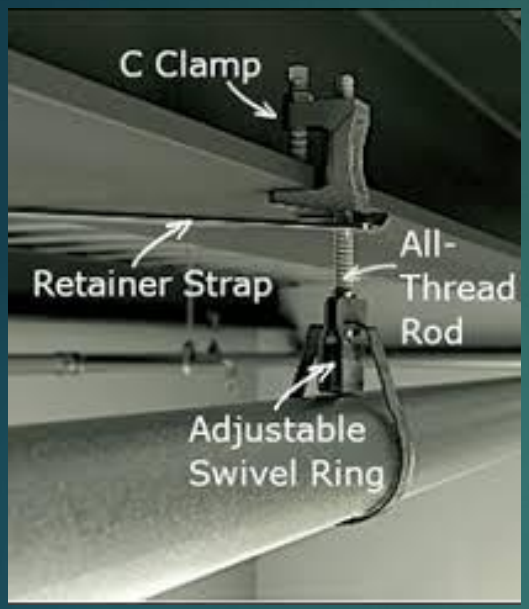
This upright sprinkler should be oriented with its arms parallel to the sprinkler pipe. *Photo courtesy of Byron Blake.*

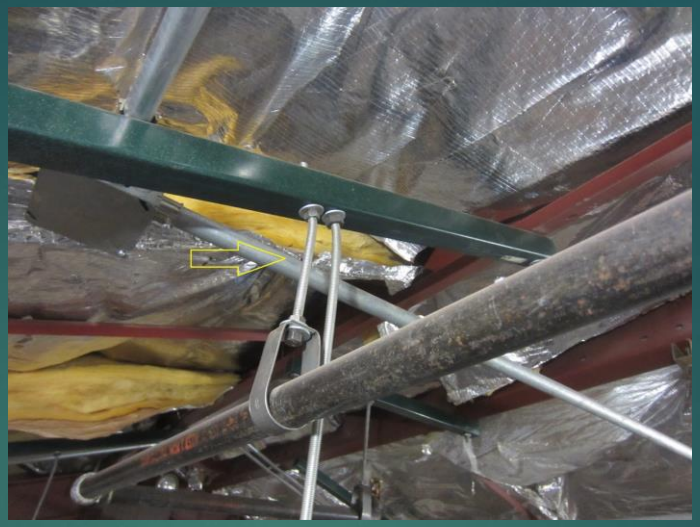
Chapter 9 Hanging, Bracing, and Restraint of Systems Pipping.

Lets take a review.



Hangers


C Clamp
Retainer Strap
All-
Thread
Rod
Adjustable
Swivel Ring



Testing The Sprinkler

- Hydrostatic 200 # for 2hr.
- 50 psi above static pressure when in excess of 150 #

Systems Acceptance

- Installing Contractor Shall:
- Notify Building - Fire and owner of the date and time of the test
- Perform required acceptance tests
- Complete and sign appropriate contractor's material and test certificates

HYDRAULIC-SYSTEM

This system as shown on _____

company print # _____ dated _____

for _____

at _____

is designed to discharge at a rate of _____ gpm

(L/min) per sq ft (m²) of floor area over a maximum area of

_____ sq ft (m²) when supplied

with water at the rate of _____ gpm (L/min)

at _____ psi (bars) at the base of the riser.

Hose stream allowance of _____ gpm (L/min)

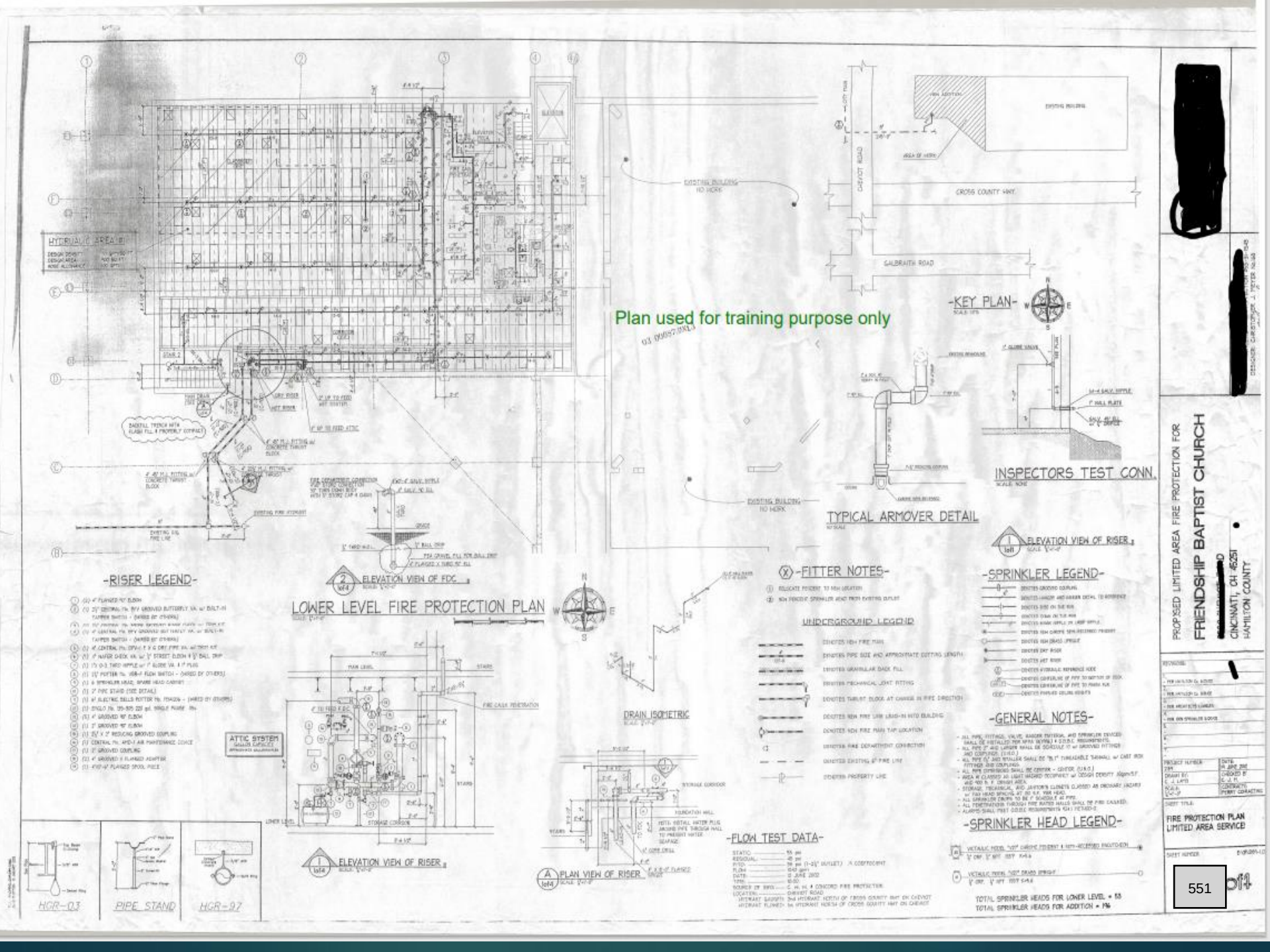
is included in the above.

Occupancy classification: _____

Commodity classification: _____

Maximum storage height: _____

Installed by: _____


Plan used for training purpose only
-KEY PLAN-
-RISER LEGEND-
LOWER LEVEL FIRE PROTECTION PLAN
ELEVATION VIEW OF FDC
ELEVATION VIEW OF RISER
PLAN VIEW OF RISER
DRAIN ISOMETRIC
TYPICAL ARMOVER DETAIL
INSPECTORS TEST CONN.
-FITTER NOTES-
UNDERGROUND LEGEND
-SPRINKLER LEGEND-
-GENERAL NOTES-
-SPRINKLER HEAD LEGEND-
-FLOW TEST DATA-
ATTIC SYSTEM
HGR-03
PIPE STAND
HGR-97
PROPOSED LIMITED AREA FIRE PROTECTION FOR
FRIENDSHIP BAPTIST CHURCH
CINCINNATI, OH 45251
HAMILTON COUNTY
FIRE PROTECTION PLAN
LIMITED AREA SERVICE
551

Don’t forget to sign the paperwork


THE
END

File Attachments for Item:

ER-5 What Is It? Classifying Use and Occupancy (2- and 4- hour versions) (David Molnar)

All certifications (2-hour and 4-hour versions)

Staff Notes: A reduction and expansion, respectively, of the original three-hour course. The two-hour version is a Conference version. The attached "Outline" explains in detail how the three versions differ in content.

Committee Recommendation:

David Molnar

PROFESSIONAL EXPERIENCE

Richland County, Mansfield, OH

Master Plans Examiner, September 2020 – Present

The City of Aurora, OH

Chief Building Official, September 2019 – Present

Medina County, Medina, OH

Chief Building Official, December 2019 – Present
Commercial Plans Examiner, December 2018 – Present

The City of Canton, Canton, OH

Chief Building Official, November 2013 – December 2018

Creo Design, Inc., Akron, OH

President, January 2003 – December 2013

CERTIFICATION/LICENSE

Ohio Board of Building Standards (OBBS), Reynoldsburg, OH **Personnel ID # 4704**
Building Official (ICC)
Master Plans Examiner
Residential Building Official
Mechanical Plans Examiner (ICC)
Plumbing Plans Examiner (ICC)
Building Plans Examiner (ICC)

Ohio Architects Board, Columbus, OH **License # 0012706**
Registered Architect, November 2000

National Council of Architectural Registration Boards (NCARB) **Certificate # 54000574**
NCARB Certificate, January 2002

State of California (Cal OES - Governor's Office of Emergency Services) **Personnel ID # 88931**
Safety Assessment Program (SAP)

Emergency Management Institute (FEMA)
IS-100, IS-200, IS-700, IS-800, ICS-300 and ICS-400, June 2014

David Molnar

EDUCATION

Baldwin Wallace University, Berea, OH

Project Manager Certification, May 1998

Kent State University, Kent, OH
Bachelor of Architecture, May 1993
Bachelor of Science, May 1993

PROFESSIONAL AFFILIATIONS , SOCIETY MEMBERSHIPS AND ORGANIZATIONS

- *International Code Council (ICC) Member* — *May 2007 - Present*
- *Ohio Building Officials Association (OBOA) Board of Directors* — *January 2018 - Present*
- *Five-County Building Officials Association (FBOA) President* — *January 2018 - Present*
- *Copley-Fairlawn Athletic Association (CAA) President* — *December 2012 - Present*

[redacted]

APPLICATION
FOR
Continuing Education Course Approval

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

COURSE SUBMITTER

Course Submitter: David Molnar
(Contact Name)

Organization: ____________
(Organization/Company)

Address: 4201 Copley Rd
(Include Room Number, Suite, etc.)

City: Copley State: OH Zip: 44321

E-Mail: dmolnar1@hotamil.com

Telephone: (330) 714-0982 Fax: ____________

Course Sponsor: ____________

COURSE INFORMATION

Course Title: What is IT? Classifying Use and Occupancy

New Course Submittal: ☐ Update Course: ☐ Prior Approval Number: ____________

Purpose and Objective: Classifying Use, Occupancy and Managing Risks with the 2017 Ohio Building Code, Ohio Mechanical Code, Ohio Plumbing Code and the 2017 NFPA 70 (National Electrical Code). Defining the Use and Occupancy of spaces, understanding the concept of managing the inherent risks of differing Uses and Occupancies, exploring the trade-offs afforded within the Codes and following the trade-offs and risks through the Mechanical, Plumbing and Electrical Codes.

Number of Instructional Contact Hours that can be obtained upon completion: 2-hour version and

If Multi-Session, Number of Instructional Contact Hours Per Session: 4-hour version

Program Applicable for the Following Participants:

Building Official ■ Master Plans Examiner ■ Building Inspector ■ Fire Protection Inspector ■ Mechanical Inspector ■
Plumbing Plans Exam. ■ Plumbing Inspector ■
Electrical Plans Exam. ■ Non-Res IU Inspector ☒
Mechanical Plans Exam. ■

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ■ Res IU Inspector ☒

Electrical Safety Inspectors ☒
Location of ESI Course: ____________ Date(s) of ESI Course(s): ____________

SUBMITTAL CHECKLIST: **Make Sure all of the Following Information is Submitted:**		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	
Content of Program:	Include collated agenda, time schedule, course outline: list specific sections of code, references, and topics covered	
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

What Is It

Presented by David Molnar

The Original Purpose and Objectives of the course will remain for each of the proposed courses: two-hour, three-hour and four-hour times.

Classifying Use, Occupancy and Managing Risks with the 2017 Ohio Building Code, Ohio Mechanical Code, Ohio Plumbing Code and the 2017 NFPA 70 (National Electrical Code). Defining the Use and Occupancy of spaces, understanding the concept of managing the inherent risks of differing Uses and Occupancies, exploring the trade-offs afforded within the Codes and following the trade-offs and risks through the Mechanical, Plumbing and Electrical Codes.

This was planned to be a three-hour course including questions and answers and has been presented as such three times to date. Post presentation discussions have led to requests for providing more discussions on various use groups and how to classify the ones not listed in OBC Chapter 3 as well as if this course could be abbreviated to two hours and use at the OBOA Joint Conference to offer tools for various certifications to understand some of the broader concepts of risks that separate the various Occupancies.

The Two-Hour Course: The 1,000 mile overview

The original slide deck has 219 slides with many diving deeper into the subsections of the specific Code Sections and I do spend time pointing out underlined portions and talking between the lines. To shorten the presentation time, I would just show these slides on the screen and move to the next without the details. There are over 20 slides with specific OBC Sections that can be mostly eliminated and just the Section number and titles used without the paragraphs of text. My goal is to reduce 30 from the OBC portion and 30 minutes total from the OMC, OPC and NFPA70/NEC combined times.

Eliminate the break after Chapter 3.

There are six slides that expand the focus in Chapter 4 would be removed and a brief discussion can be had on the two slides listing the 26 Sections and their titles to make the participants aware of specific Special Detailed Occupancies.

Chapter 5’s in depth discussion on mezzanines and equipment platforms would be reduced to just defining them. The specifics and calculations for area increases would become Subsection identifiers and titles to point out their existence. Unlimited Area buildings and Mixed-Use would also focus on their definitions without expanding beyond that.

Chapter 9 would remain intact except reduction of detailed references for Smoke and Heat Removal. Some slides would only be shown without deeper discussion then various Occupancies requirements per fire area.

Chapter 10 would remain as is.

The first and only break would be here

Chapter 27 and NFPA 70/NEC, the OMC and the OPC slides would not be focused on the specific, but present the various Sections that are managing the risks associated with the Use/Occupancy.

The Four-Hour Course: The Master Class

While some of the questions are brought forth during the presentation, there are those at the end which lean towards the 'how do I classify something that's not obvious'. While not drifting into an in-depth course on Mixed Use, I do want to remind through examples that the use of a structure can be complex and the Code allows for the safe occupancy by managing the risks associated with each.

Some of the Occupancies discussed would include:

A tool or car rental business that includes sales transactions, display area where some of the rental items are kept and a service area where the rental units are cleaned, maintained and repaired. Compare and contrast with the traditional motor car dealership and discuss size of parts storage.

Self-storage units with offices as well as without offices. The concerns between S-2 and S-1 and the uniform classification of buildings.

Drive through beverage stores that are only the vehicle tunnel and those that include a walk-in area for customers to select products and pay. Both models have product storage to classify, but the walk-in area can resemble Mercantile's storage as well as display. The vehicle tunnel can be compared to a car wash in Chapter 3 as well as discussion of the motor-vehicle requirements in Chapter 4.

Open air pavilions that are typical in most parks, but are becoming common place in planned developments both residential and office/retail. Discussions will focus on gathering vs consumption of food and drink for assembly, plumbing fixture counts and the importance of occupant loads. Also the question whether a design professional is required.

The use of a model home as a sales office while the planned development is being sold/constructed vs model homes built as permanent sales offices.

Arts centers have become a grey area for the art world. Some are dedicated to showing pieces of art like a museum or gallery, others mix in live performances and recitals, while some have taken to sharing their skills through workshops with structured classes in a series to single sessions. There are various craft and socialize businesses that are growing in numbers that set up shop in storefront businesses. A discussion regarding food and drink being part of any of the functions.

A compare and contrast between Day Care centers offering after school care programs and training studios that have programs for school age children.

While each of these may seem independent to some, others may see similarities. Tattoo parlors, piercing shops, tanning salons, micro blading and others share similarities with barber shops and beauty salons. A discussion on other state agencies providing licensure for the business or individual will focus on working with the owner and those agencies to manage the risks and requirements to achieve a safe and sanitary business while stressing the authority of Building Officials is only the built environment and Certificate of Occupancy.

While these examples provide a structured talking points, audience members could ask for help determining a specific or hypothetical project that perplexes them and a group exercise could take place by leading them through identified risks and what the Code has to manage that with ultimately being able to have the best representation on the Certificate of Occupancy for all to use.

What is It?

Classifying Use, Occupancy and Managing Risks with the 2017 Ohio Building Code

Objectives:

- Based on the 2017 Ohio Building Code effective November 1, 2017
  - with Amendments Group 95 effective August 1, 2018.
- Defining the Use and Occupancy of spaces
- Understanding the concept of managing the inherent risks
- Exploring the trade-offs afforded within the Codes
- Following the trade-offs and risks through the Mechanical, Plumbing and Electrical Codes.

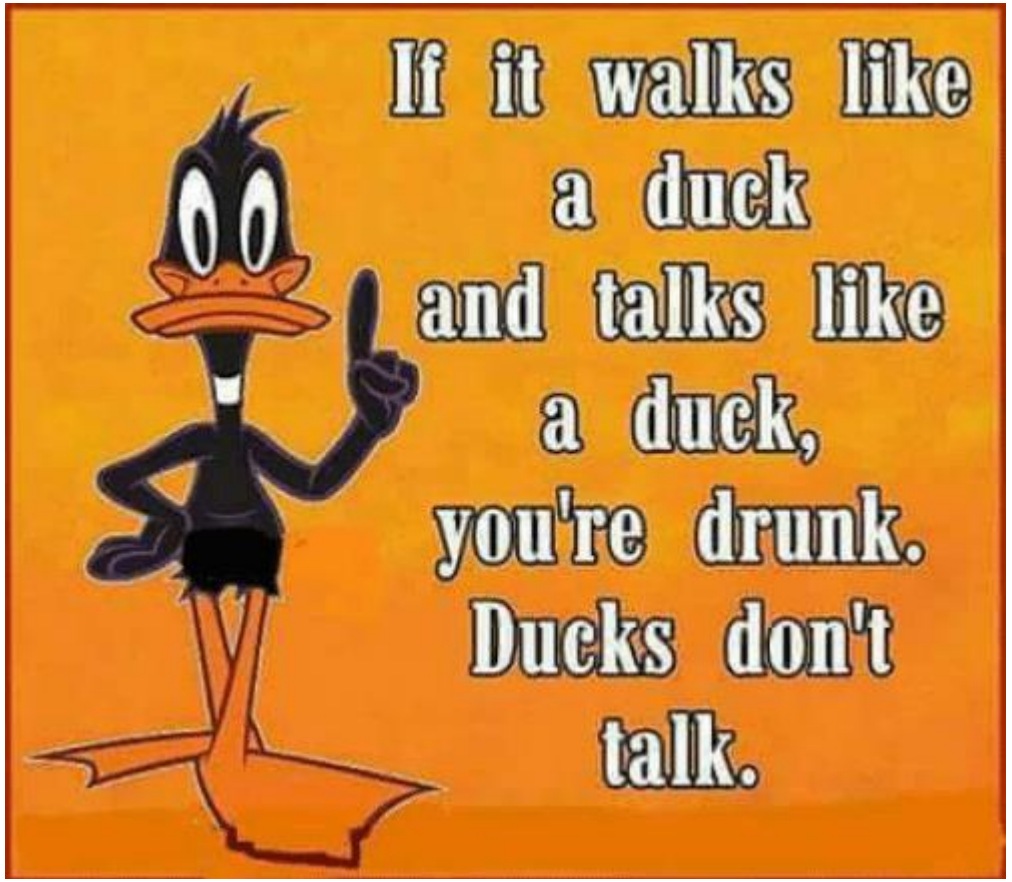
Where to Start?

- OBC Chapter 1 – Administration
  - To establish authority and responsibility to fulfill the purpose of the Code
  - **OBC 101.3 *Intent.*** *The purpose of this code is to establish uniform minimum requirements for the erection, construction, repair, alteration, and maintenance of buildings, including construction of industrialized units. Such requirements shall relate to the conservation of energy, safety, and sanitation of buildings for their intended use and occupancy with consideration for the following:*
- OBC Chapter 2 – Definitions
  - To define terms and establish a common understanding
  - Consult often

OBC Chapter 2 – Definitions

- SECTION 201 GENERAL
  - **201.1 Scope.** Unless otherwise expressly stated…
  - **201.2 Interchangeability.** Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.
  - **201.3 Terms defined in other codes**… shall have the meanings ascribed to them as in those codes.
  - **201.4 Terms not defined**… shall have ordinarily accepted meanings such as the context implies.
- SECTION 202 DEFINITIONS
  - ***OCCUPANCY.*** *The purpose for which a building, or portion thereof, is used.*

If it walks like a duck, and talks like a duck…



"When I see a bird that walks like a duck and swims like a duck and quacks like a duck, I call that bird a duck."

James Whitcomb Riley

OBC 302 Classification

OBC Chapter 3 Use and Occupancy Classification

- **302.1 General.** Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed in this section. A room or space that is intended to be occupied at different times for different purposes shall comply with all of the requirements that are applicable to each of the purposes for which the room or space will be occupied. Structures with multiple occupancies or uses shall comply with Section 508. Where a structure is proposed for a purpose that is not specifically provided for in this code, such structure shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard involved.

OBC 302 Classification

- **302.1 General.**
  - Assembly: Groups A-1, A-2, A-3, A-4 and A-5.
  - Business: Group B.
  - Educational: Group E.
  - Factory and Industrial: Groups F-1 and F-2.
  - High Hazard: Groups H-1, H-2, H-3, H-4 and H-5.
  - Institutional: Groups I-1, I-2, I-3 and I-4.
  - Mercantile: Group M.
  - Residential: Groups R-1, R-2, R-3 and R-4.
  - Storage: Groups S-1 and S-2.
  - Utility and Miscellaneous: Group U.

OBC 303 Assembly Group A

- …the use of a building or structure, or a portion thereof, for the gathering of persons for purposes such as civic, social or religious functions; recreation, food or drink consumption or awaiting transportation.

OBC 303 Assembly Group A

- **303.1.1 Small buildings and tenant spaces.** A building or tenant space used for assembly purposes with an occupant load of less than 50 persons shall be classified as a Group B occupancy.
- **303.1.2 Small assembly spaces.** The following rooms and spaces shall not be classified as Assembly occupancies:
  - 1. … an occupant load of less than 50 persons and accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.
  - 2. … less than 750 square feet (70 m^2) in area and accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.
- **303.1.3 Associated with Group E occupancies.** A room or space used for assembly purposes that is associated with a Group E occupancy is not considered a separate occupancy.
- **303.1.4 Accessory to places of religious worship.** Accessory religious educational rooms and religious auditoriums with occupant loads of less than 100 per room or space are not considered separate occupancies.

Definitions

- **OBC 508.2 Accessory occupancies**. Accessory occupancies are those occupancies that are ancillary to the main occupancy of the building or portion thereof. Accessory occupancies shall comply with the provisions of Sections 508.2.1 through 508.2.4.

  - Ancillary
    - 1: Subordinate, Subsidiary *the main factory and its ancillary plants*
    - 2: Auxiliary, Supplementary
  - Associated
    - 1: joined together often in a working relationship
    - 2: related, connected, or combined together

OBC 303 Assembly Group A

- **A-1** - assembly uses, usually with fixed seating, intended for the production and viewing of the performing arts or motion pictures including, but not limited to:
  - Motion picture theaters
  - Symphony and concert halls
  - Television and radio studios admitting an audience
  - Theaters

OBC 303 Assembly Group A

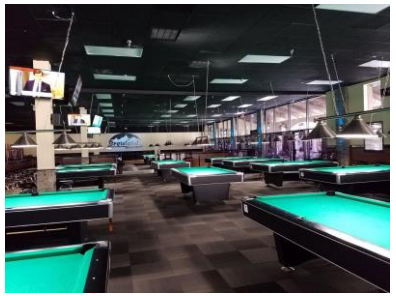
- **A-2** - assembly uses intended for food and/or drink consumption including, but not limited to:
  - Banquet halls
  - Casinos (gaming areas)
  - Nightclubs
  - Restaurants, cafeterias and similar dining facilities (including associated commercial *food service establishments*)
  - Taverns and bars




OBC 303 Assembly Group A

- **A-3** - assembly uses intended for worship, recreation or amusement and other assembly uses not classified elsewhere in Group A including, but not limited to:
  - Amusement arcades
  - Art galleries
  - Bowling alleys
  - Community halls
  - Courtrooms
  - Dance halls (not including food or drink consumption)
  - Exhibition halls
  - Funeral parlors
  - Gymnasiums (without spectator seating)
  - Indoor swimming pools (without spectator seating)
  - Indoor tennis courts (without spectator seating)
  - Lecture halls
  - Libraries
  - Museums
  - Places of religious worship
  - Pool and billiard parlors
  - Waiting areas in transportation terminals

OBC 303 Assembly Group A-3









OBC 303 Assembly Group A

- **A-4** - assembly uses intended for viewing of indoor sporting events and activities with spectator seating including, but not limited to:
  - Arenas
  - Skating rinks
  - Swimming pools
  - Tennis courts

OBC 303 Assembly Group A

- **A-5** - assembly uses intended for participation in or viewing outdoor activities including, but not limited to:
  - Amusement park structures
    - **exception OBC 101.2 10**. Amusement rides and portable electric generators and wiring supplying carnival and amusement rides regulated by the Ohio Department of Agriculture pursuant to sections 1711.50 to 1711.57 of the Revised Code.
    - ***OBC Section 202 Amusement Ride.*** *Any mechanical, aquatic, or inflatable device, or combination of those devices that carries or conveys passengers on, along, around, over, or through a fixed or restricted course or within a defined area for the purpose of providing amusement, pleasure, or excitement and includes carnival rides, bungee jumping facilities, and fair rides but does not include passenger tramways as defined in section 4169.01 of the Revised Code or amusement rides operated solely at trade shows for a limited period of time. For regulation and definitions, see sections 1711.50 to 1711.57 of the Revised Code. Amusement rides are not regulated by this code but are regulated by the Ohio department of agriculture. Also see section 411, Special Amusement Buildings.*

OBC 303 Assembly Group A

- **A-5** - assembly uses intended for participation in or viewing outdoor activities including, but not limited to:
  - Bleachers
  - Grandstands
  - Stadiums

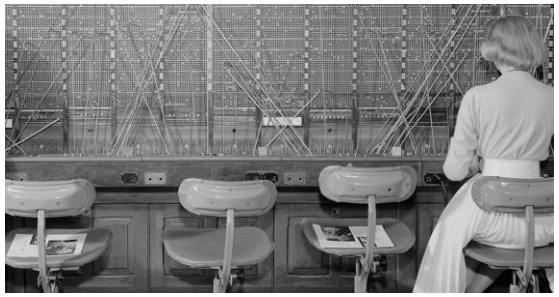
OBC 304 Business Group B

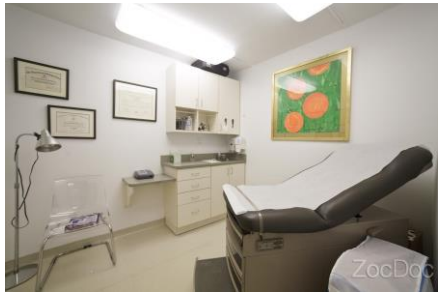
- **B** - the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts. Business occupancies shall include, but not be limited to, the following:
  - Airport traffic control towers
  - Ambulatory care facilities
  - Animal hospitals, kennels and pounds
  - Banks
  - Barber and beauty shops
  - Car wash
  - Civic administration
  - Clinic, outpatient
  - Dry cleaning and laundries: pick-up and delivery stations and self-service
  - Educational occupancies for students above the 12th grade
  - Electronic data processing

OBC 304 Business Group B

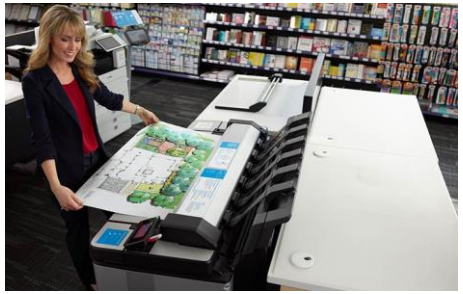
- Food processing establishments and commercial *food service establishments* not associated with restaurants, cafeterias and similar dining facilities not more than 2,500 square feet (232 m^2) in area.
- Laboratories: testing and research
- Motor vehicle showrooms Post offices
- Professional services (architects, attorneys, dentists, physicians, engineers, etc.)
- Print shops
- Radio and television stations
- Telephone exchanges
- Training and skill development not in a school or academic program (this shall include, but not be limited to, tutoring centers, martial arts studios, gymnastics and similar uses regardless of the ages served, and where not classified as a Group A occupancy).

OBC 304 Business Group B





OBC 304 Business Group B



OBC 305 Education Group E

- **E** - the use of a building or structure, or a portion thereof, by six or more persons at any one time for educational purposes through the 12th grade.
  - 305.1.1 **Accessory to places of religious worship.** Religious educational rooms and religious auditoriums, which are accessory to places of religious worship in accordance with Section 303.1.4 and have occupant loads of less than 100 per room or space, shall be classified as Group A-3 occupancies.




OBC 305 Education Group E

- **305.2 Group E, day care facilities - *more than 2 ½ years of age.*** *Except for a Type A or Type B Family Daycare facilities, this* group includes buildings and structures or portions thereof occupied by more than five children older than 2½ years of age who receive educational, supervision or personal care services for fewer than 24 hours per day.
  - 305.2.1 **Within places of religious worship.** Rooms and spaces within places of religious worship providing such day care during religious functions shall be classified as part of the primary occupancy.
  - 305.2.2 **Five or fewer children.** *Except for a Type A or Type B Family Daycare facilities, a* facility having five or fewer children receiving such day care shall be classified as part of the primary occupancy.
  - 305.2.3 **Five or fewer children in a dwelling unit.** *Except for a Type A or Type B Family Daycare facilities, a* facility such as the above within a dwelling unit and having five or fewer children receiving such day care shall be classified as a Group R-3. *The facility may* comply with the *construction requirements of the "Residential Code of Ohio for One-, Two-, or Three-Family Dwellings."*

OBC 305 Education Group E

Chapter 2 – Definitions

- ***FAMILY DAY-CARE HOME, TYPE A.*** *A home where the administrator permanently resides and where care is provided for seven to twelve children under six years of age or four to twelve children when at least four are under two years of age. Licensure is required of these homes by the Ohio Department of Job and Family Services when at least one of the children cared for is not a sibling of the others and the home is not the permanent residence of the children. These homes are also referred to as Type A Homes and Type A Child Care and are exempt from the rules of the board. Also see Chapter 5104. of the Revised Code.*
- ***FAMILY DAY-CARE HOME, TYPE B.*** *A home where the administrator permanently resides and where care is provided for one to six children under six years of age with no more than three children under two years of age when at least one of the children cared for is not a sibling of the others and the home is not the permanent residence of the children. These homes are also referred to as Type B Homes and Type B Child Care and are exempt from the rules of the board. Also see Chapter 5104. of the Revised Code.*

OBC 305 Education Group E

- **305.3 *Group E, day care facilities - 2 ½ years or less of age.*** *A day care facility that provides care for more than five but no more than 100 children 2 ½ years or less of age and the day care facilities are at the level of exit discharge, and where every room where care is provided has no fewer than one exterior exit door for which the exit access and exit discharge do not require the traversing of stairs.*




OBC 306 Factory Group F

- …use of a building or structure, or a portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H hazardous or Group S storage occupancy.
- F-1 **Moderate-hazard factory industrial**
  - OBC 306.2 …uses that are not classified as Factory Industrial F-2 Low Hazard shall be classified as F-1 Moderate Hazard and shall include, but not be limited to, the following:
- F-2 **Low-hazard factory industrial**
  - OBC 306.3 …uses that involve the fabrication or manufacturing of noncombustible materials that during finishing, packing or processing do not involve a significant fire hazard shall be classified as F-2 occupancies and shall include, but not be limited to, the following:

OBC 306.3 Low-hazard Group F-2

- **OBC 306.3** …noncombustible materials that…do not involve a significant fire hazard…include, but not be limited to, the following:
  - Beverages: up to and including 16-percent alcohol content
  - Brick and masonry
  - Ceramic products
  - Foundries
  - Glass products
  - Gypsum
  - Ice
  - Metal products (fabrication and assembly)





OBC 306.2 Moderate-hazard Group F-1

- …not classified as a Group H hazardous or Group S storage occupancy.

- Aircraft (manufacturing, not to include repair)
- Appliances
- Athletic equipment
- Automobiles and other motor vehicles
- Bakeries
- Beverages: over 16-percent alcohol content
- Bicycles
- Boats
- Brooms or brushes
- Business machines
- Cameras and photo equipment
- Canvas or similar fabric
- Carpets and rugs (includes cleaning)
- Clothing
- Construction and agricultural machinery
- Disinfectants
- Dry cleaning and dyeing
- Electric generation plants
- Electronics
- Engines (including rebuilding)
- Food processing establishments and commercial *food service establishments* not associated with restaurants, cafeterias and similar dining facilities more than 2,500 square feet (232 m^2) in area.
- Furniture
- Hemp products
- Jute products
- Laundries
- Leather products
- Machinery
- Metals
- Millwork (sash and door)
- Motion pictures and television filming (without spectators)
- Musical instruments
- Optical goods
- Paper mills or products
- Photographic film
- Plastic products
- Printing or publishing
- Recreational vehicles
- Refuse incineration
- Shoes
- Soaps and detergents
- Textiles
- Tobacco
- Trailers
- Upholstering
- Wood; distillation
- Woodworking (cabinet)

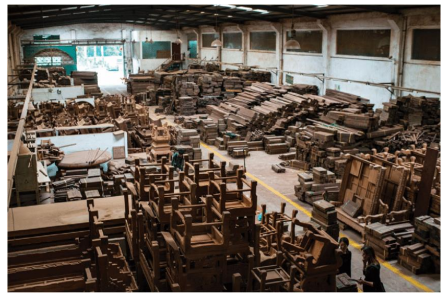
OBC 306.2 Moderate-hazard Group F-1

- …not classified as a Group H hazardous or Group S storage occupancy.
  - Bakeries
  - Beverages: over 16-percent alcohol content
  - Food processing establishments and commercial *food service establishments* not associated with restaurants, cafeterias and similar dining facilities more than 2,500 square feet (232 m^2) in area.




OBC 306.2 Moderate-hazard Group F-1

- …not classified as a Group H hazardous or Group S storage occupancy.
  - Furniture
  - Millwork (sash and door)
  - Musical instruments
  - Woodworking (cabinet)
  - Paper mills or products
  - Upholstering
  - Wood; distillation





OBC 306.2 Moderate-hazard Group F-1

- …not classified as a Group H hazardous or Group S storage occupancy.
  - Carpets and rugs (includes cleaning)
  - Clothing
  - Shoes
  - Textiles
  - Canvas or similar fabric
  - Hemp products
  - Jute products
  - Tobacco





OBC 306.2 Moderate-hazard Group F-1

- …not classified as a Group H hazardous or Group S storage occupancy.
  - Dry cleaning and dyeing
  - Laundries
  - Leather products
  - Photographic film
  - Plastic products
  - Printing or publishing
  - Disinfectants
  - Soaps and detergents




OBC 306.2 Moderate-hazard Group F-1

- …not classified as a Group H hazardous or Group S storage occupancy.
  - Aircraft (manufacturing, not to include repair)
  - Automobiles and other motor vehicles
  - Boats
  - Construction and agricultural machinery
  - Engines (including rebuilding)
  - Machinery
  - Recreational vehicles
  - Trailers

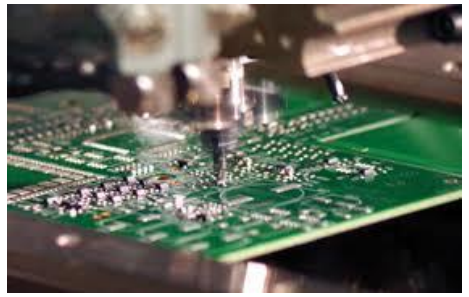




OBC 306.2 Moderate-hazard Group F-1

- …not classified as a Group H hazardous or Group S storage occupancy.
  - Appliances
  - Athletic equipment
  - Bicycles
  - Brooms or brushes
  - Business machines
  - Cameras and photo equipment
  - Electronics
  - Metals
  - Optical goods






OBC 306.2 Moderate-hazard Group F-1

- …not classified as a Group H hazardous or Group S storage occupancy.
  - Electric generation plants
  - Motion pictures and television filming (without spectators)
  - Refuse incineration




OBC 307 High-Hazard Group H

- …use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generation or storage of materials that constitute a physical or health hazard in quantities in excess of those allowed in control areas complying with Section 414, based on the maximum allowable quantity limits for control areas set forth in Tables 307.1(1) and 307.1(2). Hazardous occupancies are classified in Groups H-1, H-2, H-3, H-4 and H-5 and shall be in accordance with this section, the requirements of Section 415 and the *fire code*. Hazardous materials stored, or used on top of roofs or canopies, shall be classified as outdoor storage or use and shall comply with the *fire code*.

OBC 307 High-Hazard Group H

- **OBC Section 202 CONTROL AREA**. Spaces within a building where quantities of hazardous materials not exceeding the maxi- mum allowable quantities per control area are stored, dispensed, used or handled. See the definition of "Outdoor control area" in the fire code.
- **OFC** "Outdoor control area." An outdoor area that contains hazardous materials in amounts not exceeding the maximum allowable quantities of Table 5003.1.1(3) or Table 5003.1.1(4) of rule 1301:7-7-50 of the Administrative Code.

OBC 307 High-Hazard Group H

- 307.1.1 **Uses other than Group H.** An occupancy that stores, uses or handles hazardous materials as described in one or more of the following items shall not be classified as Group H, but shall be classified as the occupancy that it most nearly resembles.
  - 1. Buildings and structures occupied for the application of flammable finishes, provided that such buildings or areas conform to the requirements of Section 416 and the *fire code*.
  - 2. Wholesale and retail sales and storage of flammable and combustible liquids in mercantile occupancies conforming to the *fire code.*
  - 3. Closed piping system containing flammable or combustible liquids or gases utilized for the operation of machinery*, building service equipment,* or *process* equipment.

OBC 307 High-Hazard Group H

- 307.1.1 **Uses other than Group H.**
  - 4. Cleaning establishments that utilize combustible liquid solvents having a flash point of 140°F (60°C) or higher in closed systems employing equipment listed by an approved testing agency, provided that this occupancy is separated from all other areas of the building by 1-hour fire barriers constructed in accordance with Section 707 or 1hour horizontal assemblies constructed in accordance with Section 711, or both.
  - 5. Cleaning establishments that utilize a liquid solvent having a flash point at or above 200°F (93°C).
  - 6. Liquor stores and distributors without bulk storage.
  - 7. Refrigeration systems.
  - 8. The storage or utilization of materials for agricultural purposes on the premises.

OBC 307 High-Hazard Group H

- 307.1.1 **Uses other than Group H.**
  - 9. Stationary batteries utilized for facility emergency power, uninterruptable power supply or telecommunication facilities, provided that the batteries are provided with safety venting caps and ventilation is provided in accordance with the *mechanical code*.
  - 10. Corrosive personal or household products in their original packaging used in retail display.
  - 11. Commonly used corrosive building materials.
  - 12. Buildings and structures occupied for aerosol storage shall be classified as Group S-1, provided that such buildings conform to the requirements of the *fire code*.

OBC 307 High-Hazard Group H

- 307.1.1 **Uses other than Group H.**
  - 13. Display and storage of nonflammable solid and nonflammable or noncombustible liquid hazardous materials in quantities not exceeding the maximum allowable quantity per control area in Group M or S occupancies complying with Section 414.2.5.
  - 14. The storage of black powder, smokeless propellant and small arms primers in Groups M and R-3 and special industrial explosive devices in Groups B, F, M and S, provided such storage conforms to the quantity limits and requirements prescribed in the *fire code*.
- 307.1.2 **Hazardous materials.** Hazardous materials in any quantity shall conform to the requirements of this code, including Section 414, and the *fire code*.

OBC 307 High-Hazard Group H

- 307.3 **High-hazard Group H-1.** Buildings and structures containing materials that pose a detonation hazard shall be classified as Group H-1. Such materials shall include, but not be limited to, the following:
  - Detonable pyrophoric materials

    OBC 202 PYROPHORIC. A chemical with an auto-ignition temperature in air, at or below a temperature of 130°F (54.4 °C).

    Pyrophoric materials are substances that ignite instantly upon exposure to oxygen. They can also be water-reactive, where heat and hydrogen (a flammable gas) are produced. Other common hazards include corrosivity, teratogenicity, and organic peroxide.

OBC 307 High-Hazard Group H

- 307.3 **High-hazard Group H-1.**
  - Explosives:
    - Division 1.1
    - Division 1.2
    - Division 1.3
    - Division 1.4
    - Division 1.5
    - Division 1.6
  - Organic peroxides, unclassified detonable Oxidizers, Class 4
  - Unstable (reactive) materials, Class 3 detonable and Class 4

OBC 307 High-Hazard Group H

- 307.3 **High-hazard Group H-1.**
  - 307.3.1 **Occupancies containing explosives not classified as H-1.** The following occupancies containing explosive materials shall be classified as follows:
    - 1. Division 1.3 explosive materials that are used and maintained in a form where either confinement or configuration will not elevate the hazard from a mass fire to mass explosion hazard shall be allowed in H-2 occupancies.
    - 2. Articles, including articles packaged for shipment, that are not regulated as a Division 1.4 explosive under Bureau of Alcohol, Tobacco, Firearms and Explosives regulations, or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles shall be allowed in H-3 occupancies.

OBC 307 High-Hazard Group H

- 307.4 **High-hazard Group H-2.** Buildings and structures containing materials that pose a deflagration hazard or a hazard from accelerated burning shall be classified as Group H-2. Such materials shall include, but not be limited to, the following:
  - Class I, II or IIIA flammable or combustible liquids that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 pounds per square inch gauge (103.4 kPa).
  - Combustible dusts where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 414.1.3.

OBC 307 High-Hazard Group H

- 307.4 **High-hazard Group H-2.**
  - Cryogenic fluids, flammable.
  - Flammable gases.
  - Organic peroxides, Class I.
  - Oxidizers, Class 3, that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 pounds per square inch gauge (103 kPa).
  - Pyrophoric liquids, solids and gases, nondetonable.
  - Unstable (reactive) materials, Class 3, nondetonable.
  - Water-reactive materials, Class 3.

OBC 307 High-Hazard Group H

- 307.5 **High-hazard Group H-3.** Buildings and structures containing materials that readily support combustion or that pose a physical hazard shall be classified as Group H-3. Such materials shall include, but not be limited to, the following:
  - Class I, II or IIIA flammable or combustible liquids that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103.4 kPa) or less.
  - Combustible fibers, other than densely packed baled cotton, where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 414.1.3.
  - Consumer fireworks, 1.4 G (Class C, Common)

OBC 307 High-Hazard Group H

- 307.5 **High-hazard Group H-3.**
  - Cryogenic fluids, oxidizing
  - Flammable solids
  - Organic peroxides, Class II and III
  - Oxidizers, Class 2
  - Oxidizers, Class 3, that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103 kPa) or less
  - Oxidizing gases
  - Unstable (reactive) materials, Class 2
  - Water-reactive materials, Class 2

OBC 307 High-Hazard Group H

- 307.6 **High-hazard Group H-4.** Buildings and structures containing materials that are health hazards shall be classified as Group H-4. Such materials shall include, but not be limited to, the following:
  - Corrosives
  - Highly toxic materials
  - Toxic materials

OBC 307 High-Hazard Group H

- 307.7 **High-hazard Group H-5.** Semiconductor fabrication facilities and comparable research and development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials is in excess of those listed in Tables 307.1(1) and 307.1(2) shall be classified as Group H-5. Such facilities and areas shall be designed and constructed in accordance with Section 415.11.
  - From Wikipedia, the free encyclopedia
    - Health hazards in semiconductor manufacturing occupations are a major issue of occupational hygiene due to the chemical hazards required to produce semiconductors in the semiconductor industry. The manifestations of exposure to health hazards during the production process often occurs at a low level and the effects of the toxins may take decades to surface.
    - Use of toxic materials such as arsine, phosphine and others potentially expose workers to health hazards which include cancer, miscarriages and birth defects.
    - Protective gear issued to workers protects the products and process from contamination by workers but is not designed to protect workers from contamination by the process, products and materials.
    - The use of vast variety of toxic chemicals in semiconductor manufacturing makes it difficult to evaluate or pin-point the possibilities of contamination.

OBC 307 High-Hazard Group H

- 307.8 **Multiple hazards.** Buildings and structures containing a material or materials representing hazards that are classified in one or more of Groups H-1, H-2, H-3 and H-4 shall conform to the code requirements for each of the occupancies so classified.

OBC 308 Institutional Group I

- 308.1 **Institutional Group I.** Institutional Group I occupancy includes, among others, the use of a building or structure, or a portion thereof, in which care *(personal, custodial, or medical)* or supervision is provided to persons who are or are not capable of self-preservation without physical assistance or in which persons are detained for penal or correctional purposes or in which the liberty of the occupants is restricted. Institutional occupancies shall be classified as Group I-1, I-2, I-3 or I-4.
  - ***Exception:*** *Ambulatory care facilities and outpatient clinics shall be classified as Group B.*
- 308.2 **Definitions.** The following terms are defined in Chapter 2:
  - *CARE FACILITY.*
  - CUSTODIAL CARE.
  - DETOXIFICATION FACILITIES.
  - FOSTER CARE FACILITIES.
  - HOSPITALS AND PSYCHIATRIC HOSPITALS.
  - INCAPABLE OF SELF-PRESERVATION.
  - MEDICAL CARE.
  - NURSING HOMES.
  - *PERSONAL CARE SERVICE.*

OBC 308 Institutional Group I

- 308.3 **Institutional Group I-1.***Except as provided in Sections 308.3.2 and 308.3.3,* Institutional Group I-1 occupancy shall include buildings, structures or portions thereof for more than 16 persons, excluding staff, who reside in a supervised environment, receive care *and are capable of self-preservation*. This group shall include, but not be limited to, the following:
  - Alcohol and drug centers
  - Assisted living facilities
  - Congregate care facilities
  - Group homes
  - Halfway houses
  - Residential board and care facilities
  - Social rehabilitation facilities

OBC 308 Institutional Group I

- 308.3 **Institutional Group I-1.***Except as provided in Sections 308.3.2 and 308.3.3,*
  - 308.3.1 ***Occupancy conditions.*** *Buildings of Group I-1 shall be classified as one of the occupancy conditions specified in Section 308.3.1.1 or 308.3.1.2.*
    - 308.3.1.1 **Condition 1.** This occupancy condition shall include buildings in which all persons receiving care who, without any assistance, are capable of responding to an emergency situation to complete building evacuation.
    - 308.3.1.2 **Condition 2.** This occupancy condition shall include buildings in which there are any persons receiving care who require limited verbal or physical assistance while responding to an emergency situation to complete building evacuation.
  - 308.3.2 **Six to 16 persons receiving care.** A *care* facility housing not fewer than six and not more than 16 persons receiving care shall be classified as Group R-4.
  - 308.3.3 **Five or fewer persons receiving care.** A *care* facility with five or fewer persons receiving care shall be classified as *Group R as provided in Section 310.*

OBC 308 Institutional Group I

- 308.4 **Institutional Group I-2.** *Except as provided in Section 308.4.2*, Institutional Group I-2 occupancy shall include buildings and structures used for care for more than five persons who are incapable of self-preservation *for more than 24 hours*. This group shall include, but not be limited to, the following:
  - Foster care facilities
  - Detoxification facilities
  - Hospitals
  - Nursing homes
  - Psychiatric hospitals




OBC 308 Institutional Group I

- 308.4 **Institutional Group I-2.** *Except as provided in Section 308.4.2*
  - 308.4.1 **Occupancy conditions.** Buildings of Group I-2 shall be classified as one of the occupancy conditions specified in Section 308.4.1.1 or 308.4.1.2.
    - 308.4.1.1 **Condition 1.** This occupancy condition shall include facilities that provide care but do not provide emergency care, surgery, obstetrics or in- patient stabilization units for psychiatric or detoxification, including but not limited to nursing homes and foster care facilities.
    - 308.4.1.2 **Condition 2.** This occupancy condition shall include facilities that provide care and could provide emergency care, surgery, obstetrics or in- patient stabilization units for psychiatric or detoxification, including but not limited to hospitals.
  - 308.4.2 **Five or fewer persons receiving care.** A *care* facility with five or fewer persons *incapable of self-preservation* receiving care shall be classified as *Group R as provided in Section 310*.

OBC 308 Institutional Group I

- 308.5 **Institutional Group I-3.** *Except as provided in Section 308.5.2,* Institutional Group I-3 occupancy shall include buildings and structures that are inhabited by more than five persons who are under restraint or security. A Group I- 3 facility is occupied by persons who are generally incapable of self-preservation due to security measures not under the occupants' control. This group shall include, but not be limited to, the following:
  - Correctional centers
  - Detention centers
  - Jails
  - Prerelease centers
  - Prisons Reformatories

OBC 308 Institutional Group I

- 308.5 **Institutional Group I-3.** *Except as provided in Section 308.5.2,*
  - 308.5.1 ***Occupancy conditions.*** Buildings of Group I-3 shall be classified as one of the occupancy conditions specified in Sections *308.5.1.1* through *308.5.1.5* (see Section 408.1).
    - 308.5.1.1 **Condition 1.** This occupancy condition shall include buildings which free movement is allowed from sleeping areas, and other spaces where access or occupancy is permitted, to the exterior via means of egress without restraint. A Condition 1 facility is permitted to be constructed as Group R.
    - 308.5.1.2 **Condition 2.** This occupancy condition shall include buildings in which free movement is allowed from sleeping areas and any other occupied smoke compartment to one or more other smoke compartments. Egress to the exterior is impeded by locked exits.
    - 308.5.1.3 **Condition 3.** This occupancy condition shall include buildings in which free movement is allowed within individual smoke compartments, such as within a residential unit comprised of individual sleeping units and group activity spaces, where egress is impeded by remote-controlled release of means of egress from such a smoke compartment to another smoke compartment.
    - 308.5.1.4 **Condition 4.** This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Remote-controlled release is provided to permit movement from sleeping units, activity spaces and other occupied areas within the smoke compartment to other smoke compartments.
    - 308.5.1.5 **Condition 5.** This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Staff-controlled manual release is provided to permit movement from sleeping units, activity spaces and other occupied areas within the smoke compartment to other smoke compartments.
  - 308.5.2 ***Five or fewer persons secured or restrained.*** *Buildings containing five or fewer persons who are being secured or restrained shall be classified as part of the primary occupancy.*

OBC 308 Institutional Group I

- 308.6 **Institutional Group I-4.** *Except for Type A or Type B Family Daycares facilities and except as provided in Sections 308.6.1 through 308.6.4*, Institutional Group I-4 occupancy shall include buildings and structures occupied by more than five persons of any age *who are capable of self-preservation with limited physical assistance or incapable of self-preservation*, who receive care for fewer than 24 hours per day by persons other than parents or guardians, relatives by blood, marriage or adoption and in a place other than the home of the person cared for. This group shall include, but not be limited to, the following:
  - Adult day care
  - Child day care

OBC 308 Institutional Group I

- 308.6 **Institutional Group I-4.** *Except for Type A or Type B Family Daycares facilities and except as provided in Sections 308.6.1 through 308.6.4*
  - 308.6.1 **Classification as Group E.** *A day care facility that provides care for more than five but no more than 100 children 2 ½ years or less of age and the day care facilities are at the level of exit discharge, and where every room where care is provided has no fewer than one exterior exit door for which the exit access and exit discharge do not require the traversing of stairs,* shall be classified as Group E.
  - 308.6.2 **Within a place of religious worship.** Rooms and spaces within places of religious worship providing such care during religious functions shall be classified as part of the primary occupancy.
  - 308.6.3 **Five or fewer persons receiving care.** *Except as provided in Section 308.6.4, a care* facility having five or fewer persons receiving care shall be classified as part of the primary occupancy.
  - 308.6.4 **Five or fewer persons receiving care in a dwelling unit.** *Except for Type B Family Daycare facilities, a care* facility within a dwelling unit and having five or fewer persons receiving care shall be classified as Group R *as provided in Section 310.*

OBC 309 Mercantile Group M

- 309.1 **Mercantile Group M.** Mercantile Group M occupancy includes, among others, the use of a building or structure or a portion thereof for the display and sale of merchandise, and involves stocks of goods, wares or merchandise incidental to such purposes and accessible to the public. Mercantile occupancies shall include, but not be limited to, the following:
  - Department stores
  - Drug stores
  - Markets
  - Motor fuel-dispensing facilities
  - Retail or wholesale stores
  - Sales rooms



OBC 309 Mercantile Group M

- 309.2 **Quantity of hazardous materials.** The aggregate quantity of nonflammable solid and nonflammable or non-combustible liquid hazardous materials stored or displayed in a single control area of a Group M occupancy shall not exceed the quantities in Table 414.2.5(1).

OBC 310 Residential Group R

- 310.1 **Residential Group R.** Residential Group R includes, among others, the use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when *not within the scope of the "Residential Code of Ohio for One-, Two-, or Three- Family Dwellings."*
  - 310.1.1 ***Detached One-, Two-, or Three- Family Dwellings.*** *The "Residential Code of Ohio for One-, Two-, or Three- Family Dwellings" shall apply to structures comprised exclusively of one-, two-, or three-family dwellings (having independent exits) and their accessory structures. If no residential department is certified in a jurisdiction, construction documents for structures comprised exclusively of one-, two-, or three-family dwellings are not required to be submitted for approval.*
    - 310.1.1.1 ***Five or fewer persons receiving care in a single family dwelling.***
      A single family dwelling with five or fewer persons, excluding staff, who reside in a supervised environment, receive care, and are capable of self-preservation with or without limited verbal or physical assistance is not classified as Group R and is within the scope of the "Residential Code of Ohio for One-, Two-, or Three- Family Dwellings."

OBC 310 Residential Group R

- 310.1 **Residential Group R.**
  - 310.1.2 *Group R with both shared exits and independent exits. A building with both shared exits and independent exits shall be classified Group R-2, unless the shared exit is not a required exit, in which case, the building shall be classified Group R-3.*
- 310.2 Definitions. The following terms are defined in Chapter 2:
  - BOARDING HOUSE.
  - CARE FACILITY.
  - CONGREGATE LIVING FACILITIES.
  - *CUSTODIAL CARE.*
  - DORMITORY.
  - GROUP HOME.
  - GUEST ROOM.
  - LODGING HOUSE.
  - PERSONAL CARE SERVICE.
  - TRANSIENT. *Occupancy of a dwelling unit or sleeping unit for not more than 30 days.*

OBC 310 Residential Group R

- 310.3 **Residential Group R-1.** *Except as provided in Section 310.3.3,* Residential Group R-1 occupancies containing sleeping units where the occupants are primarily transient in nature, including:
    - Boarding houses (transient) with more than 10 occupants
    - Congregate living facilities (transient) with more than 10 occupants
    - Hotels (transient)
    - Motels (transient)
    - *SRO (Single room occupancy) facility (transient)*
    - *Transient lodging structures*
  - 310.3.1 ***Units not used primarily as permanent residences.*** *R-1 occupancies typically will include sleeping units but may also include dwelling units when those units are not used primarily as permanent residences.*

OBC 310 Residential Group R

- 310.3 **Residential Group R-1.**
  - 310.3.2 ***Transient lodging structures.*** *Except as provided in Sections 310.3.2.1 or 310.3.2.2, a Group R-1 structure composed exclusively of a single dwelling unit with no more than twenty transient occupants may comply with the construction requirements of the "Residential Code of Ohio for One-, Two-, and Three- Family Dwellings" in lieu of the requirements of this code under the following conditions:*
    - 1. *The structure is located to maintain a minimum fire separation distance of thirty feet; and*
    - 2. *There are no more than two stories above grade plane, not including mezzanines/lofts that meet the area limitations of Section 505 of this code; and*
    - 3. *The maximum travel distance to an exit directly to the exterior at the level of exit discharge is 75 feet; and*
    - 4. *Egress from all habitable levels is by stair, ramp or an exit directly to the exterior in compliance with the Residential Code of Ohio; and*

OBC 310 Residential Group R

- 310.3 **Residential Group R-1.**
  - 310.3.2 ***Transient lodging structures...***<u>*no more than twenty transient occupants…*</u>
    - 5. *For a structure with* <u>*eleven to twenty occupants*</u>*, at least two exits are provided from all habitable levels; and*
    - 6. *Portable fire extinguishers are installed in accordance with Section 906 of this code; and*
    - 7. *Artificial light is provided that is adequate to provide an average illumination of 1 foot-candle over the area of the room at a height of thirty inches above the floor level; and*
    - 8. *Accessibility requirements of Chapter 11 of this code shall apply.* ***Exception:*** *If the owner provides documentation that the structure is not a place of public accommodation as defined in 28 C.F.R. 36.104;*
      - (a) When a place of public accommodation is located in a private residence, the portion of the residence used exclusively as a residence is not covered by this part, but that portion used exclusively in the operation of the place of public accommodation or that portion used both for the place of public accommodation and for residential purposes is covered by this part.
      - (b) The portion of the residence covered under paragraph (a) of this section extends to those elements used to enter the place of public accommodation, including the homeowner's front sidewalk, if any, the door or entryway, and hallways; and those portions of the residence, interior or exterior, available to or used by customers or clients, including restrooms.
    - *Hotel licensure requirements of Chapter 3731 of the Revised Code may apply to the occupancy of a transient lodging structure but are outside the scope of this code.*

OBC 310 Residential Group R

- 310.3 **Residential Group R-1.**
  - 310.3.2.1 ***Semi-primitive transient lodging structures no greater than 400 sq. ft. in area.*** *A Group R-1 structure that provides permanent provisions for sleeping only or sleeping with either sanitation or kitchen facilities, but not both, may comply with the applicable construction requirements of the "Residential Code of Ohio for One-, Two-, and Three-Family Dwellings" in lieu of the requirements of this code under the following conditions:*
    - 1. *The structure is located to maintain a minimum fire separation distance of thirty feet; and*
    - 2. *There is no more than one story, no basement, and no habitable loft; and*
    - 3. *There is no more than 400 sq. ft. in area in total; and*
    - 4. *There are no more than five occupants; and*
    - 5. *There is at least one means of egress complying with Section 311 of the Residential Code of Ohio; and*

OBC 310 Residential Group R

- 310.3 **Residential Group R-1.**
  - 310.3.2.1 ***Semi-primitive transient lodging structures no greater than 400 sq. ft. in area:***
    - *6. Portable fire extinguishers are installed in accordance with Section 906 of this code; and*
    - *7. Accessibility requirements of Chapter 11 of this code shall apply.* ***Exception:*** *If the owner provides documentation that the structure is not a place of public accommodation as defined in 28 C.F.R. 36.104;*

      Exceptions*: Semi-primitive transient lodging structures shall not be required to comply with the following provisions of the Residential Code of Ohio:*
      - *1. Chapter 11 if the semi-primitive structure does not contain conditioned space or has a peak design rate of energy usage of less than 3.4 BTU/h·ft^{2}or 1.0 watt/ft^{2}as described in the International Energy Conservation Code.*
      - *2. Section 303.6 for exterior stairway illumination if no commercial power is available*

OBC 310 Residential Group R

- 310.3 **Residential Group R-1.**
  - 310.3.2.2 ***Primitive or semi-primitive transient lodging structures greater than 400 sq. ft. in area.*** *A Group R-1 structure, for not more than twenty transient occupants, that is greater than 400 sq. ft. in area, provides permanent provisions for sleeping only or sleeping with either sanitation or kitchen facilities, but not both, may comply with the applicable construction requirements of the "Residential Code of Ohio for One-, Two, and Three-Family Dwellings" in lieu of the requirements of this code under the following conditions:*
    - 1. *The structure is located to maintain a minimum fire separation distance of thirty feet; and*
    - 2. *There are no more than two stories above grade plane, not including mezzanines/lofts that meet the area limitations of Section 505 of this code; and*
    - 3. *The maximum travel distance to an exit directly to the exterior at the level of exit discharge is 75 feet; and*
    - 4. *Egress from all habitable levels is by stair, ramp or an exit directly to the exterior in compliance with the Residential Code of Ohio; and*
    - 5. *For a structure with eleven to twenty occupants, at least two exits are provided from all habitable levels; and*

OBC 310 Residential Group R

- 310.3 **Residential Group R-1.**
  - 310.3.2.2 ***Primitive or semi-primitive transient lodging structures greater than 400 sq. ft. in area.***
    - 6. *Portable fire extinguishers are installed in accordance with Section 906 of this code; and*
    - 7. *Accessibility requirements of Chapter 11 of this code shall apply.* ***Exception:*** *If the owner provides documentation that the structure is not a place of public accommodation as defined in 28 C.F.R. 36.104;*
    - ***Exceptions****: Primitive or semi-primitive transient lodging structures greater than 400 sq. ft. in area shall not be required to comply with the following provisions of the Residential Code of Ohio:*
      - 1. *Chapter 11 if the semi-primitive structure does not contain conditioned space or has a peak design rate of energy usage of less than 3.4 BTU/h·ft^{2}or 1.0 watt/ft^{2}as described in the International Energy Conservation Code.*
      - 2. *Section 303.6 for exterior stairway illumination if no commercial power is available and the structure is a single story with no basement or habitable loft.*
  - 310.3.3 ***Ten or fewer persons in a boarding house or congregate living.***

OBC 310 Residential Group R

- 310.4 **Residential Group R-2.** *Except as provided in Sections 301.4.1 through 310.4.4*, Residential Group R-2 occupancies containing sleeping units or more than *three* dwelling units, where the occupants are primarily permanent in nature *and where the units share an exit*, including:
  - Apartment houses
  - Boarding houses (nontransient) *where occupants share an exit*
  - Congregate living facilities (nontransient) *where occupants share an exit*
  - Convents
  - Dormitories
  - Fraternities and sororities
  - Hotels (nontransient)
  - Live/work units
  - Monasteries
  - Motels (nontransient)
  - *SRO (Single room occupancy) facility (nontransient)* Vacation timeshare properties

OBC 310 Residential Group R

- 310.4 **Residential Group R-2.**
  - 310.4.1 ***Five or fewer persons receiving care.*** *A care facility with shared exit for five or fewer persons receiving care shall be classified as Group R-2.*
  - 310.4.2 ***Dwelling units in mixed occupancy buildings.*** *This group includes residential occupancies in buildings or structures of mixed use containing one or more dwelling units where the occupants are primarily permanent in nature in structures with shared exits.*
  - 310.4.3 ***Dwelling units with a shared exit.*** *This group includes buildings or structures containing two or three dwelling units where the occupants are primarily permanent in nature and when the dwelling units share an exit.*
  - 310.4.4 ***Sixteen or fewer persons in a boarding house or congregate living.*** *A boarding house or congregate living in a dwelling unit with an independent exit for sixteen or fewer persons shall be classified as Group R-3.*

OBC 310 Residential Group R

- 310.5 **Residential Group R-3.** *Except as provided herein,* residential Group R-3 occupancies where the occupants are primarily permanent in nature and not classified as Group R-1, R-2, R-4 or I, *and where each dwelling unit has an independent exit* including:
    - Boarding houses (nontransient) with 16 or fewer occupants *per dwelling unit*
    - Care facilities that provide accommodations for five or fewer persons receiving care
    - Congregate living facilities (nontransient) with 16 or fewer occupants *per dwelling unit*
    - Lodging houses with five or fewer guest rooms
    - *Vacation timeshare properties*
  - 310.5.1 ***Five or fewer persons receiving care not in a dwelling.*** *A care facility with an independent exit for five or fewer persons receiving care shall be classified as Group R-3.*

OBC 310 Residential Group R

- 310.5 **Residential Group R-3.** …primarily permanent in nature and not classified as Group R-1, R-2, R-4 or I, *and where each dwelling unit has an independent exit* including:
  - 310.5.2 ***Five or fewer persons receiving care within a dwelling.*** *A Group R-3 two- or three-family dwelling used exclusively as care facilities for an aggregate of five or fewer persons receiving care but are capable of self-preservation shall be permitted to comply with the construction requirements of the "Residential Code of Ohio for One-, Two-, or Three- Family Dwellings."*
    - *A Group R-3 one-, two- or three-family dwelling used exclusively as care facilities for an aggregate of five or fewer persons receiving care and are incapable of self-preservation shall be permitted to comply with the construction requirements of the "Residential Code of Ohio for One-, Two-, or Three- Family Dwellings" provided an automatic sprinkler system is installed in all of the dwelling units in accordance with Sections 903.3.1.1, 903.3.1.2, 903.3.1.3 or Section 2904* of the "Residential Code of Ohio for One-, Two-, or Three- Family Dwellings."

OBC 310 Residential Group R

- 310.5 **Residential Group R-3.**
  - 310.5.3 ***Dwelling units in mixed occupancy buildings.*** *This group includes residential occupancies in buildings or structures of mixed use containing one or more dwelling units where the occupants are primarily permanent in nature and where each dwelling unit has an independent exit.*
  - 310.5.4 **Lodging houses.** *A Group R-3 owner-occupied* lodging *house* with five or fewer guest rooms *may comply with the construction requirements of the "Residential Code of Ohio for One-, Two-, or Three- Family Dwellings."*
  - 310.5.5 ***Multi-family alternative compliance.*** *A Group R-3 building may use Chapters 2 to 10 and 44 of the "Residential Code of Ohio for One-, Two-, and Three-Family Dwellings" (RCO) in place of the requirements of this code for Group R-3 occupancies under the following conditions:*
    - 1. *The building is comprised exclusively of dwelling units; and*
    - 2. *The building is not used as a care facility; and*
    - 3. *The building is three stories or less in height; and*
    - 4. *Each dwelling unit in the building has an independent exit; and*

OBC 310 Residential Group R

- 310.5 **Residential Group R-3.**
  - 310.5.5 ***Multi-family alternative compliance.***
    - 5. *No more than one dwelling unit is allowed to be located above another dwelling unit; and*
    - 6. *Fire separation between units within a grouping of two units, including a unit located partially or totally above another unit, shall be in accordance with the RCO section 302.2. Fire separation between any grouping of two units and other adjacent units shall be in accordance with RCO sections 302.2 through 302.6; and*
    - 7. *Chapter 1 of the OBC shall be applicable for code administration purposes; and*
    - 8. *The edition of NFPA 70 listed in Chapter 35 of the OBC shall be applicable for electrical components, equipment, and system requirements; and*
    - 9. *The mechanical code shall apply for mechanical appliances, equipment, and system requirements, including fuel gas requirements; and*

OBC 310 Residential Group R

- 310.5 **Residential Group R-3.**
  - 310.5.5 ***Multi-family alternative compliance.***
    - 7. *Chapter 1 of the OBC shall be applicable for code administration purposes; and*
    - 8. *The edition of NFPA 70 listed in Chapter 35 of the OBC shall be applicable for electrical components, equipment, and system requirements; and*
    - 9. *The mechanical code shall apply for mechanical appliances, equipment, and system requirements, including fuel gas requirements; and*
    - 10. *The plumbing code shall apply for plumbing fixtures, equipment, water supply, and sanitary systems; and*
    - 11. *Chapter 13 of this code shall apply for energy conservation; and*
    - 12. *Except for Items 7 through 11 above, the edition of standards listed in Chapter 35 of this code shall be used when the same standard is referenced in Chapter 44 of the "Residential Code of Ohio for One-, Two-, and Three-Family Dwellings."*
  - 310.5.6 ***More than sixteen occupants in a Boarding House or Congregate Living.*** *A boarding house or congregate living building for more than sixteen persons shall be classified as Group R-2.*

OBC 310 Residential Group R

- 310.6 **Residential Group R-4.** Residential Group R-4 occupancy shall include buildings, structures or portions thereof for more than five but not more than 16 persons, excluding staff, who reside in a supervised residential environment and receive care. The persons receiving care are capable of self-preservation. This group shall include, but not be limited to, the following:
    - Alcohol and drug centers
    - Assisted living facilities
    - Congregate care facilities
    - Group homes
    - Halfway houses
    - Residential board and care facilities
    - Social rehabilitation facilities
    - *Where Group R-4 design criteria is not provided in this code, the construction shall meet the requirements for Group R-3*.

OBC 310 Residential Group R

- 310.6 **Residential Group R-4.** …more than five but not more than 16 persons, excluding staff, who reside in a supervised residential environment and receive care. The persons receiving care are capable of self-preservation…:
  - 310.6.1 ***Occupancy conditions.*** *Buildings of Group R-4 shall be classified as one of the occupancy conditions specified in Section 310.6.1.1 or 310.6.1.2.*
    - 310.6.1.1 **Condition 1.** This occupancy condition shall include buildings in which all persons receiving care, without any assistance, are capable of responding to an emergency situation to complete building evacuation.
    - 310.6.1.2 **Condition 2.** This occupancy condition shall include buildings in which there are any persons receiving care who require limited verbal or physical assistance while responding to an emergency situation to complete building evacuation.

OBC 311 Storage Group S

- 311.1 **Storage Group S.** Storage Group S occupancy includes, among others, the use of a building or structure, or a portion thereof, for storage that is not classified as a hazardous occupancy.
  - 311.1.1 **Accessory storage spaces.** A room or space used for storage purposes 2 that is less than 100 square feet (9.3 m) in area and accessory to another occupancy shall be classified as part of that occupancy. The aggregate area of such rooms or spaces shall not exceed the allowable area limits of Section 508.2.
- 311.2 **Moderate-hazard storage, Group S-1.** Storage Group S-1 occupancies are buildings occupied for storage uses that are not classified as Group S-2, including, but not limited to, storage of the following:
- 311.3 **Low-hazard storage, Group S-2.** Storage Group S-2 occupancies include, among others, buildings used for the storage of noncombustible materials such as products on wood pallets or in paper cartons with or without single thickness divisions; or in paper wrappings. Such products are permitted to have a negligible amount of plastic trim, such as knobs, handles or film wrapping. Group S-2 storage uses shall include, but not be limited to, storage of the following:

OBC 311.2 Storage Group S-1

- Aerosols, Levels 2 and 3
- Aircraft hangar (storage and repair)
- Bags: cloth, burlap and paper
- Bamboos and rattan
- Baskets
- Belting: canvas and leather
- Books and paper in rolls or packs
- Boots and shoes
- Buttons, including cloth covered, pearl or bone
- Cardboard and cardboard boxes
- Clothing, woolen wearing apparel
- Cordage
- Dry boat storage (indoor)
- Furniture
- Furs
- Glues, mucilage, pastes and size
- Grains
- Horns and combs, other than celluloid
- Leather
- Linoleum
- Lumber
- Motor vehicle repair garages complying with the maximum allowable quantities of hazardous materials listed in Table 307.1(1) (see Section 406.8)
- Photo engravings
- Resilient flooring
- Silks
- Soaps
- Sugar
- Tires, bulk storage of
- Tobacco, cigars, cigarettes and snuff
- Upholstery and mattresses
- Wax candles

OBC 311.3 Storage Group S-2

- Asbestos
- Beverages up to and including 16-percent alcohol in metal, glass or ceramic containers
- Cement in bags
- Chalk and crayons
- Dairy products in nonwaxed coated paper containers
- Dry cell batteries
- Electrical coils
- Electrical motors
- Empty cans
- Food products
- Foods in noncombustible containers
- Fresh fruits and vegetables in nonplastic trays or containers
- Frozen foods
- Glass
- Glass bottles, empty or filled with noncombustible liquids
- Gypsum board
- Inert pigments
- Ivory
- Meats
- Metal cabinets
- Metal desks with plastic tops and trim
- Metal parts
- Metals
- Mirrors
- Oil-filled and other types of distribution transformers
- Parking garages, open or enclosed
- Porcelain and pottery
- Stoves
- Talc and soapstones
- Washers and dryers
-

OBC 312 Utility and Miscellaneous Group U

- 312.1 **General.** Buildings and structures of an accessory character and miscellaneous structures not classified in any specific occupancy shall be constructed, equipped and maintained to conform to the requirements of this code commensurate with the fire and life hazard incidental to their occupancy. Group U shall include, but not be limited to, the following:

OBC 312 Utility and Miscellaneous Group U

- 312.1 **General.**
  - Agricultural buildings*
  - Barns*
  - Carports
  - Fences more than 6 feet (1829 mm) in height
  - Grain silos*
  - Greenhouses*
  - Livestock shelters*
  - Private garages
  - Retaining walls *(see exceptions in Section 101.2)*
  - Sheds*
  - Stables*
  - *Tanks associated with building services equipment*
  - Towers *(see exceptions in Section 101.2)*
  - ** Not used for agricultural purposes as defined in section 3781.06 of the Revised Code.*

What is It?

Break Time

OBC Chapter 4 Special Detailed Requirements Based On Use And Occupancy

- OBC 401.1 Detailed use and occupancy requirements. In addition to the occupancy and construction requirements in this code, the provisions of this chapter apply to the special uses and occupancies described herein.

OBC Chapter 4 Special Detailed Requirements Based On Use And Occupancy

- Section 402 Covered Mall And Open Mall Buildings
- Section 403 High-rise Buildings
- Section 404 Atriums
- Section 405 Underground Buildings
- Section 406 Motor-vehicle-related Occupancies
- Section 407 Group I-2
- Section 408 Group I-3
- Section 409 Motion Picture Projection Rooms
- Section 410 Stages, Platforms And Technical Production Areas
- Section 411 Special Amusement Buildings
- Section 412 Aircraft-related Occupancies

OBC Section 402 Covered Mall And Open Mall Buildings

- 402.1 **Applicability.** The provisions of this section shall apply to buildings or structures defined herein as covered or open mall buildings not exceeding three floor levels at any point nor more than three stories above grade plane. Except as specifically required by this section, covered and open mall buildings shall meet applicable provisions of this code.
  - **Exceptions:**
  - 1. Foyers and lobbies of Groups B, R-1 and R-2 are not required to comply with this section.
  - 2. Buildings need not comply with the provisions of this section where they totally comply with other applicable provisions of this code.
  - 402.1.1 **Open space…**mall…and attached anchor buildings and parking garages shall be surrounded on all sides by a permanent open space or not less than 60 feet (18 288 mm).
    - **Exception:** The permanent open space of 60 feet (18 288 mm) shall be permitted to be reduced to not less than 40 feet (12 192 mm), provided the following requirements are met:
  - 402.1.2 **Open mall building perimeter line…**The perimeter line shall define the extent of the open mall building. Anchor buildings and parking structures shall be outside of the perimeter line and are not considered as part of the open mall building.

OBC Section 402 Covered Mall And Open Mall Buildings

- 402.2 **Definitions.** The following terms are defined in Chapter 2:
  - **ANCHOR BUILDING.**
  - **COVERED MALL BUILDING.**
  - **Mall.**
  - **Open mall.**
  - **Open mall building.**
  - **FOOD COURT.**
  - **GROSS LEASABLE AREA.**
- 402.3 **Lease plan…**provide both the building and fire departments…to the extent known, showing the location of each occupancy and its exits before the certificate of occupancy has been issued. As a condition of the certificate of occupancy, such plans shall be kept current by the owner. No modifications or changes in occupancy or use shall be made from that shown on the lease plan without prior approval of the building official.

OBC Section 402 Covered Mall And Open Mall Buildings

- 402.4.1.1 **Covered and open mall buildings.** The building area…shall not be limited…does not exceed three floor levels at stories above grade plane, and is of Type I, II, III or IV construction.
- 402.4.1.2 **Anchor buildings…**anchor building shall not be limited…not more than three stories above grade plane, and is of Type I, II, III or IV construction.
- 402.4.2.1 **Tenant separations…**separated from other tenant spaces by a fire partition complying with Section 708…not required between any tenant space and the mall.
- 402.4.2.2.1 **Openings between anchor building and mall…**anchor buildings of Type IA, IB, IIA or IIB construction and the mall need not be protected.
- 402.5 **Automatic sprinkler system.**
- 402.6.3 **Children's play structures**.
- 402.7 **Emergency systems.** Standpipe system, Smoke control, Emergency power, Emergency voice/alarm communication system, Fire department access to equipment.
- 402.8.1 **Mall width.**
- 402.8.2.1 **Occupant formula…**OLF is not required to be less than 30 and shall not exceed 50.

OBC Section 403 High-rise Buildings

- **Section 202 HIGH-RISE BUILDING.** A building with an occupied floor located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.
- 403.2.3 **Structural integrity of interior exit stairways and elevator hoistway enclosures.**
- 403.3 **Automatic sprinkler system.** Buildings and structures shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and a secondary water supply where required by Section 403.3.3.
- 403.4 **Emergency systems.** Smoke detection, Fire alarm system, Standpipe system, Emergency voice/alarm communication system, Emergency responder radio coverage, Fire command, Smoke removal, Standby and emergency power.

OBC Section 411, Special Amusement Buildings

- **411.1 General.** Special amusement buildings having an occupant load of 50 or more shall comply with the requirements for the appropriate Group A occupancy and Sections 411.1 through 411.8. Special amusement buildings having an occupant load of less than 50 shall comply with the requirements for a Group B occupancy and Sections 411.1 through 411.8.
  - **Exception:** Special amusement buildings or portions thereof that are without walls or a roof and constructed to prevent the accumulation of smoke need not comply with this section. For flammable decorative materials, see the *fire code*.
- **411.2 Definition.** defined in Chapter 2: **SPECIAL AMUSEMENT BUILDING.**
  - **OBC Section 202 Special Amusement Building.** A special amusement building is any temporary or permanent building or portion thereof that is occupied for amusement, entertainment or educational purposes and that contains a device or system that conveys passengers or provides a walkway along, around or over a course in any direction so arranged that the means of egress path is not readily apparent due to visual or audio distractions or is intentionally confounded or is not readily available because of the nature of the attraction or mode of conveyance through the building or structure.

OBC Section 411, Special Amusement Buildings

- **411.3 Automatic fire detection.**
- **411.4 Automatic sprinkler system.**
- **411.5 Alarm.**
- **411.6 Emergency voice/alarm communications system.**
- **411.7 Exit marking…**Where mirrors, mazes or other designs are utilized that disguise the path of egress travel such that they are not apparent, approved and listed low-level exit signs that comply with Section 1013.5, and directional path markings listed in accordance with UL 1994, shall be provided and located not more than 8 inches (203 mm) above the walking surface and on or near the path of egress travel. Such markings shall become visible in an emergency. The directional exit marking shall be activated by the automatic fire detection system and the automatic sprinkler system in accordance with Section 907.2.12.2.
  - **411.7.1 Photoluminescent exit signs.** Where photoluminescent exit signs are installed, activating light source and viewing distance shall be in accordance with the listing and markings of the signs.
- **411.8 Interior finish.** The interior finish shall be Class A

OBC Chapter 4 Special Detailed Requirements Based On Use And Occupancy

- OBC 401.1
  - Section 413 Combustible Storage
  - Section 414 Hazardous Materials
  - Section 415 Groups H-1, H-2, H-3, H-4 And H-5
  - Section 416 Application Of Flammable Finishes
  - Section 417 Drying Rooms
  - Section 418 Organic Coatings
  - Section 419 Live/Work Units
  - Section 420 Groups I-1, R-1, R-2, R-3 And R-4
  - Section 421 Hydrogen Fuel Gas Rooms
  - Section 422 Ambulatory Care Facilities
  - Section 423 Storm Shelters
  - Section 424 Children's Play Structures
  - Section 425 Hyperbaric Facilities
  - Section 426 Combustible Dusts, Grain Processing And Storage

OBC Chapter 5 General Building Heights and Areas

- **SECTION 505 MEZZANINES AND EQUIPMENT PLATFORMS**
  - **OBC Section 202**
  - **MEZZANINE**. An intermediate level or levels between the floor and ceiling of any story and in accordance with Section 505.
  - **EQUIPMENT PLATFORM.** An unoccupied, elevated plat- form used exclusively for mechanical systems or industrial process equipment, including the associated elevated walkways, stairways, alternating tread devices and ladders necessary to access the platform (see Section 505.3).

OBC Chapter 5 General Building Heights and Areas

- 505.2 **Mezzanines.** A mezzanine or mezzanines in compliance with Section 505.2 shall be considered a portion of the story below. Such mezzanines shall not contribute to either the building area or number of stories as regulated by Section 503.1. The area of the mezzanine shall be included in determining the fire area. The clear height above and below the mezzanine floor construction shall be not less than 7 feet (2134 mm).
  - 505.2.1 **Area limitation.** The aggregate area of a mezzanine or mezzanines within a room shall be not greater than one-third of the floor area of that room or space in which they are located…Where a room contains both a mezzanine and an equipment platform, the aggregate area of the two raised floor levels shall be not greater than two-thirds of the floor area of that room or space in which they are located.
  - 505.2.2 **Means of egress…**shall comply with the applicable provisions of Chapter 10.
  - 505.2.3 **Openness.** A mezzanine shall be open and unobstructed to the room in which such mezzanine is located…

OBC Chapter 5 General Building Heights and Areas

- 505.3 **Equipment platforms.** Equipment platforms in buildings shall not be considered as a portion of the floor below. Such equipment platforms shall not contribute to either the building area or the number of stories as regulated by Section 503.1. The area of the equipment platform shall not be included in determining the fire area in accordance with Section 903. Equipment platforms shall not be a part of any mezzanine and such platforms and the walkways, stairs, alternating tread devices and ladders providing access to an equipment platform shall not serve as a part of the means of egress from the building.
  - 505.3.1 **Area limitation.** The aggregate area of all equipment platforms within a room shall be not greater than two-thirds of the area of the room in which they are located. Where an equipment platform is located in the same room as a mezzanine, the area of the mezzanine shall be determined by Section 505.2.1…
  - 505.3.2 **Automatic sprinkler system.** Where located in a building that is required to be protected by an automatic sprinkler system, equipment platforms shall be fully protected by sprinklers above and below the platform, where required by the standards referenced in Section 903.3.
  - 505.3.3 **Guards.** Equipment platforms shall have guards where required by Section 1015.2.

OBC Chapter 5 General Building Heights and Areas

- **SECTION 509 INCIDENTAL USES**
- 509.1 **General** Incidental uses located within single occupancy or mixed occupancy buildings shall comply with the provisions of this section. Incidental uses are ancillary functions associated with a given occupancy that generally pose a greater level of risk to that occupancy and are limited to those uses listed in Table 509.

  Exception: Incidental uses within and serving a dwelling unit are not required to comply with this section.
- 509.2 **Occupancy classification.** Incidental uses shall not be individually classified in accordance with Section 302.1. Incidental uses shall be included in the building occupancies within which they are located.
- 509.3 **Area limitations.** Incidental uses shall not occupy more than 10 percent of the building area of the story in which they are located.
- 509.4 **Separation and protection.** The incidental uses listed in Table 509 shall be separated from the remainder of the building or equipped with an automatic sprinkler system, or both, in accordance with the provisions of that table.

OBC Chapter 5 General Building Heights and Areas

- OBC Table 509 **Incidental Uses**
  - Furnace room; Rooms with boilers; Refrigerant machinery room
  - Hydrogen fuel gas rooms, not classified as Group H
  - Incinerator rooms
  - Paint shops, not classified as Group H, located in occupancies other than Group F
  - Laboratories and vocational shops not classified as Group H - In Group E or I-2 occupancies; In ambulatory care facilities.
  - Laundry rooms over 100 square feet: I-2, I-3
  - In Group I-2, physical plant maintenance shops
  - Waste and linen collection rooms
  - In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than 100 square feet
  - Stationary storage battery systems…used for facility standby power, emergency power or uninterruptable power supplies

OBC Chapter 5 General Building Heights and Areas

- SECTION 503 **GENERAL BUILDING HEIGHT AND AREA LIMITATIONS**
  - 503.1 **General**. Unless otherwise specifically modified in Chapter 4 and this chapter, building height, number of stories and building area shall not exceed the limits specified in Sections 504 and 506 based on the type of construction as determined by Section 602 and the occupancies as determined by Section 302 except as modified hereafter. Building height, number of stories and building area provisions shall be applied independently. Each portion of a building separated by one or more fire walls complying with Section 706 shall be considered a separate building.
    - 503.1.1 **Special industrial occupancies**. Buildings and structures designed to house special industrial processes that require large areas and unusual building heights to accommodate craneways or special machinery and equipment, including, among others, rolling mills; structural metal fabrication shops and foundries; or the production and distribution of electric, gas or steam power, shall be exempt from the building height, number of stories and building area limitations specified in Sections 504 and 506.

OBC Chapter 5 General Building Heights and Areas

- SECTION 504 **BUILDING HEIGHT AND NUMBER OF STORIES**
  - 504.1 **General**. The height, in feet, and the number of stories of a building shall be determined based on the type of construction, occupancy classification and whether there is an automatic sprinkler system installed throughout the building.

    Exception: The building height of one-story aircraft hangars, aircraft paint hangars and buildings used for the manufacturing of aircraft shall not be limited where the building is provided with an automatic sprinkler system or automatic fire-extinguishing system in accordance with Chapter 9 and is entirely surrounded by public ways or yards not less in width than one and one-half times the building height.
    - 504.1.1 Unlimited area buildings. The height of unlimited area buildings shall be designed in accordance with Section 507.
    - 504.1.2 Special provisions. The special provisions of Section 510 permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable heights of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in Section 510.

OBC Chapter 5 General Building Heights and Areas

- Table 504.3 Allowable Building Height In Feet Above Grade Plane
- Table 504.4 Allowable Number of Stories Above Grade Plane
- Table 506.2 Allowable Area Factor

OBC Chapter 5 General Building Heights and Areas

- **SECTION 506 BUILDING AREA**
  - 506.2 **Allowable area determination.** The allowable area of a building shall be determined in accordance with the applicable provisions of Sections 506.2.1 through 506.2.4 and Section 506.3.
    - 506.2.1 **Single-occupancy, one-story buildings.** The allowable area of a single-occupancy building with no more than one story above grade plane shall be determined in accordance with Equation 5-1:
      $A_a = A_t + (NS \times I_f)$

      where:
      - A_a = Allowable area (square feet).
      - A_t = Tabular allowable area factor (NS, S1, or S13R value, as applicable) in accordance with Table 506.2.
      - NS = Tabular allowable area factor in accordance with Table 506.2 for nonsprinklered building (regardless of whether the building is sprinklered).
      - I_f = Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.

OBC Chapter 5 General Building Heights and Areas

- 506.2.2 **Mixed-occupancy, one-story buildings.** The allowable area of a mixed-occupancy building with no more than one story above grade plane shall be determined in accordance with the applicable provisions of Section 508.1 based on Equation 5-1 for each applicable occupancy.
  - 506.2.2.1 **Group H-2 or H-3 mixed occupancies.** For a building containing Group H-2 or H-3 occupancies, the allowable area shall be determined in accordance with Section 508.4.2, with the sprinkler system increase applicable only to the portions of the building not classified as Group H-2 or H-3.
- 506.2.3 **Single-occupancy, multistory buildings.** The allowable area of a single-occupancy building with more than one story above grade plane shall be determined in accordance with Equation 5-2:
  - $A_a = [A_t + (NS \times I_f)] \times S_a$

    where:
    - A_a = Allowable area (square feet).
    - A_t = Tabular allowable area factor (NS, S13R or SM value, as applicable) in accordance with Table 506.2.
    - NS = Tabular allowable area factor in accordance with Table 506.2 for a nonsprinklered building (regardless of whether the building is sprinklered).
    - I_f = Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.
    - Sa = Actual number of building stories above grade plane, not to exceed three.
    - For buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2, use the actual number of building stories above grade plane, not to exceed four.
    - No individual story shall exceed the allowable area (A_a) as determined by Equation 5-2 using the value of $S_a = 1$.

OBC Chapter 5 General Building Heights and Areas

- 506.2.4 **Mixed-occupancy, multistory buildings**. Each story of a mixed-occupancy building with more than one story above grade plane shall individually comply with the applicable requirements of Section 508.1. For buildings with more than three stories above grade plane, the total building area shall be such that the aggregate sum of the ratios of the actual area of each story divided by the allow- able area of such stories, determined in accordance with Equation 5-3 based on the applicable provisions of Section 508.1, shall not exceed three.
  - $A_a = [A_t + (NS \times I_f)]$

    where:
    - A_a = Allowable area (square feet).
    - A_t = Tabular allowable area factor (NS, S13R or SM value, as applicable) in accordance with Table 506.2.
    - NS = Tabular allowable area factor in accordance with Table 506.2 for a nonsprinklered building (regardless of whether the building is sprinklered).
    - I_f = Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.
  - Exception: For buildings designed as separated occupancies under Section 508.4 and equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2, the total building area shall be such that the aggregate sum of the ratios of the actual area of each story divided by the allowable area of such stories determined in accordance with Equation 5-3 based on the applicable provisions of Section 508.1, shall not exceed four.
  - 506.2.4.1 Group H-2 or H-3 mixed occupancies. For a building containing Group H-2 or H-3 occupancies, the allowable area shall be determined in accordance with Section 508.4.2, with the sprinkler system increase applicable only to the portions of the building not classified as Group H-2 or H-3.

OBC Chapter 5 General Building Heights and Areas

- SECTION 507 **UNLIMITED AREA BUILDINGS**
  - 507.1 **General**. The area of buildings of the occupancies and configurations specified in Sections 507.1 through 507.12 shall not be limited. Basements not more than one story below grade plane shall be permitted.
    - 507.1.1 Accessory occupancies. Accessory occupancies shall be permitted in unlimited area buildings in accordance with the provisions of Section 508.2, otherwise the requirements of Sections 507.2 through 507.12 shall be applied, where applicable.
  - 507.3 **Nonsprinklered, one-story buildings**. The area of a Group F-2 or S-2 building no more than one story in height shall not be limited where the building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

OBC Chapter 5 General Building Heights and Areas

- SECTION 507 **UNLIMITED AREA BUILDINGS**
  - 507.4 **Sprinklered, one-story buildings**. The area of a Group A-4 building no more than one story above grade plane of other than Type V construction, or the area of a Group B, F, M or S building no more than one story above grade plane of any construction type, shall not be limited where the building is provided with an automatic sprinkler system throughout in accordance with Section 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.
    Exceptions:
    - 1. Buildings and structures of Type I or II construction for rack storage facilities that do not have access by the public shall not be limited in height, provided that such buildings conform to the requirements of Sections 507.3 and 903.3.1.1 and Chapter 32 of the Fire Code.
    - 2. The automatic sprinkler system shall not be required in areas occupied for indoor participant sports, such as tennis, skating, swimming and equestrian activities in occupancies in Group A-4, provided that both of the following criteria are met:
      - 2.1. Exit doors directly to the outside are pro- vided for occupants of the participant sports areas.
      - 2.2. The building is equipped with a fire alarm system with manual fire alarm boxes installed in accordance with Section 907.

OBC Chapter 5 General Building Heights and Areas

- SECTION 507 **UNLIMITED AREA BUILDINGS**
  - 507.4.1 Mixed occupancy buildings with Groups A-1 and A-2. Group A-1 and A-2 occupancies of other than Type V construction shall be permitted within mixed occupancy buildings of unlimited area complying with Section 507.3, provided all of the following criteria are met:
    - 1. Group A-1 and A-2 occupancies are separated from other occupancies as required for separated occupancies in Section 508.4.4 with no reduction allowed in the fire-resistance rating of the separation based upon the installation of an automatic sprinkler system.
    - 2. Each area of the portions of the building used for Group A-1 or A-2 occupancies shall not exceed the maximum allowable area permitted for such occupancies in Section 503.1.
    - 3. Exit doors from Group A-1 and A-2 occupancies shall discharge directly to the exterior of the building.
  - 507.5 **Two-story buildings**. The area of a Group B, F, M or S building no more than two stories above grade plane shall not be limited where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

OBC Chapter 5 General Building Heights and Areas

- SECTION 507 **UNLIMITED AREA BUILDINGS**
  - 507.6 Group A-3 buildings of Type II construction.
  - 507.7 Group A-3 buildings of Type III and IV construction.
  - 507.8 Group H-2, H-3 and H-4 occupancies. Group H-2, H- 3 and H-4 occupancies shall be permitted in unlimited area buildings containing Group F or S occupancies in accordance with Sections 507.3 and 507.4 and the provisions of Sections 507.8.1 through 507.8.4.
  - 507.9 Unlimited mixed occupancy buildings with Group H-5. The area of a Group B, F, H-5, M or S building no more than two stories above grade plane shall not be limited where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, and is sur-rounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width, provided all of the following criteria are met:

OBC Chapter 5 General Building Heights and Areas

- SECTION 507 UNLIMITED AREA BUILDINGS
  - 507.10 **Aircraft paint hangar**. The area of a Group H-2 air- craft paint hangar no more than one story above grade plane shall not be limited…
  - 507.11 **Group E buildings**. The area of a Group E building no more than one story above grade plane, of Type II, IIIA or IV construction…
  - 507.12 **Motion picture theaters**. In buildings of Type II construction, the area of a motion picture theater located on the first story above grade…
  - 507.13 **Covered and open mall buildings and anchor buildings**. The area of covered and open mall buildings and anchor buildings not exceeding three stories…

OBC Chapter 5 General Building Heights and Areas

- SECTION 508 **MIXED USE AND OCCUPANCY**
  - 508.1 **General**. Each portion of a building shall be individually classified in accordance with Section 302.1. Where a building contains more than one occupancy group, the building or portion thereof shall comply with the applicable provisions of Section 508.2, 508.3 or 508.4, or a combination of these sections.
    Exceptions:
    - 1. Occupancies separated in accordance with Section 510.
    - 2. Where required by Table 415.6.2, areas of Group H- 1, H-2 and H-3 occupancies shall be located in a detached building or structure.
    - 3. Uses within live/work units, complying with Section 419, are not considered separate occupancies.

OBC Chapter 5 General Building Heights and Areas

- 508.2 **Accessory occupancies**. Accessory occupancies are those occupancies that are ancillary to the main occupancy of the building or portion thereof. Accessory occupancies shall comply with the provisions of Sections 508.2.1 through 508.2.4.
  - 508.2.1 **Occupancy classification**. Accessory occupancies shall be individually classified in accordance with Section 302.1. The requirements of this code shall apply to each portion of the building based on the occupancy classification of that space.
  - 508.2.2 **Allowable building height**. The allowable height and number of stories of the building containing accessory occupancies shall be in accordance with Section 504 for the main occupancy of the building.
  - 508.2.3 **Allowable building area**. The allowable area of the building shall be based on the applicable provisions of Section 506 for the main occupancy of the building. Aggregate accessory occupancies shall not occupy more than 10 percent of the floor area of the story in which they are located and shall not exceed the tabular values for non-sprinklered buildings in Table 506.2 for each such accessory occupancy.
  - 508.2.4 **Separation of occupancies**. No separation is required between accessory occupancies and the main occupancy.

    Exceptions:
    - 1. Group H-2, H-3, H-4 and H-5 occupancies shall be separated from all other occupancies in accordance with Section 508.4.
    - 2. Group I-1, R-1, R-2 and R-3 dwelling units and sleeping units shall be separated from other dwelling or sleeping units and from accessory occupancies contiguous to them in accordance with the requirements of Section 420.

OBC Chapter 5 General Building Heights and Areas

- 508.3 **Nonseparated occupancies**. Buildings or portions of buildings that comply with the provisions of this section shall be considered as nonseparated occupancies.
  - 508.3.1 **Occupancy classification**. Nonseparated occupancies shall be individually classified in accordance with Section 302.1. The requirements of this code shall apply to each portion of the building based on the occupancy classification of that space. In addition, the most restrictive provisions of Chapter 9 that apply to the nonseparated occupancies shall apply to the total nonseparated occupancy area. Where nonseparated occupancies occur in a high-rise building, the most restrictive requirements of Section 403 that apply to the nonseparated occupancies shall apply throughout the high-rise building.
  - 508.3.2 **Allowable building area and height**. The allow- able building area and height of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration for the type of construction of the building in accordance with Section 503.1.
  - 508.3.3 **Separation**. No separation is required between nonseparated occupancies.
    Exceptions:
    - 1. Group H-2, H-3, H-4 and H-5 occupancies shall be separated from all other occupancies in accordance with Section 508.4.
    - 2. Group I-1, R-1, R-2 and R-3 dwelling units and sleeping units shall be separated from other dwelling or sleeping units and from other occupancies contiguous to them in accordance with the requirements of Section 420.

OBC Chapter 5 General Building Heights and Areas

- 508.4 **Separated occupancies**. Buildings or portions of buildings that comply with the provisions of this section shall be considered as separated occupancies.
  - 508.4.1 **Occupancy classification**. Separated occupancies shall be individually classified in accordance with Section 302.1. Each separated space shall comply with this code based on the occupancy classification of that portion of the building.
  - 508.4.2 **Allowable building area**. In each story, the building area shall be such that the sum of the ratios of the actual building area of each separated occupancy divided by the allowable building area of each separated occupancy shall not exceed 1.
  - 508.4.3 **Allowable height**. Each separated occupancy shall comply with the building height limitations based on the type of construction of the building in accordance with Section 503.1.
    Exception: Special provisions of Section 510 shall permit occupancies at building heights other than provided in Section 503.1.
  - 508.4.4 **Separation**. Individual occupancies shall be separated from adjacent occupancies in accordance with Table 508.4.
    - 508.4.4.1 Construction. Required separations shall be fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies.

OBC Chapter 5 General Building Heights and Areas

- Table 508.4 Required Separation of Occupancies (Hours)

OCCUPANCY	A, E		I-1[a] , I-3, I-4		I-2		R[a]		F-2, S-2[b] , U		B[e] , F-1, M, S-1		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1[a] , I-3, I-4	-	-	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	-	-	-	-	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	-	-	-	-	-	-	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b] , U	-	-	-	-	-	-	-	-	N	N	1	2	NP	NP	3	4	2	3	2	NP
B[e] , F-1, M, S-1	-	-	-	-	-	-	-	-	-	-	N	N	NP	NP	2	3	1	2	1	NP
H-1	-	-	-	-	-	-	-	-	-	-	-	-	N	NP	NP	NP	NP	NP	NP	NP
H-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	NP	1	NP	1	NP
H-3, H-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1[d]	NP	1	NP
H-5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	NP

OBC Chapter 5 General Building Heights and Areas

- SECTION 510 SPECIAL PROVISIONS
  - 510.1 General. The provisions in Sections 510.2 through 510.9 shall permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable building heights and areas of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in this section for such condition and other applicable requirements of this code. The provisions of Sections 510.2 through 510.8 are to be considered independent and separate from each other.
  - 510.2 Horizontal building separation allowance. A building shall be considered as separate and distinct buildings for the purpose of determining area limitations, continuity of fire walls, limitation of number of stories and type of construction where all of the following conditions are met:
    - 1. The buildings are separated with a horizontal assembly having a fire-resistance rating of not less than 3 hours.
    - 2. The building below the horizontal assembly is of Type IA construction.
    - 3. Shaft, stairway, ramp and escalator enclosures through the horizontal assembly shall have not less than a 2- hour fire-resistance rating with opening protectives in accordance with Section 716.5.

OBC Chapter 5 General Building Heights and Areas

- SECTION 510 SPECIAL PROVISIONS
- 510.2 Horizontal building separation allowance.

  Exception: Where the enclosure walls below the horizontal assembly have not less than a 3-hour fire- resistance rating with opening protectives in accordance with Section 716.5, the enclosure walls extending above the horizontal assembly shall be permitted to have a 1-hour fire-resistance rating, provided:
  - 1. The building above the horizontal assembly is not required to be of Type I construction;
  - 2. The enclosure connects fewer than four stories; and
  - 3. The enclosure opening protectives above the horizontal assembly have a fire protection rating of not less than 1 hour.
  - 4. The building or buildings above the horizontal assembly shall be permitted to have multiple Group A occupancy uses, each with an occupant load of less 300, or Group B, M, R or S occupancies.
  - 5. The building below the horizontal assembly shall be protected throughout by an approved automatic sprinkler system in accordance with Section 903.3.1.1, and shall be permitted to be any occupancy allowed by this code except Group H.
  - 6. The maximum building height in feet (mm) shall not exceed the limits set forth in Section 504.3 for the building having the smaller allowable height as measured from the grade plane.

OBC Chapter 5 General Building Heights and Areas

- SECTION 510 SPECIAL PROVISIONS
  - 510.3 Group S-2 enclosed parking garage with Group S-2 open parking garage above
  - 510.4 Parking beneath Group R
  - 510.5 Group R-1 and R-2 buildings of Type IIIA construction
  - 510.6 Group R-1 and R-2 buildings of Type IIA construction
  - 510.7 Open parking garage beneath Groups A, I, B, M and R
  - 510.8 Group B or M buildings with Group S-2 open parking garage above.
  - 510.9 Multiple buildings above a horizontal assembly

OBC Chapter 6 Types of Construction

- Table 602 Fire-resistance Rating Requirements For Exterior Walls Based On Fire Separation Distance

FIRE SEPARATION DISTANCE =X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP He	OCCUPANCY GROUP F-1, M, S-1f	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U
X < 5[b]	All	3	2	1
5 < X < 10	IA	3	2	1
	Others	2	1	1
10 < X < 30	IA, IB	2	1	1c
	IIB, VB	1	0	0
	Others	1	1	1c
X > 30	All	0	0	0

OBC Chapter 9 Fire Protection Systems

- Section 903 Automatic Sprinkler Systems
  - **903.2.1.6 Assembly occupancies on roofs.** Where an occupied roof has an assembly occupancy with an occupant load exceeding 100 for Group A-2 and 300 for other Group A occupancies, all floors between the occupied roof and the level of exit discharge shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
    Exception: Open parking garages of Type I or Type II construction
  - **903.2.4.1 Woodworking operations.** An automatic sprinkler system shall be provided throughout all Group F-1 occupancy fire areas that contain woodworking operations in excess of 2,500 square feet (232 m2) in area that generate finely divided combustible waste or use finely divided combustible materials.
    903.2.7.1 High-piled storage. An automatic sprinkler system shall be provided in accordance with the *fire code* in all buildings of Group M where storage of merchandise is in high-piled or rack storage arrays.

OBC Chapter 9 Fire Protection Systems

- Section 903 Automatic Sprinkler Systems
  - **903.2.9 Group S-1.** An automatic sprinkler system shall be provided throughout all buildings containing a Group S-1 occupancy where one of the following conditions exists:
    4. A Group S-1 fire area used for the storage of commercial motor vehicles where the fire area exceeds 5,000 square feet (464 m2).
    5. A Group S-1 occupancy used for the storage of upholstered furniture or mattresses exceeds *8000* square feet (232 m2).
  - **903.2.9.1 Repair garages.** An automatic sprinkler system shall be provided throughout all buildings used as repair garages in accordance with Section 406, as shown:1. Buildings having two or more stories above grade plane, including basements, with a fire area containing a repair garage exceeding 10,000 square feet (929 m2).
    2. Buildings not more than one story above grade plane, with a fire area containing a repair garage exceeding 12,000 square feet (1115 m2).
    3. Buildings with repair garages servicing vehicles parked in basements.
  - **903.2.9.2 Bulk storage of tires.** Buildings and structures where the area for the storage of tires exceeds 20,000 cubic feet (566 m3) shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1

OBC Chapter 9 Fire Protection Systems

- Section 903 Automatic Sprinkler Systems
  - **903.2.10 Group S-2 enclosed parking garages.** An automatic sprinkler system shall be provided throughout buildings classified as enclosed parking garages in accordance with Section 406.6 where either of the following conditions exists:
  - 1. Where the fire area of the enclosed parking garage exceeds 12,000 square feet (1115 m2).
  - 2. Where the enclosed parking garage is located beneath other groups.
  - **Exception:** Enclosed parking garages located beneath Group R-3 occupancies.
    - **903.2.10.1 Commercial parking garages.** An automatic sprinkler system shall be provided throughout buildings used for storage of commercial motor vehicles where the fire area exceeds 5,000 square feet (464 m2).

OBC Chapter 9 Fire Protection Systems

- Section 903 Automatic Sprinkler Systems
  - **903.2.11 Specific building areas and hazards.** In all occupancies other than Group U, an automatic sprinkler system shall be installed for building design or hazards in the locations set forth in Sections 903.2.11.1 through 903.2.11.6.
    - **903.2.11.4 Ducts conveying hazardous exhausts.** Where required by the *mechanical code*, automatic sprinklers shall be provided in ducts conveying hazardous exhaust or flammable or combustible materials.
      Exception: Ducts where the largest cross-sectional diameter of the duct is less than 10 inches (254 mm).
    - **903.2.11.5 Commercial cooking operations.** An automatic sprinkler system shall be installed in commercial kitchen exhaust hood and duct systems where an automatic sprinkler system is used to comply with Section 904.
    - **903.2.11.6 Other required suppression systems.** In addition to the requirements of Section 903.2, the provisions indicated in Table 903.2.11.6 require the installation of a fire suppression system for certain buildings and areas.

OBC Chapter 9 Fire Protection Systems

- **TABLE 903.2.11.6 ADDITIONAL REQUIRED SUPPRESSION SYSTEMS**
  - 402.5, 402.6.2 Covered and open mall buildings
  - 403.3 High-rise buildings
  - 404.3 Atriums
  - 405.3 Underground structures
  - 407.6 Group I-2
  - 410.7 Stages
  - 411.4 Special amusement buildings
  - 412.3.6 Airport traffic control towers
  - 412.4.6, 412.4.6.1, 412.6.5 Aircraft hangars
  - 415.11.11 Group H-5 HPM exhaust ducts
  - 416.5 Flammable finishes
  - 417.4 Drying rooms
  - 419.5 Live/work units
  - 424.3 Children’s play structures
  - 507 Unlimited area buildings
  - 509.4 Incidental uses
  - 1029.6.2.3 Smoke-protected assembly seating
  - IFC Sprinkler system requirements as set forth in Section 903.2.11.6 of the *fire code*

OBC Chapter 9 Fire Protection Systems

- Section 905 Standpipe Systems
  - 905.3.2 Group A. Class I automatic wet standpipes shall be provided in nonsprinklered Group A buildings having an occupant load exceeding 1,000 persons.
  - 905.3.3 Covered and open mall buildings. Covered mall and open mall buildings shall be equipped throughout with a standpipe system where required by Section 905.3.1
  - 905.3.6 Helistops and heliports. Buildings with a rooftop helistop or heliport shall be equipped with a Class I or III standpipe system extended to the roof level on which the helistop or heliport is located in accordance with Section 2007.5 of the *fire code*.
  - 905.3.8 Rooftop gardens and landscaped roofs. Buildings or structures that have rooftop gardens or landscaped roofs and that are equipped with a standpipe system shall have the standpipe system extended to the roof level on which the rooftop garden or landscaped roof is located.
- 905.4 Location of Class I standpipe hose connections. Class I standpipe hose connections shall be provided in all of the following locations:
  - 4. In covered mall buildings, adjacent to each exterior public entrance to the mall and adjacent to each entrance from an exit passageway or exit corridor to the mall. In open mall buildings, adjacent to each public entrance to the mall at the perimeter line and adjacent to each entrance from an exit passageway or exit corridor to the mall.

OBC Chapter 9 Fire Protection Systems

- **Section 905 Standpipe Systems**
  - 905.5 Location of Class II standpipe hose connections. Class II standpipe hose connections shall be accessible and located so that all portions of the building are within 30 feet (9144 mm) of a nozzle attached to 100 feet (30 480 mm) of hose.
    - 905.5.1 Groups A-1 and A-2. In Group A-1 and A-2 occupancies having occupant loads exceeding 1,000 persons, hose connections shall be located on each side of any stage, on each side of the rear of the auditorium, on each side of the balcony and on each tier of dressing rooms.
- **Section 906 Portable Fire Extinguishers**
  - 906.1 Where required. Portable fire extinguishers shall be installed in all of the following locations:
    - 1. In Group A, B, E, F, H, I, M, R-1, R-2, R-4 and S occupancies.

OBC Chapter 9 Fire Protection Systems

- **Section 907 Fire Alarm and Detection Systems**
  - 907.2.1 **Group A.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group A occupancies where the occupant load due to the assembly occupancy is 300 or more. Group A occupancies not separated from one another in accordance with Section 707.3.10 shall be considered as a single occupancy for the purposes of applying this section. Portions of Group E occupancies occupied for assembly purposes shall be provided with a fire alarm system as required for the Group E occupancy.
  - 907.2.2 **Group B.** A manual fire alarm system shall be installed in Group B occupancies where one of the following conditions exists:
  - 907.2.3 **Group E.** A manual fire alarm system that initiates the occupant notification signal utilizing an emergency voice/alarm communication system meeting the requirements of Section 907.5.2.2 and installed in accordance with Section 907.6 shall be installed in Group E occupancies. When automatic sprinkler systems or smoke detectors are installed, such systems or detectors shall be connected to the building fire alarm system.

OBC Chapter 9 Fire Protection Systems

- **Section 907 Fire Alarm and Detection Systems**
  - 907.2.4 **Group F.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group F occupancies where both of the following conditions exist:
  - 907.2.5 **Group H.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group H-5 occupancies and in occupancies used for the manufacture of organic coatings. An automatic smoke detection system shall be installed for highly toxic gases, organic peroxides and oxidizers in accordance with Chapters 60, 62 and 63, respectively, of the *fire code*.
  - 907.2.6 **Group I.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group I occupancies. An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be provided in accordance with Sections 907.2.6.1, 907.2.6.2 and 907.2.6.3.3.

OBC Chapter 9 Fire Protection Systems

- **Section 907 Fire Alarm and Detection Systems**
  - 907.2.7 **Group M.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group M occupancies where one of the following conditions exists:
  - 907.2.8 **Group R-1.** Fire alarm systems and smoke alarms shall be installed in Group R-1 occupancies as required in Sections 907.2.8.1 through 907.2.8.3.
  - 907.2.9 **Group R-2.** Fire alarm systems and smoke alarms shall be installed in Group R-2 occupancies as required in Sections 907.2.9.1 through 907.2.9.3.
    - 907.2.9.3 **Group R-2 college and university buildings.** An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R2 occupancies *owned or* operated by a college or university for student or staff housing in all of the following locations:
  - 907.2.10 **Group R-4.** Fire alarm systems and smoke alarms shall be installed in Group R-4 occupancies as required in Sections 907.2.10.1 through 907.2.10.3.

OBC Chapter 9 Fire Protection Systems

- **Section 907 Fire Alarm and Detection Systems**
  - 907.2.10 **Group R-4.** Fire alarm systems and smoke alarms shall be installed in Group R-4 occupancies as required in Sections 907.2.10.1 through 907.2.10.3.

OBC Chapter 9 Fire Protection Systems

- **SECTION 910 SMOKE AND HEAT REMOVAL**
  - 910.1 **General.** Where required by this code, smoke and heat vents or mechanical smoke removal systems shall conform to the requirements of this section.
  - 910.2 **Where required.** Smoke and heat vents or a mechanical smoke removal system shall be installed as required by Sections 910.2.1 and 910.2.2.
    - **Exceptions:**
    - 1. Frozen food warehouses used solely for storage of Class I and II commodities where protected by an approved automatic sprinkler system.
    - 2. Smoke and heat removal shall not be required in areas of buildings equipped with early suppression fast-response (ESFR) sprinklers.
    - 3. Smoke and heat removal shall not be required in areas of buildings equipped with control mode special application sprinklers with a response time index of 50 $(m \cdot s)^{1/2}$ or less that are listed to control a fire in stored commodities with 12 or fewer sprinklers.
    - 910.2.1 **Group F-1 or S-1.** Smoke and heat vents installed in accordance with Section 910.3 or a mechanical smoke removal system installed in accordance with Section 910.4 shall be installed in buildings and portions thereof used as a Group F-1 or S-1 occupancy having more than 50,000 square feet (4645 m^2) of undivided area. In occupied portions of a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 where the upper surface of the story is not a roof assembly, a mechanical smoke removal system in accordance with Section 910.4 shall be installed.
      - **Exception:** Group S-1 aircraft repair hangars.

OBC Chapter 9 Fire Protection Systems

- **SECTION 910 SMOKE AND HEAT REMOVAL**
  - 910.2 **Where required.** Smoke and heat vents or a mechanical smoke removal system shall be installed as required by Sections 910.2.1 and 910.2.2.
    - **Exceptions:**
    - 910.2.2 **High-piled combustible storage.** Smoke and heat removal required by Table 3206.2 of the *fire code* for buildings and portions thereof containing high-piled combustible storage shall be installed in accordance with Section 910.3 in unsprinklered buildings. In buildings and portions thereof containing high-piled combustible storage equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, a smoke and heat removal system shall be installed in accordance with Section 910.3 or 910.4. In occupied portions of a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, where the upper surface of the story is not a roof assembly, a mechanical smoke removal system in accordance with Section 910.4 shall be installed.

OBC Chapter 9 Fire Protection Systems

- **SECTION 910 SMOKE AND HEAT REMOVAL**
  - 910.3 **Smoke and heat vents.** The design and installation of smoke and heat vents shall be in accordance with Sections 910.3.1 through 910.3.3.
    - 910.3.1 **Listing and labeling.** Smoke and heat vents shall be listed and labeled to indicate compliance with UL 793 or FM 4430.
    - 910.3.2 **Smoke and heat vent locations.** Smoke and heat vents shall be located 20 feet (6096 mm) or more from adjacent lot lines and fire walls and 10 feet (3048 mm) or more from fire barriers. Vents shall be uniformly located within the roof in the areas of the building where the vents are required to be installed by Section 910.2 with consideration given to roof pitch, sprinkler location and structural members.

OBC Chapter 9 Fire Protection Systems

- **SECTION 910 SMOKE AND HEAT REMOVAL**
  - 910.3 **Smoke and heat vents.** The design and installation of smoke and heat vents shall be in accordance with Sections 910.3.1 through 910.3.3.
    - 910.3.3 **Smoke and heat vents area.** The required aggregate area of smoke and heat vents shall be calculated as follows:
      - For buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1:
        AVR = V/9000
      - where:
        - AVR = The required aggregate vent area (ft^2).
        - V = Volume (ft^3) of the area that requires smoke removal.
        - For unsprinklered buildings:
        - where:
        - AVR = The required aggregate vent area (ft^2).
        - AFA = The area of the floor in the area that requires smoke removal.

OBC Chapter 9 Fire Protection Systems

- **SECTION 910 SMOKE AND HEAT REMOVAL**
  - 910.4 **Mechanical smoke removal systems.** Mechanical smoke removal systems shall be designed and installed in accordance with Sections 910.4.1 through 910.4.7.
    - 910.4.1 **Automatic sprinklers required.** The building shall be equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.
    - 910.4.2 **Exhaust fan construction.** Exhaust fans that are part of a mechanical smoke removal system shall be rated for operation at 221°F (105°C). Exhaust fan motors shall be located outside of the exhaust fan air stream.
    - 910.4.3 **System design criteria.** The mechanical smoke removal system shall be sized to exhaust the building at a minimum rate of two air changes per hour based upon the volume of the building or portion thereof without contents. The capacity of each exhaust fan shall not exceed 30,000 cubic feet per minute (14.2 m^3/sec).
      - 910.4.3.1 **Makeup air.** Makeup air openings shall be provided within 6 feet (1829 mm) of the floor level. Operation of makeup air openings shall be manual or automatic. The minimum gross area of makeup air inlets shall be 8 square feet per 1,000 cubic feet per minute (0.74 m^2 per 0.4719 m^3/s) of smoke exhaust.

OBC Chapter 9 Fire Protection Systems

- **SECTION 910 SMOKE AND HEAT REMOVAL**
  - 910.4 **Mechanical smoke removal systems.** Mechanical smoke removal systems shall be designed and installed in accordance with Sections 910.4.1 through 910.4.7.
    - 910.4.4 **Activation.** The mechanical smoke removal system shall be activated by manual controls only.
    - 910.4.5 **Manual control location.** Manual controls shall be located so as to be accessible to the fire service from an exterior door of the building and protected against interior fire exposure by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.
    - 910.4.6 **Control wiring.** Wiring for operation and control of mechanical smoke removal systems shall be connected ahead of the main disconnect in accordance with Section 701.12 E of NFPA 70 and be protected against interior fire exposure to temperatures in excess of 1,000°F (538°C) for a period of not less than 15 minutes.
    - 910.4.7 **Controls.** Where building air-handling and mechanical smoke removal systems are combined or where independent building air-handling systems are provided, fans shall automatically shut down in accordance with the *mechanical code*. The manual controls provided for the smoke removal system shall have the capability to override the automatic shutdown of fans that are part of the smoke removal system.
- 910.5 **Maintenance.** Smoke and heat vents and mechanical smoke removal systems shall be maintained in accordance with the *fire code*.

OBC Chapter 10 Means of Egress

- **SECTION 1003 GENERAL MEANS OF EGRESS**
  - 1003.2 **Ceiling height.** The means of egress shall have a ceiling height of not less than 7 feet 6 inches (2286 mm).
    - **Exceptions:**
    - 2. Ceilings of dwelling units and sleeping units within residential occupancies in accordance with Section 1208.2.
    - 4. Stair headroom in accordance with Section 1011.3.
      - 1011.3 **Headroom. Exception** 2. In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual dwelling units in Group R-2 occupancies
- **SECTION 1004 Design Occupant Load**

What is It?

Break Time

OBC Chapter 27 Electrical

- **SECTION 2701 GENERAL**
  - 2701.1 **Scope.** This chapter governs the electrical components, equipment and systems used in buildings and structures covered by this code. Electrical components, equipment and systems shall be designed and constructed in accordance with the provisions of NFPA 70. (2017 per OBC Chapter 35)
- **SECTION 2702 EMERGENCY AND STANDBY POWER SYSTEMS**
  - 2702.1.7 **Group I-2 occupancies.** In Group I-2 occupancies, in new construction or where the building is substantially damaged, where an essential electrical system is located in flood hazard areas established in Section 1612.3, the system shall be located and installed in accordance with ASCE 24.
  - 2702.2.6 **Group I-2 occupancies.** Essential electrical systems for Group I-2 occupancies shall be in accordance with Section 407.10.
  - 2702.2.7 **Group I-3 occupancies.** Emergency power shall be provided for power-operated doors and locks in Group I-3 occupancies as required in Section 408.4.2.

OBC Chapter 27 Electrical

- **SECTION 2702 EMERGENCY AND STANDBY POWER SYSTEMS**
  - 2702.2.8 **Hazardous materials.** Emergency or standby power shall be provided in occupancies with hazardous materials *in accordance with Section 414.5.2*.
  - 2702.2.9 **High-rise buildings.** Emergency and standby power shall be provided in high-rise buildings as required in Sections 403.4.8.
  - 2702.2.13 **Pyrophoric materials.** Emergency power shall be provided for occupancies with silane gas in accordance with the *fire code*.
  - 2702.2.14 **Semiconductor fabrication facilities.** Emergency power shall be provided for semiconductor fabrication facilities as required in Section 415.11.10.
  - 2702.2.15 **Smoke control systems.** Standby power shall be provided for smoke control systems as required in Sections 404.7, 909.11, 909.20.6.2 and 909.21.5.
  - 2702.2.16 **Underground buildings.** Emergency and standby power shall be provided in underground buildings as required in Section 405.

NFPA 70 Chapter 2 Wiring and Protection

- **210.8 Ground-Fault Circuit-Interrupter Protection for Personnel**
  - (A) Dwelling Units
  - (B) Other Than Dwelling Units
  - (C) Boat Hoists
  - (D) Kitchen Dishwasher Branch Circuit (in dwelling unit locations)
  - (E) Crawl Space Lighting Outlets
- **210.12 Arc-Fault Circuit-Interrupter Protection**
  - (A) Dwelling Units
  - (B) Dormitory Units
  - (C) Guest Rooms and Guest Suites
  - (D) Branch Circuit Extensions or Modifications – Dwelling Units and Dormitory Units

NFPA 70 Chapter 5 Special Occupancies

- Article 500 **Hazardous (Classified Locations)**
- Article 501 **Class I Locations**
- Article 502 **Class II Locations**
- Article 503 **Class III Locations**
- Article 504 **Intrinsically Safe Systems**
- Article 505 **Zone 0, 1 and 2 Locations**
- Article 506 **Zone 20, 21, and 22 Locations for Combustible Dusts or Ignitible Fibers/Flyings**
- Article 510 **Hazardous (Classified) Locations - Specific**

NFPA 70 Chapter 5 Special Occupancies

- Article 511 **Commercial Garages, Repair and Storage**
- Article 513 **Aircraft Hangars**
- Article 514 **Motor Fuel Dispensing Facilities**
- Article 515 **Bulk Storage Plants**
- Article 516 **Spray Application, Dipping, Coating, and Printing Processes Using Flammable or Combustible Materials**

NFPA 70 Chapter 5 Special Occupancies

- Article 517 **Health Care Facilities**
- Article 518 **Assembly Occupancies**
- Article 520 **Theaters, Audience Areas of Motion Picture and Television Studios, Performance Areas, and Similar Locations**
- Article 522 **Control Systems for Permanent Amusement Attractions**
- Article 525 **Carnivals, Circuses, Fairs, and Similar Events** exempt from rules of the Board if regulated by the Department of Agriculture

NFPA 70 Chapter 5 Special Occupancies

- Article 530 **Motion Picture and Television Studios and Similar Locations**
- Article 540 **Motion Picture Projection Rooms**
- Article 545 **Manufactured Buildings**
- Article 547 **Agricultural Buildings** exempt from rules of the Board

NFPA 70 Chapter 6 Special Equipment

- Article 605 **Office Furnishings**
- Article 610 **Cranes and Hoists**
- Article 646 **Modular Data Centers**
- Article 647 **Sensitive Electronic Equipment**
- Article 650 **Pipe Organs** low voltage

NFPA 70 Chapter 6 Special Equipment

- Article 660 **X-Ray Equipment**
- Article 669 **Electroplating**
- Article 670 **Industrial Machinery**
- Article 675 **Electrically Driven or Controlled Irrigation Machines**
- Article 680 **Swimming Pools, Fountains, and Similar Installations**

NFPA 70 Chapter 7 Special Conditions

- Article 700 **Emergency Systems**
- Article 701 **Legally Required Standby Systems**
- Article 702 **Optional Standby Systems**
- Article 705 **Interconnected Electric Power Production Sources**
- Article 706 **Energy Storage Systems**
- Article 708 **Critical Operations Power Systems (COPS)**

OBC Chapter 28 Mechanical Systems

- Section 2801.1 **Scope.** Mechanical appliances, equipment and systems shall be constructed, installed and maintained in accordance with the *mechanical code* and the " International Fuel Gas Code". Masonry chimneys, fireplaces and barbecues shall comply with the *mechanical code* and Chapter 21 of this code.

OMC Chapter 3 General Regulations

- **SECTION 303 EQUIPMENT AND APPLIANCE LOCATION**
  - 303.1 **General.** Equipment and appliances shall be located as required by this section, specific requirements elsewhere in this code and the conditions of the equipment and appliance listing.
  - 303.2 **Hazardous locations.** Appliances shall not be located in a hazardous location unless listed and approved for the specific installation.
  - 303.3 **Prohibited locations.** Fuel-fired appliances shall not be located in, or obtain combustion air from, any of the following rooms or spaces:
    - 1. Sleeping rooms.
    - 2. Bathrooms.
    - 3. Toilet rooms.
    - 4. Storage closets.
    - 5. Surgical rooms.
    - **Exceptions**

OMC Chapter 3 General Regulations

- **SECTION 304 INSTALLATION**
  - 304.3 **Elevation of ignition source.** Equipment and appliances having an ignition source and located in hazardous locations and public garages, private garages, repair garages, automotive motor fuel-dispensing facilities and parking garages shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor surface on which the equipment or appliance rests. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.
    - **Exception:** Elevation of the ignition source is not required for appliances that are listed as flammable vapor ignition resistant.
    - 304.3.1 **Parking garages.** Connection of a parking garage with any room in which there is a fuel-fired appliance shall be by means of a vestibule providing a two-doorway separation, except that a single door is permitted where the sources of ignition in the appliance are elevated in accordance with Section 304.3.
      - **Exception:** This section shall not apply to appliance installations complying with Section 304.6.
  - 304.4 **Prohibited equipment and appliance location.** Equipment and appliances having an ignition source shall not be installed in Group H occupancies or control areas where open use, handling or dispensing of combustible, flammable or explosive materials occurs.

OMC Chapter 3 General Regulations

- **SECTION 304 INSTALLATION**
  - 304.5 **Hydrogen-generating and refueling operations.** Hydrogen-generating and refueling appliances shall be installed and located in accordance with their listing and the manufacturer's instructions. Ventilation shall be required in accordance with Section 304.5.1, 304.5.2 or 304.5.3 in public garages, private garages, repair garages, automotive motor fuel-dispensing facilities and parking garages that contain hydrogen-generating appliances or refueling systems. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.
    - 304.5.1 **Natural ventilation.**
      - 304.5.1.1 **Two openings.**
      - 304.5.1.2 **Louvers and grilles.**
    - 304.5.2 **Mechanical ventilation.** Indoor locations intended for hydrogen-generating or refueling operations shall be ventilated in accordance with Section 502.16. In such locations, equipment and appliances having an ignition source shall be located such that the source of ignition is below the mechanical ventilation outlet(s).
    - 304.5.3 **Specially engineered installations.** As an alternative to the provisions of Sections 304.5.1 and 304.5.2, the necessary supply of air for ventilation and dilution of flammable gases shall be provided by an approved engineered system.

OMC Chapter 3 General Regulations

- **SECTION 304 INSTALLATION**
  - 304.6 **Public garages.** Appliances located in public garages, motor fueling-dispensing facilities, repair garages or other areas frequented by motor vehicles, shall be installed not less than 8 feet (2438 mm) above the floor. Where motor vehicles are capable of passing under an appliance, the appliance shall be installed at the clearances required by the appliance manufacturer and not less than 1 foot (305 mm) higher than the tallest vehicle garage door opening.
    - **Exception:** The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and installed in accordance with Section 304.3 and NFPA 30A.
  - 304.7 **Private garages.** Appliances located in private garages and carports shall be installed with a minimum clearance of 6 feet (1829 mm) above the floor.
    - **Exception:** The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and installed in accordance with Section 304.3.
  - 304.8 **Construction and protection.** Boiler rooms and furnace rooms shall be protected as required by the *building code*.

OMC Chapter 3 General Regulations

- **SECTION 310 EXPLOSION CONTROL**
  - 310.1 **Required.** Structures occupied for purposes involving explosion hazards shall be provided with explosion control where required by the *building code or the fire code*. Explosion control systems shall be designed and installed in accordance with Section 911 of the *fire code*.
- **SECTION 311 SMOKE AND HEAT VENTS**
  - 311.1 **Required.** Approved smoke and heat vents shall be installed in the roofs of one-story buildings where required by the *building code*. Smoke and heat vents shall be designed and installed in accordance with the *building code*.
    - OBC **Section 910 Smoke and Heat Removal**

OMC Chapter 4 Ventilation

- **SECTION 401 GENERAL**
  - 401.1 **Scope.** This chapter shall govern the ventilation of spaces within a building intended to be occupied. Mechanical exhaust systems, including exhaust systems serving clothes dryers and cooking appliances; hazardous exhaust systems; dust, stock and refuse conveyor systems; subslab soil exhaust systems; smoke control systems; energy recovery ventilation systems and other systems specified in Section 502 shall comply with Chapter 5.

OMC Chapter 4 Ventilation

- **SECTION 401 GENERAL**
  - 401.2 **Ventilation required.** Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. *When a blower door test is required by the applicable energy conservation code referenced from Chapter 13 of the building code, or when a blower door test is otherwise performed, and where* the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2 -inch water column (50 Pa), the dwelling unit shall be ventilated by mechanical means in accordance with Section 403. Ambulatory care facilities and Group I-2 occupancies shall be ventilated by mechanical means in accordance with Section 407.

OMC Chapter 4 Ventilation

- **SECTION 403 MECHANICAL VENTILATION**
  - 403.1 **Ventilation system.** Mechanical ventilation shall be provided by a method of supply air and return or exhaust air except that mechanical ventilation air requirements for Group R-2, R-3 and R-4 occupancies three stories and less in height above grade plane shall be provided by an exhaust system, supply system or combination thereof. The amount of supply air shall be approximately equal to the amount of return and exhaust air. The system shall not be prohibited from producing negative or positive pressure. The system to convey ventilation air shall be designed and installed in accordance with Chapter 6.

OMC Chapter 4 Ventilation

- **SECTION 403 MECHANICAL VENTILATION**
  - 403.3 **Outdoor air and local exhaust airflow rates.** Group R-2, R-3 and R-4 occupancies three stories and less in height above grade plane shall be provided with outdoor air and local exhaust in accordance with Section 403.3.2. All other buildings intended to be occupied shall be provided with outdoor air and local exhaust in accordance with Section 403.3.1.

OMC Chapter 4 Ventilation

- **TABLE 403.3.1.1 MINIMUM VENTILATION RATES**

OMC Chapter 4 Ventilation

- **SECTION 404 ENCLOSED PARKING GARAGES**
  - 404.1 **Enclosed parking garages.** Where mechanical ventilation systems for enclosed parking garages operate intermittently, such operation shall be automatic by means of carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors. Such detectors shall be installed in accordance with their manufacturers' recommendations.
  - 404.2 **Minimum ventilation.** Automatic operation of the system shall not reduce the ventilation airflow rate below 0.05 cfm per square foot (0.00025 m^3/s . m^2) of the floor area and the system shall be capable of producing a ventilation airflow rate of 0.75 cfm per square foot (0.0038 m^3/s . m^2) of floor area.
  - 404.3 **Occupied spaces accessory to public garages.** Connecting offices, waiting rooms, ticket booths and similar uses that are accessory to a public garage shall be maintained at a positive pressure and shall be provided with ventilation in accordance with Section 403.3.1.

OMC Chapter 4 Ventilation

- **SECTION 406 VENTILATION OF UNINHABITED SPACES**
  - 406.1 **General.** Uninhabited spaces, such as crawl spaces and attics, shall be provided with natural ventilation openings as required by the *building code* or shall be provided with a mechanical exhaust and supply air system. The mechanical exhaust rate shall be not less than 0.02 cfm per square foot (0.00001 m^3/s . m^2) of horizontal area and shall be automatically controlled to operate when the relative humidity in the space served exceeds 60 percent.

OMC Chapter 4 Ventilation

- **SECTION 407 AMBULATORY CARE FACILITIES AND GROUP I-2 OCCUPANCIES**
  - 407.1 **General.** Mechanical ventilation for ambulatory care facilities and Group I-2 occupancies shall be designed and installed in accordance with this code and ASHRAE 170.

OMC Chapter 5 Exhaust Systems

- **SECTION 501 GENERAL**
  - 501.1 **Scope.** This chapter shall govern the design, construction and installation of mechanical exhaust systems, including exhaust systems serving clothes dryers and cooking appliances; hazardous exhaust systems; dust, stock and refuse conveyor systems; subslab soil exhaust systems; smoke control systems; energy recovery ventilation systems and other systems specified in Section 502.
  - 501.2 **Independent system required**. Single or combined mechanical exhaust systems for environmental air shall be independent of all other exhaust systems. Dryer exhaust shall be independent of all other systems. Type I exhaust systems shall be independent of all other exhaust systems except as provided in Section 506.3.5. Single or combined Type II exhaust systems for food-processing operations shall be independent of all other exhaust systems. Kitchen exhaust systems shall be constructed in accordance with Section 505 for domestic equipment and Sections 506 through 509 for commercial equipment.

OMC Chapter 5 Exhaust Systems

- **SECTION 501 GENERAL**
  - 501.3 **Exhaust discharge.** The air removed by every mechanical exhaust system shall be discharged outdoors at a point where it will not cause a public nuisance and not less than the distances specified in Section 501.3.1. The air shall be discharged to a location from which it cannot again be readily drawn in by a ventilating system. Air shall not be exhausted into an attic, crawl space, or be directed onto walkways.
    - **Exceptions:**
    - 1. Whole-house ventilation-type attic fans shall be permitted to discharge into the attic space of dwelling units having private attics.
    - 2. Commercial cooking recirculating systems.
    - 3. Where installed in accordance with the manufacturer's instructions and where mechanical or natural ventilation is otherwise provided in accordance with Chapter 4, listed and labeled domestic ductless range hoods shall not be required to discharge to the outdoors.

OMC Chapter 5 Exhaust Systems

- **SECTION 501 GENERAL**
  - 501.3 **Exhaust discharge.**
    - 501.3.1 **Location of exhaust outlets.** The termination point of exhaust outlets and ducts discharging to the outdoors shall be located with the following minimum distances:
      - 1. For ducts conveying explosive or flammable vapors, fumes or dusts:
      - 2. For other product-conveying outlets:
      - 3. For all environmental air exhaust:…for all occupancies other than Group U, and 10 feet (3048 mm) from mechanical air intakes. Such exhaust shall not be considered hazardous or noxious.
      - 4. Exhaust outlets serving structures in flood hazard areas
      - 5. For specific systems see the following sections:
        - 5.1. Clothes dryer exhaust, Section 504.4.
        - 5.2. Kitchen hoods and other kitchen exhaust equipment, Sections 506.3.13, 506.4 and 506.5.
        - 5.3. Dust stock and refuse conveying systems, Section 511.2.
        - 5.4. Subslab soil exhaust systems, Section 512.4.
        - 5.5. Smoke control systems, Section 513.10.3.
        - 5.6. Refrigerant discharge, Section 1105.7.
        - 5.7. Machinery room discharge, Section 1105.6.1.

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
  - 502.1 **General.** An exhaust system shall be provided, maintained and operated as specifically required by this section and for all occupied areas where machines, vats, tanks, furnaces, forges, salamanders and other appliances, equipment and processes in such areas produce or throw off dust or particles sufficiently light to float in the air, or which emit heat, odors, fumes, spray, gas or smoke, in such quantities so as to be irritating or injurious to health or safety.
    - 502.1.1 **Exhaust location.**
    - 502.1.2 **Fuel-dispensing areas.**
    - 502.1.3 **Equipment, appliance and service rooms.**
    - 502.1.4 **Hazardous exhaust.** The mechanical exhaust of high concentrations of dust or hazardous vapors shall conform to the requirements of Section 510.
  - 502.2 **Aircraft fueling and defueling.**

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
  - 502.3 **Battery-charging areas for powered industrial trucks and equipment.**
  - 502.4 **Stationary storage battery systems.**
    - **Exception:** Lithium-ion and lithium metal polymer batteries shall not require additional ventilation beyond that which would normally be required for human occupancy of the space.
  - 502.5 **Valve-regulated lead-acid batteries in cabinets.**
  - 502.6 **Dry cleaning plants.** Ventilation in dry cleaning plants shall be adequate to protect employees and the public in accordance with this section and DOL 29 CFR Part 1910.1000, where applicable.
    - 502.6.1 **Type II systems.**
    - 502.6.2 **Type IV and V systems.**
    - 502.6.3 **Spotting and pretreating.**

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
  - 502.7 **Application of flammable finishes.**
    - 502.7.1 **During construction.**
    - 502.7.4 **Dipping operations.**
    - 502.7.5 **Electrostatic apparatus.**
    - 502.7.6 **Powder coating.**
    - 502.7.7 **Floor resurfacing operations.**
  - 502.8 **Hazardous materials-general requirements**
    - 502.8.1 **Storage in excess of the maximum allowable quantities.** with exceptions
    - 502.8.2 **Gas rooms, exhausted enclosures and gas cabinets.**
    - 502.8.3 **Indoor dispensing and use.** with exception
    - 502.8.4 **Indoor dispensing and use-point sources.** with exception
    - 502.8.5 **Closed systems.**

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
- 502.9 **Hazardous materials-requirements for specific materials.** Exhaust ventilation systems for specific hazardous materials shall be provided as required in Section 502.8 and Sections 502.9.1 through 502.9.11.
  - 502.9.1 **Compressed gases-medical gas systems.**
  - 502.9.2 **Corrosives.**
  - 502.9.3 **Cryogenics** with exceptions
  - 502.9.4 **Explosives.**

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
- 502.9 **Hazardous materials-requirements for specific materials.**
  - 502.9.5 **Flammable and combustible liquids.**
    - **Exception:** This section shall not apply to *the following:*
    - 1. *…flammable liquids in motor fuel-dispensing facilities, airports and marinas as identified in Chapter 23 of the fire code.*
    - 2. *Medicines, foodstuffs, cosmetics and commercial or institutional products containing …*
    - 3. *Quantities of alcoholic beverages in retail or wholesale sales or storage occupancies, … 1.3 gallons (5 L).*
    - 4. *Fuel oil and diesel oil tanks and containers connected to oil- burning or fuel-burning equipment. … chapter 13.*
    - 5. *Refrigerant liquids and oils in refrigeration systems (see chapter 11 of this code).*
    - 6. *Storage and display of aerosol products complying with chapter 51 of the fire code.*
    - 7. *Storage and use of liquids that have no fire point when tested in accordance with ASTM D 92.*
    - 8. *Liquids with a flash point greater than ninety-five degrees Fahrenheit in a water-miscible solution or dispersion with a water and inert (noncombustible) solids content of more than eighty per cent by weight, which do not sustain combustion.*
    - 9. *Liquids without flash points that can be flammable under some conditions, …halogenated hydrocarbons and mixtures …*
    - 10. *The storage of distilled spirits and wines in wooden barrels and casks.*
    - 11. *Commercial cooking oil storage tank systems located within a building … Section 610 of the fire code and NFPA 30.*
    - 12. *Underground storage tanks installed in accordance with the fire code and …enforced by the fire official,*

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
- 502.9 **Hazardous materials-requirements for specific materials.** Exhaust ventilation systems for specific hazardous materials shall be provided as required in Section 502.8 and Sections 502.9.1 through 502.9.11.
  - 502.9.5 **Flammable and combustible liquids.**
    - 502.9.5.1 **Vaults.** Vaults that contain tanks of Class I liquids…
    - 502.9.5.2 **Storage rooms and warehouses.**
    - 502.9.5.3 **Cleaning machines.**
    - 502.9.5.4 **Use, dispensing and mixing.**
      - **Exception:** Where natural ventilation can be shown to be effective for the materials used, dispensed or mixed.
    - 502.9.5.5 **Bulk plants or terminals.**

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
- 502.9 **Hazardous materials-requirements for specific materials.** Exhaust ventilation systems for specific hazardous materials shall be provided as required in Section 502.8 and Sections 502.9.1 through 502.9.11.
  - 502.9.6 **Highly toxic and toxic liquids.**
  - 502.9.7 **Highly toxic and toxic compressed gases - any quantity.**
    - Ventilation exhaust shall be provided for highly toxic and toxic compressed gases in any quantity as required by Sections 502.9.7.1 and 502.9.7.2.
    - 502.9.7.1 **Gas cabinets.**
    - 502.9.7.2 **Exhausted enclosures.**
  - 502.9.8 **Highly toxic and toxic compressed gases - quantities exceeding the maximum allowable quantity per control area.**
  - 502.9.9 **Ozone gas generators.**
  - 502.9.10 **LP-gas distribution facilities.**
  - 502.9.11 **Silane gas.**

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
  - 502.10 **Hazardous production materials (HPM).** Exhaust ventilation systems and materials for ducts utilized for the exhaust of HPM shall comply with this section, other applicable provisions of this code, the *building code* and the *fire code.*
    - 502.10.1 **Where required.** Exhaust ventilation systems shall be provided in the following locations in accordance with the requirements of this section and the *building code*.
      - 1. Fabrication areas:
      - 2. Workstations:
      - 3. Liquid storage rooms: …Section 502.8.1.1 and the *building code*.
      - 4. HPM rooms: …Section 502.8.1.1 and the *building code*.
      - 5. Gas cabinets: …Section 502.8.2. …allowed to connect to a workstation ventilation system. …containing highly toxic or toxic gases shall also comply with Sections 502.9.7 and 502.9.8.
      - 6. Exhausted enclosures: …Section 502.8.2. …containing highly toxic or toxic gases …Sections 502.9.7 and 502.9.8.
      - 7. Gas rooms: …Section 502.8.2. … containing highly toxic or toxic gases …Sections 502.9.7 and 502.9.8.
      - 8. Cabinets containing pyrophoric liquids or Class 3 water-reactive liquids…Section 2705.2.3.4 of the *fire code*.

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
  - 502.10 **Hazardous production materials (HPM).** Exhaust ventilation systems and materials for ducts utilized for the exhaust of HPM shall comply with this section, other applicable provisions of this code, the *building code* and the *fire code.*
    - 502.10.2 **Penetrations.** Exhaust ducts penetrating fire barriers constructed in accordance with Section 707 of the *building code* or horizontal assemblies constructed in accordance with Section 711 of the *building code* shall be contained in a shaft of equivalent fire-resistance-rated construction. Exhaust ducts shall not penetrate fire walls. Fire dampers shall not be installed in exhaust ducts.
    - 502.10.3 **Treatment systems.** Treatment systems for highly toxic and toxic gases shall comply with *Section 6004.2.2.7 of the fire code.*

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
  - 502.11 **Motion picture projectors.** Motion picture projectors shall be exhausted in accordance with Section 502.11.1 or 502.11.2.
    - 502.11.1 **Projectors with an exhaust discharge.**
    - 502.11.2 **Projectors without exhaust connection.**
  - 502.12 **Organic coating processes.** Enclosed structures involving organic coating processes in which Class I liquids are processed or handled shall be ventilated at a rate of not less than 1 cfm/ft^2 [0.00508 $m^3/(s \cdot m^2)$] of solid floor area. Ventilation shall be accomplished by exhaust fans that intake at floor levels and discharge to a safe location outside the structure. Noncontaminated intake air shall be introduced in such a manner that all portions of solid floor areas are provided with continuous uniformly distributed air movement.

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
- 502.13 **Public garages.** Mechanical exhaust systems for public garages, as required in Chapter 4, shall operate continuously or in accordance with Section 404.
- 502.14 **Motor vehicle operation.** In areas where motor vehicles operate, mechanical ventilation shall be provided in accordance with Section 403. Additionally, areas in which stationary motor vehicles are operated shall be provided with a source capture system that connects directly to the motor vehicle exhaust systems. Such system shall be engineered by a registered design professional or shall be factory-built equipment designed and sized for the purpose.
  - **Exceptions:**
  - 1. This section shall not apply where the motor vehicles being operated or repaired are electrically powered.
  - 2. *Deleted*.
  - 3. This section shall not apply to motor vehicle service areas where engines are operated inside the building only for the duration necessary to move the motor vehicles in and out of the building.
- 502.15 **Repair garages.** Where Class I liquids or LP-gas are stored or used within a building having a basement or pit wherein flammable vapors could accumulate, the basement or pit shall be provided with ventilation designed to prevent the accumulation of flammable vapors therein.

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
- 502.16 **Repair garages for natural gas- and hydrogen-fueled vehicles.** Repair garages used for the repair of natural gas- or hydrogen-fueled vehicles shall be provided with an approved mechanical ventilation system. The mechanical ventilation system shall be in accordance with Sections 502.16.1 and 502.16.2.
  - **Exception:** Where approved by the code official, natural ventilation shall be permitted in lieu of mechanical ventilation.
  - 502.16.1 **Design**
  - 502.16.2 **Operation.** The mechanical ventilation system shall operate continuously.
    - **Exceptions:**
    - 1. Mechanical ventilation systems that are interlocked with a gas detection system designed in accordance with the *fire code*.
    - 2. Mechanical ventilation systems in garages that are used only for the repair of vehicles fueled by liquid fuels or odorized gases, such as CNG, where the ventilation system is electrically interlocked with the lighting circuit.

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
  - 502.17 **Tire rebuilding or recapping.** Each room where rubber cement is used or mixed, or where flammable or combustible solvents are applied, shall be ventilated in accordance with the applicable provisions of NFPA 91.
    - 502.17.1 **Buffing machines.** Each buffing machine shall be connected to a dust-collecting system that prevents the accumulation of the dust produced by the buffing process.
  - 502.18 **Specific rooms.** Specific rooms, including bathrooms, locker rooms, smoking lounges and toilet rooms, shall be exhausted in accordance with the ventilation requirements of Chapter 4.

OMC Chapter 5 Exhaust Systems

- **SECTION 502 REQUIRED SYSTEMS**
  - 502.19 **Indoor firing ranges.** Ventilation shall be provided in an approved manner in areas utilized as indoor firing ranges. Ventilation shall be designed to protect employees and the public in accordance with DOL 29 CFR 1910.1025 where applicable.
  - 502.20 **Manicure and pedicure stations.** Manicure and pedicure stations shall be provided with an exhaust system in accordance with Table 403.3.1.1, Note h. Manicure tables and pedicure stations not provided with factory-installed exhaust inlets shall be provided with exhaust inlets located not more than 12 inches (305 mm) horizontally and vertically from the point of chemical application.

OMC Chapter 5 Exhaust Systems

- **SECTION 504 CLOTHES DRYER EXHAUST**
  - 504.8 **Domestic clothes dryer ducts.**
  - 504.9 **Commercial clothes dryers.**
  - 504.10 **Common exhaust systems for clothes dryers located in multistory structures.**
- **SECTION 505 DOMESTIC KITCHEN EXHAUST EQUIPMENT**
  - 505.3 **Common exhaust systems for domestic kitchens located in multistory structures.**
  - 505.5 ***Group I-2.****Where domestic cooking appliances are installed within Group I-2 nursing homes, rooms or spaces and the appliances are utilized for domestic purposes, such appliances shall be provided with domestic range hoods in accordance with this section and Section 407.2.6 of the building code.*

OMC Chapter 5 Exhaust Systems

- **SECTION 506 COMMERCIAL KITCHEN HOOD VENTILATION SYSTEM DUCTS AND EXHAUST EQUIPMENT**
- **SECTION 507 COMMERCIAL KITCHEN *EXHAUST* HOODS**
  - 507.2 **Type I hoods.**
  - 507.3 **Type II hoods.**
- **SECTION 508 COMMERCIAL KITCHEN MAKEUP AIR**
- **SECTION 509 FIRE SUPPRESSION SYSTEMS**

OMC Chapter 5 Exhaust Systems

- **SECTION 510 HAZARDOUS EXHAUST SYSTEMS**
  - 510.2 **Where required.**
    - 510.2.1 **Lumber yards and woodworking facilities.**
    - 510.2.2 **Combustible fibers.**
- **SECTION 511 DUST, STOCK AND REFUSE CONVEYING SYSTEMS**
- **SECTION 513 SMOKE CONTROL SYSTEMS**
- **SECTION 514 ENERGY RECOVERY VENTILATION SYSTEMS**

OMC Chapter 6 Duct Systems

- **SECTION 603 DUCT CONSTRUCTION AND INSTALLATION**
  - 603.18 **Registers, grilles and diffusers.**
    - 603.18.2 **Prohibited locations.** Diffusers, registers and grilles shall be prohibited in the floor or its upward extension within toilet and bathing rooms required by the *building code* to have smooth, hard, nonabsorbent surfaces.
      - **Exception:** Dwelling units.

OMC Chapter 9 Specific appliances, fireplaces and solid fuel-burning equipment..

- **SECTION 907 INCINERATORS AND CREMATORIES**
  - 907.1 **General.** Incinerators and crematories shall be listed and labeled in accordance with UL 791 and shall be installed in accordance with the manufacturer's instructions.
- **SECTION 916 POOL AND SPA HEATERS**
- **SECTION 917 COOKING APPLIANCES**
  - 917.1 **Cooking appliances.**
  - 917.2 **Domestic *cooking* appliances.** Cooking appliances installed within dwelling units and within areas where domestic-*type* cooking operations occur shall be listed and labeled as *domestic or* household type appliances for domestic use.

OMC Chapter 11 Refrigeration

- **SECTION 1104 SYSTEM APPLICATION REQUIREMENTS**
  - 1104.1 **General.** The refrigerant, occupancy and system classification cited in this section shall be determined in accordance with Sections 1103.1, 1103.2 and 1103.3, respectively.
  - 1104.2 **Machinery room.**
    - 1104.2.1 **Institutional occupancies.**
    - 1104.2.2 **Industrial occupancies and refrigerated rooms.**
  - 1104.3 **Refrigerant restrictions.**
    - 1104.3.1 **Air-conditioning for human comfort.** In other than industrial occupancies … refrigerants shall not be used in high-probability systems for air-conditioning for human comfort.
    - 1104.3.2 **Nonindustrial occupancies.**
      - **Exception:** This section does not apply to laboratories where the floor area per occupant is not less than 100 square feet (9.3 m^2).
    - 1104.3.3 **All occupancies.**

OBC Chapter 29 Plumbing Systems

- Section 2901.1 **Scope.** The provisions of this chapter and the *plumbing code* shall govern the erection, installation, alteration, repairs, relocation, replacement, addition to, use or maintenance of plumbing equipment and systems. Toilet and bathing rooms shall be constructed in accordance with Section 1210. Plumbing systems and equipment shall be constructed, installed and maintained in accordance with the *plumbing code*.

OPC Chapter 3 General Requirements

- Section 302 Exclusion Of Materials Detrimental To The Sewer System
  - 302.1 Detrimental or dangerous materials. Ashes, cinders or rags; flammable, poisonous or explosive liquids or gases; oil, grease or any other insoluble material capable of obstructing, damaging or overloading the building drainage or sewer system, or capable of interfering with the normal operation of the sewage treatment processes, shall not be deposited, by any means, into such systems.
  - 302.2 Industrial wastes. Waste products from manufacturing or industrial operations shall not be introduced into the public sewer until it has been determined by the *building* official or other authority having jurisdiction that the introduction thereof will not damage the public sewer system or interfere with the functioning of the sewage treatment plant.

OPC Chapter 4 Fittings, faucets and fixture fittings

- Section 403 Minimum Plumbing Facilities (OBC 2902)
  - 403.1 Minimum number of fixtures. Plumbing fixtures shall be provided in the minimum number as shown in Table 403.1 based on the actual use of the building or space. Uses not shown in Table 403.1 shall be considered individually by the code official. The number of occupants shall be determined by this code. *When the actual occupant load will be significantly different than that determined by section 1004 of the building code, the building official may establish an alternate basis for determining the occupant load. This alternate basis shall be included in the special stipulations and conditions section of the certificate of occupancy issued for that structure pursuant to section 111. For accessibility requirements, see "Chapter 11, Accessibility" of the building code.*

OPC Chapter 4 Fittings, faucets and fixture fittings

- Table 403.1 Minimum Number of Required Plumbing Fixtures (OBC Table 2902.1) footnotes
  - b. Toilet facilities for employees shall be separate from facilities for inmates or care recipients.
  - c. A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient sleeping units shall be permitted, provided that each patient sleeping unit has direct access to the toilet room and provisions for privacy for the toilet room user are provided.
  - d. The occupant load for seasonal outdoor seating and entertainment areas shall be included when determining the minimum number of facilities required.
  - e. For business and mercantile occupancies with an occupant load of 15 or fewer, service sinks shall not be required.
  - f. *Mercantile occupancies are not required to provide customer facilities when the occupant load is 50 or less.*

OPC Chapter 4 Fittings, faucets and fixture fittings

- OPC 403.2 Separate facilities. Where plumbing fixtures are required, separate facilities shall be provided for each sex.
  Exceptions:
  - 1. Separate facilities shall not be required for dwelling units and sleeping units.
  - 3. Separate facilities shall not be required in mercantile occupancies in which the maximum occupant load is 100 or fewer.

OPC Chapter 4 Fittings, faucets and fixture fittings

- OPC 403.3 **Required public toilet facilities.** Customers, patrons and visitors shall be provided with public toilet facilities in structures and tenant spaces intended for public utilization. The number of plumbing fixtures located within the required toilet facilities shall be provided in accordance with Section 403 for all users. Employees shall be provided with toilet facilities in all occupancies. Employee toilet facilities shall be either separate or combined employee and public toilet facilities.

  Exception: Public toilet facilities shall not be required in:

  1. Open or enclosed parking garages.
  2. Structures and tenant spaces intended for quick transactions, including takeout, pickup and dropoff, having a public access area less than or equal to 300 square feet (28 m^2).

  - 403.3.1 **Access.** The route to the public toilet facilities required by Section 403.3 shall not pass through kitchens, storage rooms, closets *or similar spaces not available to the public*. Access to the required facilities shall be from within the building or from the exterior of the building. Routes shall comply with the accessibility requirements of the *building code*. The public shall have access to the required toilet facilities at all times that the building is occupied. *The building owner is permitted to control access to the toilet facilities. Where such access is controlled, a sign shall be posted indicating how access is to be obtained.*
  - 403.3.2 **Prohibited toilet room location.** Toilet rooms shall not open directly into a room used for the preparation of food for service to the public.

OPC Chapter 4 Fittings, faucets and fixture fittings

- 403.3.3 **Location of toilet facilities in occupancies other than malls.** In occupancies other than covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 500 feet (152 m).

  Exception: The location and maximum distances of travel to required employee facilities in factory and industrial occupancies are permitted to exceed that required by this section, provided that the location and maximum distance of travel are approved.
- 403.3.4 **Location of toilet facilities in malls.** In covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 300 feet (91 m). In mall buildings, the required facilities shall be based on total square footage within a covered mall building or within the perimeter line of an open mall building, and facilities shall be installed in each individual store or in a central toilet area located in accordance with this section. The maximum distance of travel to central toilet facilities in mall buildings shall be measured from the main entrance of any store or tenant space. In mall buildings, where employees' toilet facilities are not provided in the individual store, the maximum distance of travel shall be measured from the employees' work area of the store or tenant space.

OPC Chapter 4 Fittings, faucets and fixture fittings

- Section 410 Drinking Fountains
  - 410.2 Small occupancies. Drinking fountains shall not be required for an occupant load of 15 or fewer.
  - 410.4 Substitution. Where restaurants provide drinking water in a container free of charge, drinking fountains shall not be required in those restaurants. In other occupancies*, where water* dispensers *are provided,* drinking fountains *shall not be required*.
- Section 412 Floor And Trench Drains
  - 412.4 Public laundries and central washing facilities. In public coin-operated laundries and in the central washing facilities of multiple-family dwellings, the rooms containing automatic clothes washers shall be provided with floor drains located to readily drain the entire floor area. Such drains shall have an outlet of not less than 3 inches (76 mm) in diameter.

OPC Chapter 4 Fittings, faucets and fixture fittings

- Section 422 Health Care Fixtures And Equipment
  - 422.1 **Scope.** This section shall govern those aspects of health care plumbing systems that differ from plumbing systems in other structures. Health care plumbing systems shall conform to the requirements of this section in addition to the other requirements of this code. The provisions of this section shall apply to the special devices and equipment installed and maintained in the following occupancies: nursing homes, homes for the aged, orphanages, infirmaries, first aid stations, psychiatric facilities, clinics, professional offices of dentists and doctors, mortuaries, educational facilities, surgery, dentistry, research and testing laboratories, establishments manufacturing pharmaceutical drugs and medicines and other structures with similar apparatus and equipment classified as plumbing.
  - 422.2 **Approval.** All special plumbing fixtures, equipment, devices and apparatus shall be of an approved type.
  - 422.3 **Protection.** All devices, appurtenances, appliances and apparatus intended to serve some special function, such as sterilization, distillation, processing, cooling, or storage of ice or foods, and that connect to either the water supply or drainage system, shall be provided with protection against backflow, flooding, fouling, contamination of the water supply system and stoppage of the drain.

OPC Chapter 4 Fittings, faucets and fixture fittings

- Section 422 Health Care Fixtures And Equipment
  - 422.4 **Materials.** Fixtures designed for therapy, special cleansing or disposal of waste materials, combinations of such purposes, or any other special purpose, shall be of smooth, impervious, corrosion-resistant materials and, where subjected to temperatures in excess of 180°F (82°C), shall be capable of withstanding, without damage, higher temperatures.
  - 422.5 **Access.** Access shall be provided to concealed piping in connection with special fixtures where such piping contains steam traps, valves, relief valves, check valves, vacuum breakers or other similar items that require periodic inspection, servicing, maintenance or repair. Access shall be provided to concealed piping that requires periodic inspection, maintenance or repair.
  - 422.6 **Clinical sink.** A clinical sink shall have an integral trap in which the upper portion of a visible trap seal provides a water surface. The fixture shall be designed so as to permit complete removal of the contents by siphonic or blowout action and to reseal the trap. A flushing rim shall provide water to cleanse the interior surface. The fixture shall have the flushing and cleansing characteristics of a water closet.
  - 422.7 **Prohibited usage of clinical sinks and service sinks.** A clinical sink serving a soiled utility room shall not be considered as a substitute for, or be utilized as, a service sink. A service sink shall not be utilized for the disposal of urine, fecal matter or other human waste.

OPC Chapter 4 Fittings, faucets and fixture fittings

- Section 422 Health Care Fixtures And Equipment
  - 422.8 **Ice prohibited in soiled utility room.** Machines for manufacturing ice, or any device for the handling or storage of ice, shall not be located in a soiled utility room.
    - 422.9 **Sterilizer equipment requirements.** The approval and installation of all sterilizers shall conform to the requirements of the *mechanical code*.
    - 422.9.1 **Sterilizer piping.** Access for the purposes of inspection and maintenance shall be provided to all sterilizer piping and devices necessary for the operation of sterilizers.
    - 422.9.2 **Steam supply.** Steam supplies to sterilizers, including those connected by pipes from overhead mains or branches, shall be drained to prevent any moisture from reaching the sterilizer. The condensate drainage from the steam supply shall be discharged by gravity.
    - 422.9.3 **Steam condensate return.** Steam condensate returns from sterilizers shall be a gravity return system.
    - 422.9.4 **Condensers.** Pressure sterilizers shall be equipped with a means of condensing and cooling the exhaust steam vapors. Nonpressure sterilizers shall be equipped with a device that will automatically control the vapor, confining the vapors within the vessel.
  - 422.10 **Special elevations.** Control valves, vacuum outlets and devices protruding from a wall of an operating, emergency, recovery, examining or delivery room, or in a corridor or other location where patients are transported on a wheeled stretcher, shall be located at an elevation that prevents bumping the patient or stretcher against the device.

OPC Chapter 6 Water Supply and Distribution

- Section 608 Protection Of Potable Water Supply
  - 608.1 General. A potable water supply system *within a building* shall be designed, installed and maintained in such a manner so as to prevent contamination from nonpotable liquids, solids or gases being introduced into the *building* potable water supply through cross connections or any other piping connections to the system. *Isolation backflow prevention device applications* shall conform to Table 608.1, except as specifically stated in Sections 608.2 through 608.16.10.
  - Table 608.1 Application Of Backflow Preventers

OPC Chapter 6 Water Supply and Distribution

- Section 609 Health Care Plumbing
  - 609.1 Scope. This section shall govern those aspects of health care plumbing systems that differ from plumbing systems in other structures. Health care plumbing systems shall conform to the requirements of this section in addition to the other requirements of this code. The provisions of this section shall apply to the special devices and equipment installed and maintained in the following occupancies: nursing homes, homes for the aged, orphanages, infirmaries, first aid stations, psychiatric facilities, clinics, professional offices of dentists and doctors, mortuaries, educational facilities, surgery, dentistry, research and testing laboratories, establishments manufacturing pharmaceutical drugs and medicines and other structures with similar apparatus and equipment classified as plumbing.
  - 609.2 Water service. Hospitals shall have two water service pipes installed in such a manner so as to minimize the potential for an interruption of the supply of water in the event of a water main or water service pipe failure.
  - 609.3 Hot water. Hot water shall be provided to supply all of the hospital fixture, kitchen and laundry requirements. Special fixtures and equipment shall have hot water supplied at a temperature specified by the manufacturer. The hot water system shall be installed in accordance with Section 607.

OPC Chapter 6 Water Supply and Distribution

- Section 609 Health Care Plumbing
  - 609.4 Vacuum breaker installation. Vacuum breakers shall be installed not less than 6 inches (152 mm) above the flood level rim of the fixture or device in accordance with Section 608. The flood level rim of hose connections shall be the maximum height at which any hose is utilized.
  - 609.5 Prohibited water closet and clinical sink supply. Jet or water-supplied orifices, except those supplied by the flush connections, shall not be located in or connected with a water closet bowl or clinical sink. This section shall not prohibit an approved bidet installation.
  - 609.6 Clinical, hydrotherapeutic and radiological equipment. Clinical, hydrotherapeutic, radiological or any equipment that is supplied with water or that discharges to the waste system shall conform to the requirements of this section and Section 608.
  - 609.7 Condensate drain trap seal. A water supply shall be provided for cleaning, flushing and resealing the condensate trap, and the trap shall discharge through an air gap in accordance with Section 608.
  - 609.8 Valve leakage diverter. Each water sterilizer filled with water through directly connected piping shall be equipped with an approved leakage diverter or bleed line on the water supply control valve to indicate and conduct any leakage of unsterile water away from the sterile zone.

OPC Chapter 7 Sanitary Drainage

- Section 713 Health Care Plumbing
  - 713.1 Scope. This section shall govern those aspects of health care plumbing systems that differ from plumbing systems in other structures. Health care plumbing systems shall conform to this section in addition to the other requirements of this code. The provisions of this section shall apply to the special devices and equipment installed and maintained in the following occupancies: nursing homes; homes for the aged; orphanages; infirmaries; first aid stations; psychiatric facilities; clinics; professional offices of dentists and doctors; mortuaries; educational facilities; surgery, dentistry, research and testing laboratories; establishments manufacturing pharmaceutical drugs and medicines; and other structures with similar apparatus and equipment classified as plumbing.
  - 713.2 Bedpan washers and clinical sinks.
  - 713.3 Indirect waste.
  - 713.4 Vacuum system station.
  - 713.5 Bottle system.
  - 713.6 Central disposal system equipment.
  - 713.7 Central vacuum or disposal systems.
  - 713.8 Vent connections prohibited.
  - 713.9 Local vents and stacks for bedpan washers.
  - 713.10 Sterilizer vents and stacks.
  - 713.11 Sterilizer vent stack sizes.

OPC Chapter 8 Indirect/Special Waste

- Section 802 Indirect Wastes
  - 802.1 **Where required.** Food-handling equipment, in other than dwelling units, clear-water waste, dishwashing machines and utensils, pots, pans and dishwashing sinks shall discharge through an indirect waste pipe as specified in Sections 802.1.1 through 802.1.8. Health-care related fixtures, devices and equipment shall discharge to the drainage system through an indirect waste pipe by means of an air gap in accordance with this chapter and Section 713.3. Fixtures not required by this section to be indirectly connected shall be directly connected to the plumbing system in accordance with Chapter 7.
    - ***Exception:*** *Approved health care related fixtures, devices, and equipment may be directly connected to the drainage system if required to be directly connected in accordance with the manufacturer's installation instructions.*
    - 802.1.1 **Food handling.** Equipment and fixtures utilized for the storage, preparation and handling of food shall discharge through an indirect waste pipe by means of an air gap. Each well of a multiple-compartment sink shall discharge independently to a waste receptor.
    - 802.1.2 **Floor drains in food storage areas.** Floor drains located within walk-in refrigerators or freezers in food service and food establishments shall be indirectly connected to the sanitary drainage system by means of an *air gap*. Where a floor drain is located within an area subject to freezing, the waste line serving the floor drain shall not be trapped and shall indirectly discharge into a waste receptor located outside of the area subject to freezing.
      - **Exception:** Where protected against backflow by a backwater valve, such floor drains shall be indirectly connected to the sanitary drainage system by means of an air break or an air gap.

OPC Chapter 8 Indirect/Special Waste

- Section 802 Indirect Wastes
  - 802.1 **Where required.**
    - 802.1.3 **Potable clear-water waste.** Where devices and equipment, such as sterilizers and relief valves, discharge potable water to the building drainage system, the discharge shall be through an indirect waste pipe by means of an air gap.
    - 802.1.4 **Swimming pools.** Where waste water from swimming pools, backwash from filters and water from pool deck drains discharge to the building drainage system, the discharge shall be through an indirect waste pipe by means of an air gap.
    - 802.1.5 **Nonpotable clear-water waste.** Where devices and equipment such as process tanks, filters, drips and boilers discharge nonpotable water to the building drainage system, the discharge shall be through an indirect waste pipe by means of an air break or an air gap.
    - 802.1.6 **Domestic dishwashing machines.** Domestic dishwashing machines shall discharge indirectly through an air gap or air break into a waste receptor in accordance with Section 802.2, or discharge into a wye branch fitting on the tailpiece of the kitchen sink or the dishwasher connection of a food waste disposer. The waste line of a domestic dishwashing machine discharging into a kitchen sink tailpiece or food waste disposer shall connect to a deck-mounted air gap or the waste line shall rise and be securely fastened to the underside of the sink rim or counter.
    - 802.1.7 **Commercial dishwashing machines.** The discharge from a commercial dishwashing machine shall be through an air gap or air break into a waste receptor in accordance with Section 802.2.
    - 802.1.8 **Food utensils, dishes, pots and pans sinks.** Sinks, in other than dwelling units, used for the washing, rinsing or sanitizing of utensils, dishes, pots, pans or service ware used in the preparation, serving or eating of food shall discharge indirectly through an air gap or an air break to the drainage system.

OPC Chapter 8 Indirect/Special Waste

- Section 802 Indirect Wastes
  - 802.2 **Installation.** Indirect waste piping shall discharge through an air gap or air break into a waste receptor. Waste receptors shall be trapped and vented and shall connect to the building drainage system. Indirect waste piping that exceeds 30 inches (762 mm) in developed length measured horizontally, or 54 inches (1372 mm) in total developed length, shall be trapped.
    - **Exception:** Where a waste receptor receives only clear water waste and does not directly connect to a sanitary drainage system, the receptor shall not require a trap.
    - 802.2.1 **Air gap.** The air gap between the indirect waste pipe and the flood level rim of the waste receptor shall be not less than twice the effective opening of the indirect waste pipe.
    - 802.2.2 **Air break.** An air break shall be provided between the indirect waste pipe and the trap seal of the waste receptor.
  - 802.3 **Waste receptors.** For other than hub drains that receive only clear-water waste and standpipes, a removable strainer or basket shall *be installed in* waste receptors. Waste receptors shall not be installed in concealed spaces. Waste receptors shall not be installed in plenums, crawl spaces, attics, interstitial spaces above ceilings and below floors. Ready access shall be provided to waste receptors.
    - 802.3.1 **Size of receptors.** A waste receptor shall be sized for the maximum discharge of all indirect waste pipes served by the receptor. Receptors shall be installed to prevent splashing or flooding.
    - 802.3.2 **Hub drains.** A hub drain shall be in the form of a hub or a pipe extending not less than 1 inch (25 mm) above a water-impervious floor.
    - 802.3.3 **Standpipes.** Standpipes shall be individually trapped. Standpipes shall extend not less than 18 inches (457 mm) but not greater than 42 inches (1066 mm) above the trap weir. Access shall be provided to standpipes and drains for rodding.

OPC Chapter 8 Indirect/Special Waste

- **Section 803 Special Wastes**
  - 803.1 **Neutralizing device required for corrosive wastes.** Corrosive liquids, spent acids or other harmful chemicals that destroy or injure a drain, sewer, soil or waste pipe, or create noxious or toxic fumes or interfere with sewage treatment processes shall not be discharged into the plumbing system without being thoroughly diluted, neutralized or treated by passing through an approved dilution or neutralizing device. Such devices shall be automatically provided with a sufficient supply of diluting water or neutralizing medium so as to make the contents non injurious before discharge into the drainage system. The nature of the corrosive or harmful waste and the method of its treatment or dilution shall be approved prior to installation.
  - 803.2 **System design.** A chemical drainage and vent system shall be designed and installed in accordance with this code. Chemical drainage and vent systems shall be completely separated from the sanitary systems. Chemical waste shall not discharge to a sanitary drainage system until such waste has been treated in accordance with Section 803.1.

OPC Chapter 9 Vents

- **SECTION 901 GENERAL**
  - 901.3 **Chemical waste vent systems.** The vent system for a chemical waste system shall be independent of the sanitary vent system and shall terminate separately through the roof to the outdoors or to an air admittance valve that complies with ASSE 1049. Air admittance valves for chemical waste systems *shall comply with Section 918.8 and* shall be constructed of materials approved in accordance with Section 702.5 and shall be tested for chemical resistance in accordance with ASTM F 1412.
  - 901.4 **Use limitations.** The plumbing vent system shall not be utilized for purposes other than the venting of the plumbing system.

OPC Chapter 10 Traps, Interceptors and Separators

- **SECTION 1002 TRAP REQUIREMENTS**
  - 1002.9 **Acid-resisting traps.** Where a vitrified clay or other brittleware, acid-resisting trap is installed underground, such trap shall be embedded in concrete extending 6 inches (152 mm) beyond the bottom and sides of the trap.
  - 1002.10 **Plumbing in mental health centers.** In mental health centers, pipes and traps shall not be exposed.

OPC Chapter 10 Traps, Interceptors and Separators

- **SECTION 1003 INTERCEPTORS AND SEPARATORS**
  - 1003.1 **Where required.** *Where required by the local sewer purveyor or as otherwise required in this section, interceptors* and separators shall be provided to prevent the discharge of oil, grease, sand and other substances harmful or hazardous to the public sewer, the private sewage system or the sewage treatment plant or processes.
    - 1003.1.1 ***Industrial processes, meat packing and food processing facilities.*** *Wastes from industrial processes, meat packing and food processing facilities and similar processing plants shall be drained in accordance with the rules of the "Ohio Environmental Protection Agency", or the authority in charge of the sewerage system into which the wastes are to be discharged. (See sections 6111.44 and 6111.45 of the Revised Code.)*
  - 1003.2 **Approval.** The size, type and location of each interceptor and of each separator shall be designed and installed in accordance with the manufacturer's instructions and the requirements of this section based on the anticipated conditions of use. Wastes that do not require treatment or separation shall not be discharged into any interceptor or separator.

OPC Chapter 10 Traps, Interceptors and Separators

- **SECTION 1003 INTERCEPTORS AND SEPARATORS**
  - 1003.3 **Grease interceptors.**
    - 1003.3.1 **Grease interceptors and automatic grease removal devices required.** A grease interceptor or automatic grease removal device shall be required to receive the drainage from fixtures and equipment with grease-laden waste located in food preparation areas, such as in restaurants, hotel kitchens, hospitals, school kitchens, bars, factory cafeterias and clubs. Fixtures and equipment shall include pot sinks, prerinse sinks; soup kettles or similar devices; wok stations; floor drains or sinks into which kettles are drained; automatic hood wash units and dishwashers without prerinse sinks. Grease interceptors and automatic grease removal devices shall receive waste only from fixtures and equipment that allow fats, oils or grease to be discharged. Where lack of space or other constraints prevent the installation or replacement of a grease interceptor, one or more grease interceptors shall be permitted to be installed on or above the floor and upstream of an existing grease interceptor.
    - 1003.3.2 **Food waste disposers.** Where food waste disposers connect to grease interceptors, a solids interceptor shall separate the discharge before connecting to the grease interceptor. Solids interceptors and grease interceptors shall be sized and rated for the discharge of the food waste disposers. Emulsifiers, chemicals, enzymes and bacteria shall not discharge into the food waste disposer.

OPC Chapter 10 Traps, Interceptors and Separators

- **SECTION 1003 INTERCEPTORS AND SEPARATORS**
  - 1003.3 **Grease interceptors.**
    - 1003.3.3 **Grease interceptors and automatic grease removal devices not required.** A grease interceptor or an automatic grease removal device shall not be required for individual dwelling units or any private living quarters.
    - 1003.3.4 **Hydromechanical grease interceptors, fats, oils and greases disposal systems and automatic grease removal devices.** Hydromechanical grease interceptors; fats, oils, and greases disposal systems and automatic grease removal devices shall be sized in accordance with ASME A112.14.3, ASME 112.14.4, ASME A112.14.6, CSA B 481.3 or PDI G101. Hydromechanical grease interceptors; fats, oils, and greases disposal systems and automatic grease removal devices shall be designed and tested in accordance with ASME A112.14.3, ASME 112.14.4, CSA B 481.1, PDI G101 or PDI G102. Hydromechanical grease interceptors; fats, oils, and greases disposal systems and automatic grease removal devices shall be installed in accordance with the manufacturer's instructions. Where manufacturer's instructions are not provided, hydromechanical grease interceptors; fats, oils, and greases disposal systems and automatic grease removal devices shall be installed in compliance with ASME A112.14.3, ASME 112.14.4, ASME A112.14.6, CSA B 481.3 or PDI G101.
      - 1003.3.4.1 **Grease interceptor capacity.** Grease interceptors shall have the grease retention capacity indicated in Table 1003.3.4.1 for the flow-through rates indicated.
      - 1003.3.4.2 **Rate of flow controls.** Grease interceptors shall be equipped with devices to control the rate of water flow so that the water flow does not exceed the rated flow. The flow-control device shall be vented and terminate not less than 6 inches (152 mm) above the flood rim level or be installed in accordance with the manufacturer's instructions.

OPC Chapter 10 Traps, Interceptors and Separators

- **SECTION 1003 INTERCEPTORS AND SEPARATORS**
  - 1003.3 **Grease interceptors.**
    - 1003.3.5 **Automatic grease removal devices.** Where automatic grease removal devices are installed, such devices shall be located downstream of each fixture or multiple fixtures in accordance with the manufacturer's instructions. The automatic grease removal device shall be sized to pretreat the measured or calculated flows for all connected fixtures or equipment. Ready access shall be provided for inspection and maintenance.
    - 1003.3.6 **Gravity grease interceptors and gravity grease interceptors with fats, oils, and greases disposal systems.** The required capacity of gravity grease interceptors and gravity grease interceptors with fats, oils, and greases disposal systems shall be determined by multiplying the peak drain flow into the interceptor in gallons per minute by a retention time of 30 minutes. Gravity grease interceptors shall be designed and tested in accordance with IAPMO/ANSI Z1001. Gravity grease interceptors with fats, oils, and greases disposal systems shall be designed and tested in accordance with ASME A112.14.6 and IAPMO/ANSI Z1001. Gravity grease interceptors and gravity grease interceptors with fats, oils, and greases disposal systems shall be installed in accordance with manufacturer's instructions. Where manufacturer's instructions are not provided, gravity grease interceptors and gravity grease interceptors with fats, oils, and greases disposal systems shall be installed in compliance with ASME A112.14.6 and IAPMO/ANSI Z1001.
    - 1003.3.7 **Direct connection.** The discharge piping from a grease interceptor shall be directly connected to the sanitary drainage system.

OPC Chapter 10 Traps, Interceptors and Separators

- **SECTION 1003 INTERCEPTORS AND SEPARATORS**
  - 1003.4 **Oil separators required.** At repair garages where floor or trench drains are provided, car washing facilities, factories where oily and flammable liquid wastes are produced, oil separators shall be installed into which oil-bearing, grease-bearing or flammable wastes shall be discharged before emptying into the building drainage system or other point of disposal.
    - 1003.4.1 **Separation of liquids.** A mixture of treated or untreated light and heavy liquids with various specific gravities shall be separated in an approved receptacle.
    - 1003.4.2 **Oil separator design.** Oil separators shall be listed and labeled, or designed in accordance with Sections 1003.4.2.1 and 1003.4.2.2.
      - 1003.4.2.1 **General design requirements.** Oil separators shall have a depth of not less than 2 feet (610 mm) below the invert of the discharge drain. The outlet opening of the separator shall have not less than an 18inch (457 mm) water seal.
      - 1003.4.2.2 **Garages and service stations.** Where automobiles are serviced, greased, repaired or washed or where gasoline is dispensed, oil separators shall have a capacity of not less than 6 cubic feet (0.168 m^3) for the first 100 square feet (9.3 m^2) of area to be drained, plus 1 cubic foot (0.028 m^3) for each additional 100 square feet (9.3 m^2) of area to be drained into the separator. Parking garages in which servicing, repairing or washing is not conducted, and in which gasoline is not dispensed, shall not require a separator. Areas of commercial garages utilized only for storage of automobiles are not required to be drained through a separator.

OPC Chapter 10 Traps, Interceptors and Separators

- **SECTION 1003 INTERCEPTORS AND SEPARATORS**
  - 1003.5 **Sand interceptors in commercial establishments.** Sand and similar interceptors for heavy solids shall be designed and located so as to be provided with ready access for cleaning, and shall have a water seal of not less than 6 inches (152 mm).
  - 1003.6 **Clothes washer discharge interceptor.** Clothes washers shall discharge through an interceptor that is provided with a wire basket or similar device, removable for cleaning, that prevents passage into the drainage system of solids 1/2 inch (12.7 mm) or larger in size, string, rags, buttons or other materials detrimental to the public sewage system.
    - **Exceptions:**
    - 1. Clothes washers in individual dwelling units shall not be required to discharge through an interceptor.
    - 2. A single clothes washer designed for use in individual dwelling units and installed in a location other than an individual dwelling unit shall not be required to discharge through an interceptor.

OPC Chapter 10 Traps, Interceptors and Separators

- **SECTION 1003 INTERCEPTORS AND SEPARATORS**
  - 1003.7 **Bottling establishments.** Bottling plants shall discharge process wastes into an interceptor that will provide for the separation of broken glass or other solids before discharging waste into the drainage system.
  - 1003.8 **Slaughterhouses.** Slaughtering room and dressing room drains shall be equipped with approved separators. The separator shall prevent the discharge into the drainage system of feathers, entrails and other materials that cause clogging.
  - 1003.9 **Venting of interceptors and separators.** Interceptors and separators shall be designed so as not to become air bound. Interceptors and separators shall be vented in accordance with one of the methods in Chapter 9.
  - 1003.10 **Access and maintenance of interceptors and separators.** Access shall be provided to each interceptor and separator for service and maintenance. Interceptors and separators shall be maintained by periodic removal of accumulated grease, scum, oil, or other floating substances and solids deposited in the interceptor or separator.

OPC Chapter 12 Special Piping and Storage Systems

- **SECTION 1201 GENERAL**
  - 1201.1 **Scope.** The provisions of this chapter *and Chapter 53 of the fire code* shall govern the design and installation of piping and storage systems for nonflammable medical gas systems and *medical* oxygen systems. All maintenance and operations of such systems shall be in accordance with *Chapter 34 of* the *building code and the applicable chapters of the fire code.*

OPC Chapter 12 Special Piping and Storage Systems

- **SECTION 1202 MEDICAL GASES**
  - 1202.1 **Nonflammable medical gases.** Nonflammable medical gas systems, inhalation anesthetic systems and vacuum piping systems shall be designed and installed in accordance with NFPA 99.
    - **Exceptions:**
    - 1. This section shall not apply to portable systems or cylinder storage.
    - 2. *Deleted.*
  - 1202.2 ***Enforcement.*** *Plan review and inspection of nonflammable medical gas and vacuum systems shall be performed by one of the following:*
    - *1.A building department certified to enforce medical gas systems and having in its employ or under contract a certified medical gas inspector; or*
    - 2. *A local health district requesting enforcement responsibility and having in its employ or under contract a certified medical gas inspector; or*
    - 3. *If a certified department does not hold the certification to enforce medical gas piping system requirements and a local health district does not request enforcement authority, then the enforcement shall be done by the division of industrial compliance in the department of commerce.*

What is It?

Thank You!

What is It?

Questions?

File Attachments for Item:

ER-6 What Is It? Classifying Use and Occupancy (3-hour version) (David Molnar)

All certifications (3 hours)

Staff Notes: This course is already approved for 2022 for all certifications except ESI. Request is to eliminate the exception.

Committee Recommendation:

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: David Molnar (Contact Name)

Organization: (Organization/Company)

Address: 4201 Copley Rd (Include Room Number, Suite, etc.)

City: Copley State: OH Zip: 44321

E-Mail: dmolnar1@hotamil.com

Telephone: (330) 714-0982 Fax:

Course Sponsor:

COURSE INFORMATION:

Course Title: What is IT? Classifying Use and Occupancy

New Course Submittal: ☐ Update Course: ■ Prior Approval Number: BBS2020-496

Purpose and Objective: Classifying Use, Occupancy and Managing Risks with the 2017 Ohio Building Code, Ohio Mechanical Code, Ohio Plumbing Code and the 2017 NFPA 70 (National Electrical Code). Defining the Use and Occupancy of spaces, understanding the concept of managing the inherent risks of differing Uses and Occupancies, exploring the trade-offs afforded within the Codes and following the trade-offs and risks through the Mechanical, Plumbing and Electrical Codes.

Number of Instructional Contact Hours that can be obtained upon completion: 3

If Multi-Session, Number of Instructional Contact Hours Per Session: —

Program Applicable for the Following Participants:

Building Official ■	Master Plans Examiner ■	Building Inspector ■	Fire Protection Inspector ■	Mechanical Inspector ■
	Plumbing Plans Exam. ■			Plumbing Inspector ■
	Electrical Plans Exam. ■			Non-Res IU Inspector ☒
	Mechanical Plans Exam. ■			

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ■ Res IU Inspector ☒

Electrical Safety Inspectors ☒

Location of ESI Course: Date(s) of ESI Course(s):

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

File Attachments for Item:

ER-7 Atrium Design, Vertical Space Design, and Wide Span Opening Protectives (McKeon Door)

BO, MPE, BPE, BI, FPI, NRIUI (3 hours)

Staff Notes: Six sample slides provided.

Committee Recommendation:

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: David Dodge
(Contact Name)
Organization: McKEON
(Organization/Company)
Address: 44 Sawgrass Drive
(Include Room Number, Suite, etc.)
City: Bellport State: NY Zip: 11713
E-Mail: ddodge@mckeondoor.com
Telephone: 801-471-7210 Fax: _____
Course Sponsor: McKEON

COURSE INFORMATION:

Course Title: Atrium Design, Vertical Space Design & Wide Span Opening Protectives

New Course Submittal: ■ Update Course: ☐ Prior Approval Number: _____

Purpose and Objective: To learn the fundamental principles that govern the provisions of the International Building Code and NFPA regarding Atriums, vertical spaces and openings through floor assemblies. The following four items define the overall course objective:

1. Learn the fundamental code requirements that regulate atrium design to include applicable referenced standards regarding appendage components.
2. Examine definitive provisions of the atrium to include required separation vertically and horizontally from the building structure.
3. Understand the regulatory standards governing the use and application of opening protectives in atrium separations. 4. Explore the myths and facts behind code compliance use of fire protective curtain assemblies.

Number of Instructional Contact Hours that can be obtained upon completion: (3) hours

If Multi-Session, Number of Instructional Contact Hours Per Session: _____

Program Applicable for the Following Participants:

Building Official ■	Master Plans Examiner ■	Building Inspector ■	Fire Protection Inspector ■	Mechanical Inspector ☐
	Plumbing Plans Exam. ☐			Plumbing Inspector ☐
	Electrical Plans Exam. ☐			Non-Res IU Inspector ☐
	Mechanical Plans Exam. ☐			

Res Building Official ☐ Res Plans Examiner ☐ Res Building Inspector ☐ Res Mechanical Inspector ☐ Res IU Inspector ☐

Electrical Safety Inspectors ☐
Location of ESI Course: _____ Date(s) of ESI Course(s): August 3, 2022

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	x
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		x

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

David L. Dodge, CSI, CDT

VICE PRESIDENT, BUSINESS AND CODE DEVELOPMENT

David has been involved in the construction industry since 1975. With an extensive background in project estimating and management and a bachelor's degree in business management, David soon realized a great deal of success in building product marketing and sales. Within this venue he found his passion – building code development and architectural design compliance. Since 1988, he has assisted architectural firms in understanding and implementing the provisions of the model codes as they pertain to fire and life safety. His particular focus is on the fire door industry, promoting cutting edge technology to resolve code compliance challenges.

David is a corporate member of the International Code Council (ICC) and earned his Construction Document Technologist (CDT) from the Construction Specifications Institute. He has served on several ICC committees, both local, regional and national, for the adoption and implementation of the International Building Code throughout the US. He is a recognized speaker and instructor, teaching the fire and life safety provisions of the model codes to design professionals and regulatory officials. David is a certified CEU instructor under the ICC Education Provider program. As part of the McKeon Door Company team David draws on his 30-plus years of experience in the building code arena when assisting design professionals and product representatives with code and design compliance challenges.

Atrium Design, Vertical Space Design & Wide Span Opening Protectives

Seminar - 3 Hour Interactive Slide Presentation

Seminar Objectives

To understand the fundamental principles that govern the provisions of the International Building Code and NFPA regarding atriums, vertical spaces and openings through floor assemblies. The following four bullet items define the overall course objective:

- Learn the fundamental code requirements that regulate atrium design to include applicable referenced standards regarding appendage components.
- Examine definitive provisions of the atrium to include required separation vertically and horizontally from the building structure.
- Understand the regulatory standards governing the use and application of opening protectives in atrium separations.
- Explore the myths and facts behind code compliance use of fire protective curtain assemblies.

Outline

Definitions

- Atrium - IBC, Section 404
- Opening Protection - IBC, Section 716
- UL 10B, 10C, 10D
- Hose Stream
- Time-Temperature Curve
- Structural Floor Loads
- Fire Resistance - IBC, Chapter 7
- Fire Protection - IBC, Chapter 7
- Fire Protection Curtain Assemblies - IBC, Section 716.4 (2021 Edition)

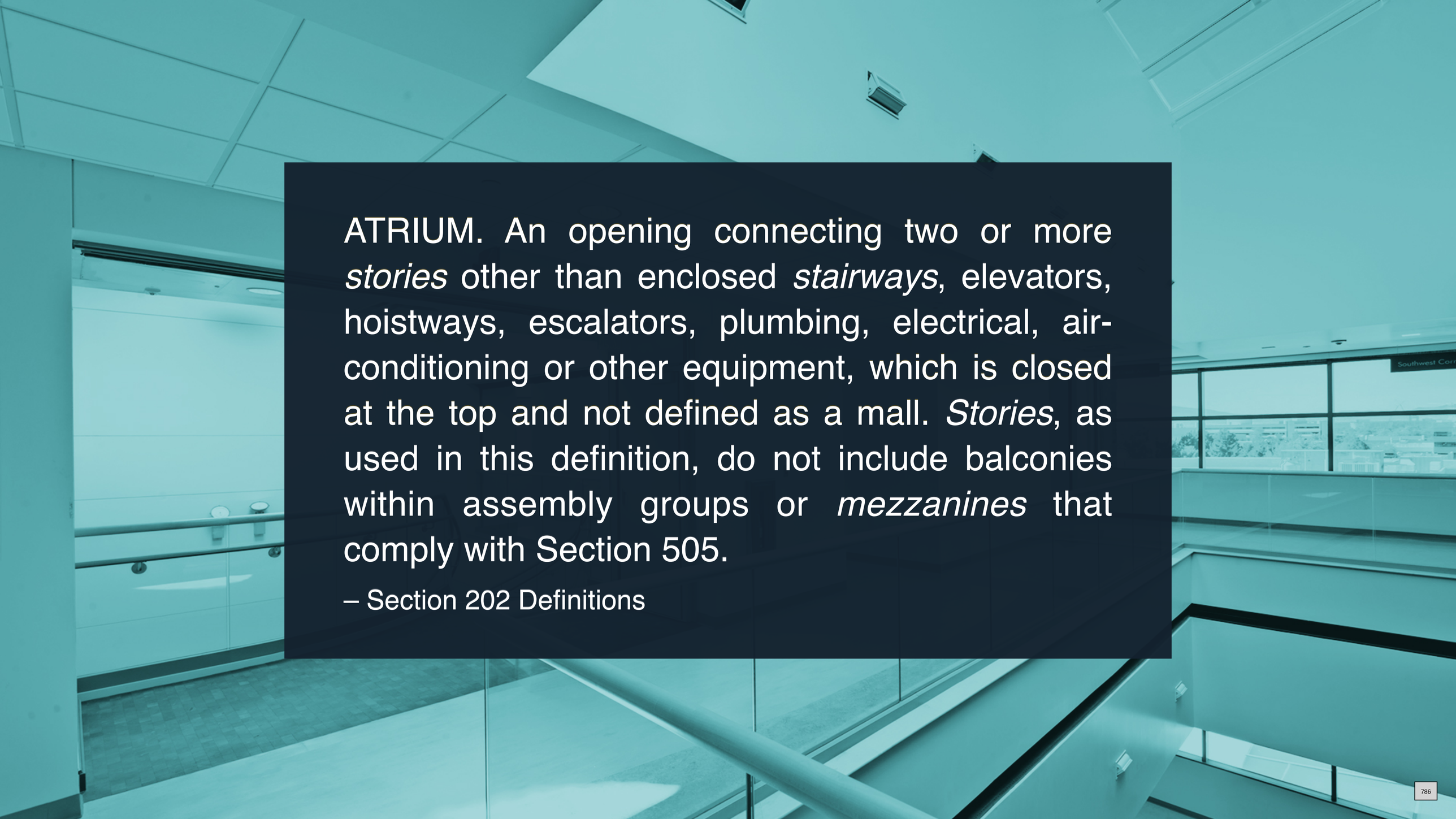
Vertical Compartmentation

- Smoke Control - IBC, Chapter 9, NFPA 92
- Floor Opening Protection - IBC, Chapter 7
- Roof Hatches & Access Doors - IBC, Section 712
- NFPA 288

Facts vs Myths

- Fire Protective Curtain Assemblies
- Emily Carr University Case Study
- Structural Floor Loads

Building Code Summary

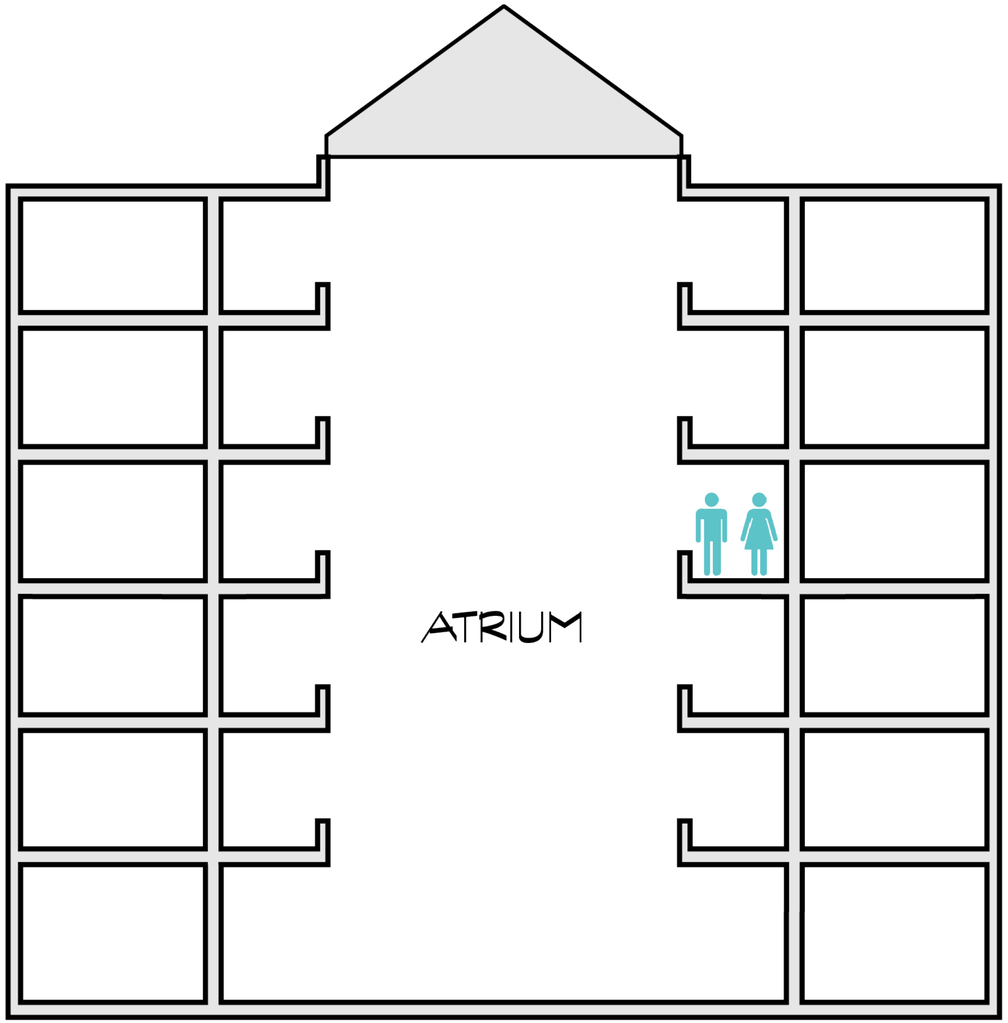


ATRIUM. An opening connecting two or more *stories* other than enclosed *stairways*, elevators, hoistways, escalators, plumbing, electrical, air-conditioning or other equipment, which is closed at the top and not defined as a mall. *Stories*, as used in this definition, do not include balconies within assembly groups or *mezzanines* that comply with Section 505.

– Section 202 Definitions

By definition, an atrium is an opening connecting two or more floor levels that is closed at the top. In other words, it is considered to be an interconnected series of floor openings inside of a building that create a physical connection and common atmosphere between floor levels of the building. The code definition assumes an atrium has an enclosed top.

– Francis D.K. Ching / Steven R. Winkel, FAIA, Building Codes Illustrated



Atrium Commentary

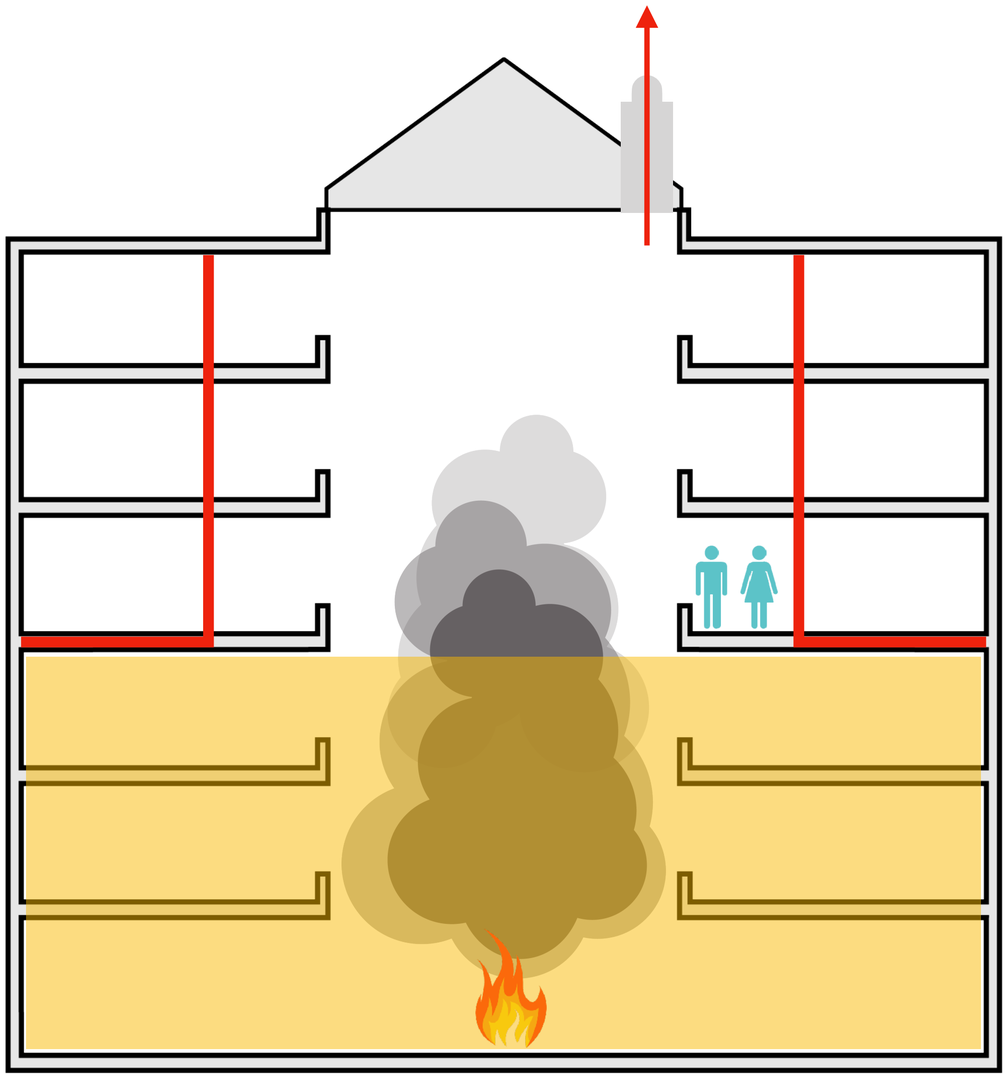
404.5 Smoke control. A smoke control system shall be installed in accordance with Section 909.

- In order to prevent the migration of smoke throughout interconnected levels of a building via the atrium, a mechanical smoke control system is to be installed in all atriums connecting more than two stories … The smoke control system is to be installed in accordance with the provisions of Section 909 … For spaces such as atriums, the primary method of smoke control, in accordance with Section 909, is the exhaust method …

Vertical Orientation

Section 404.6, Exception 3

3. A *fire barrier* is not required between the *atrium* and the adjoining spaces of up to three floors of the *atrium* provided such spaces are accounted for in the design of the smoke control system.



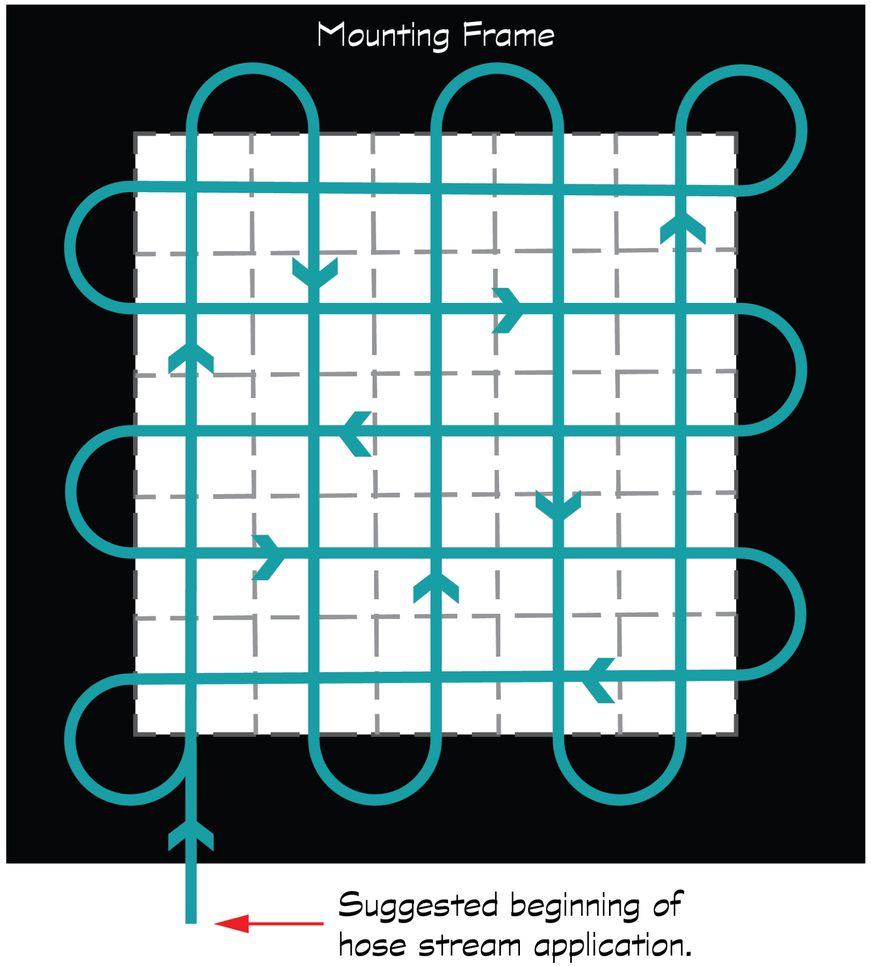
ASTM INTERNATIONAL

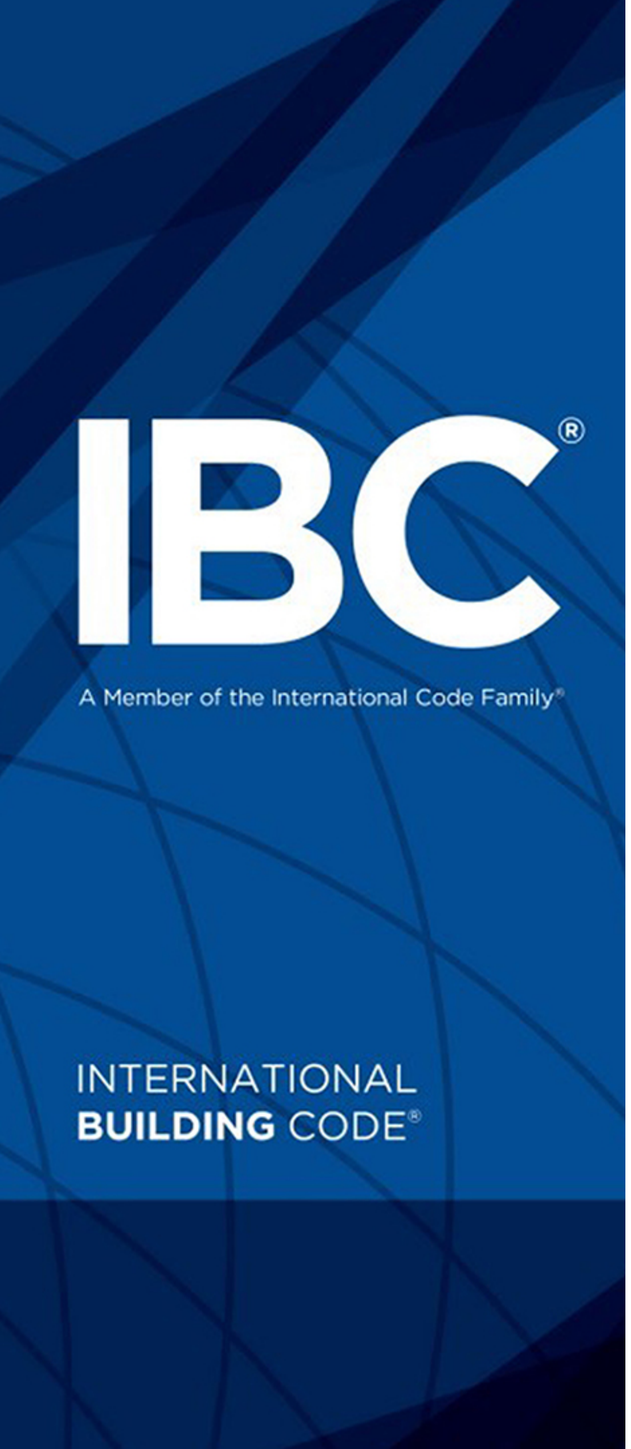
ASTM E2226 Standard Practice for Application of Hose Stream

Basic Test Criteria

Minimum 30 psi for 2.5 minutes in a basic zig-zag style pattern.

10' x 10' Wall Test Specimen
Mounted in Test Furnace Frame





International Building Code, 2021

202 Definitions, 716 Opening Protectives, Referenced Standards

The development and final vote of the following code sections have been completed and will be published in the 2021 edition of the IBC:

Section 202 Definitions

FIRE PROTECTIVE CURTAIN ASSEMBLY. An assembly consisting of a fabric curtain, bottom bar, guides, coil, operating and closing system.

Section 716 Opening Protectives

716.4 Fire protective curtain assembly. Approved fire protective curtain assemblies shall be constructed of any materials or assembly of component materials tested without hose stream in accordance with UL 10D, and shall comply with Sections 716.4.1 through 716.4.3.

716.4.1 Label. Fire protective curtain assemblies used as opening protectives in fire rated walls and smoke partitions shall be labeled in accordance with 716.2.9.

716.4.2 Smoke and draft control. Fire protective curtain assemblies used to protect openings where smoke and draft control assemblies are required shall comply with Section 716.2.1.4.

716.4.3 Installation. Fire protective curtain assemblies shall be installed in accordance with NFPA 80.

Referenced Standards

UL 10D-17, Standard for Fire Tests of Fire Protective Curtain Assemblies (shown on the following slide)

File Attachments for Item:

ER-8 Substantial Damage Determinations (OBOA/Decker)

4 hours, all certifications.

Tabled to August meeting for slide submission.

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

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COURSE SUBMITTER: James E. Decker, Jr.

Course Submitter: James E. Decker, Jr. (Contact Name)

Organization: Ohio Building Officials Association (Organization/Company)

Address: PO Box 1506 (Include Room Number, Suite, etc.)

City: Columbus State: OH Zip: 43216

E-Mail: jedjrpe@gmail.com; jdecker@safebuilt.com

Telephone: 440-476-1400 Fax:

Course Sponsor: James E. Decker, Jr.

COURSE INFORMATION:

Course Title: Substantial Damage Determinations

New Course Submittal: ■ Update Course: ☐ Prior Approval Number:

Purpose and Objective: The purpose of the course is to train individuals on the procedures for performing substantial damage determinations for structures located in a special flood hazard area who have received damage due to flood, wind, fire, etc.

The objective is to prepare a list of individuals who are willing to deploy throughout Ohio to assist local floodplain administrators in performing substantial damage determinations. The course outline will include an overview of the requirements of the RCO and OBC with respect to floods, training in utilizing a damage assessment triage form and the requirements for employer acknowledgment to participate in the Damage Assessment Response Team (DART)

Number of Instructional Contact Hours that can be obtained upon completion: 4 hours

If Multi-Session, Number of Instructional Contact Hours Per Session:

Program Applicable for the Following Participants:

Building Official ■ Master Plans Examiner ■ Building Inspector ■ Fire Protection Inspector ■ Mechanical Inspector ■
Plumbing Plans Exam. ■ Plumbing Inspector ■
Electrical Plans Exam. ■ Non-Res IU Inspector ■
Mechanical Plans Exam. ■

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ■ Res IU Inspector ■

Electrical Safety Inspectors [X]
Location of ESI Course: Date(s) of ESI Course(s):

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	X
Course Sponsor:	Organization sponsoring or requesting the program (if any)	X
Course Title:	Name of course (related to content)	X
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	X
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	X
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	X
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	X
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	X
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

OBOA Disaster Response Course Outline

The Ohio Department of Natural Resources, Division of Water, Floodplain Management reached out to the Ohio Building Officials Association (OBOA) several years ago to request help with implementing a team of responders to assist local municipalities with damage assessments after disasters.

The Ohio Building Officials Association (OBOA) has created an Ad-Hoc committee, Disaster Response. Jim Decker, current OBOA Treasurer, is the Chair of this committee. The purpose of the committee is to create a list of trained personnel to assist with Damage Assessments after disasters.

Background:

As a community participating in the National Flood Insurance Program (NFIP), the local floodplain administrator is tasked with performing damage assessments for structures in regulated floodplains. The program requires structures damaged beyond 50 percent of the structures market value be brought into compliance with the NFIP. Damage can be from flood, fire, wind, vehicle accidents, etc.

Post disaster damage assessments can be a daunting task. Municipalities are stressed with cleanup. And the residents are pressuring the local building departments to quickly reconstruct. The requirement to perform damage assessments is an added stress.

Task:

The Ohio Building Officials Association has agreed to become the repositor of a list of qualified individuals ready to deploy throughout the state and neighboring states to assist the local floodplain administrator with damage assessments.

Qualifications:

The Damage Assistance Response Teams (DART) personnel must be qualified to be a part of this team in three manners:

1. Be knowledgeable in the building code enforcement industry by holding any certification issued by the Ohio Board of Building Standards (Building Official, Plans Examiner, Inspector, Permit Technician); holding the duties of the local floodplain administrator; or holding the duties of a local property maintenance inspector.
2. Providing signed documentation from the responders jurisdiction of a Memorandum of Understanding (MOU) between said municipality and OBOA. The MOU will contain language that will provide protections to the responding employee following the state wide EMAC procedures and IMAC procedures.
3. Providing verification the responder has attended damage response training.

Building Code References

1. RCO Section 322
2. OBC Sections 106.1.1(2.1), 202 and 1612

Presenter Resume

Jim Decker has been employed in the building code enforcement industry for over 25 years. He maintains certifications as Building Official, Master Plans Examiner, Building Inspector, Residential Building Official and Certified Floodplain Manager. Jim has presented a Mechanical Code update to a Northeast Ohio mechanical contractors group and presented at the 2020 Ohio Statewide Floodplain Managers Association annual conference. Jim is currently the presenter/monitor of BOCONEO' Plans Examiners Round Table.

Thanks, Jim Decker

File Attachments for Item:

NB-1 Changes to BBS Education Classification system

At the May meeting BBS staff briefly introduced an updated education approval application which changes the way courses are approved for certifications. Staff email and proposed new application, existing application are attached.

Committee Recommendation:

From:	Foley, Megan
To:	terrymccafferty; abstanbery@abstanberyinc.com; julie.cromwell@juliecromwell.com; Jeffrey Tyler; Jeff Samuelson; Greg Warner
Cc:	Hanshaw, Regina; Lane, Michael; Timothy Galvin
Subject:	Proposed new education form
Date:	Friday, May 20, 2022 3:32:00 PM
Attachments:	image001.png Updated Education Form 2022.pdf 216 - CRITERIA APP FOR SUBMITTING COURSES 2018.pdf

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Education Committee members:

As I reported briefly at the May 12 meeting, Regina and I have been discussing how to simplify our continuing educational requirements , especially in light of both our rules revision and planned new online personnel application and renewal portal/program.
The attached form is a proposed starting place for this change. I have included the current form (216) for comparison.

The main changes implemented on the proposed form:

1. Consolidation. Instead of listing each commercial and residential certification for inclusion in the CE credit, the form has three categories, Residential, Commercial, and All Certifications. The committee has expressed an interest in promoting cross-training, and this consolidation is a step towards that goal.
   Other categories for this could be 'Residential Only', 'Commercial and Residential', and 'Administrative'.

2. Simplified Reporting: Certified personnel will no longer have to worry if the courses they take qualify as education for the certifications they hold, beyond the broad classification of commercial and residential. This will also simplify staff review of renewals, and will simplify online reporting for course sponsors once the new program is adopted.

3. Tracking additional information: The new form provides course sponsors an opportunity to indicate if a course is an administrative course, if the course is being offered online, if the course is part of a conference, etc.

I welcome any changes and suggestions for improvement.

Ohio Department of Commerce
Ohio Board of Building Standards

Meg Foley
Professional Development Coordinator
Board of Building Standards
Department of Commerce
614.644.3779
mfoley@com.state.oh.us
Board of Building Standards

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This message and any response to it may constitute a public record and thus may be publicly available to anyone who requests it.

APPLICATION FOR CONTINUING EDUCATION APPROVAL
COURSE CONDITIONS AND GUIDELINES.

The Ohio Board of Building Standards is committed to the ongoing education and professional development of board-certified personnel through the delivery of high-quality, accurate and engaging professional continuing education content. To this end, the Board reviews and approves Continuing Education Courses for building department personnel.

Board approval is granted only for course instruction pertaining to OBC, OMC, OPC, and RCO requirements and such other content areas directly related to the responsibilities of the certification for which credit is being requested.

Promotion: Any person or organization promoting an approved course is required to make full and accurate disclosure regarding course title, course approval number, number of credit hours, categories for which the BBS has approved the class, and fees in promotion materials and advertising. ***The Board does not grant retroactive approval. It is recommended that courses be submitted for approval well in advance of any scheduling of classes and advertising***. Advertising shall not disclose improper approval information to the public.

Certificate of Completion: Course sponsors/co-sponsors shall provide participants a certificate of completion containing the following information:

- name of participant
- title of approved courses
- BBS approval #
- BBS approved certifications
- date of the continuing education program
- number of approved credit hours awarded, and
- signature of authorized sponsor or instructor.

Anyone or any organization administering an approved course shall provide the Board with advanced written information on scheduling of the course(s) (date and place) and provide to the Board a legible list of participants who completed the course with the name of course, date, and location.

Participants: Must attend the complete course as presented by the instructor to receive credit hours approved by the Board. No partial credit shall be given to any participant who failed to complete the entire course as approved. The sponsor/co-sponsor or instructor shall formulate a method to verify the individual's attendance and completion of the course.

Board approval: All courses are approved for the calendar year in which application is made. Courses may be renewed as long as the referenced code is in effect. When the referenced code is updated: courses must be updated, and new approvals sought.

Facility/training area: Course facilities shall include the following:

In Person Classes:

Sufficient seating capacity
ADA accessible facilities
Appropriate Audio/Visual devices for delivery
Writing surfaces for participants

Online Classes:

Web-accessible
ADA accessible delivery
Tech support available
Live and recorded courses permitted

In-person facilities shall be capable of comfortably and safely seating at least the number of attendees, climate controlled, non-smoking in the training room; and sound controlled so that outside noise will not interfere with the training.

Application for Continuing Education Course Approval

Provider Information:

Name:_____
Organization:_____
Sponsor:_____
Address:_____

E-mail: _____ Telephone:_____
Website:_____

Renewal:_____Prior course number _____ (*i.e. BBS2018-429*)
Renewals will only be granted for identical content and certifications, within the appropriate code cycle.
Attach a copy of prior course approval letter for confirmation.

Course Information:

Course title:_____
Course instructor:_____
Course description:_____
_____
_____
_____
Instructional hours per session:_____ Number of Sessions:_____
Course Date and Location:_____

Special Content:

Chapter 1 Instruction:_____ Conference Course:_____
Existing Buildings:_____ Conference Name:_____
Conference location:_____

Course to be offered online?_____ **On Demand_____** **Webinar_____**
Course Website: _____
Detail course participation confirmation method *(i.e. test, quizlets, participant activity confirmation)*:
_____

Course applicable for the following certifications

Residential Certifications: _____ **Commercial Certifications: _____** **All Certifications: _____**

Application materials included electronically: (Mark all that apply)

_____	This application	_____	Course Learning Objectives
_____	Course Outline	_____	Presentation Materials
_____	Course Agenda	_____	Assessment Materials
_____	Presenter Bio	_____	Date, Time, Location of Course

The board does not provide retroactive approval for continuing education courses.

OAC 4101:7-3-01(F)(4)(b) **Approval process for continuing education courses**.

(i) **Applications for approval**. Applications for continuing education course approval shall be on forms prescribed by the board and submitted at least seven days prior to the meeting of the board's education committee or the electrical safety inspectors advisory committee for continuing education courses for electrical safety inspectors. (A meeting schedule is available on the board of building standards' web page at http://www.com.ohio.gov/dico/bbs/)

(ii) **Application review**. Upon receipt of a complete application for course approval, the board of building standards education committee shall review the application and make a recommendation to the board. Following receipt of the committee's recommendation, the board may approve, table pending further review and/or receipt of additional documentation, deny the application for course approval, or take such other action as the board deems appropriate.

(a) **Course approval number**. Approved courses will be issued a course approval number with the prefix "BBSyyyy" based on the calendar year.

(b) **Course approval expiration**. Continuing education course approval will expire on December thirty-first of each year.

(c) **Course update**. The instructor or sponsor of any course(s) intended to be taught in a subsequent year, upon or near the expiration date of a current approval, shall resubmit an application for each course requesting an update. If approved, the instructor or sponsor shall receive a new approval and approval number for each course for the subsequent year. Any application for a course update shall be processed administratively as long as the course content has not changed.

(iii) **Course credit**. Board approved courses shall establish hour equivalencies for continuing education credit for each of the certification classifications requested. Course credit shall only be given for training in the respective certification classification.

Courses approved for more than one certification classification may be applied to each certification for which training is required. No credit shall be approved for duplicate courses within the same certification period. Instructors of board approved courses may apply three course hours for every one course hour taught toward their own board certification continuing education requirements except for duplicate courses within the same certification period.

(iv) **Approved course sponsor requirements**. The following are requirements that apply to all approved continuing education courses:

(a) Date(s), time(s), and location(s) the course will be taught shall be provided to the board prior to the course presentation;

(b) If course content is modified, the course must be resubmitted for course approval;

(c) When promoting an approved course, the instructor shall make full and accurate disclosure regarding course title, course approval number, number of contact hours, certifications for which approval has been given, and all fees to be charged;

(d) Course sponsors shall provide participants with a certificate of completion containing the name of the participant, title of approved course, BBS approval number, date and location of session, number of contact hours awarded, certification types for which course is approved, and signature of authorized sponsor or instructor;

(e) The sponsors of an approved continuing education course shall provide the board with a legible copy of a list of participants who completed the course including: course name, date, and location of the session;

(f) Participants must attend the complete course(s) as presented by the instructor to receive the contact hours approved by the board. No partial credit shall be given to any participant failing to complete the entire course as approved. The sponsor shall verify the participant's attendance and completion of the course; and,

(g) The board does not provide retroactive approval for continuing education courses presented prior to submission of an application for approval.

CRITERIA FOR SUBMITTING CONTINUING EDUCATION COURSES FOR BOARD OF BUILDING STANDARDS CERTIFICATIONS

The Ohio Board of Building Standards approves Continuing Education Courses for building department personnel. The courses may be used for the attainment of goals that are connected with technical and professional development as they relate to enforcing and interpreting the Ohio State Building Codes. Board approval is granted only on course instruction pertaining to OBC, OMC, OPC, and RCO requirements and such other content areas directly related to the responsibilities of the certification for which credit is being requested.

Instructors: Anyone or any organization promoting an approved course, is required to make full and accurate disclosure regarding course title, course approval number, number of credit hours, certifications for which the BBS has approved the class, and fees in promotion materials and advertising. ***The Board does not grant retroactive approval. It is recommended that courses be submitted for approval well in advance of any scheduling of classes and advertising***. Advertising shall not disclose improper approval information to the public.

Course sponsors/co-sponsors: provide participants a certificate of completion containing the following information: name of participant, title of approved courses, BBS approval #, BBS approved certifications, date of the continuing education program, number of approved credit hours awarded and signature of authorized sponsor or instructor.

Anyone or any organization administering an approved course shall provide the Board with advanced written information on scheduling of the course(s) (date and place) and provide to the Board a legible list of participants who completed the course with the name of course, date, and location.

Participants: Must attend the complete course as presented by the instructor to receive credit hours approved by the Board. No partial credit shall be given to any participant who failed to complete the entire course as approved. The sponsor/co-sponsor or instructor shall formulate a method to verify the individual's attendance and completion of the course.

Board approval: Remains in effect through the calendar year of approval. The course may be renewed administratively by sponsor application in subsequent years so long as it references current codes and standards Upon the Board's adoption of a new edition of the codes, course sponsors must update their course and submit to the Board for approval. The Board does not grant retroactive approval for courses presented prior to approval date.

Facility/training area: Shall be capable of comfortably and safely seating at least the number of attendees with writing surfaces for each attendee; accessible to/and usable for people with disabilities; sized and provided with audio/visual equipment adequate so that each attendee can see the instructor(s) and overhead screen and hear the content of the training programs; illuminated for writing and that the content on an overhead screen can be seen easily by all attendees; non-smoking in the training room; sound controlled so that outside noise will not interfere with the training.

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

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COURSE SUBMITTER:

Course Submitter: _____
(Contact Name)

Organization: _____
(Organization/Company)

Address: _____
(Include Room Number, Suite, etc.)

City: _____ State: _____ Zip: _____

E-Mail: _____

Telephone: _____ Fax: _____

Course Sponsor: _____

COURSE INFORMATION:

Course Title: _____

New Course Submittal: ☐ Update Course: ☐ Prior Approval Number: _____

Purpose and Objective: _____

Number of Instructional Contact Hours that can be obtained upon completion: _____

If Multi-Session, Number of Instructional Contact Hours Per Session: _____

Program Applicable for the Following Participants:

Building Official ☐ Master Plans Examiner ☐
Building Plans Exam. ☐
Plumbing Plans Exam. ☐
Electrical Plans Exam. ☐
Mechanical Plans Exam. ☐
Fire Protect. Plans Exam. ☐

Building Inspector ☐ Fire Protection Inspector ☐ Mechanical Inspector ☐
Plumbing Inspector ☐
Non-Res IU Inspector ☐

Res Building Official ☐ Res Plans Examiner ☐ Res Building Inspector ☐ Res Mechanical Inspector ☐ Res IU Inspector ☐

Electrical Safety Inspectors ☐
Location of ESI Course: _____ Date(s) of ESI Course(s): _____

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	
	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	
Test Materials:		
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

File Attachments for Item:

EC-1 Cincinnati Framing Checklist (Building and Fire Code Academy)

RBO, RPE, RBI, BI (6 hours in two 3-hour sessions)

RICHARD A. PICCOLO PRESIDENT
Master Code Official BUILDING & FIRE CODE ACADEMY

CERTIFICATIONS

Certified Building Official
Certified Fire Official
Illinois Certified Fire Inspector
BOCA® Certified Fire Inspector
Certified Property Maintenance Inspector
Certified Plans Examiner
Certified Building Inspector
Certified Instructor

AUTHOR/ INSTRUCTOR

Understanding the NFPA 101
Understanding the Illinois Accessibility Code
Understanding the International Building Code
Understanding the International Fire Code
Fire Resistance Rated Construction with Underwriters Laboratories
Understanding Non Structural Plan Review
Understanding the 1999 BOCA® National Building Code - Part I, II & III
Understanding the 1996 BOCA® National Building Code - Part I, II & III
Understanding the 1993 BOCA® National Building Code - Part I, II & III
Understanding the 1990 BOCA® National Building Code - Part I, II & III
Understanding the 1999 BOCA® National Fire Prevention Code
Understanding the 1996 BOCA® National Fire Prevention Code
Understanding the 1993 BOCA® National Fire Prevention Code
Understanding the 1990 BOCA® National Fire Prevention Code

INSTRUCTOR

1984 BOCA® Fire Prevention Code
National Certification For Construction Code Inspectors Workshop
Fire Prevention Principles - Levels I & II
Principles of the 1987 BOCA® National Building Code
Principles of the 1984 BOCA® National Building Code
Fire Resistive Construction Requirements

ADJUNCT FACULTY

William Rainey Harper College - Palatine, IL

ORGANIZATIONS

Chairman: Codes & Standards Committee IL Fire Inspectors Association
Delegate and Past President: Illinois Council of Code Administrators
McHenry County Building Code Advisory Committee
BOCA® Fire Code Interpretations Committee

BACKGROUND EXPERIENCE

Elk Grove Village Fire Department – 19 Years
President, Illinois Institutional Fire Training, Inc.

EDUCATION & TRAINING

Northeastern University B.A.
Harper College, Palatine IL A.S. Fire Science
240 Hour Inspectors Training Course
Fire Instructor Training: Levels I & II

EXPERT TESTIMONY

Designated Court Certified expert on Building Codes in 1995
Provided trial testimony for the County of Kankakee, IL (Plaintiff) in County of Kankakee v s Tim Harrington, U.S. District Court No. 940 V 134
Provided deposition for Village of Schiller Park, IL (Plaintiff), Village of Schiller Park vs SP Club, Inc. U.S. District Court No. 94 C 1422
Deposition for Village of Addison (Defendant), Hispanics of United Dupage County vs Village of Addison, IL U.S. District Court 94 C 6075 & 95 C 3926

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: Teresa Wawro
(Contact Name)
Organization: Buiilding & Fire Code Academy
(Organization/Company)
Address: 2420 Vantage Drive
(Include Room Number, Suite, etc.)
City: Elgin State: IL Zip: 60124
E-Mail: twawro@bfcacademy.com
Telephone: 847-428-2951 Fax: 847-428-2911
Course Sponsor:

COURSE INFORMATION:

Course Title: City of Cincinnati Framing Checklist

New Course Submittal: ■ Update Course: ☐ Prior Approval Number:

Purpose and Objective: A training course structured on the 2019 Residential Code of Ohio, Chapters 5-9. Students will be able to: Identify and explain the parts of a framing inspection; Identify the load path in a building; Utilize a framing checklist to insure all areas of the structure are checked for compliance with the approved plan and the Residential Code of Ohio; Apply the Residential Code of Ohio to a framing inspection.

Number of Instructional Contact Hours that can be obtained upon completion: 6

If Multi-Session, Number of Instructional Contact Hours Per Session: 3 hours per session, over 2 days

Program Applicable for the Following Participants:

Building Official ☐ Master Plans Examiner ☐ Building Inspector ■ Fire Protection Inspector ☐ Mechanical Inspector ☐
Plumbing Plans Exam. ☐ Plumbing Inspector ☐
Electrical Plans Exam. ☐ Non-Res IU Inspector ☐
Mechanical Plans Exam. ☐

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ☐ Res IU Inspector ☐

Electrical Safety Inspectors ☐
Location of ESI Course: Date(s) of ESI Course(s):

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	X
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	X
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	X
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	X
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	X
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	X
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	X
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	X
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		X

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

BFCA®

Building & Fire Code Academy

WELCOME

BFCA®

Building & Fire Code Academy

City of Cincinnati
Framing Inspections

Copyrighted Materials

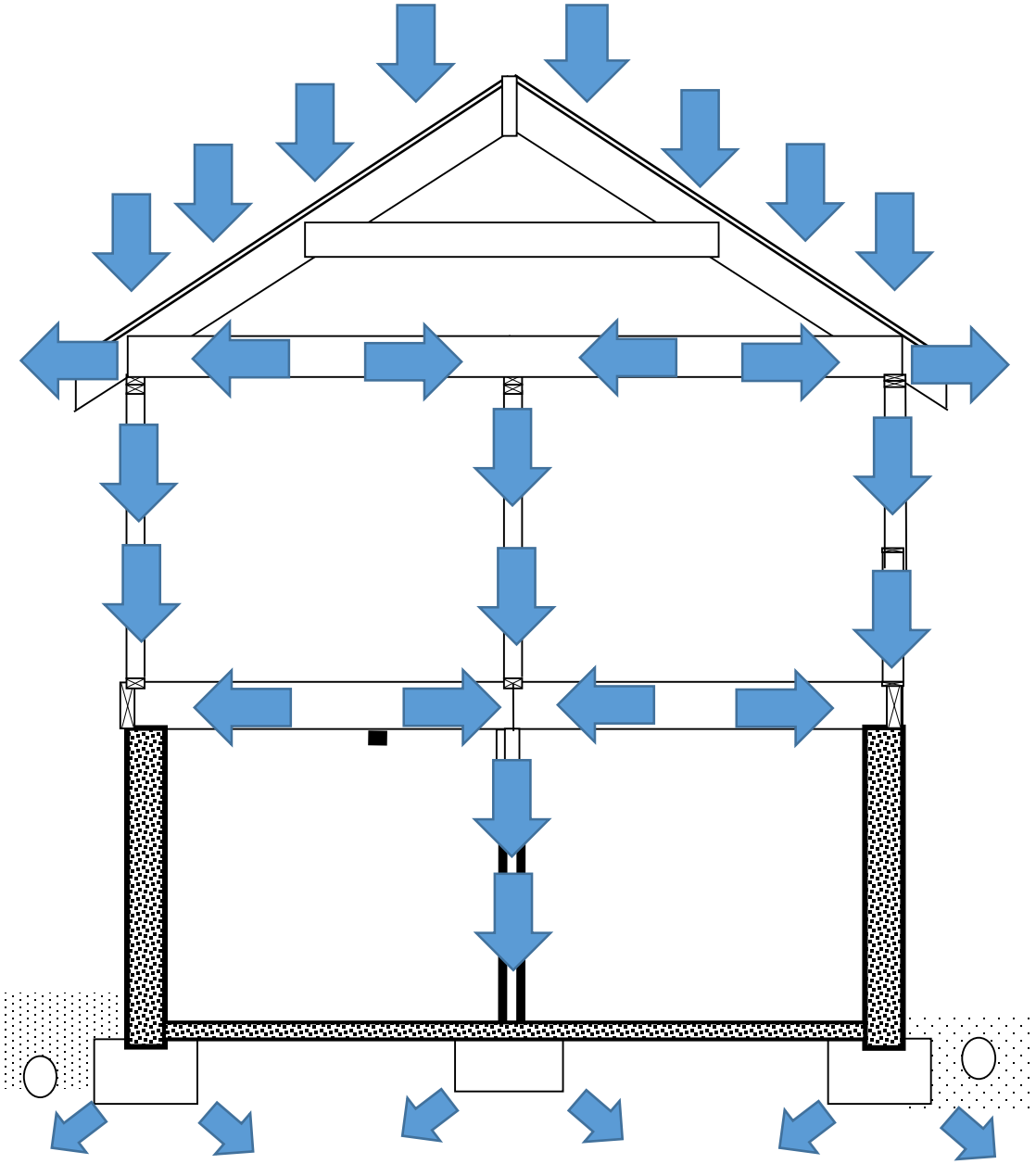
Learning Objectives and Outcomes

Students successfully completing this course will be able to:

* Identify and explain the parts of a framing inspection
* Identify the load path in a building
* Utilize a framing checklist to insure all areas of the structure are checked for compliance with the approved plan and the Residential Code of Ohio
* Apply the Residential Code of Ohio to a framing inspection

FRAMING INSPECTION

- Conventional Light Frame Construction
- Utilize the Framing Checklist
- Purpose of the Inspection
  - Check for compliance with the approved plan
  - Apply the applicable sections of the Residential Code of Ohio
  - Look for items not easily shown or not shown on plan
- Locate and Inspect the Load Path From the Ridge to the Top of the Concrete



Equipment Required

- Approved plans
- Wall bracing plan
- Checklist
- Tape measure
- Flashlight
- Appropriate clothing

Purpose of the Checklist

- Guide the inspector through the process
- Separate framing inspection report should be prepared
- Checklist starts at the top and goes down
- Reverse could be performed
- Some items on the checklist may not apply

Before You Start

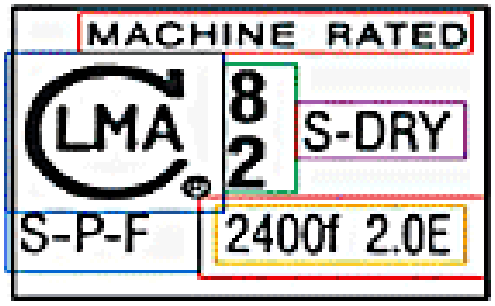
* Walk around the building
  - Number of stories
  - Garage location
  - Walk-out basement
  - Cantilevers
  - Building layout
  - Building openings
  - Special features

* Assume concrete inspections were performed and approved
  - Look for inspection reports
  - Includes footing, foundation, backfill
  - Storm water system
  - Underground plumbing, electric

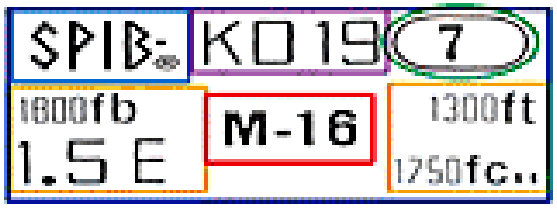
Before You Start – Grade Stamps

- Provide details on the wood framing members
- Classifies the wood based on the type of lumber and lumber grading
- Videos on reading grade stamps
- Importance of checking grade stamps

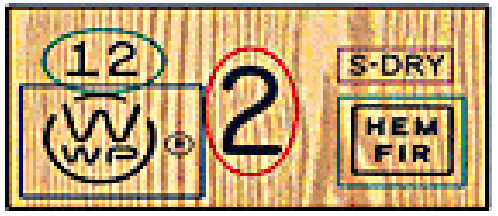
How to Read a Grade Stamp:



MSR Grade



MEL Grade



Visual Grade

- Lumber Grade
- Species Group
- Lumber Strength Properties
- Moisture Content at the time of surfacing
- Mill Producer
- Grading Agency

- MC15 or KD15 for a moisture content of 15 percent or less;
- S-DRY, KD, or KD19 for a moisture content of 19 percent or less;
- S-GRN for unseasoned with a moisture content of more than 19 percent


2
71 STUD
71 STUD


SESA
SESA ENDÜSTRİYEL YATIRIMLAR İNŞAAT SANAYİ TİCARET LİMİTED ŞİRKETİ
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06160 Siteler - ANKARA
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Fax: (0312) 353 22 26
M.Karagüzel V.D.: 764 005 1307
www.sesatrade.com
www.sesaplywood.com
E-mail: sesa@sesatrade.com

TABLE 802.4.1(1)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load = 20 psf, ceiling not attached to rafters, L/Δ = 180)

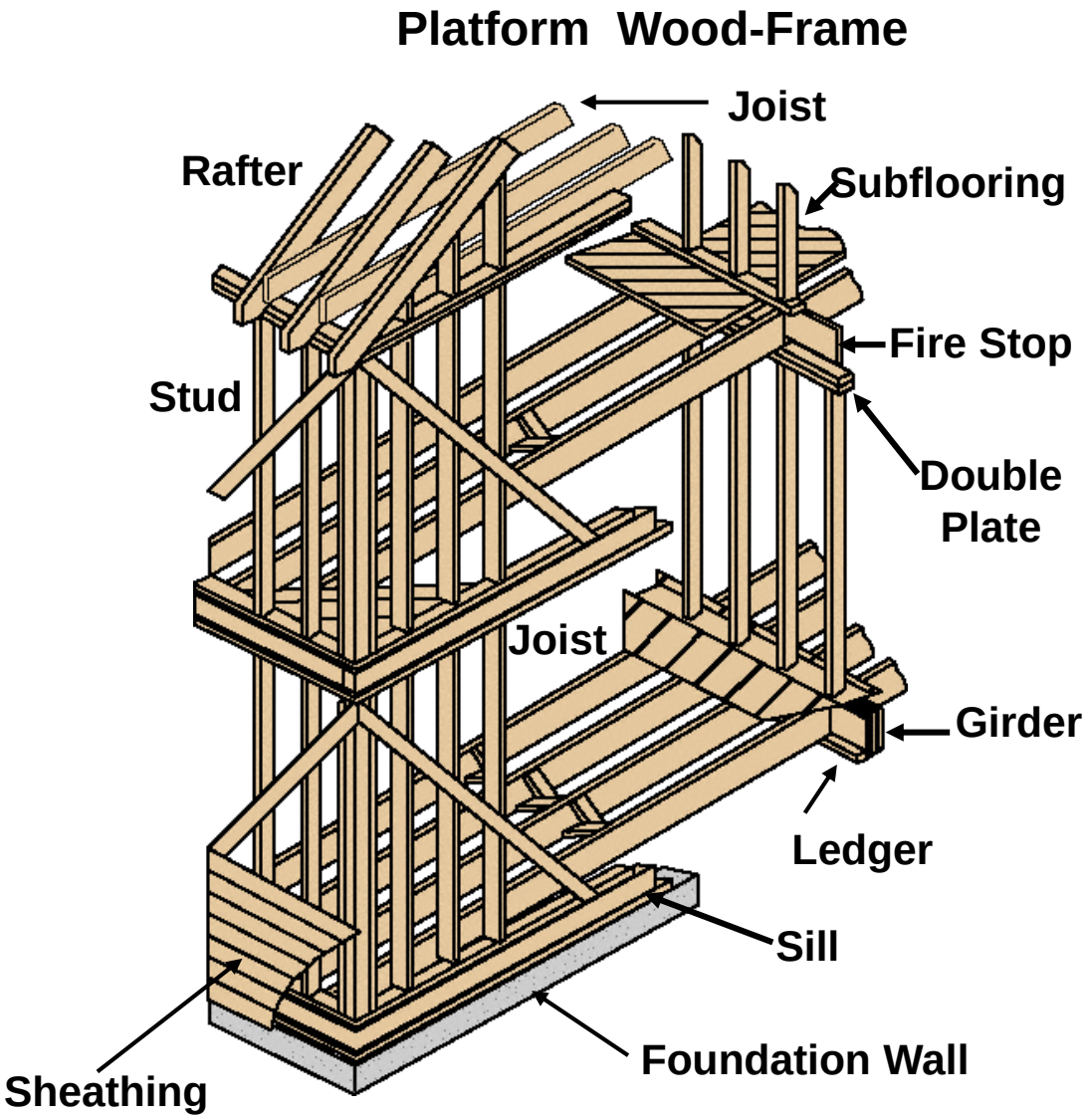
RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans[a]									
			(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
12	Douglas fir-larch	SS	11-6	18-0	23-9	Note b	Note b	11-6	18-0	23-9	Note b	Note b
	Douglas fir-larch	#1	11-1	17-4	22-5	Note b	Note b	10-6	15-4	19-5	23-9	Note b
	Douglas fir-larch	#2	10-10	16-10	21-4	26-0	Note b	10-0	14-7	18-5	22-6	26-0
	Douglas fir-larch	#3	8-9	12-10	16-3	19-10	23-0	7-7	11-1	14-1	17-2	19-11
	Hem-fir	SS	10-10	17-0	22-5	Note b	Note b	10-10	17-0	22-5	Note b	Note b
	Hem-fir	#1	10 -7	16-8	22-0	Note b	Note b	10-4	15-2	19-2	23-5	Note b
	Hem-fir	#2	10-1	15-11	20-8	25-3	Note b	9-8	14-2	17-11	21-11	25-5
	Hem-fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern pine	SS	11-3	17-8	23-4	Note b	Note b	11-3	17-8	23-4	Note b	Note b
	Southern pine	#1	10-10	17-0	22-5	Note b	Note b	10-6	15-8	19-10	23-2	Note b
	Southern pine	#2	10-4	15-7	19-8	23-5	Note b	9-0	13-6	17-1	20-3	23-10
	Southern pine	#3	8-0	11-9	14-10	18-0	21-4	6-11	10-2	12-10	15-7	18-6
	Spruce-pine-fir	SS	10-7	16-8	21-11	Note b	Note b	10-7	16-8	21-9	Note b	Note b
	Spruce-pine-fir	#1	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Spruce-pine-fir	#2	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Spruce-pine-fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6

Student Exercise

* Enter the name of the corresponding building element in the appropriate box from the following list:

Rafter	**Sill**	**Foundation Wall**
Joist	**Sheathing**	**Stud**
Subfloor	**Firestop**	**Double-plate**
Girder	**Ledger**	

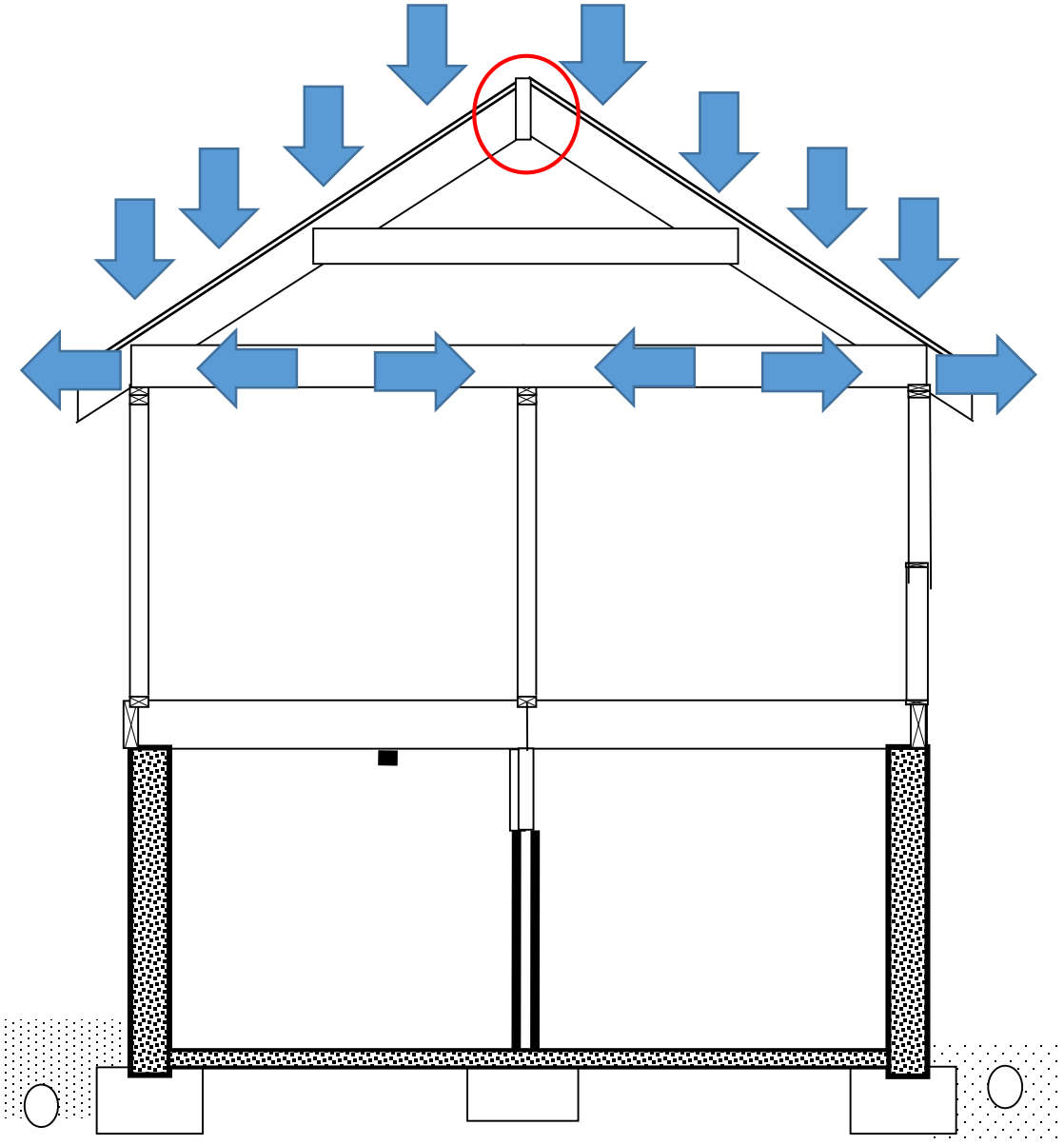
Light frame wood construction



- Let's Get Started
- Top of the Form

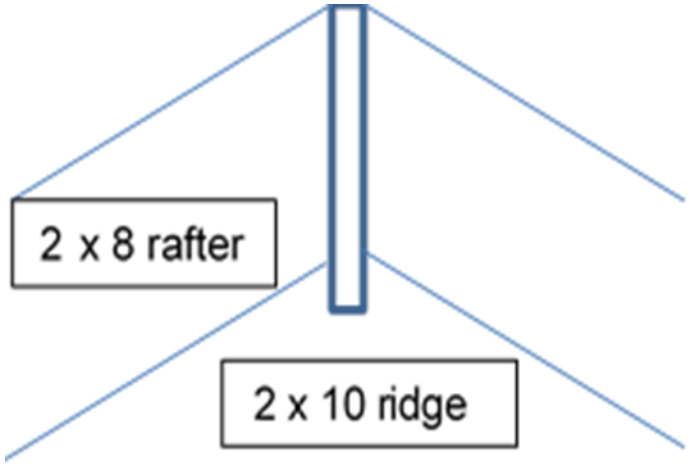
	Framing Checklist – Conventional light frame construction		
Framing plan and wall bracing plan on site		Documentation for engineered wood beams and headers	
Nails, fasteners per the Table in the code		All prefabricated metal fasteners installed and fastened per the manufacturer	
	Bearing on wood or steel beams is a minimum of 1 ½ inches Bearing on concrete or masonry is a minimum of 3 inches		

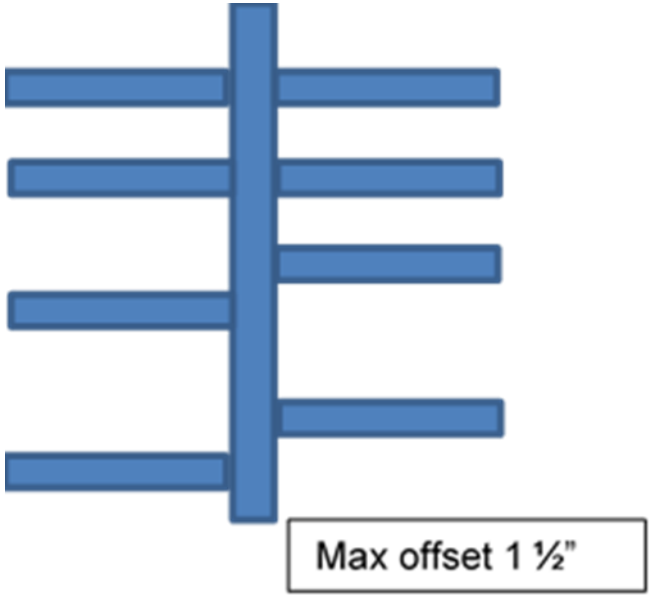
Roof framing			
	Ridge board		
		Minimum 1 inch nominal	
		Cut ends	
		Opposite each other	
	Collar ties		
		Location	
		Spacing	
		Size	
	Ridgebeam if rqrd		
	Roof rafters		
		Size, spacing, grade stamp	
		Proper fasteners	
		Purlins if used	
		Uplift protection	
		Rafter cantilever	
		Opening in roof	
		Headers, trimmers tail joist	
		Sheathing – proper rating	

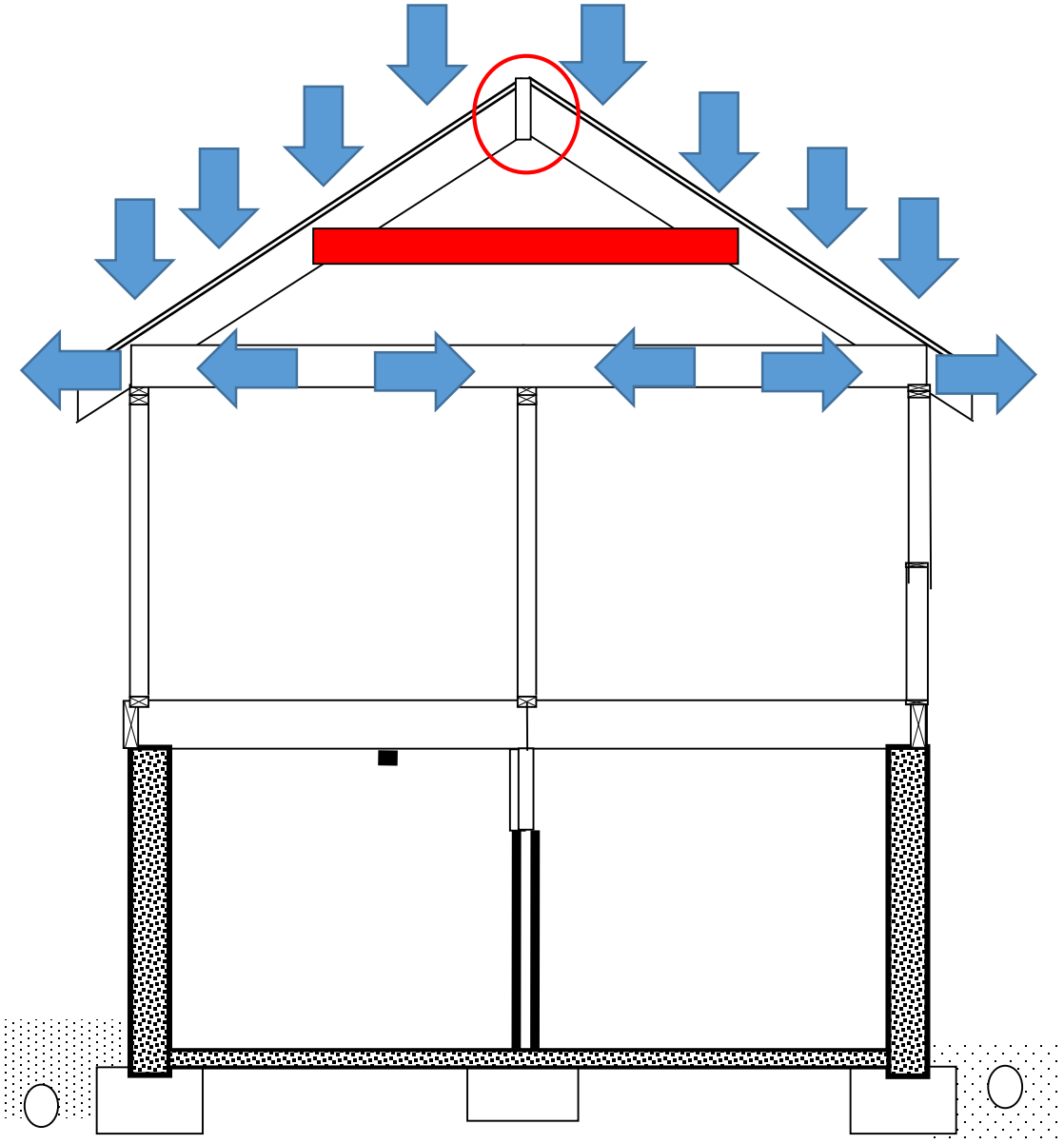



Dec 13, 2019 12:20:15 PM

- Ridge
  - Ridgeboard
    - Minimum 1” nominal thickness
    - Larger than end cut of rafter
    - Roof rafters opposite from each
      - Offset not more than $1\,{}^{1}/_{2}$”

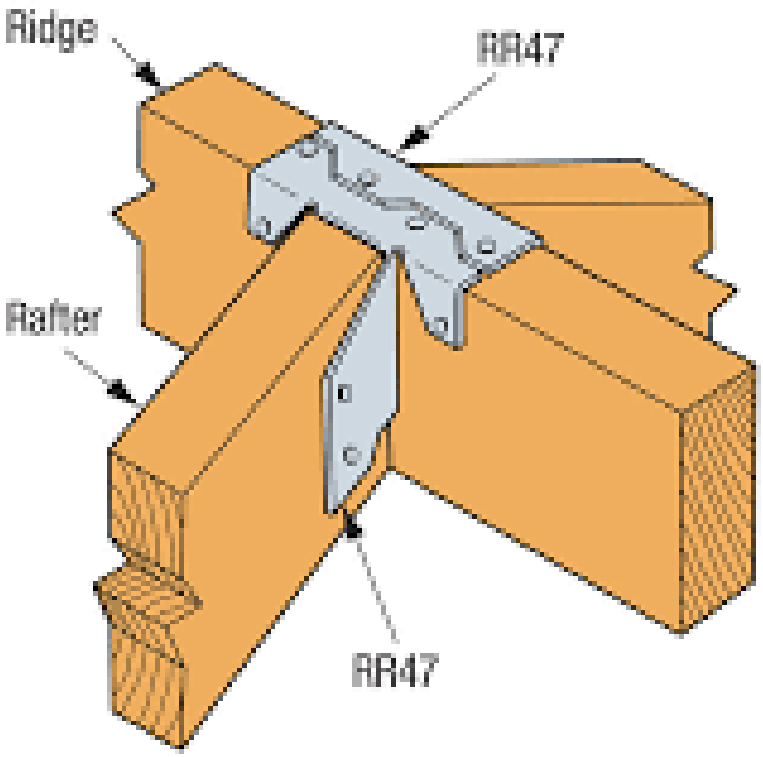






- If opposite
  - Collar ties, gusset plates or ridge strap
  - Nailed to top plate per Table 602.3.1

    Uplift protection per 802.11 – hurricane clips
  - Collar ties in upper $^{1}/_{3}$ of attic
  - Not less than a 1 x 4
  - Max 4’ on center
  - Ridge strap – no collar ties



SIMPSON Strong-Tie®
RR47 Ridge Rafter Connection

* Ridge beam
  - Required when not in compliance
  - Supported at ends with a wall, header or girder
* Roof truss systems do not require ridge boards or ridge beams
  - Truss uplift protection per 802.1 and Table 802.11
  - Truss layout plan and installation instructions

TC	FORCE	AXL	BND	CSI
1- 2	-2661	0.16	0.41	0.57
2- 3	-1826	0.02	0.45	0.48
3- 4	-1826	0.03	0.45	0.48
4- 5	-2663	0.16	0.42	0.57

BC	FORCE	AXL	BND	CSI
10- 9	2276	0.59	0.27	0.86
9- 8	2273	0.59	0.27	0.86
8- 7	2273	0.59	0.27	0.86
7- 6	2276	0.59	0.27	0.86

WEB	FORCE	WEB	FORCE
2- 9	177	4- 8	-871
2- 8	-871	4- 7	177
3- 8	983		

RHB = 1.16

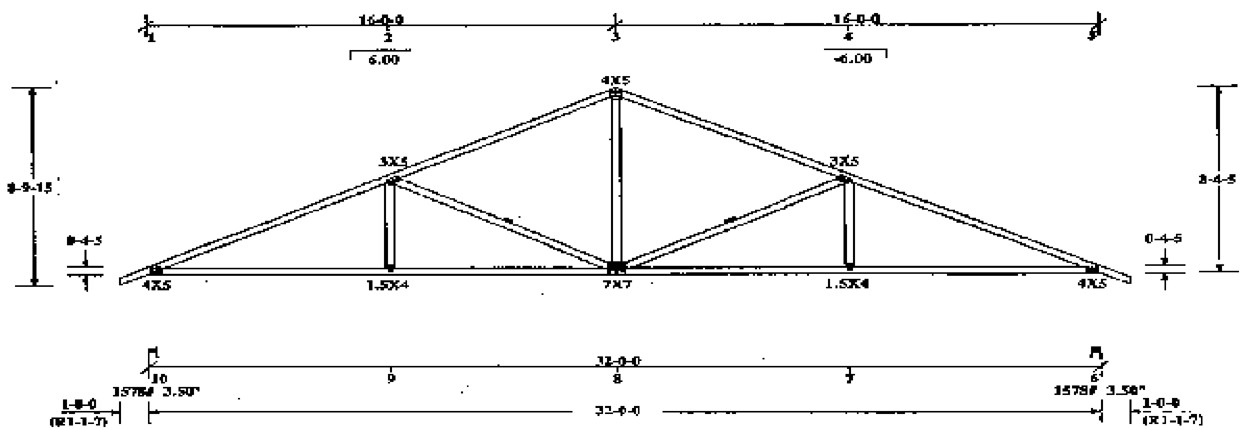
WO: TI: A23 QTY: 1

TOP CHORDS: 2x4 SP SS
BOT CHORDS: 2x4 SPF 1/2 GD
WEBS: 2x4 SP #3
All COMPRESSION Chords are assumed to be continuously braced unless noted otherwise.
MAX LIVE LOAD DEFLECTION : L/999
L=-0.14" D=-0.08" T=-0.21"

1X4 continuous lateral bracing attached with 2- 10d nails each member where shown. Bracing MUST be positioned to provide equal unbraced segments OR 2x4 "T" brace may be nailed flat to edge of web with 12d nails spaced 8" o.c. Brace must extend at least 90% of web length 2nd Brace required on any web exceeding 14'.

Joint Locations

1) 0- 0- 0	5) 32- 0- 0	9) 8- 3- 2	
2) 8- 3- 2	6) 32- 0- 0	10) 0- 0- 0	
3) 16- 0- 0	7) 23- 8-14		
4) 23- 8-14	8) 16- 0- 0		



EXCEPT AS SHOWN PLATES ARE TL20 GA TESTED PER ANSI/TPI 1-1995

scale = 0.1971

W.KOST
ROOF & FLOOR TRUSS SYSTEMS
(847) 428-0000 Fax (847) 428-0839

WARNING: READ ALL NOTES ON THIS SHEET.
A COPY OF THIS DRAWING TO BE GIVEN TO ERECTING CONTRACTOR.

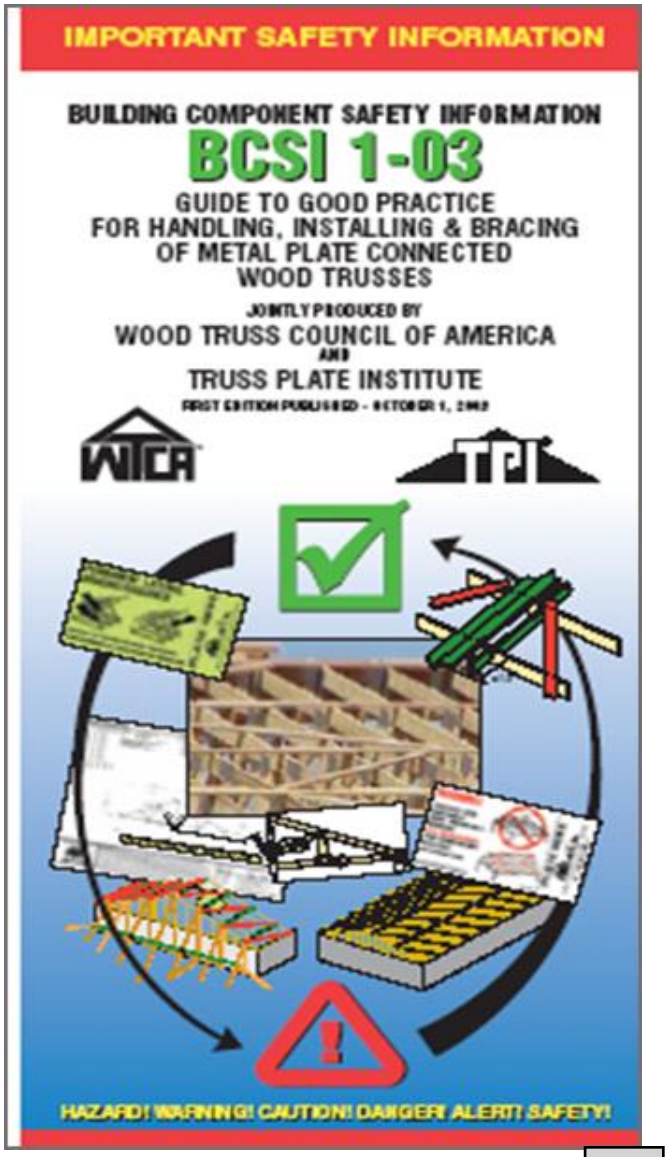
BRACING WARNING

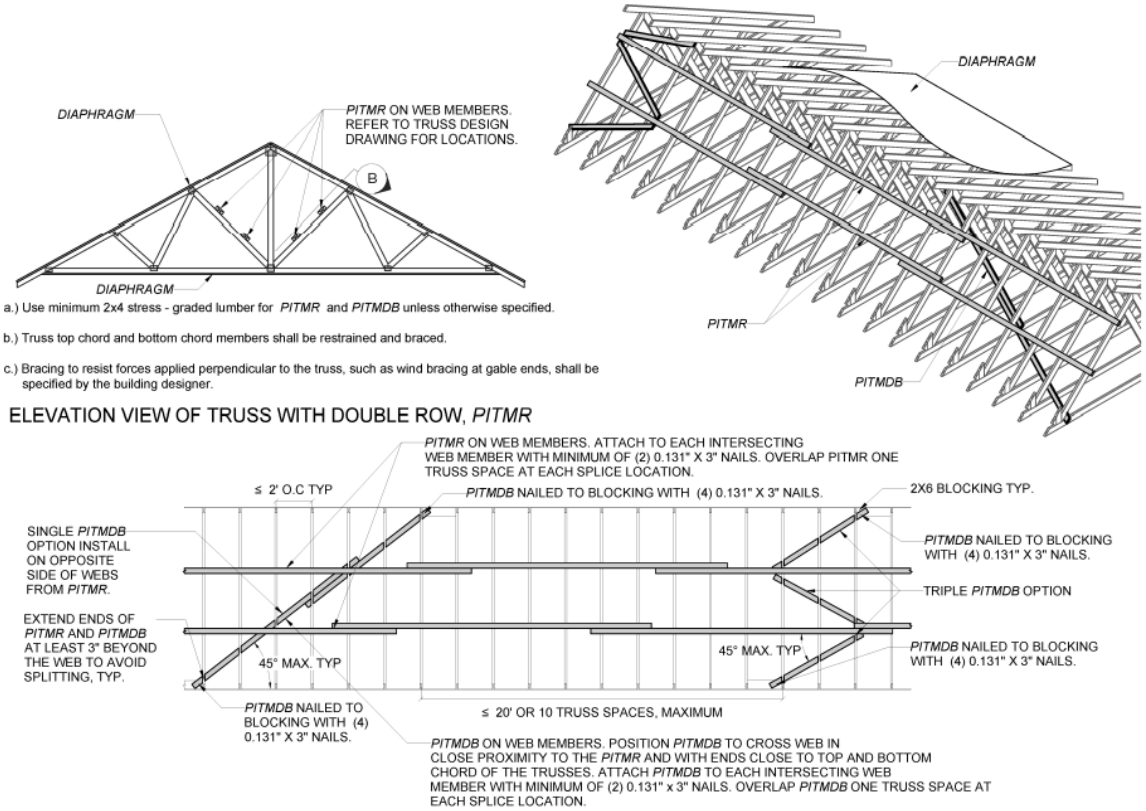
Eng. Job:
Dwg:
Degn: Chk:

TC Live	30.0	psf
TC Dead	7.0	psf
BC Live	0.0	psf
BC Dead	10.0	psf
TOTAL	47.0	psf

WO:
Truss ID: A23
Date: 3-29-96
DurFac - Lbr: 1.15
DurFac - Plt: 1.15
O.C. Spacing: 24.0"
Design Criteria: TPI
Code Desc:
V:02.14.96- 2647- 1

- Wood Truss 502.11
  - Wood truss bracing 502.11.2
  - Section references the current Guide for Truss Bracing (BCSI 1-03)





For SI:1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 2303.4.1.2(3)
PITMR AND PITMDB FOR TRUSS WEB MEMBERS REQUIRING TWO ROWS OF PITMR

See Figures 2303.4.1.2(2) 2303.4.1.2(3), 2303.4.2.2(4), 2303.4.1.2(5)


Ø701 1/2

TABLE 802.11
RAFTER OR TRUSS UPLIFT CONNECTION FORCES FROM WIND (ASD) (POUNDS PER CONNECTION)[a, b, c, d, e, f, g, h]

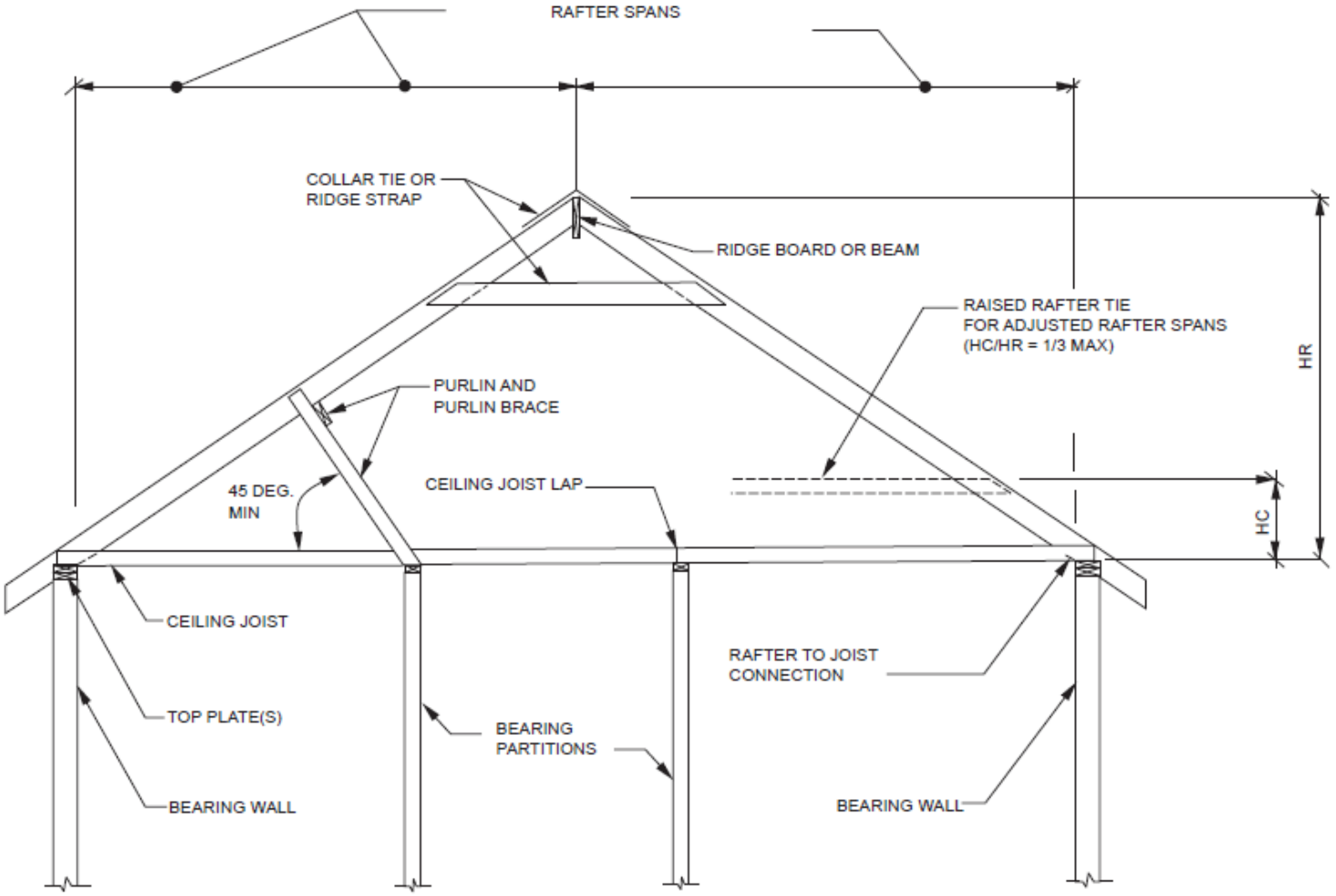
RAFTER OR TRUSS SPACING	ROOF SPAN (feet)	EXPOSURE B									
		Ultimate Design Wind Speed V_{ULT} (mph)									
		110		115		120		130		140	
		Roof Pitch		Roof Pitch		Roof Pitch		Roof Pitch		Roof Pitch	
		< 5:12	≥ 5:12	< 5:12	≥ 5:12	< 5:12	≥ 5:12	< 5:12	≥ 5:12	< 5:12	≥ 5:12
12″ o.c.	12	48	43	59	53	70	64	95	88	122	113
	18	59	52	74	66	89	81	122	112	157	146
	24	71	62	89	79	108	98	149	137	192	178
	28	79	69	99	88	121	109	167	153	216	200
	32	86	75	109	97	134	120	185	170	240	222
	36	94	82	120	106	146	132	203	186	264	244
	42	106	92	135	120	166	149	230	211	300	278
	48	118	102	151	134	185	166	258	236	336	311
16″ o.c.	12	64	57	78	70	93	85	126	117	162	150
	18	78	69	98	88	118	108	162	149	209	194
	24	94	82	118	105	144	130	198	182	255	237
	28	105	92	132	117	161	145	222	203	287	266
	32	114	100	145	129	178	160	246	226	319	295
	36	125	109	160	141	194	176	270	247	351	325
	42	141	122	180	160	221	198	306	281	399	370
	48	157	136	201	178	246	221	343	314	447	414
24″ o.c.	12	96	86	118	106	140	128	190	176	244	226
	18	118	104	148	132	178	162	244	224	314	292
	24	142	124	178	158	216	196	298	274	384	356
	28	158	138	198	176	242	218	334	306	432	400
	32	172	150	218	194	268	240	370	340	480	444
	36	188	164	240	212	292	264	406	372	528	488
	42	212	184	270	240	332	298	460	422	600	556
	48	236	204	302	268	370	332	516	472	672	622

(continued)

Roof Rafters

* Spacing and span per Tables – follow plan
* Nailed to top of wall per Table 602.3(1)
* Hips and Valleys
  - Minimum 2” nominal
  - Not less than the depth of the cut
  - Uplift protection

* Purlins can be used to reduce span
  - Equal in size to the rafters being supported
  - Down to a bearing point
  - 2 x 4 braces – maximum 4’ on center – maximum unbraced length 8’
  - Can create point loads



For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 degree = 0.018 rad.

H_C = Height of ceiling joists or rafter ties measured vertically above the top of rafter support walls.

H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

FIGURE 802.4.5
BRACED RAFTER CONSTRUCTION

* Rafter Cantilevers
  - Remaining rafter a minimum of $3\,{}^{1}/_{2}$”
  - Maximum length 24”
  - Maximum depth of cut D/4

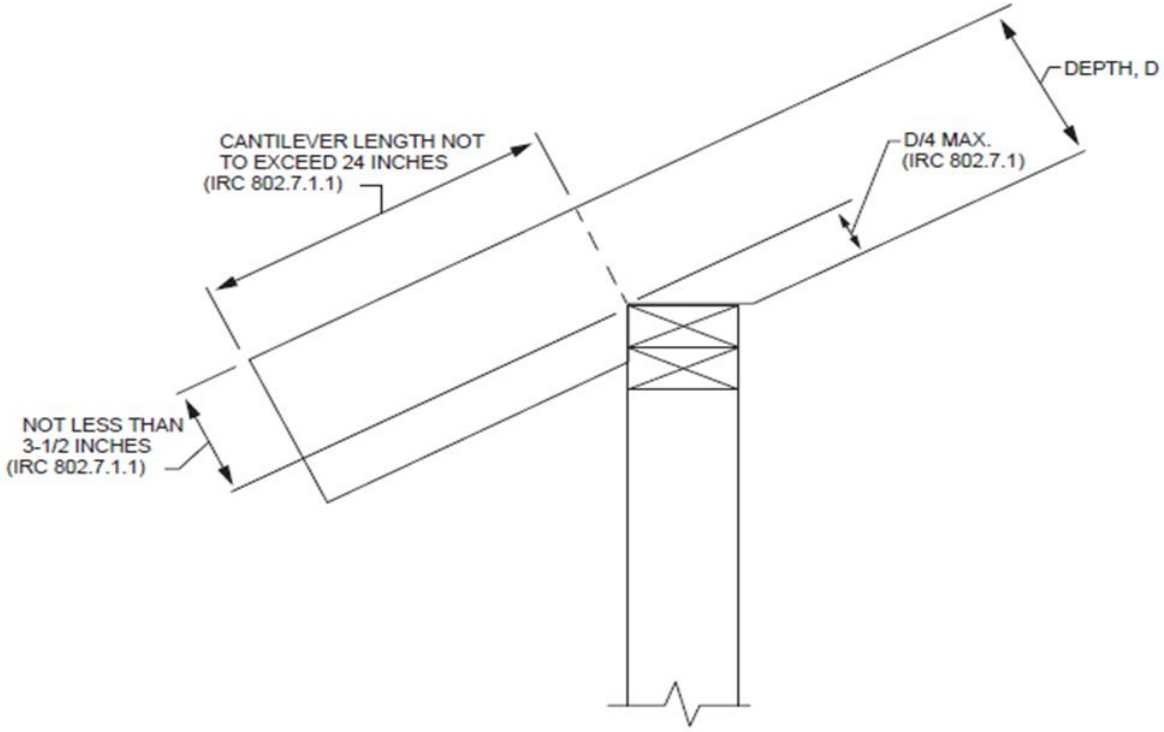


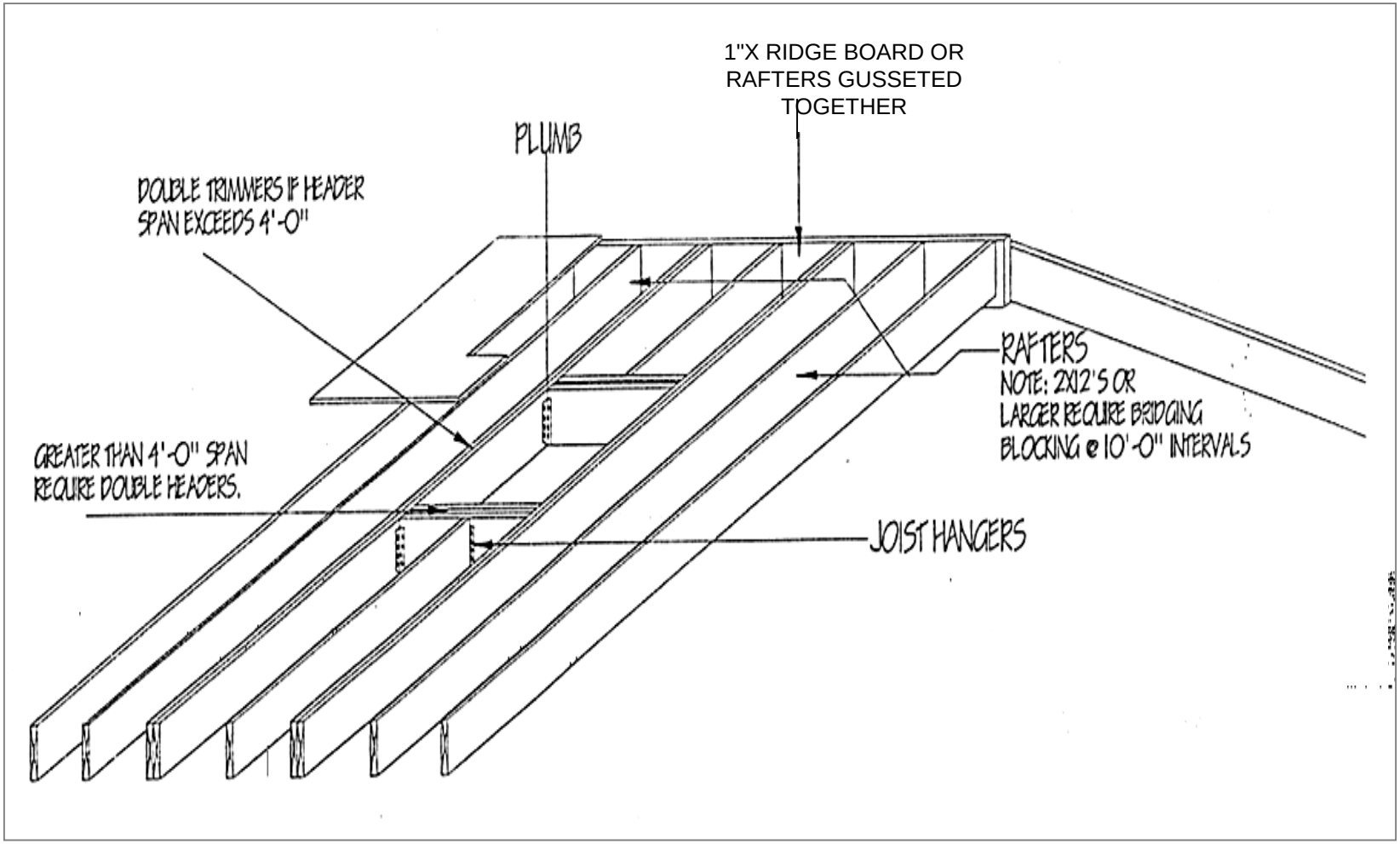
FIGURE 802.7.1.1
RAFTER NOTCH

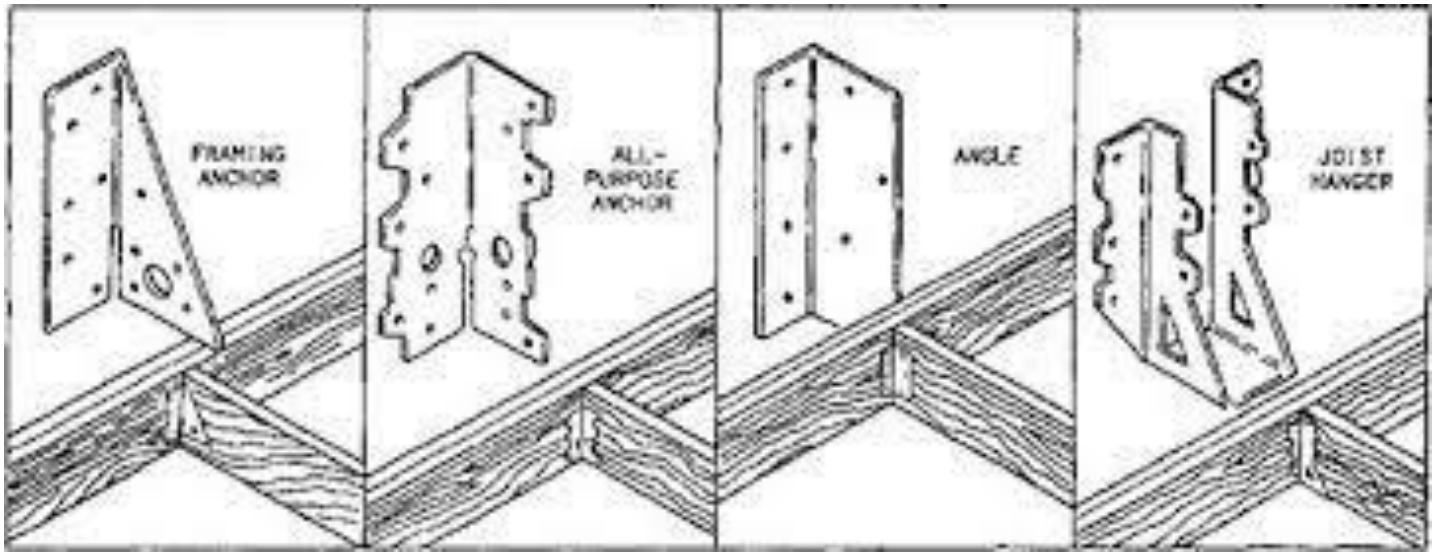
* Openings in roof
  - Applies to roof rafters and ceiling joists
  - Headers and trimmers
    - Headers less than 4’ can be single – same size as member
    - Single trimmers – single if less than 3’ from bearing
    - Span exceeds 4’ - double up trimmer and header
    - Header exceeds 6’ connection header to trimmer use joist hangers
    - Tail joist over 12’

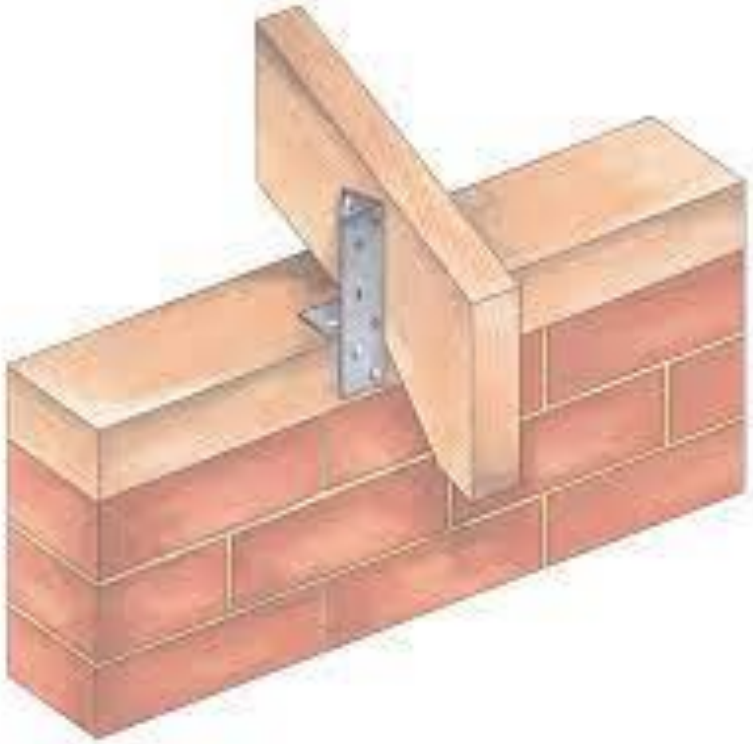
      Supported at header by framing anchors or 2 x 2 ledger

      Cutting, notches, and boring – same as floors

* Sheathing
  - Proper rating


1"X RIDGE BOARD OR
RAFTERS GUSSETED
TOGETHER
PLUMB
DOUBLE TRIMMERS IF HEADER
SPAN EXCEEDS 4'-0"
RAFTERS
NOTE: 2X12'S OR
LARGER REQUIRE BRIDGING
BLOCKING @ 10'-0" INTERVALS
GREATER THAN 4'-0" SPAN
REQUIRE DOUBLE HEADERS.
JOIST HANGERS

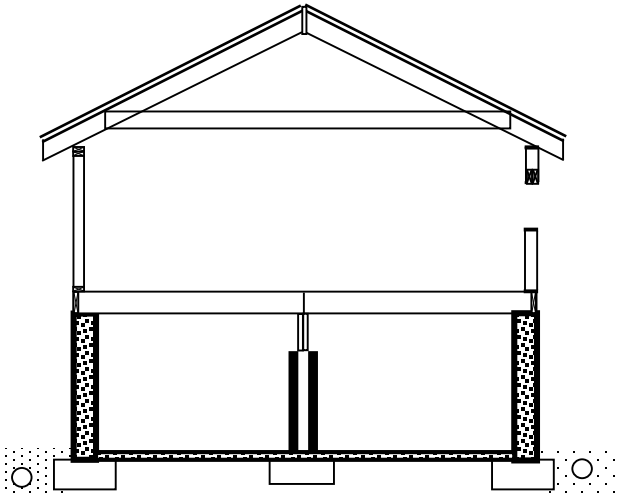

FRAMING ANCHOR
ALL-PURPOSE ANCHOR
ANGLE
JOIST HANGER

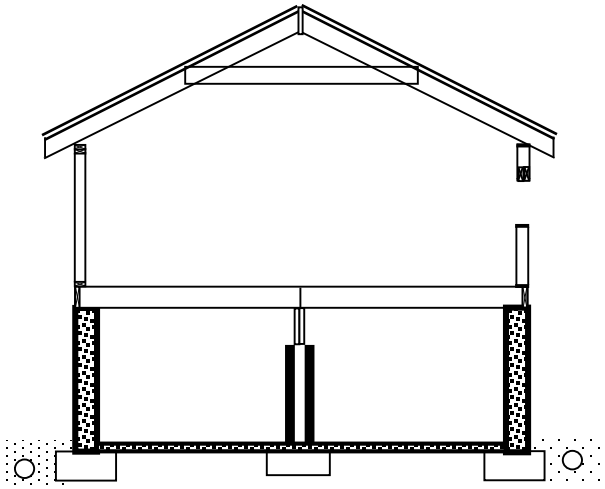


Ceiling joists			
		Spacing, size	
		Location	
		Fastening	
		Openings	
		Cutting, notching, boring	
		Lateral support	
		Bridging	
Trusses		Roof rafter/ceilingjoist	

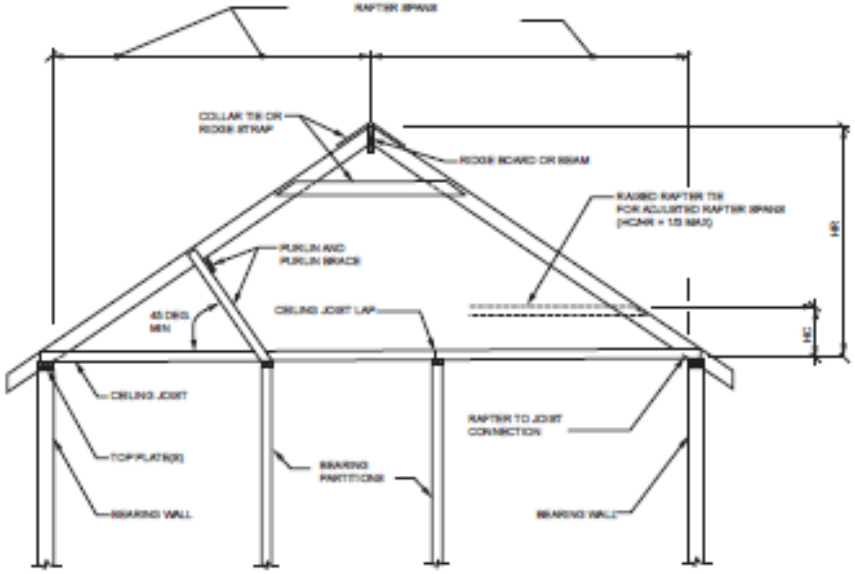
Ceiling Joist

- Spacing and span per Tables – follow plan
- Parallel to rafters
  - Connected to wall per Table 802.5.2
  - Bottom third of rafter – not connected at wall
    - Per Figure 802.4.5 and Table 802.5.2
  - Above bottom third – ridge board is designed as a beam





Ridge is a beam



For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 degree = 0.018 rad.

H_C = Height of ceiling joists or rafter ties measured vertically above the top of rafter support walls.

H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

FIGURE 802.4.5
BRACED RAFTER CONSTRUCTION

* Nailed to top of wall per Table 602.3(1)
* Check for interior bearing walls
* Overlap at bearing (walls or beams) minimum of 3”
  - Top nailed
  - Minimum bearing $1\ ^{1}/_{2}$” for wood
* Openings same as roof rafters
* Cutting, notches and boring same as floor joists

* Lateral support
  - Applies to roof rafters and ceiling joists
  - Exceeding 5 to 1 (2 x 10)
  - At bearing points
  - At ceiling joists and rafters use combined thickness if attached
* Bridging required when exceed 6 to 1 (2 x 12) or larger
  - Applies to roof rafters and ceiling joists
  - At maximum 8’ intervals
  - Solid bridging or 1 x 3 diagonal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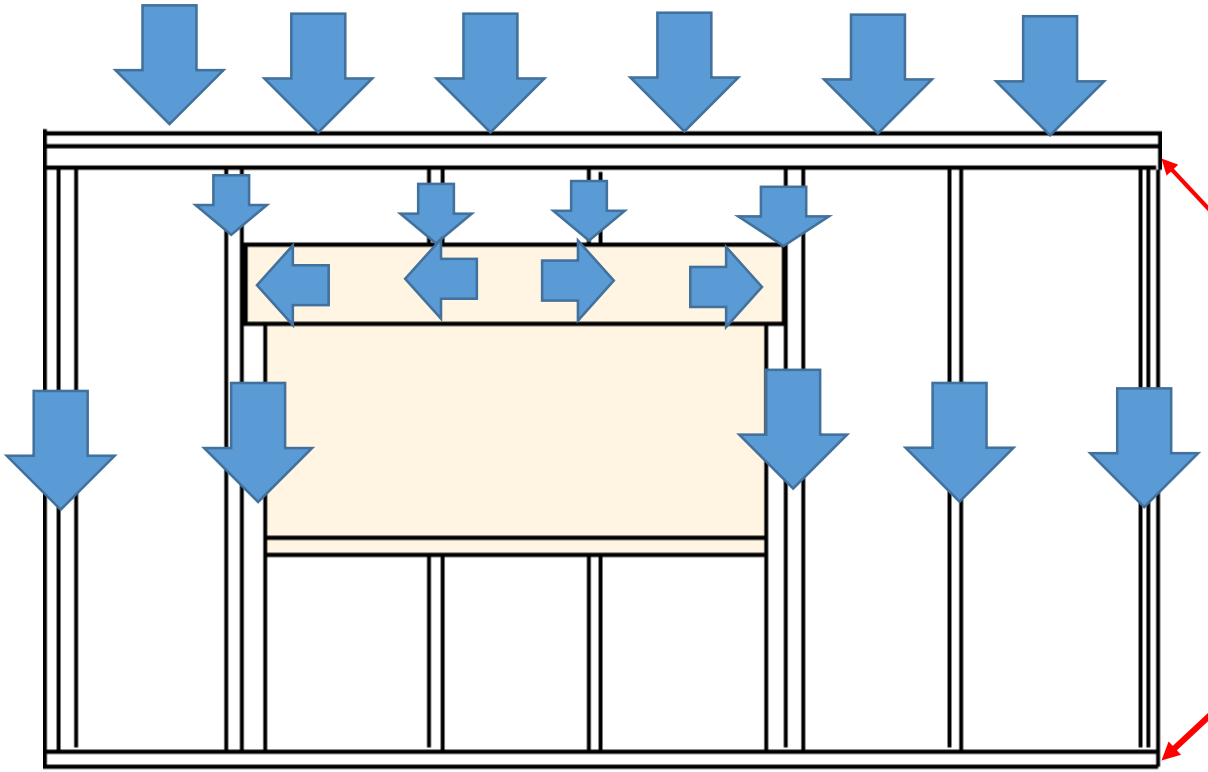
- Trusses
  - Combined roof rafters and ceiling jist
  - Per layout plan
    - Includes bracing

Exterior walls/ load bearing walls			
		Fastening	
		Plates	
		Double top, single bottom	
		Size	
		Over lap top plates	
		Headers	
		Number of jack studs	
		Studs	
		Spacing and size	

- Exterior Walls and Load Bearing Walls
  - Fastened per Table 602.3(1) – 602.3(4)
  - Continuous from sole (bottom) plate to top plate

TABLE 602.3(1)
FASTENING SCHEDULE

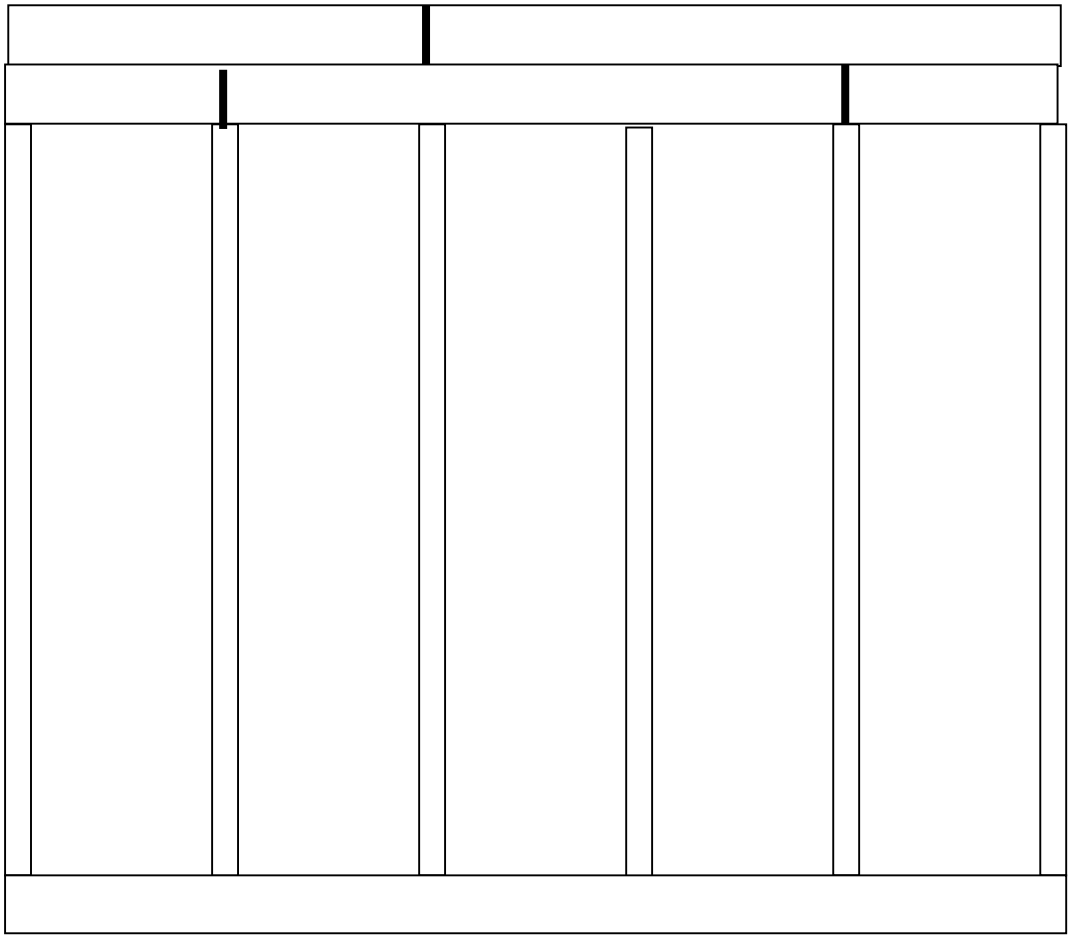
ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER[a, b, c]	SPACING AND LOCATION
		Roof	
1	Blocking between ceiling joists or rafters to top plate	4-8d box ($2^1/_2$″ × 0.113″) or 3-8d common ($2^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Toe nail
2	Ceiling joists to top plate	4-8d box ($2^1/_2$″ × 0.113″); or 3-8d common ($2^1/_2$″ × 0.131″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions (see Section 802.5.2 and Table 802.5.2)	4-10d box (3″ × 0.128″); or 3-16d common ($3^1/_2$″ × 0.162″); or 4-3″ × 0.131″ nails	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) (see Section 802.5.2 and Table 802.5.2)	Table 802.5.2	Face nail
5	Collar tie to rafter, face nail or $1^1/_4$″ × 20 ga. ridge strap to rafter	4-10d box (3″ × 0.128″); or 3-10d common (3″ × 0.148″); or 4-3″ × 0.131″ nails	Face nail each rafter
6	Rafter or roof truss to plate	3-16d box nails ($3^1/_2$″ × 0.135″); or 3-10d common nails (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss[i]
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2″ ridge beam	4-16d ($3^1/_2$″ × 0.135″); or 3-10d common (3″ × 0.148″); or 4-10d box (3″ × 0.128″); or 4-3″ × 0.131″ nails	Toe nail
		3-16d box $3^1/_2$″ × 0.135″); or 2-16d common ($3^1/_2$″ × 0.162″); or 3-10d box (3″ × 0.128″); or 3-3″ × 0.131″ nails	End nail



Top plate overlapped at corners and intersection of bearing partitions

Minimum 2 feet overlap between joints

* Top plates – double for exterior and bearing walls

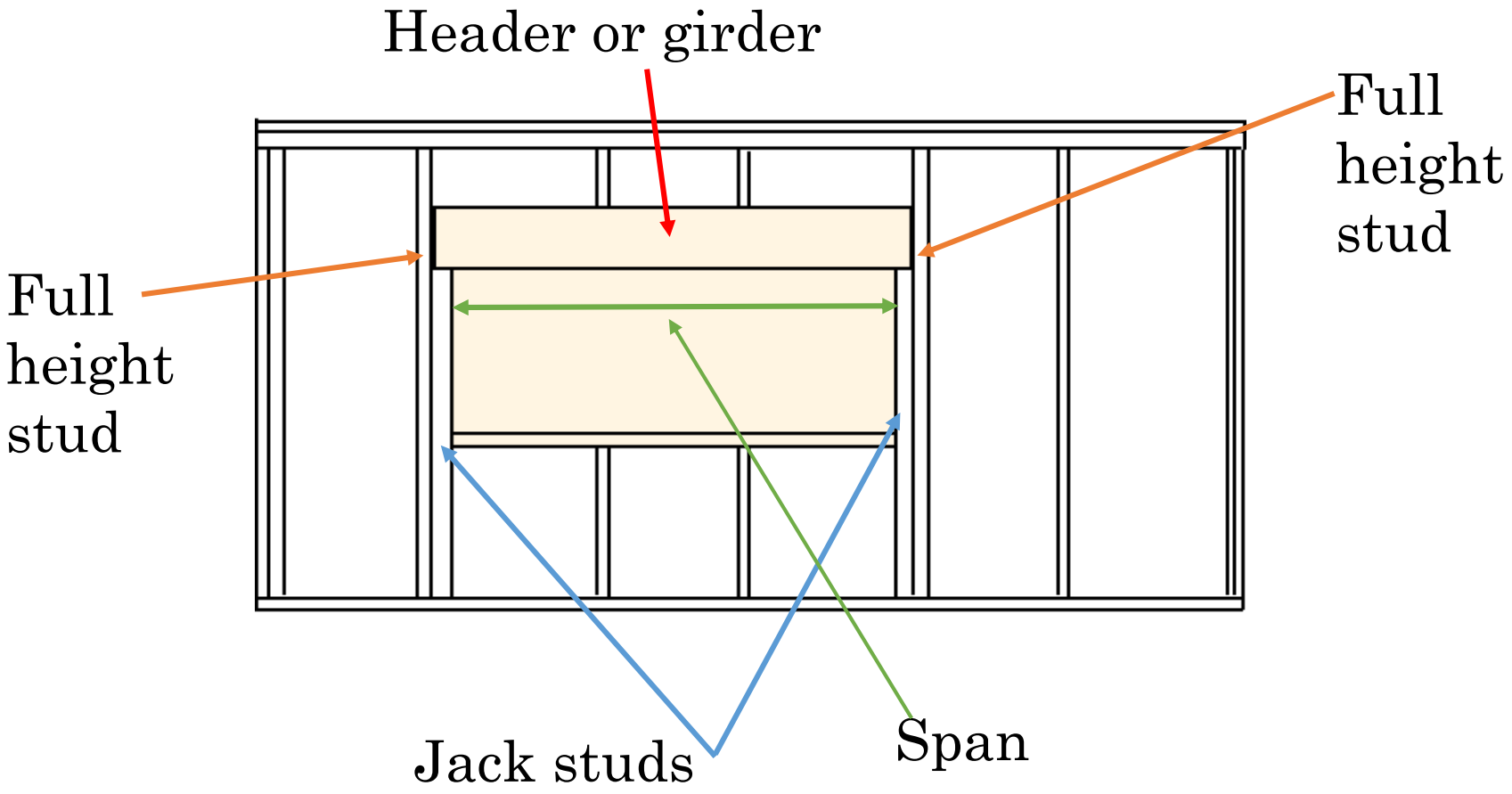


Overlapped at corners and at partitions

Top plate ends offset 48 inches

Eight 16d on each side of offset

Minimum 2 inches in depth width equal to studs



* Size of header or girder per Table 602.7(1)
  - Number of jack studs per same table
  - Full height stud on each end
  - Minimum number of full height studs per Table 602.7.5
  - End nail into header

TABLE 602.7.5
MINIMUM NUMBER OF FULL-HEIGHT STUDS AT EACH END OF HEADERS IN EXTERIOR WALLS[a]

MAXIMUM HEADER SPAN (feet)	ULTIMATE DESIGN WIND SPEED AND EXPOSURE CATEGORY	
	< 140 mph, Exposure B or < 130 mph, Exposure C	≤115 mph, Exposure B[b]
4	1	1
6	2	1
8	2	1
10	3	2
12	3	2
14	3	2
16	4	2
18	4	2

For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

a. For header spans between those given, use the minimum number of full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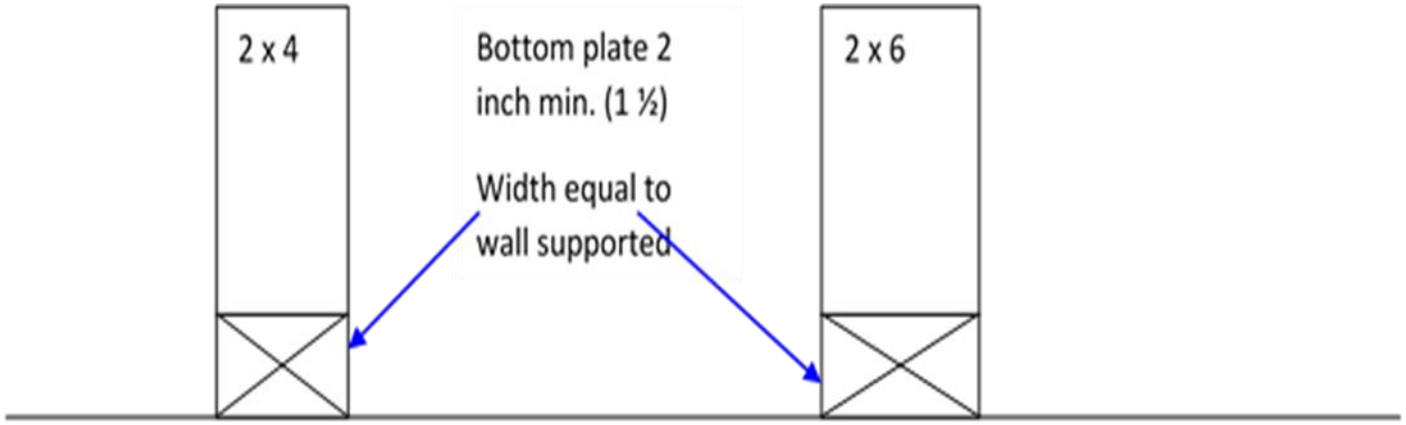
* Stud grade
  - Minimum #3, standard stud grade
  - Exception – Not supporting floor can be utility grade
* Plate and stud same size



* Stud size and spacing
  - Per Table 602.3(5)

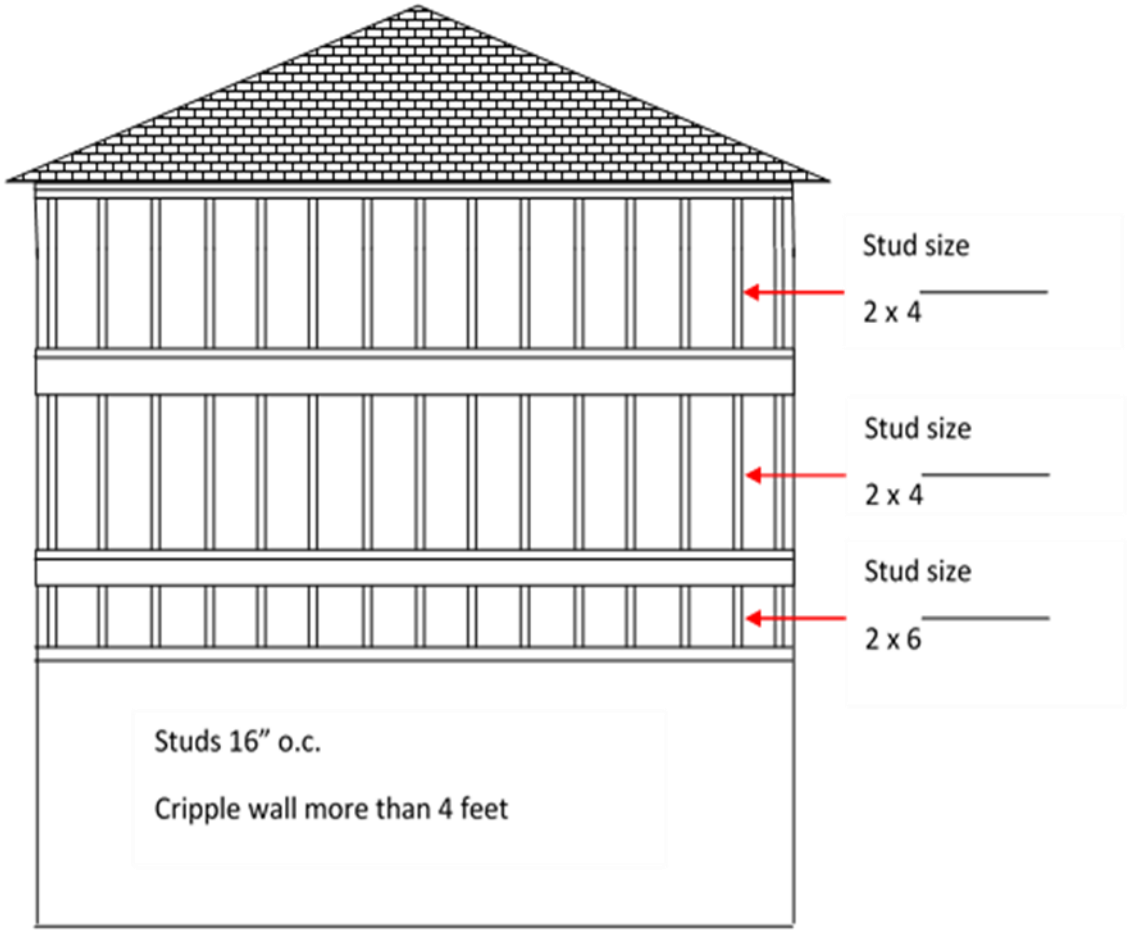
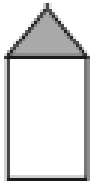
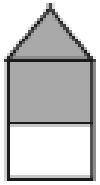
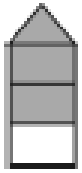
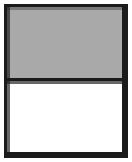


TABLE 602.3(5)
SIZE, HEIGHT AND SPACING OF WOOD STUDS[a]

STUD SIZE (Inches)	BEARING WALLS					NONBEARING WALLS	
	Laterally unsupported stud height[a] (feet)	Maximum spacing where supporting a roof-ceiling assembly or a habitable attic assembly, only (inches)	Maximum spacing where supporting one floor, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Maximum spacing where supporting two floors, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Maximum spacing where supporting one floor height[a] (inches)	Laterally unsupported stud height[a] (feet)	Maximum spacing (inches)
							
2 × 3[b]	—	—	—	—	—	10	16
2 × 4	10	24[c]	16[c]	—	24	14	24
3 × 4	10	24	24	16	24	14	24
2 × 5	10	24	24	—	24	16	24
2 × 6	10	24	24	16	24	20	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Bearing walls shall be sheathed on not less than one side or bridging shall be installed not greater than 4 feet apart measured vertically from either end of the stud. Increases in unsupported height are permitted where in compliance with Exception 2 of Section 602.3.1 or designed in accordance with accepted engineering practice.

b. Shall not be used in exterior walls.

c. A habitable attic assembly supported by 2 × 4 studs is limited to a roof span of 32 feet. Where the roof span exceeds 32 feet, the wall studs shall be increased to 2 × 6 or the studs shall be designed in accordance with accepted engineering practice.

Int nonloading bearing			
		Size, spacing	
		Plates	

Interior Nonbearing Walls

- 2 x 3 – 24” on center
- Not part of a braced wall line
  - 2 x 4 flat
  - Spaced 16” on center
- Single top plate

Cutting, notches, boring			
		Cutting, notches, boring	
		Walls	
		Top plate	

Cutting, Notching and Boring

* Drilling and notching of studs – cut or notched studs R602.6
  - Exterior walls and bearing interior partitions
  - Notching
    - Bearing ≤25% of width
    - Nonbearing ≤40% of single stud width
    - Bearing 2 x 4 X 25% = $^{7}/_{8}$” maximum
    - Bearing 2 x 6 X 25% = $1\,^{3}/_{8}$”
    - Nonbearing 2 x 4 X 40% = $1\,^{3}/_{8}$” maximum
    - Nonbearing 2 x 6 X 40% = $^{2}/_{16}$” maximum

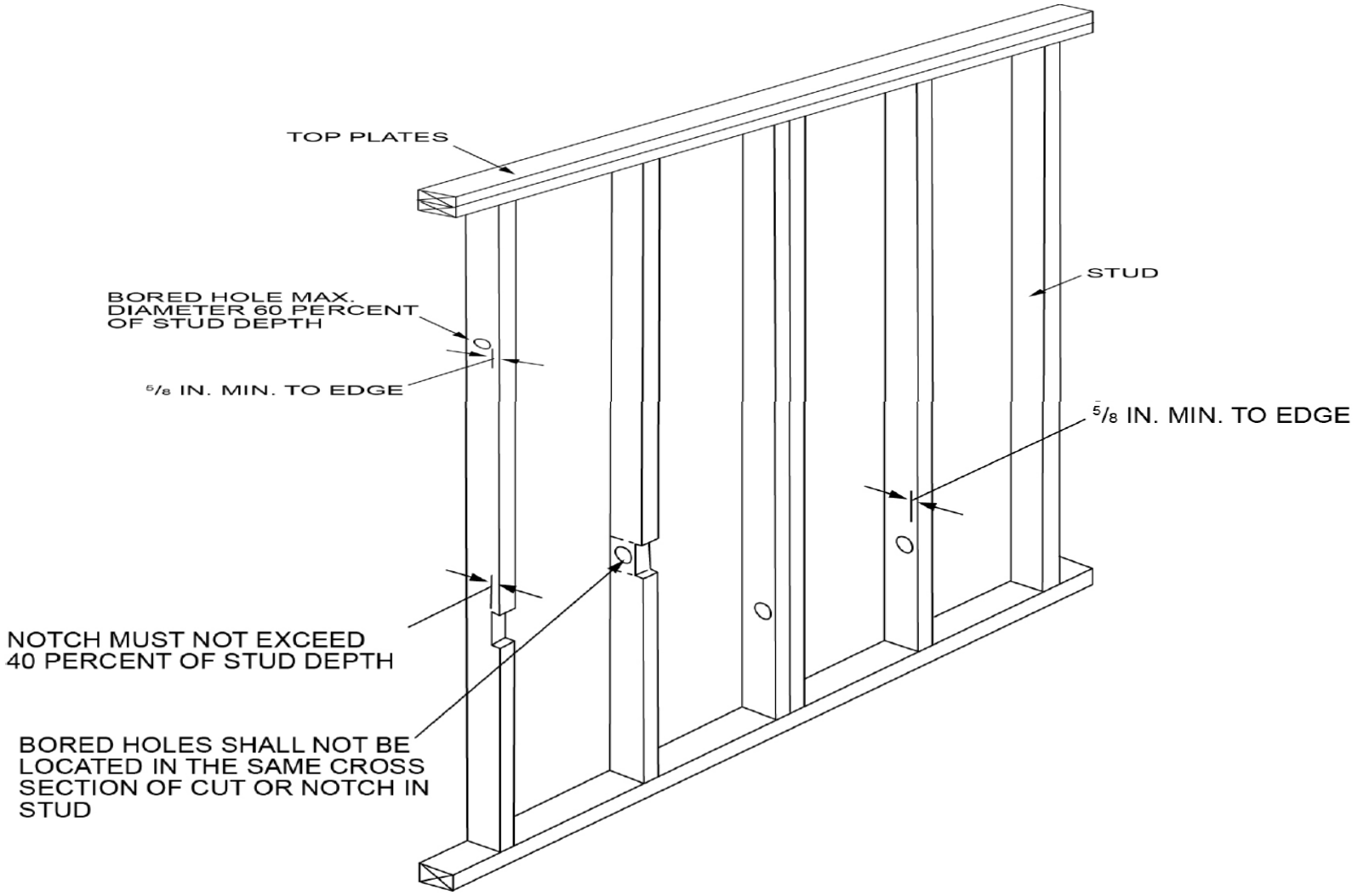
- Boring
  - ≤60% and no closer than $^{5}/_{8}$” from edge (nonbearing)
  - Exterior walls or bearing walls
  - ≥40% and no closer than $^{5}/_{8}$” from edge
  - Double the studs - not more than 2 successive studs
  - Except approved stud shoes installed per manufacturer

    2 x 4 X 60% = $2\,^{1}/_{8}$” (nonbearing)

    2 x 6 X 60% = $3\,^{3}/_{8}$” (nonbearing)

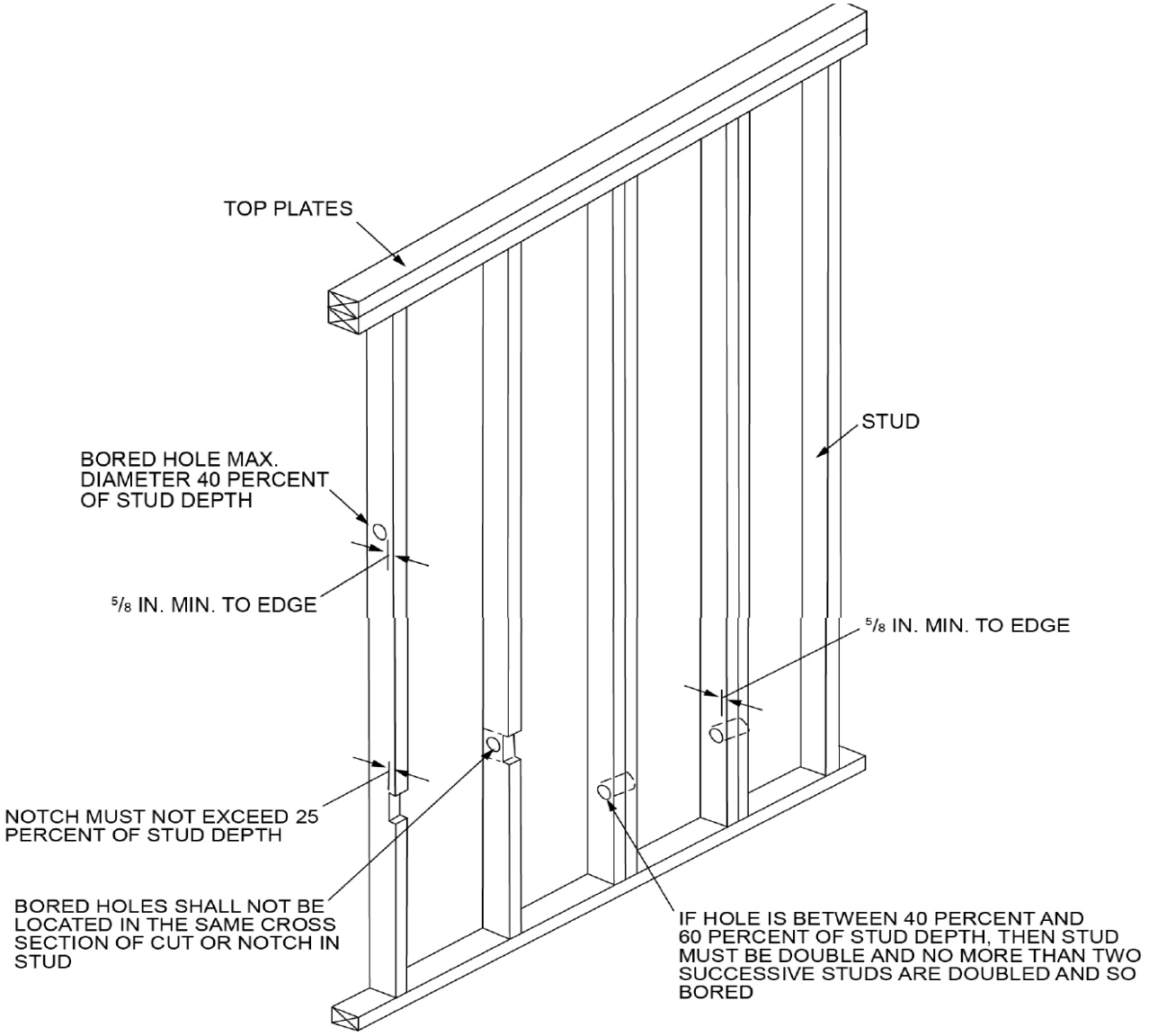
    2 x 4 X 40% = $1\,^{3}/_{8}$” (bearing)

    2 x 6 X 40% = $2\,^{3}/_{16}$” (bearing)



For SI: 1 inch = 25.4 mm.

FIGURE R602.6(2)
NOTCHING AND BORED HOLE LIMITATIONS FOR INTERIOR NONBEARING WALLS

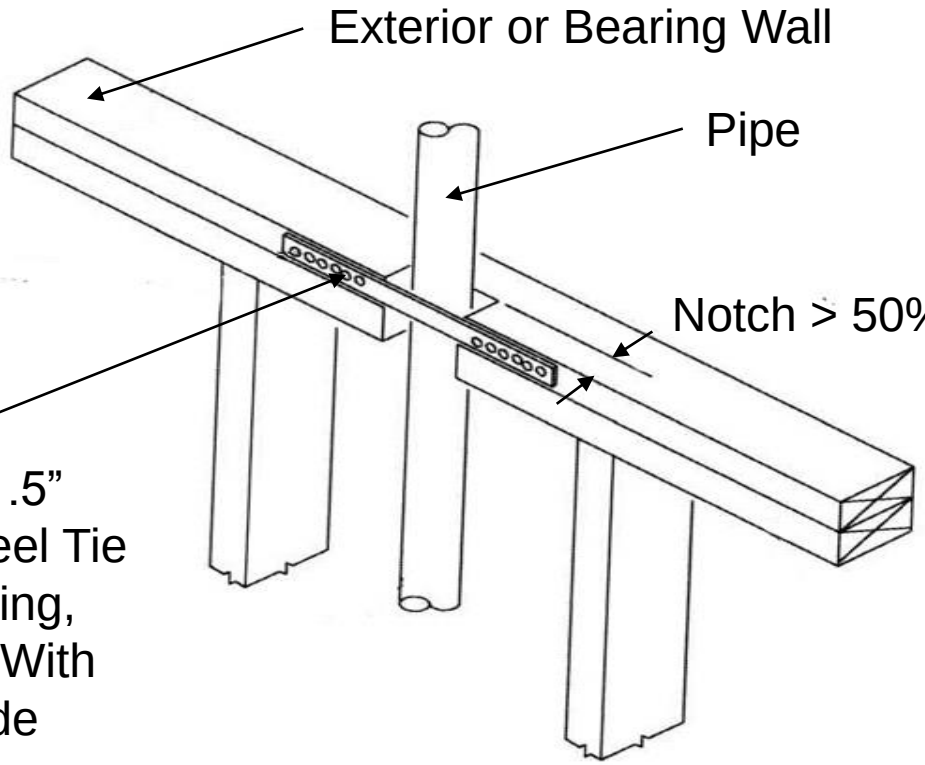


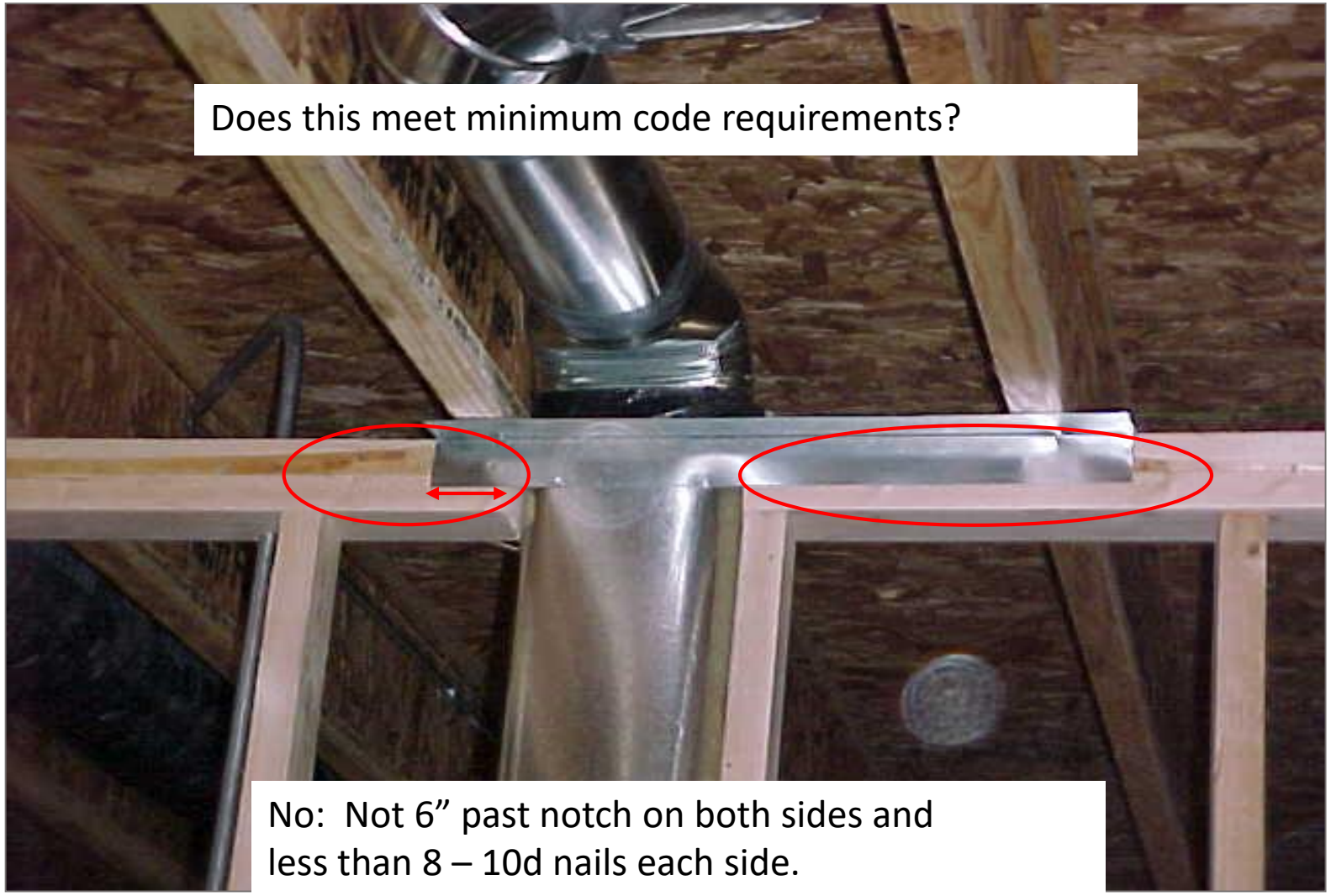
For SI: 1 inch = 25.4 mm.

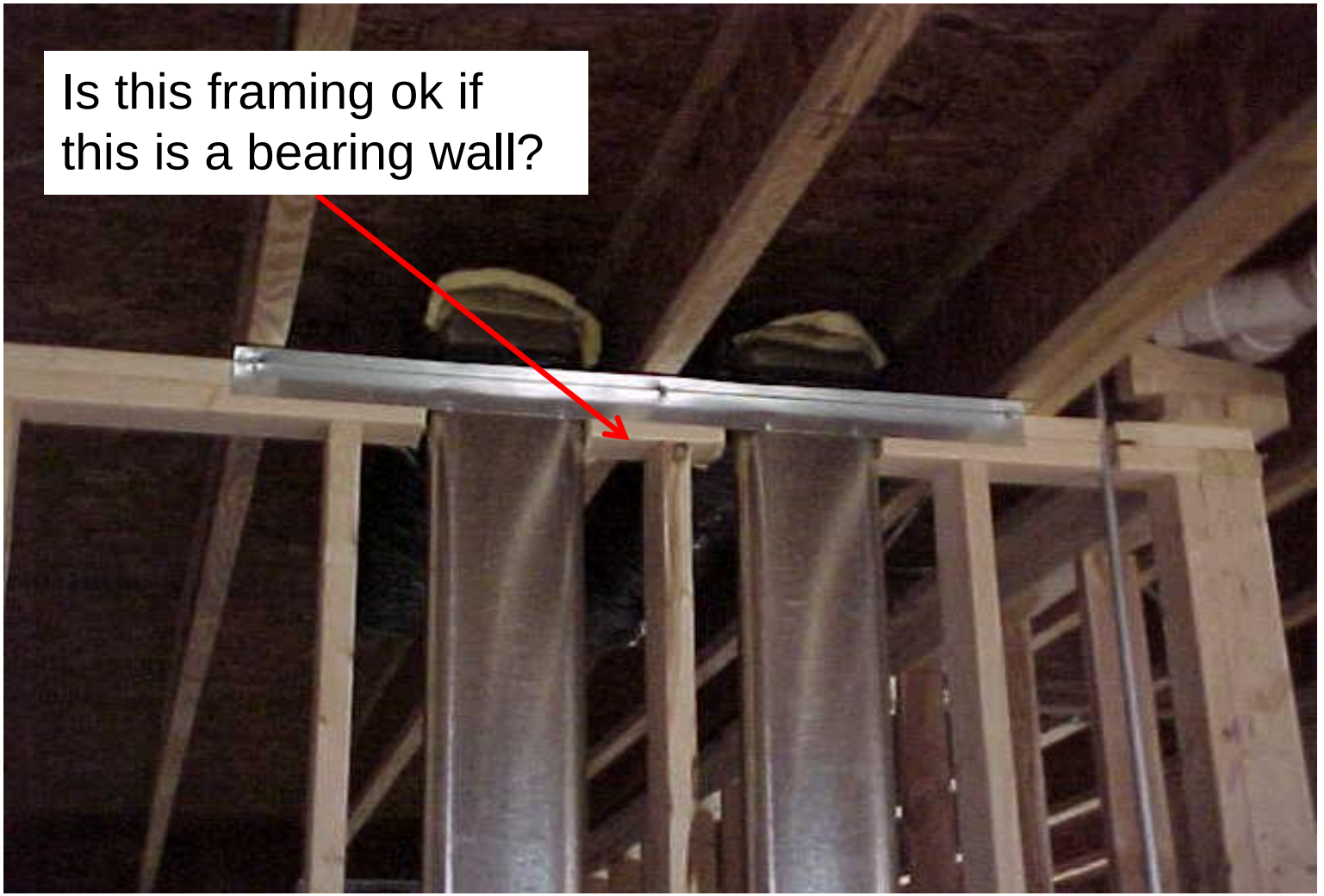
Note: Condition for exterior and bearing walls.

FIGURE R602.6(1)
NOTCHING AND BORED HOLE LIMITATIONS FOR EXTERIOR WALLS AND BEARING WALLS

* Drilling and notching top plate R602.6.1
  - Exterior wall or bearing interior wall
  - IF: Notched or bored > 50% of top plate width
  - THEN: Install a 0.054” thick galvanized metal strap
    - Minimum 6” past the opening with minimum
    - Use 8 10d mails (min $1\,{}^{1}/_{2}$” long) and 0.148 diameter on side
  - 2 x 4 top plate = $1\,{}^{7}/_{8}$”
  - 2 x 6 top plate = $2\,{}^{1}/_{4}$”

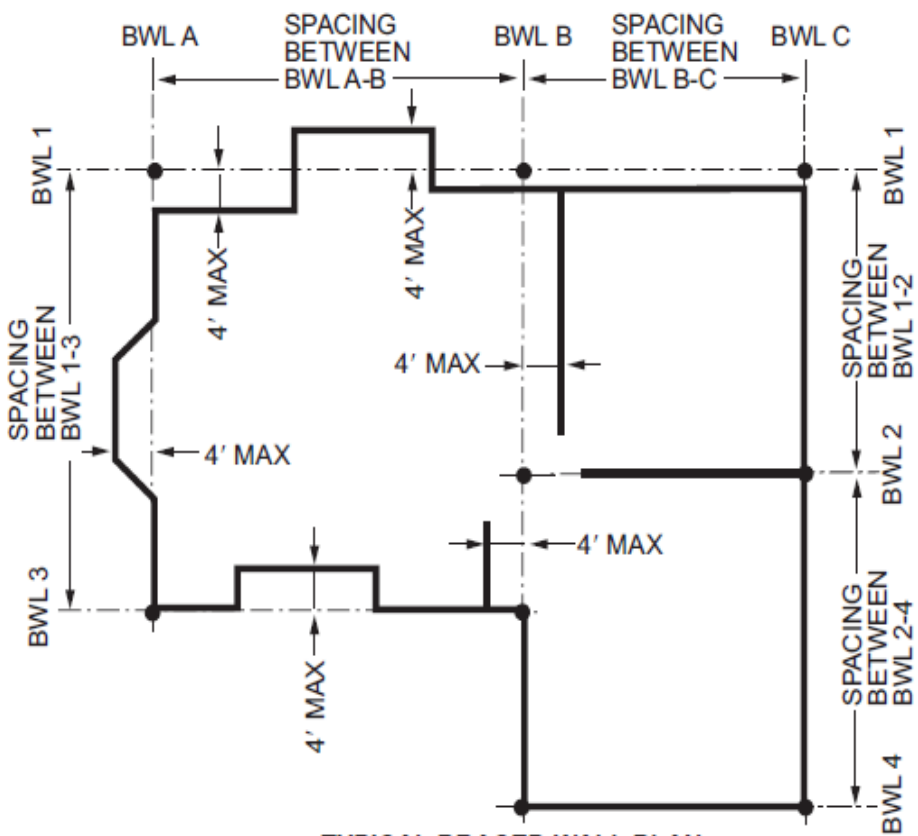

Exterior or Bearing Wall
Pipe
Notch > 50% of Top Plate Width
16 Gage (0.054”) x 1.5” Wide Galvanized Steel Tie Placed Across Opening, Fasten To Top Plate With 8-10d Nails Each Side


Does this meet minimum code requirements?
No: Not 6” past notch on both sides and less than 8 – 10d nails each side.

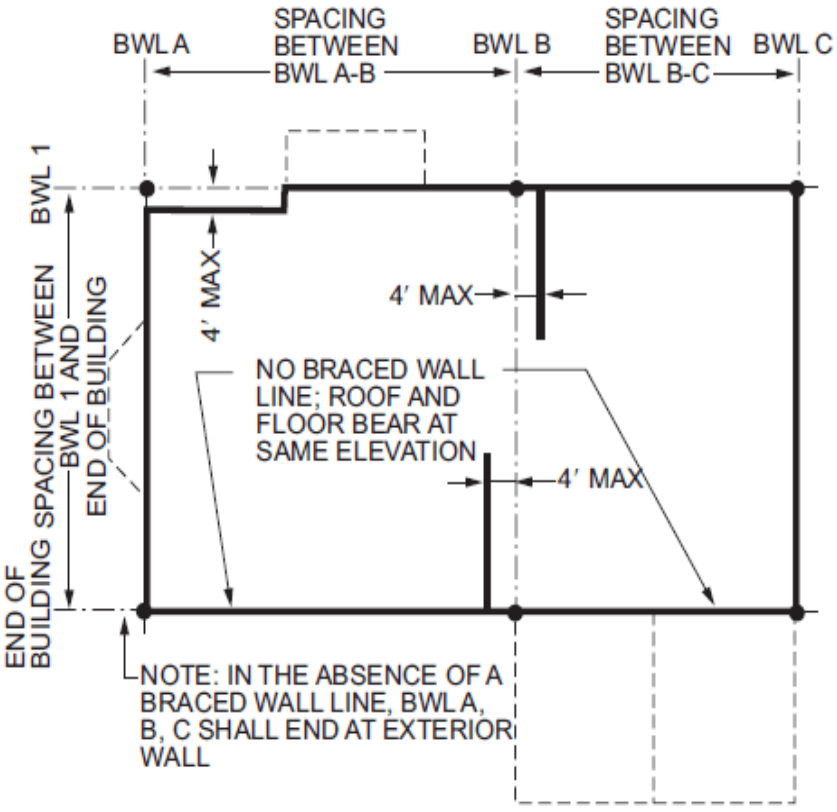

Is this framing ok if
this is a bearing wall?

		Top plate	
Wall bracing			
		Wall line number and spacing	
		Panel type	
		Panel location	
		Connections	
Misc wall issues			

- Wall Bracing
  - Understand the difference between
    - Braced wall line and braced wall panels



TYPICAL BRACED WALL PLAN



TYPICAL UPPER FLOOR BRACED WALL PLAN

For SI: 1 foot = 304.8 mm.

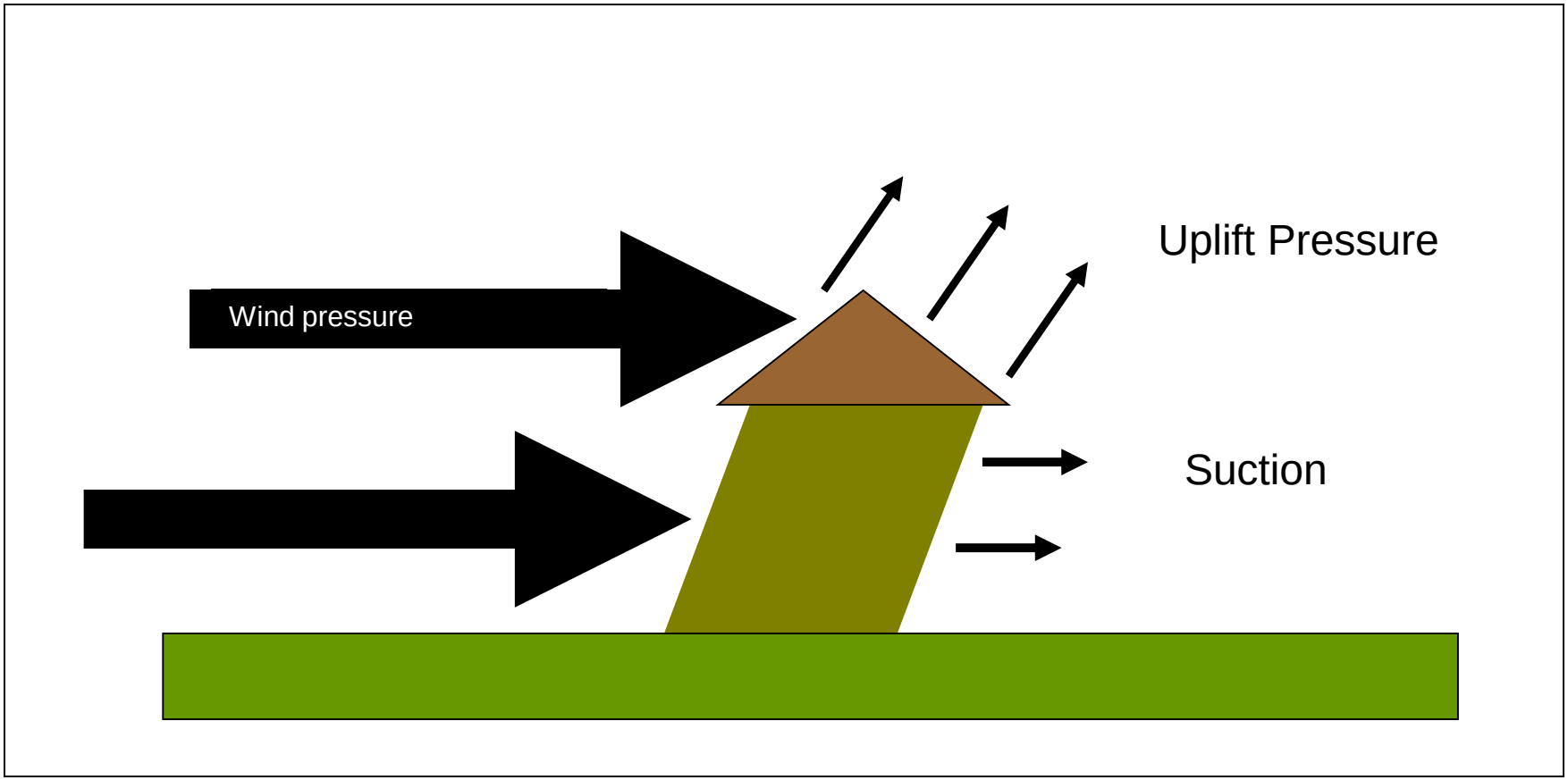
FIGURE 602.10.1.1
BRACED WALL LINES

Wall Bracing

* Consult the wall bracing plan to determine
  - Location of the braced wall lines
  - Type of wall bracing panels
  - Length of the braced wall panels
  - Spacing of braced wall panels
  - Nailing pattern for braced panels
  - Connection of braced wall panel to the floor and ceiling assemblies

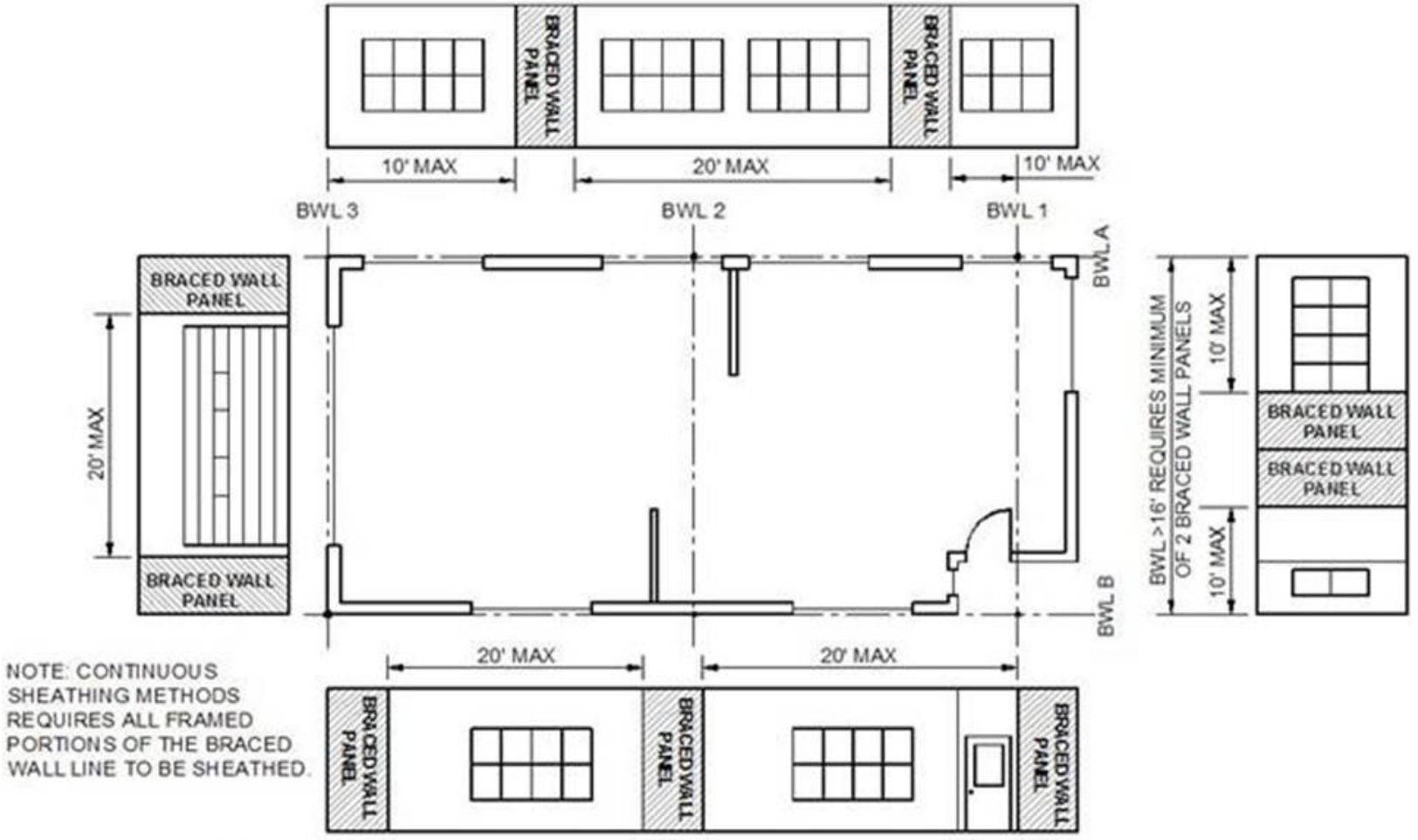
Lateral Forces on Buildings

* Wind




Rboard
Rboard
Rboard
Rboard
Rboard
Rboard

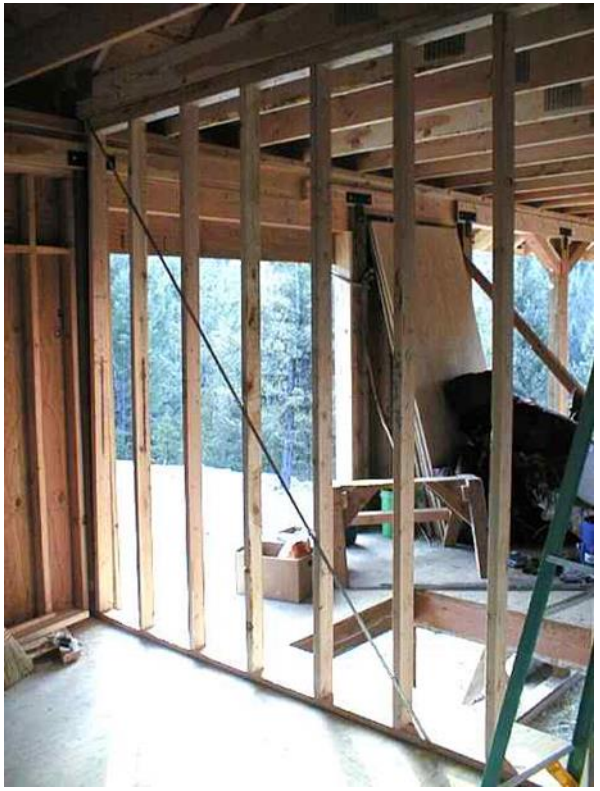
- Locations of braced wall panels R602.10.2.2
  - Must have a braced wall panel within 10’ of the end of a braced wall line
  - Maximum braced wall panel spaces is 20’ measured between adjacent edges
- Choices for braced wall panels, shown on braced wall plan



NOTE: CONTINUOUS SHEATHING METHODS REQUIRES ALL FRAMED PORTIONS OF THE BRACED WALL LINE TO BE SHEATHED.

Method LIB (Let-in Bracing)

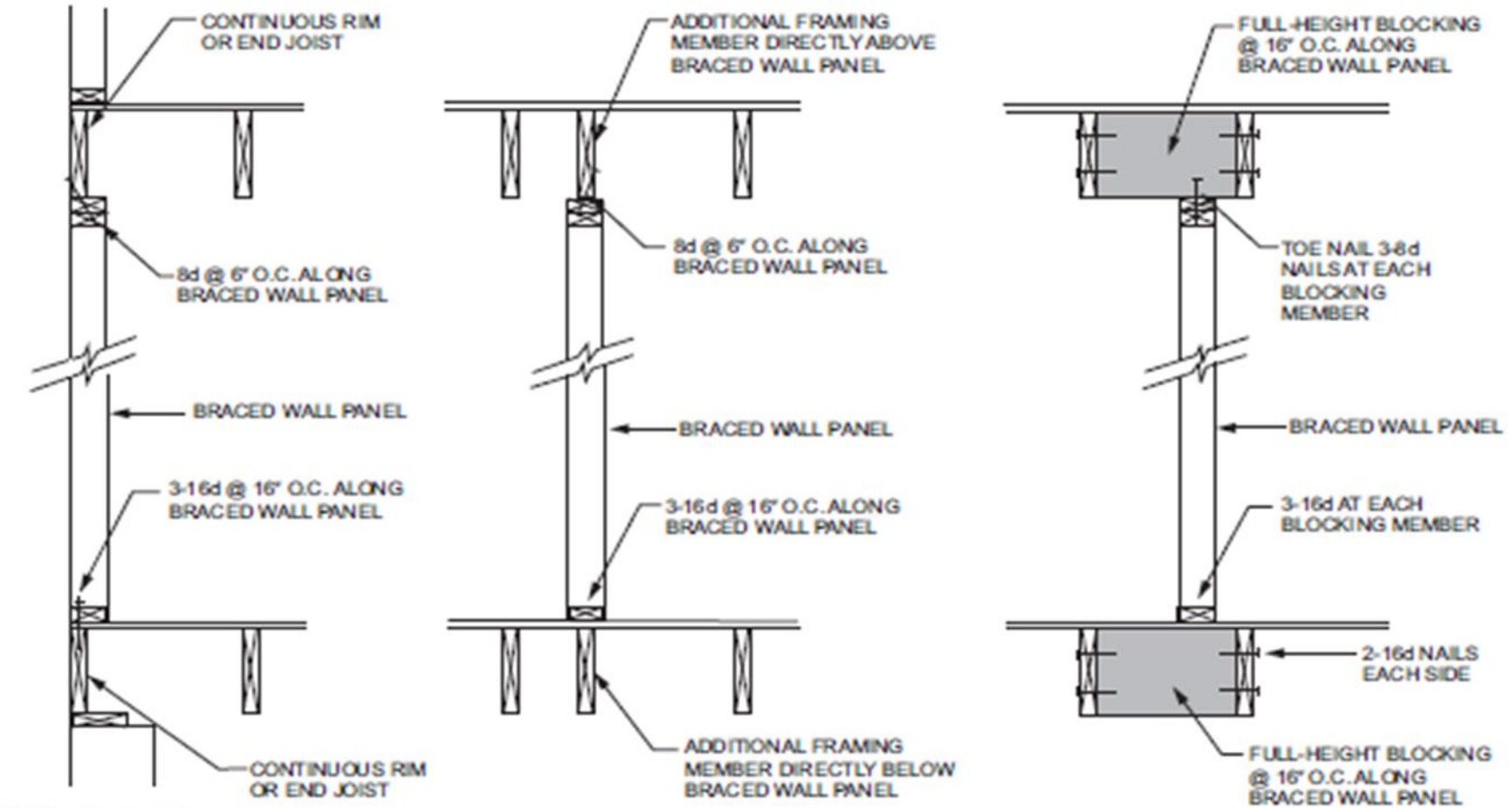
* Intermittent bracing methods Table R602.10.4
  - 1 x 4 or metal strap at 45 to 60° angle for studs 16” on center



- Method WSP (Wood Structural Panel)
  - Intermittent bracing methods Table R602.10.4
    - Minimum thickness $^{3}/_{8}$”
    - Per DOC or CSA Standard
      - Span rating Table R602.3(3)
  - Spacing of braced wall plan
    - Shown on braced wall plan

Photo courtesy of Georgia Pacific

* Connections



For SI: 1 inch = 25.4 mm.

FIGURE 602.10.8(2)
BRACED WALL PANEL CONNECTION WHEN PARALLEL TO FLOOR/CEILING FRAMING

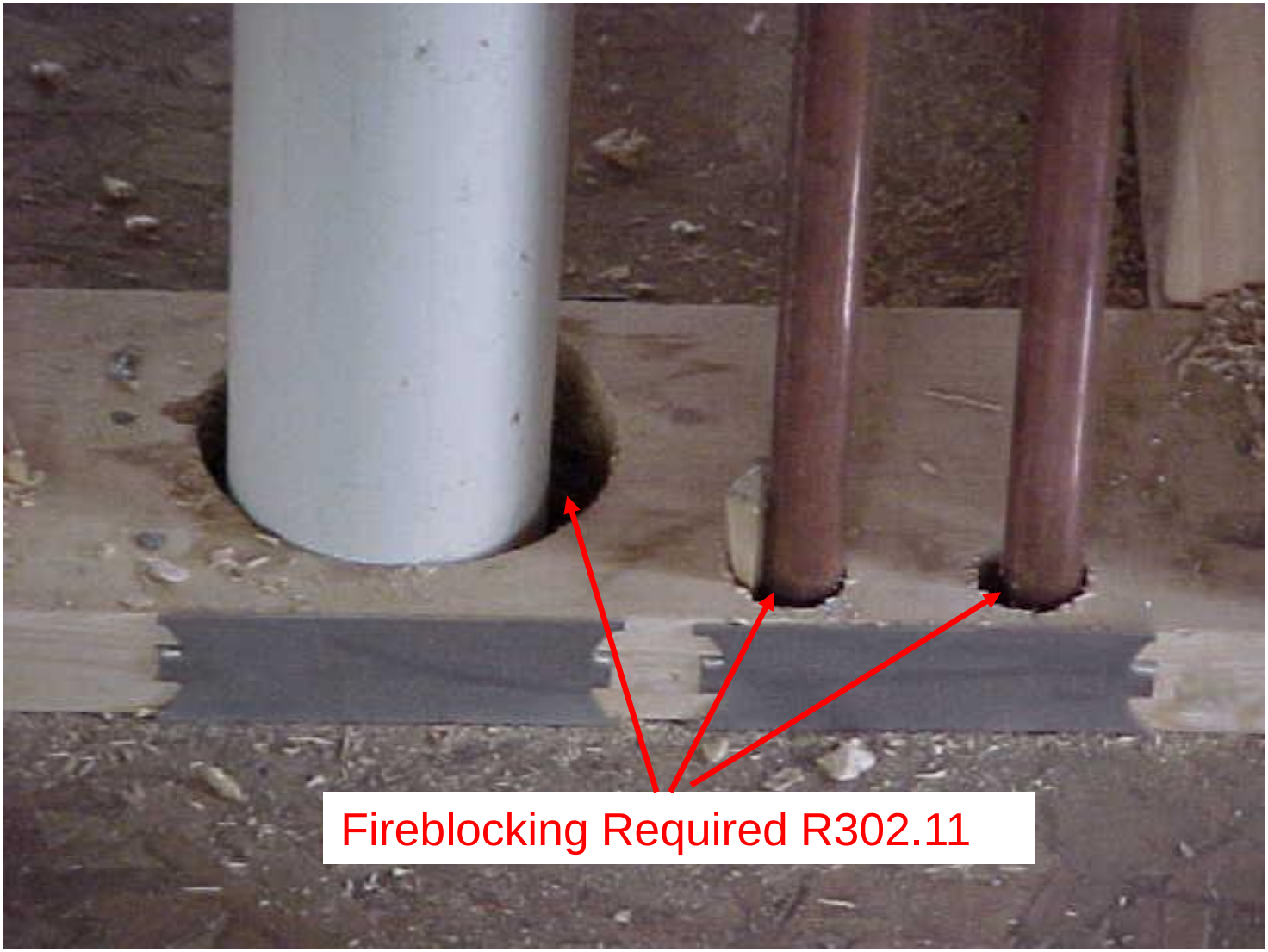
- Miscellaneous Wall Issues
  - Exterior and interior walls

- Always check all bearing points

* Point loads
  - Proper load path
  - Support
  - Check location on floor below
* Nail plates
  - Pipe within 1 1/4” of the edge of the wall
  - Plastic, copper brass, CSST
    – Except cast iron, ductile iron, steel
  - Minimum 0.0575” (No. 16 gage)
  - Cover area where pipe is present
  - 2” above bottom plate
  - 2” below bottom of top plate


OWENS CORNING
ECOTOUCH
PINK
EcoTouch
R-21

* Fireblocking R302.11



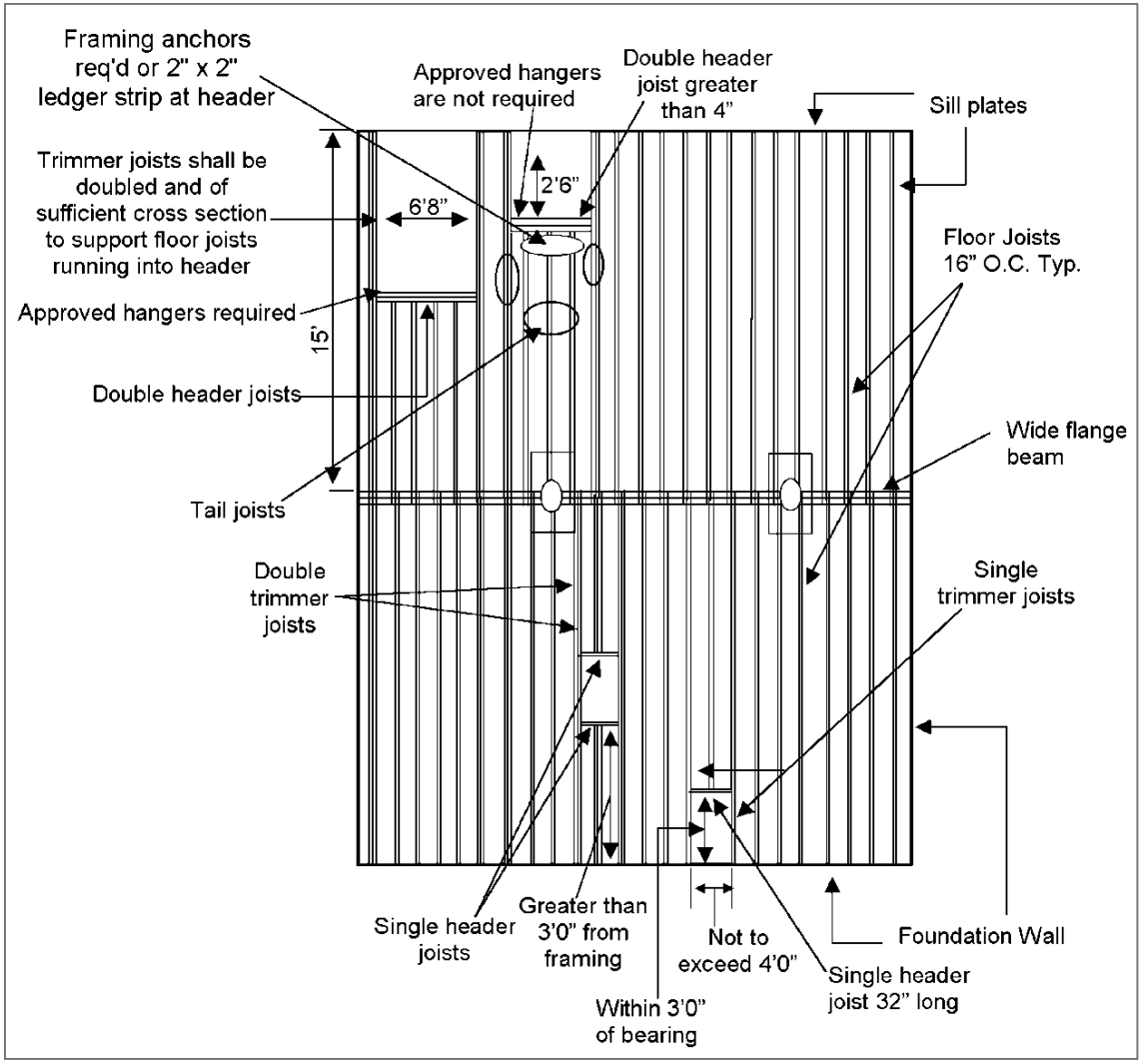

ONLY

Floors			
		Spacing, span grade	
		Fastening	
		Overlap joists	
		Openings in floors	
		Trimmers, headers, tail joists	
		Under bearing walls	
		Lateral support	
		Beams on open pockets	
		Cutting, notches, boring	
		Trusses	
		Underfloor space	


3 1'99

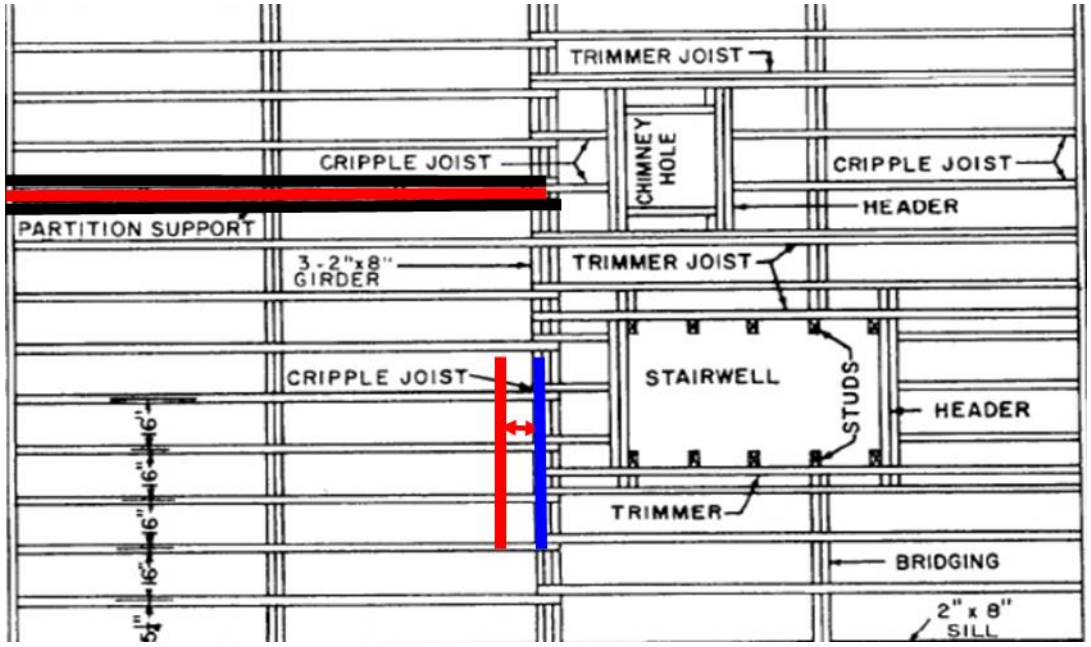
* Openings in floors
  - Headers and trimmers
    - Header less than 4’ can be single – same size as member
    - Single trimmers – single if less than 3’ from bearing
    - Span exceeds 4’ – double up trimmer and header

* Framing of floor openings

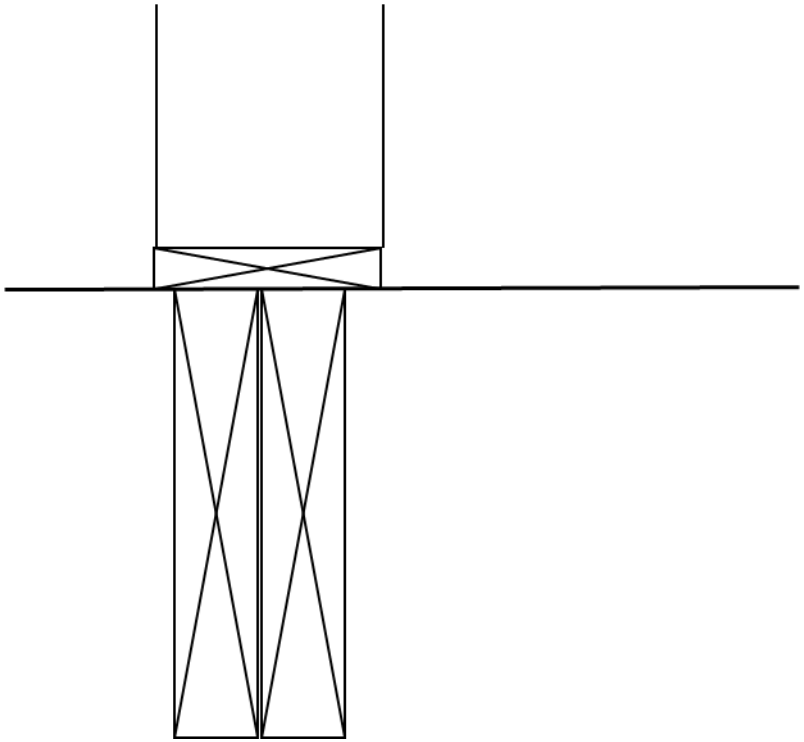


Joists Under Bearing Partitions 502.4

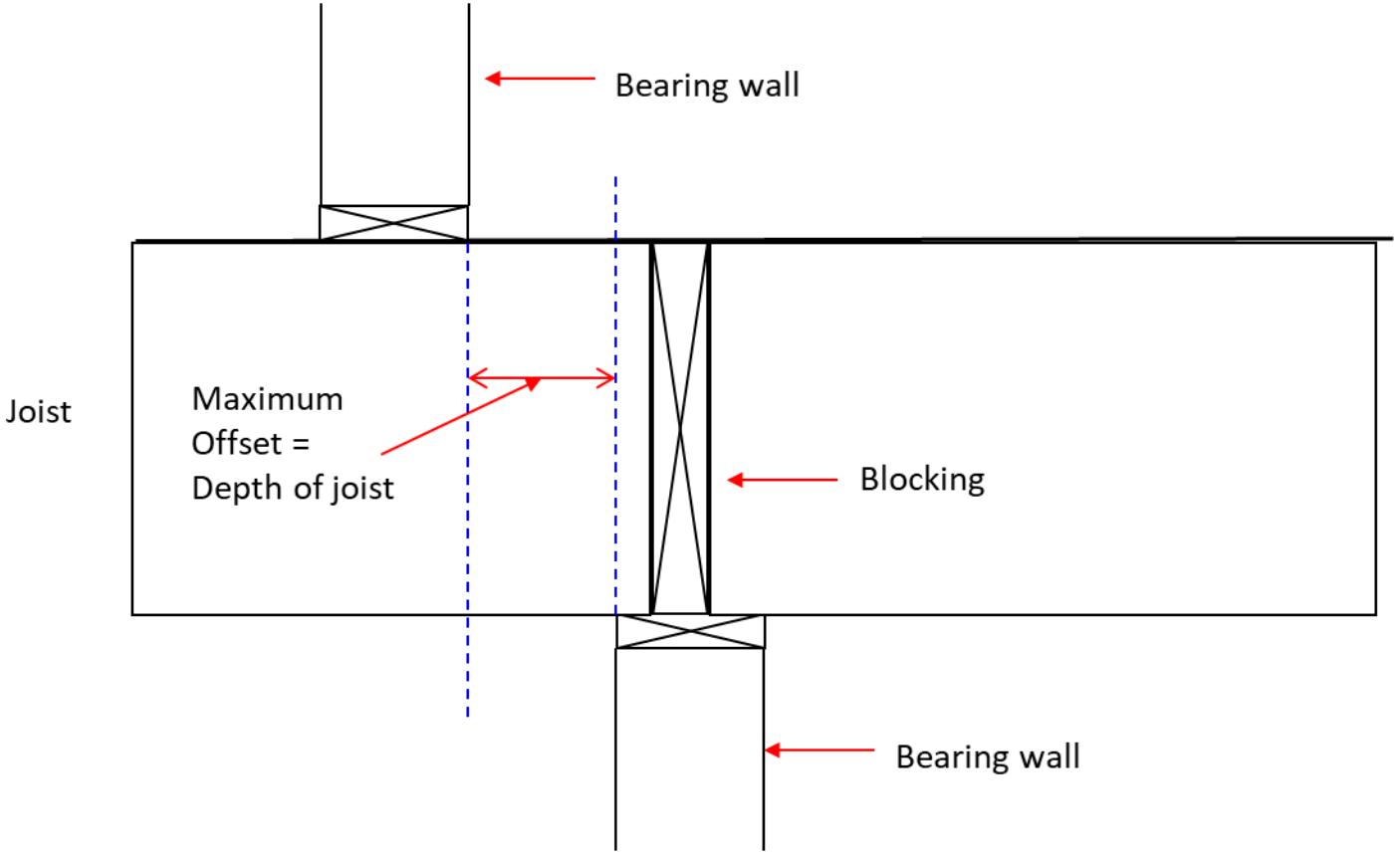
- Parallel – sized to carry load
- Special provisions under plumbing wall full depth blocking – minimum 2”
- Perpendicular – offset girder no more than 1 joist length



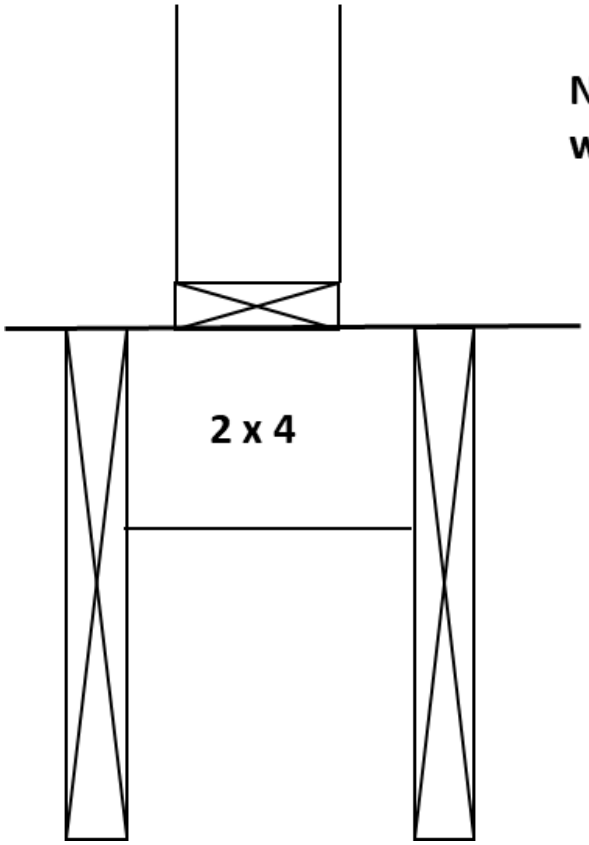
- Joists Supporting of Bearing Partitions 502.4
  - Bearing walls, beams or girders
  - Double joist



* Offset walls



* Other methods

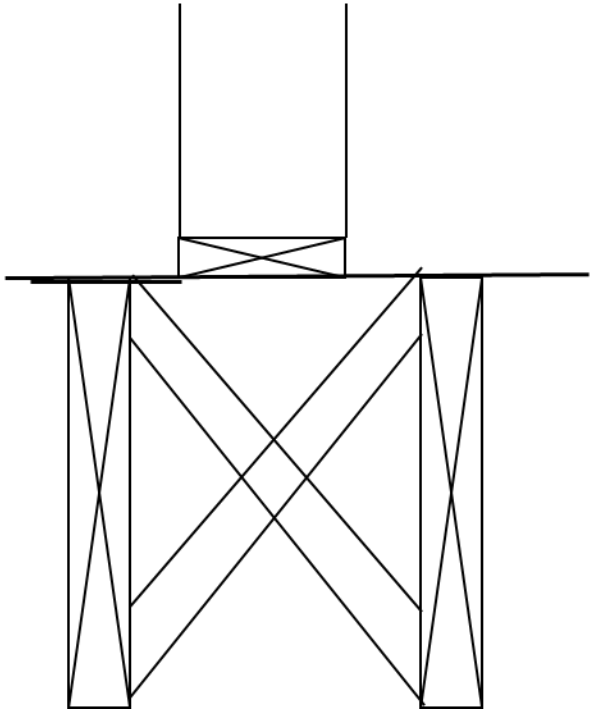


Non-bearing wall

2 x 4 recommended but not required

* Lateral support

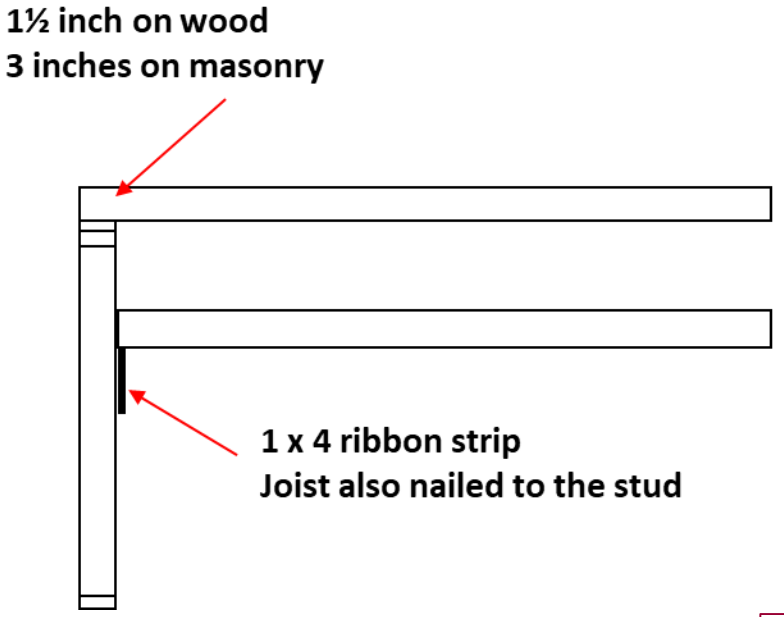
Floor, attic or roof framing
Greater than 2 x 10 requires bridging



Bridging at ends and every 8 feet

Solid bridging equal to framing or 1 x3

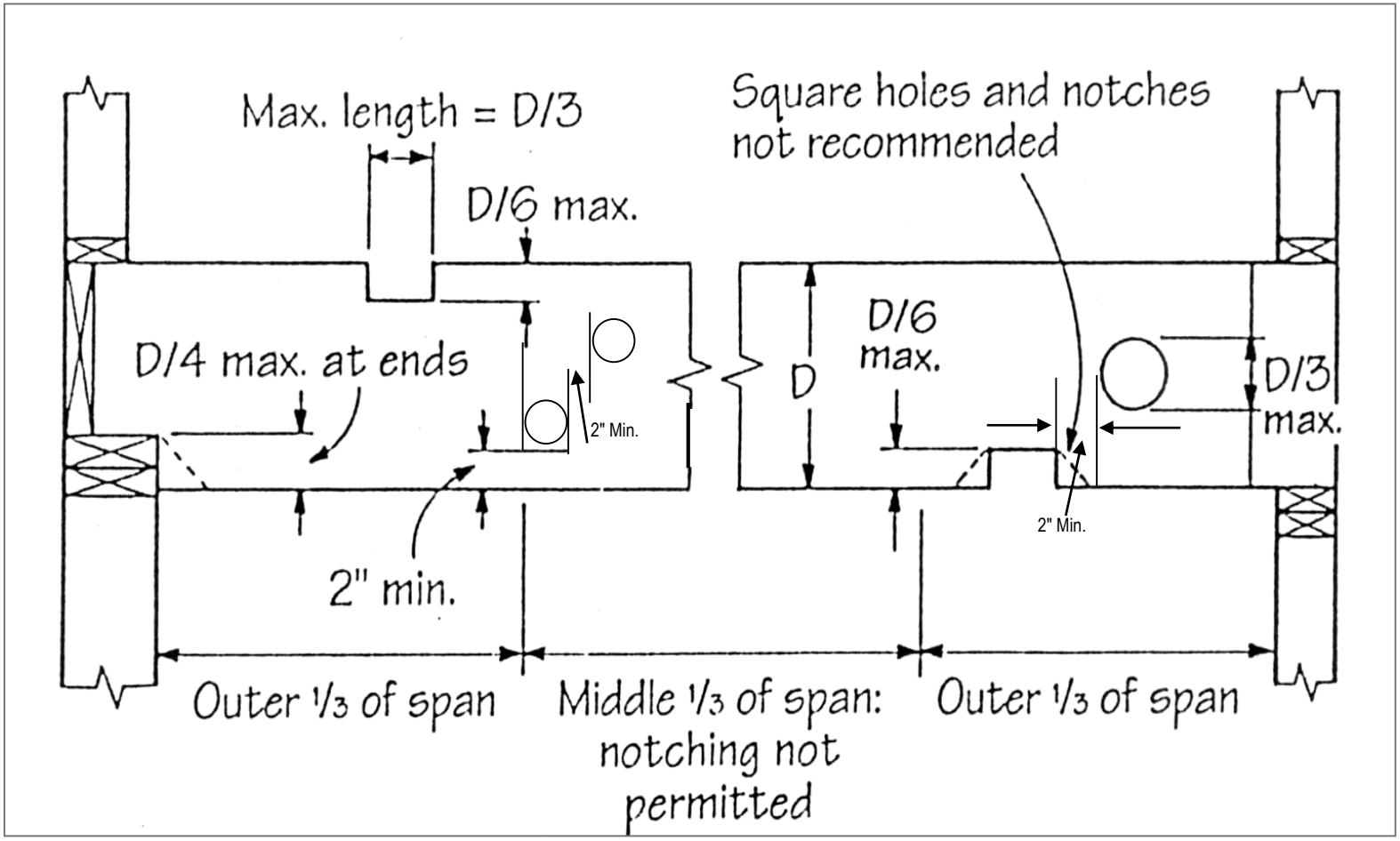
* Bearing
  - $1\,{}^{1}/_{2}$” on wood, 3” on masonry
    - Direct or a minimum 2” sill plate
  - 1 x 4 ribbon strip attached to studs
* Supported by approved joist hangars



* Headers and girders per Tables 602.7(1), 602.7(2), 607.2(3)
* Framing into side of a header approved framing anchors or ledger strips
  - Parallel – sized to carry load
* Beams ending on an open pocket
  - Minimum clip angles to foundation
    – Welded – along entire length of angle
    – Bolted – minimum $^{1}/_{2}$" bolts

      To foundation wall minimum $^{1}/_{2}$" anchor

* Cutting, drilling and notching 502.8



* Cutting, drilling and notching R502.8

* Cutting, drilling and notching R502.8


AF 100
920


ESR-1


2.0

* Column to beam fastening
  - Top plate
    - Welded – along both sides of plate perpendicular to length
    - Bolted – minimum two $^1/_2$” bolts
    - Placed diagonally top plate to column
  - Bottom plate
    - Anchored to concrete
    - Bolted – minimum two $^1/_2$” bolts
    - Placed diagonally bottom plate to column
  - No powder actuated fasteners

* Trusses
  - Truss design drawing
  - Mark of primary designer
  - Include all loads
  - Properly braced per drawing or design guide
  - No alterations to the trusses

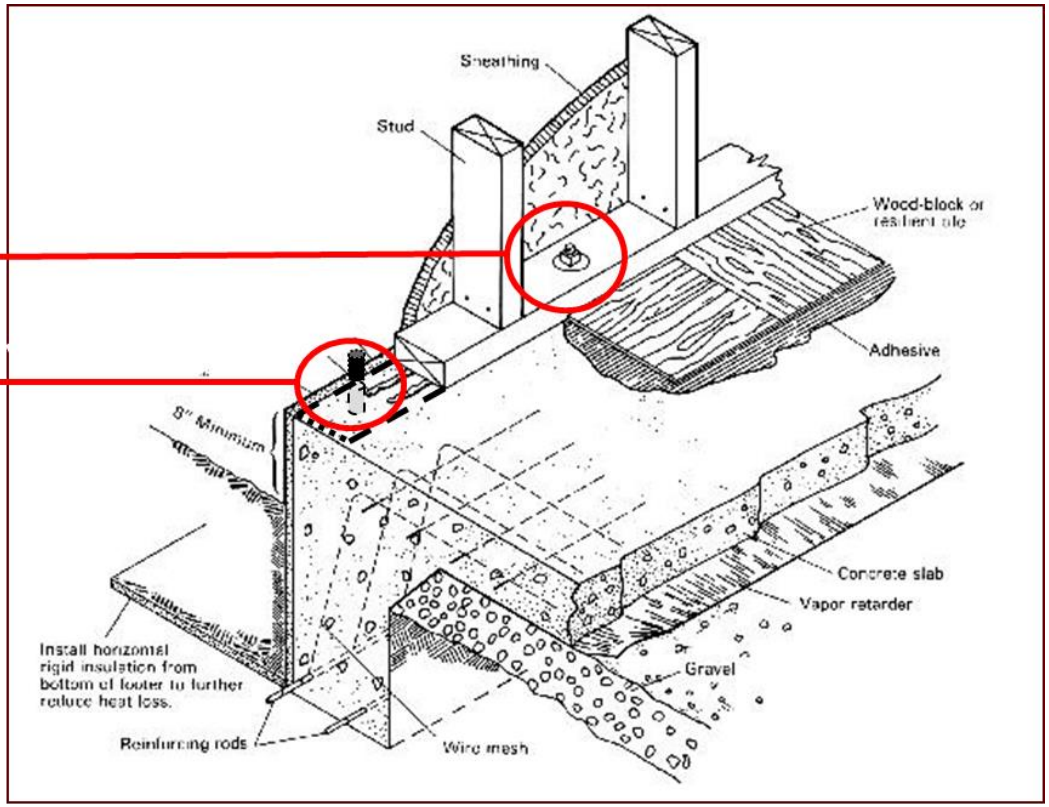
Underfloor Space

- Crawl space, or basement
- Sill plate – size match the plate above
  - Material – pressure treated
- Sill sealer – part of the energy requirements

Foundation anchorage			
		Spacing	
		Location Washer and nut	

Foundation Anchorage 403.1.6

- Check size, spacing with the plan
- Check condition and installation on site



Note: ½" minimum anchor bolts 6' O.C., 2 bolts per section of plate minimum, one bolt w/in 12" of end of plate but not less than 7 bolt diameters from end

* Size
* Spacing
  - Every 6’
    – Over 2 stories 4’ on center
  - 12” from the end of the plate
  - Minimum 2 per plate
* Location
  - Center $^{1}/_{3}$ of plate
* Washer and nut
  - Nut tightened down
  - Some exposed thread above nut
* Alternate product


08/11/2016 15:22


08/11/2016 15:22


08/11/2016 15:22

		Washer and nut	
Columns			
		Size, spacing	
		Wood. Steel Secure – top and bottom	

Columns 407

- Check size, spacing with the plan
- Wood protected against decay
- Steel columns shop coat rust inhibitive paint
- Structural requirements
  - Wood – minimum nominal 4 x 4
  - Steel – minimum 3” column, schedule 40
- Secured – top and bottom
- Bearing on columns
  - Beams – species of building or engineered product
  - Secure beam to column


PO#

		Bearing on beams	
Stairs			
		Dimensions	
		Width, tread, riser, headroom	
		Total rise, landings	

- Stairs
- Interior and Exterior
  - Check dimensions with the plan
  - Check condition and installation on site
  - Apply checklist as inspect each floor if permanent
    - Width – minimum 36”
    - Treads – minimum 9”
    - Risers – maximum $8\,{}^{1}/_{4}$”, difference shall not exceed ${}^{3}/_{8}$”
    - Headroom - minimum 6’ 8”
    - Total rise – maximum $148\,{}^{1}/_{2}$”
    - Landings – straight run minimum 36”, not required at top of interior stairs, width is not less than flight served

* Winders
  - Dimensions
    - Depth not less than 6” in walk line
    - The greatest tread depth within any flight of stairs shall not exceed the smallest by more than $^{3}/_{8}$”


04/03/2019 11:23:59

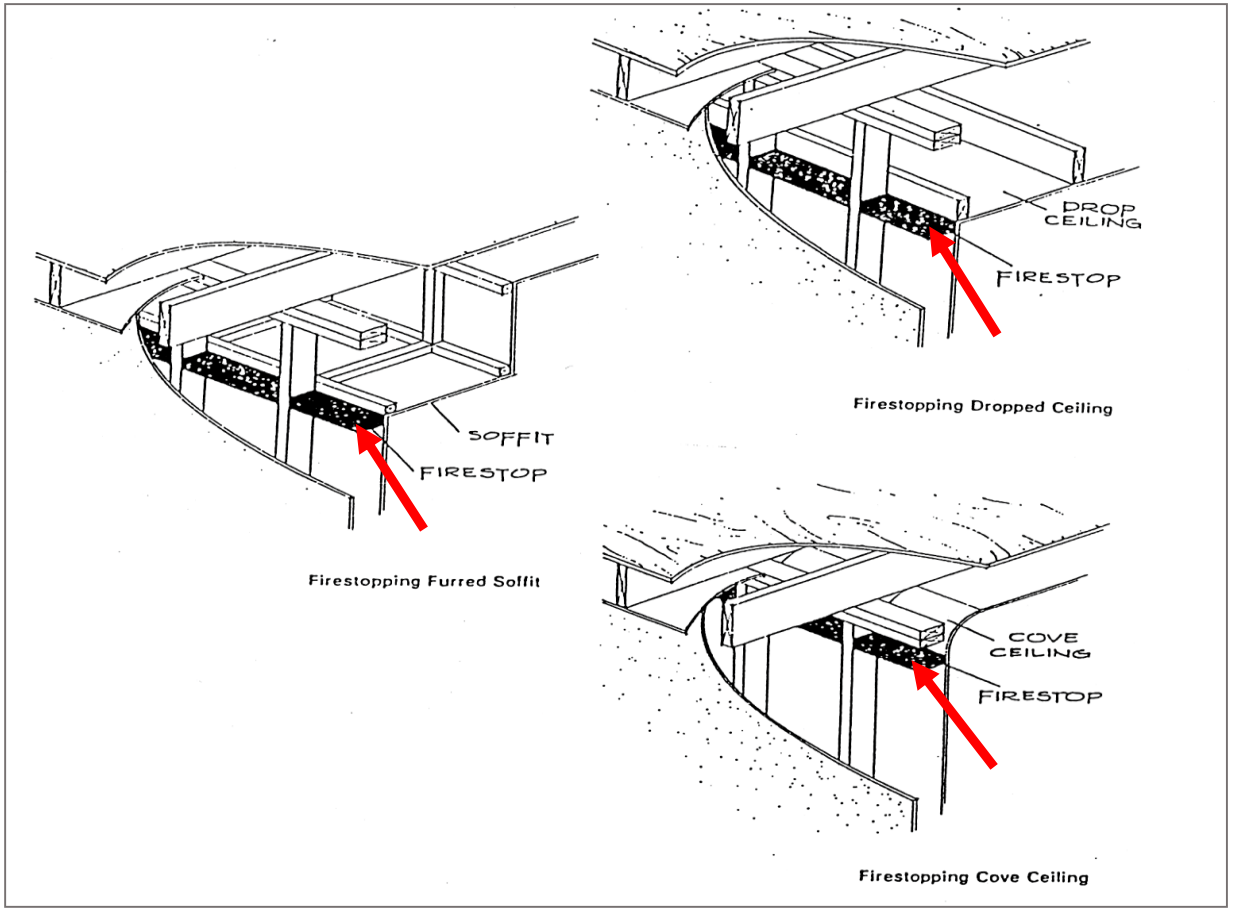
- Fire Blocking
  - Apply checklist as each floor level is inspected

		Total rise, landings	
Fire blocking			
		Location - horizontal, vertical	
		Material	

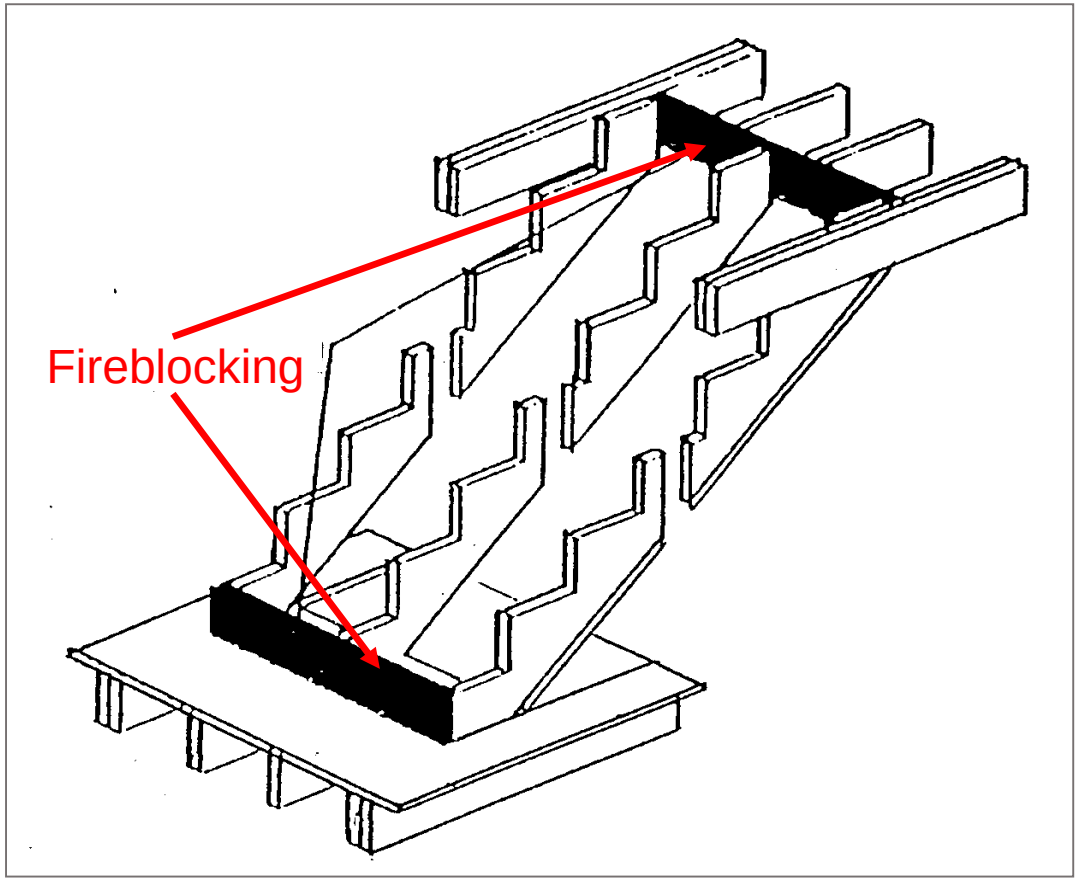
* Check where the horizontal meets the vertical
* Check material used
* Check for tight fit
* Check installation on site

- Location
  - Vertical
    - At floor lines
    - Top and bottom plates
  - Horizontal
    - Each 10’ / pipes, conduit
    - Ductwork / material – tight

- At vertical and horizontal intersections

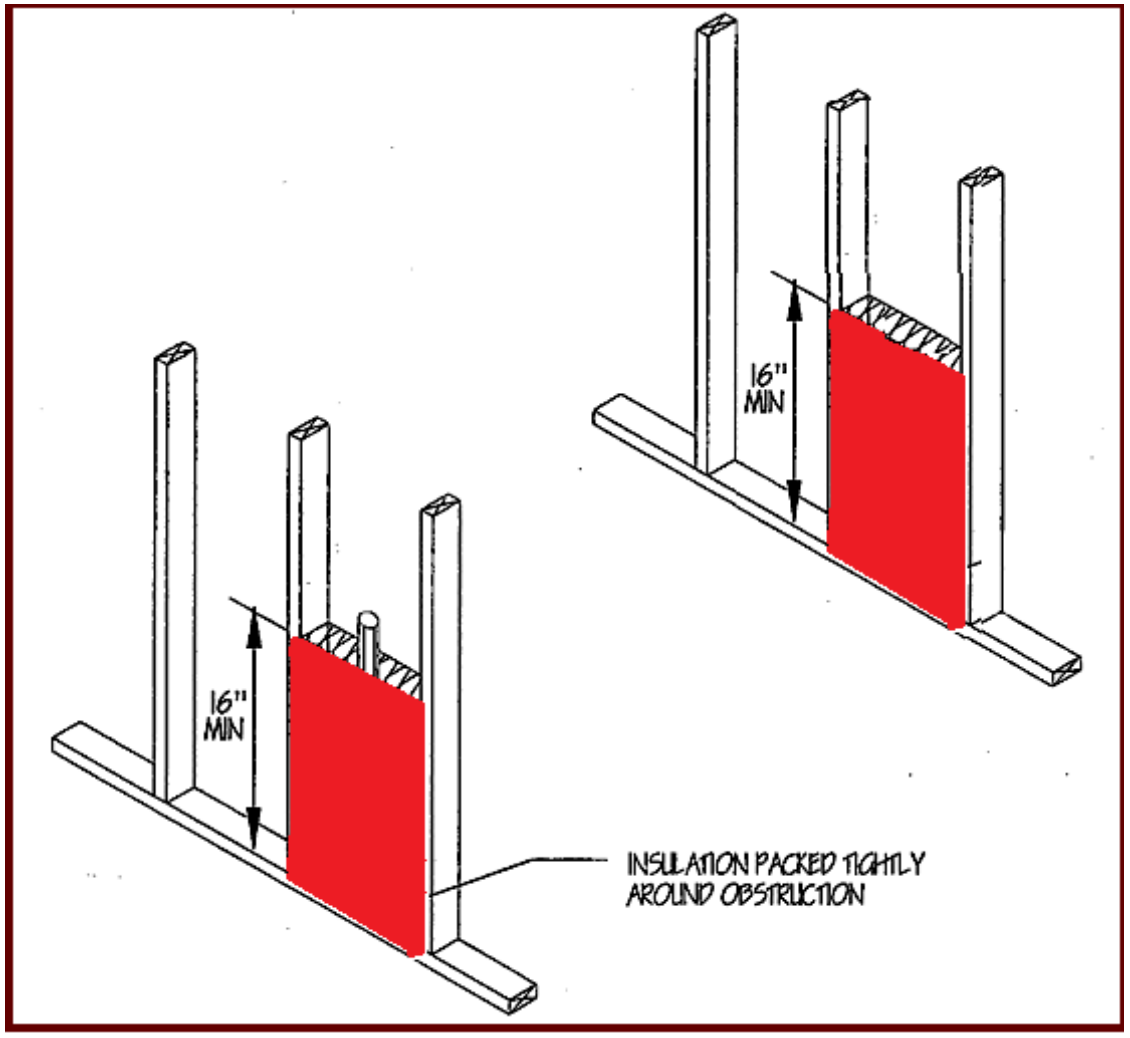


- Top and bottom of stair runs if concealed

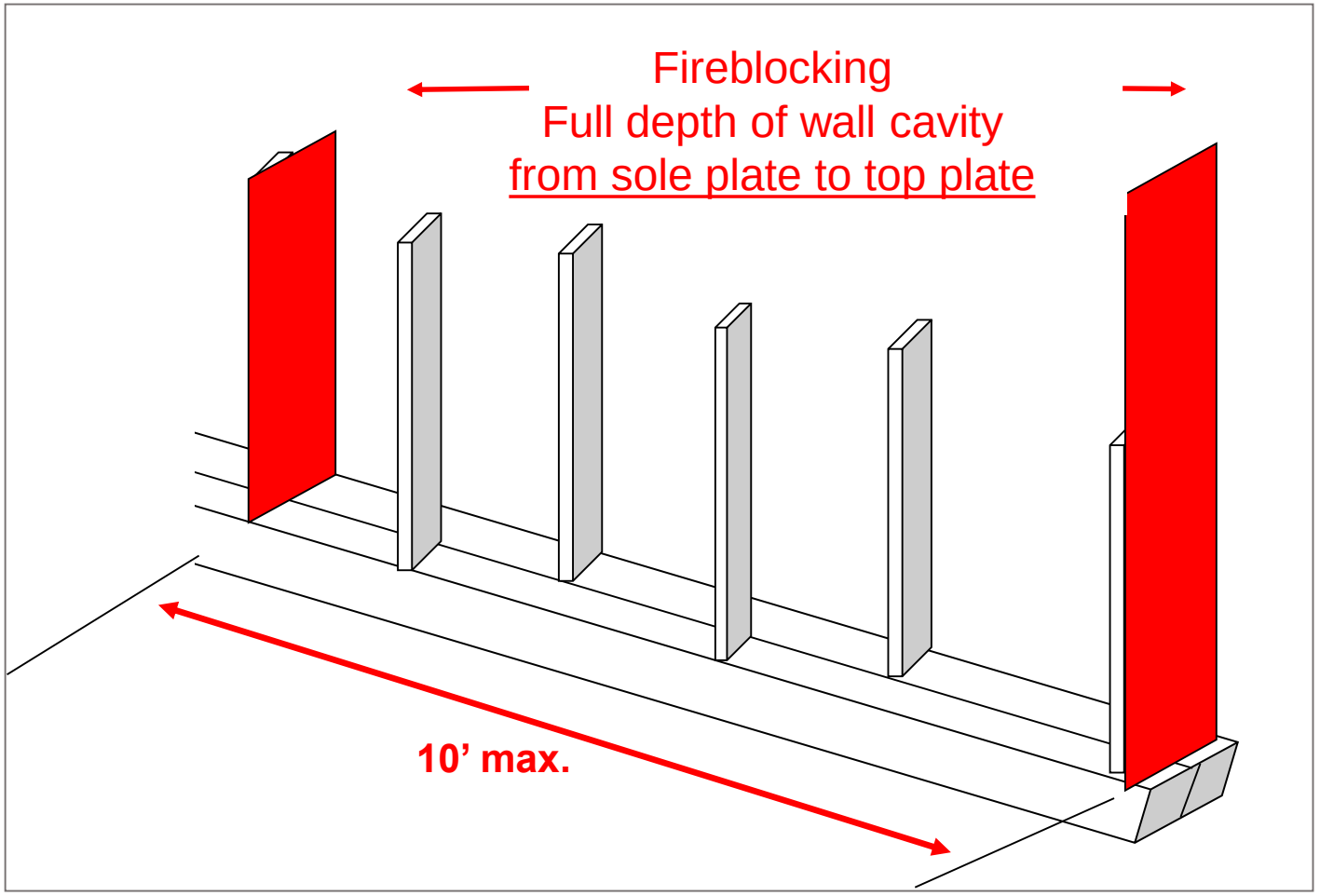


* Fire blocking material 302.11.1
* 2 x lumber, 2 layers of 1 x lumber, 23/32’ wood structural panel
  - $^{1}/_{2}$” gypsum board, $^{1}/_{4}$” cement-based millboard
  - Un-faced insulation
    – 10’ horizontal spacing – mineral or glass fiber
    – 16” vertical – packed tightly – un-faced fiberglass
  - Approved materials around cables and pipes, vents and ducts
  - Concealed wall spaces at floors and ceilings

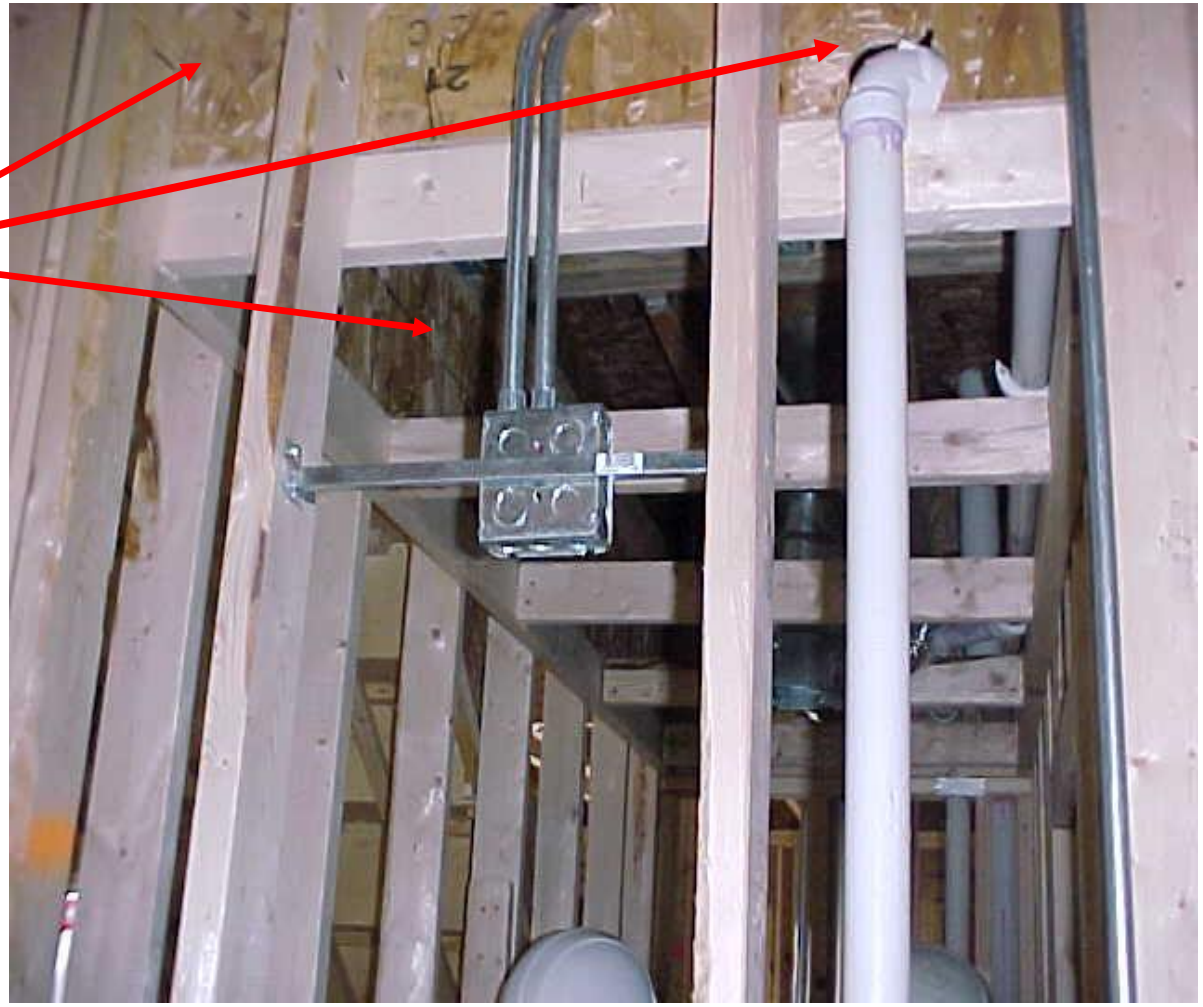
* Fireblocking 302.11.1.2

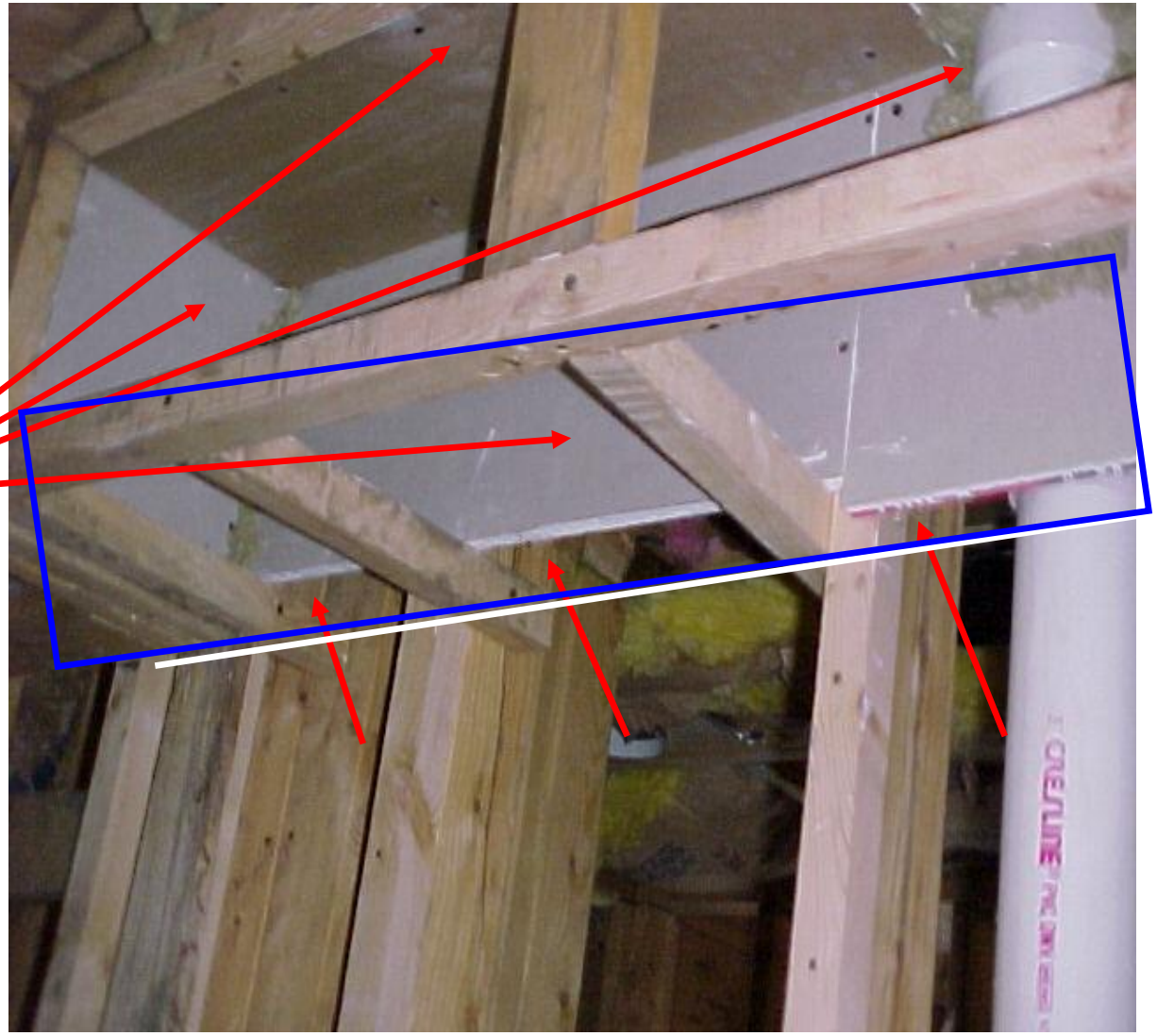


- Horizontal spacing – maximum 10’
- Parallel rows of studs or staggered studs



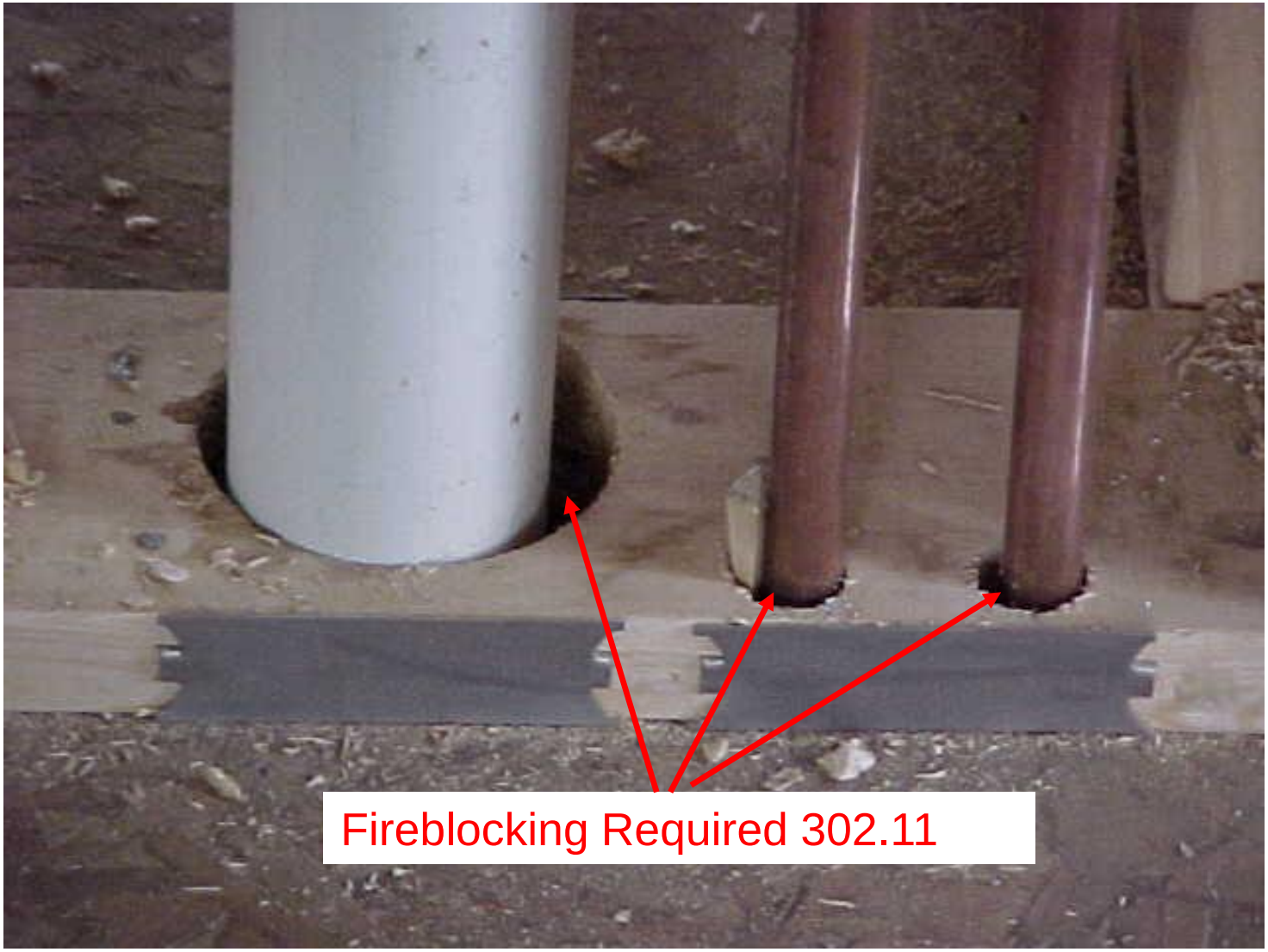
Fireblocking





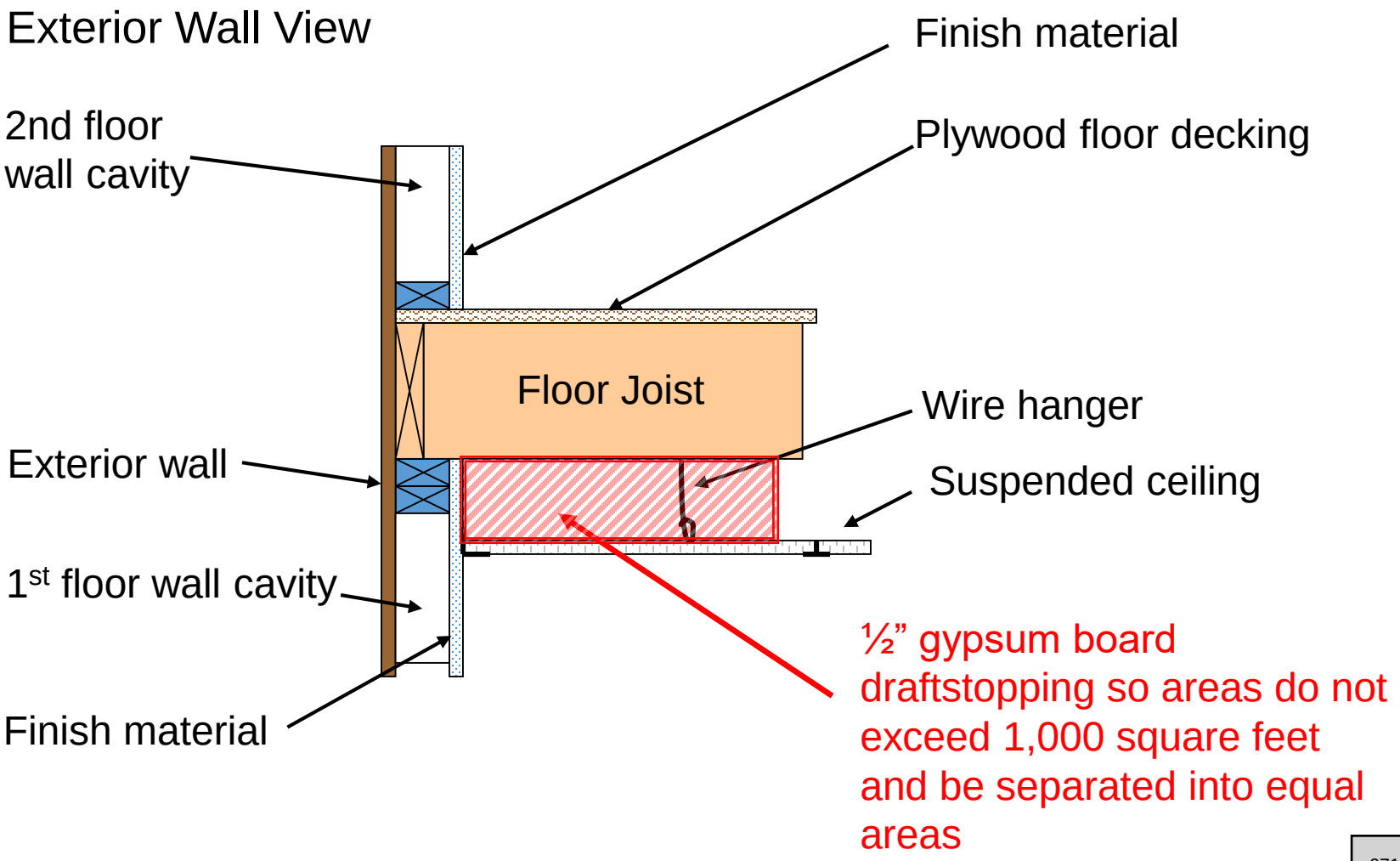
Is this dropped ceiling soffit fireblocked properly?

Fireblocking


Fireblocking Required 302.11

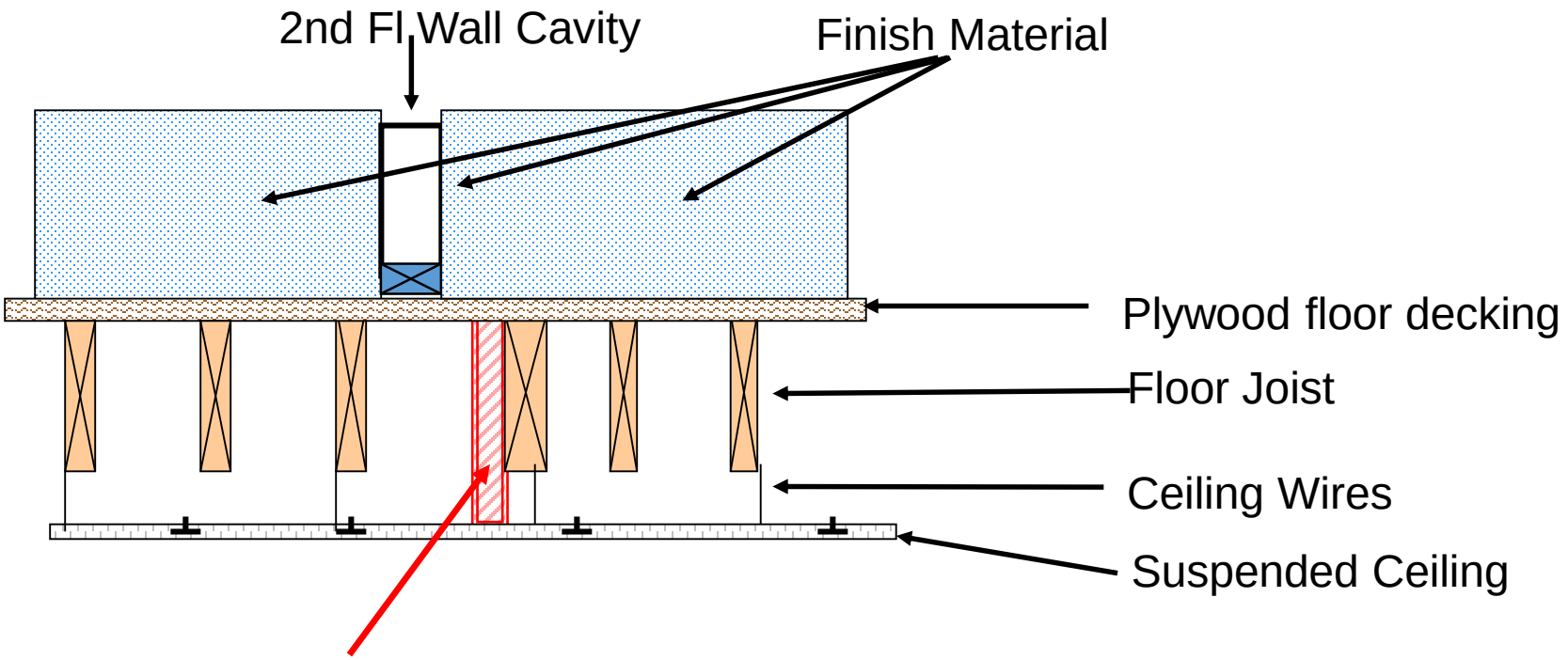

Fireblocking OK? 302.11

* Draftstopping 302.12

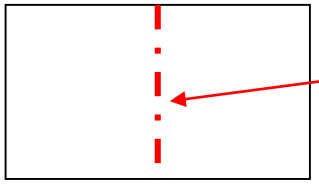


* Draftstopping 302.12

Interior floor view



½" gypsum board draftstopping so areas do not exceed 1,000 square feet and are separated into equal areas

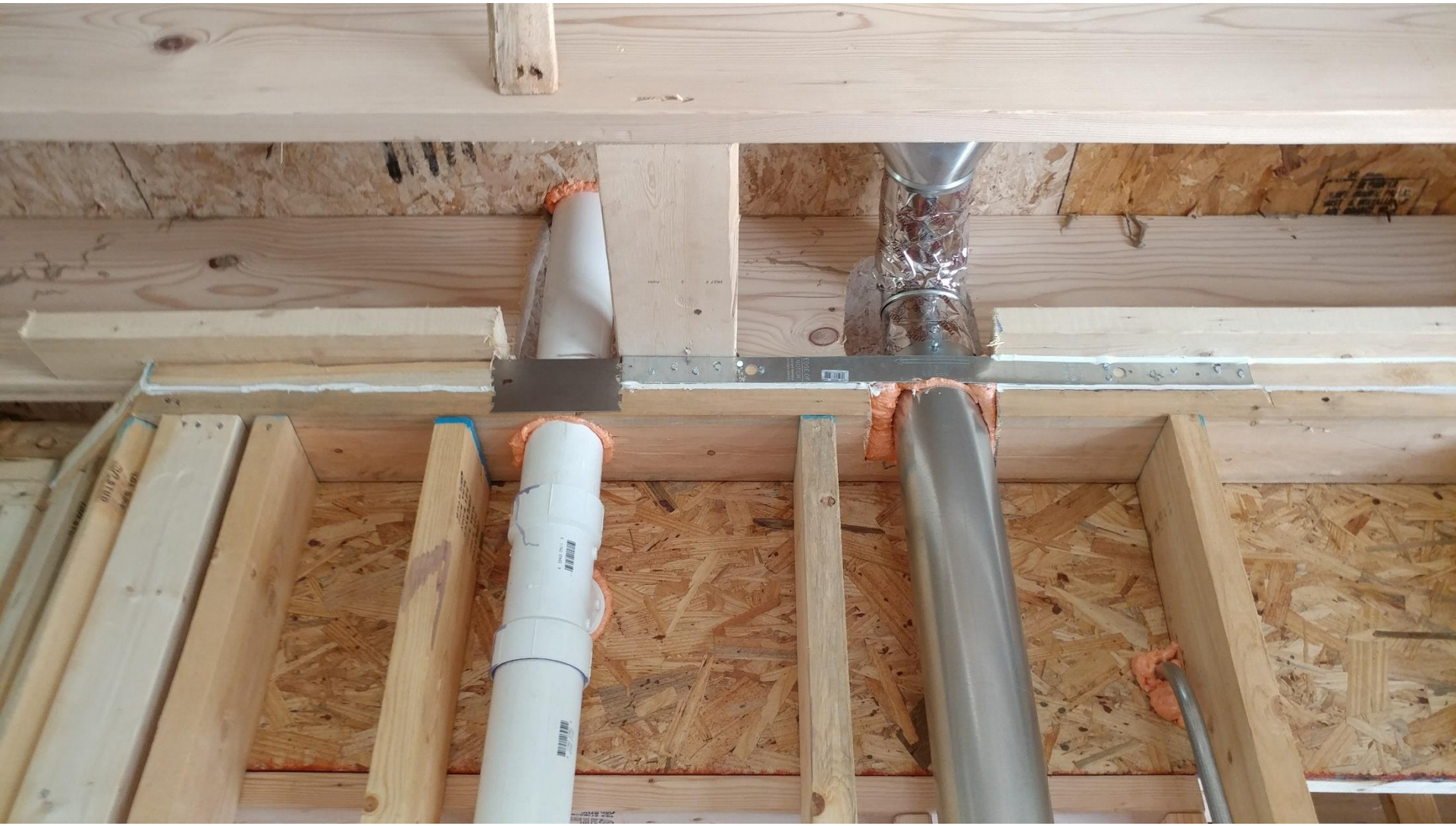


Plan View

Location of draftstopping so areas appear equal

BFCA


OWENS CORNING
ECOTOUCH™
PINK® INSULATION
EcoTouch
PureFiber® Technology
R-11
6 x 12



BFCA®

Building & Fire Code Academy

Questions?

BFCA®

Building & Fire Code Academy

Thank you!

BFCA®

Building & Fire Code Academy

Website	**www.bfcacademy.com**
Email	**info@bfcacademy.com**
Voice	**(800) 488-7057 (847) 428-2951**
Fax	**(847) 428-2911**

File Attachments for Item:

EC-2 Raceway Fill and Correction (Ohio Certificate Renewal)

All certifications except PPE, MechPE, and PI (4 hours)

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER: OHIO CERTIFICATE RENEWAL (OCR)

Course Submitter: HAROLD PLANT (by MAYDA SANCHEZ SHINGLER)
(Contact Name)

Organization: OHIO CERTIFICATE RENEWAL (aka OCR)
(Organization/Company)

Address: P. O. BOX 211102
(Include Room Number, Suite, etc.)

City: COLUMBUS State: OHIO Zip: 43221-1102

E-Mail: halplant2112@outlook.com / mayda@ohiocertificate.com

Telephone: (614)451-9003 Fax: ALT MOBILE 614.395.9689

Course Sponsor: OHIO CERTIFICATE RENEWAL

COURSE INFORMATION:

Course Title: Raceway Fill and Corrections (4hr)

New Course Submittal: ■ Update Course: ☐ Prior Approval Number: _____

Purpose and Objective: INSTRUCTOR (J.D. WHITE / ALT - R J SCHUTZ / ALT Sam Cronk) DIRECTED SEMINAR UTILIZING POWER POINT EITHER FROM CLASSROOM PLATFORM FOR ON-SITE PARTICIPANTS OR REMOTE INSTRUCTION VIA INTERNET E-LEARNING PLATFORM RELATING ELECTRICAL SYSTEMS DESIGN, INSTALLATION AND INSPECTION PRACTICES BY DIRECT REFERENCE TO THE LATEST EDITIONS OF THE NFPA STANDARD 70 -NATIONAL ELECTRICAL CODE (NEC - 2020). To enable participants to understand the process of applying NEC requirements for Raceway Type and Sizing.

Number of Instructional Contact Hours that can be obtained upon completion: 4.0

If Multi-Session, Number of Instructional Contact Hours Per Session: n/a

Program Applicable for the Following Participants:

Building Official	■	Master Plans Examiner	■	Building Inspector	■	Fire Protection Inspector	■
		Building Plans Exam.	✔				
		Plumbing Plans Exam.	☐				
		Electrical Plans Exam.	■				
		Mechanical Plans Exam.	☐				
		Fire Protect. Plans Exam.	✔				

Mechanical Inspector	■	Plumbing Inspector	☐	Non-Res IU Inspector	■				
Res Building Official	■	Res Plans Examiner	■	Res Building Inspector	■	Res Mechanical Inspector	■	Res IU Inspector	■

Electrical Safety Inspectors [X]

Location of ESI Course: OCR Classroom / Interactive Webinar Date(s) of ESI Course(s): 06/24/2022

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	X
	Organization sponsoring or requesting the program (if any)	X
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:		
Completed Application:		x

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

Ohio Certificate Renewal
(614) 451-9003
Ohio Certificate Renewal
P.O. P.O. Box 211102
Columbus, Ohio 43221-1102
www.OhioCertificate.com

Raceway Fill and Corrections

Outline Presented by Ohio Certificate Renewal

Course Hours: 4.0 Four 50-minute segments / Interactive Webinar or Classroom

Course Description: Class participants will be guided through the process of applying NEC requirements for Raceway Type and Sizing. The practical application of conductor size, quantity, and ambient temperature considerations. Proper usage of Raceway Fill Calculations, and protection of Conductors from thermal damage. A strong distinction between the issues of will they Fit and are they Allowed will be the principal guide for this course.

Course Objective: To enable participants to understand the process of applying NEC requirements for Raceway Type and Sizing. Participants will be able to consider conductor size, quantity, and ambient temperature in practical applications.

Outline:

I.	NEC Requirements for Raceway Sizing	7:30 AM	50 Minutes
II.	NEC Tables and How they are Used		
III.	Annex C and Proper Usage		50 Minutes
IV.	Ambient Correction Requirements		
V.	Raceway Fill Correction Requirements		50 Minutes
VI.	Adjusting Conductor Sizing Calculations		
VII.	Practical Application of Calculation Results		50 Minutes
VIII.	Q & A	11:30 AM	

JD White

6048 Astor Avenue
Columbus, OH 43232

614-546-7884
jd.white2000@gmail.com

Objective:

To provide timely and informative teaching relative to Electrical Theory/Fundamentals, Electrical Practices, and National Electric Code Compliance. Most teaching is geared for licensed contractors, architects, engineers, electrical inspectors, and electrician apprentices. I also provide Electrical Design and Drafting of small to moderate sized projects, using AutoCAD.

Teaching Experience:

06/2007 - Present
Columbus State Community College
Title: Skilled Trades Apprenticeship Supervisor
Supervisor: Doug House, 614-287-2576

06/2007 - Present
Columbus State Community College
Title: Adjunct Faculty Teaching:
Electrical Courses, National Electric Code, Employability, Construction Overview, Construction Estimating, Manual Drafting, and AutoCAD
Supervisor: Doug House, 614-287-2576

09/1999 – Present
Electrician Apprenticeship Instructor
Title: Year 1 – Year 4 Lead Instructor
OCILB Instructor, as needed
IEC Central Ohio 614-473-1050

10/2001 – Present
OCILB Instructor, 1-2 seminars per year
Ohio Contractor Training 614-203-1531

12/2008 – Present
OCILB Instructor, 4 seminars per year
Rebecca Warren Training 614-402-6551

11/2017 – Present
OCILB Instructor, 2-6 seminars per year
HalfMoon Education Services 715-835-5900

06/2020 – Present
OCILB, BBS, 8 seminars per year
Ohio Certificate Renewal 614-451-9003

JD White

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Columbus, OH 43232

614-546-7884
jd.white2000@gmail.com

Trade & Other Experience:

01/2006 – Present
Voltaire Electric Company, Inc. – Columbus, OH
Electrical System Design and Drafting
Title: Consultant 614-546-7884

10/2005 - 08/2006
MG Abbott Electric Company – Columbus, OH
Title: Commercial Electrician, Estimator, and ITS Coordinator
Supervisor: Joe Abbott-President, 614-837-3614

07/1995 - 08/2005
Just Dandy Electric Systems, Inc. – Columbus, OH
Title: Owner, Electrician, Estimator, Project Designer...

08/1989 - 07/1995
Safeway Electric Company, Inc. – Columbus, OH
Title: Commercial Electrician, Commercial Division Manager
Supervisor: Andy Untch, 614-443-7672

07/1976 - 09/1982
MG Abbott Electric Company – Columbus, OH
Title: Electrician, Field Supervisor
Supervisor: Gene Abbott-Owner

09/1982 - 08/1989
Delphos Wesleyan Church – Delphos, OH
Mansfield Wesleyan Church – Mansfield, OH
Title: Senior Pastor

07/1972 - 06/1974
US Navy – Quonset Point-RI
Title: ADJ (Aviation Machinist Mate Jet)
Supervisor: Various

JD White

6048 Astor Avenue
Columbus, OH 43232

614-546-7884
jd.white2000@gmail.com

Licensure:

Electrical
11/1990
Cities of: Columbus, Elyria, Springfield, Youngstown, Toledo, Dayton, and others
07/1992

Electrical State of Ohio
02/1996
State of Ohio #EL 14058

Fire Alarm Installer
02/2003
State of Ohio #54.25.3708

Education:

06/2005 – 05/2015
Columbus State Community College – Columbus, OH
ATS Electrical System Architecture Designer

09/1982 - 05/1987
Indiana Wesleyan University – Marion, IN
Christian Ministries & Biblical Literature

06/1981 - 05/1982
Columbus Technical Institute – Columbus, OH
General Education Studies

06/1973
GED Central High School, Columbus, OH

07/1972 - 08/1973
Naval Aviation Technical Training Center
Aviation A School Jet Engines – Memphis, TN
Naval Aviation Technical Training Center
Aviation B School Helicopters – Quonset Pt, RI
Rating: Aviation Machinist Mate Jet

References:

Joe Abbott - Previous Employer: 614-837-3614
Barb Tipton – Present Employer: 614-473-1050
Dr. Andy Rezin – Previous Supervisor: 614-551-8378
Doug House – Present Supervisor: 614-287-2576
Other References Available Upon Request

Sam Cronk

Sam Cronk has extensive knowledge and experience with the interpretation and application of the National Electrical Code. Sam has been involved in all aspects of the residential, commercial, and industrial electrical industry since 1985. His previous employment includes work as an electrical foreman, project manager, and estimator. He has held numerous certifications and licenses including electrical journeyman by the State of South Carolina, journeyman wireman with the International Brotherhood of Electrical Workers (I.B.E.W.), and electrical contractor with the State of Ohio. Sam currently holds certifications as an Electrical Safety Inspector and Electrical Plans Examiner.

Sam has instructed a variety of adult education and professional continuing education classes, including with Columbus Public Schools, NECA-IBEW Joint Apprenticeship Training Committee (J.A.T.C.), International Association of Electrical Inspectors (I.A.E.I.), and the International Code Council (I.C.C.).

Robert J. Schutz, P.E.

Robert J. Schutz, P.E. is the retired Chief Building Official of the City of Powell (OH) and is currently a Consulting Engineer serving as the contract Plans Examiner and Inspector for several municipalities in central Ohio. He is a civil engineering graduate of the Ohio Northern University with post-graduate studies at the Ohio State University and the University of Southern California.

Bob is a registered Professional Engineer and Professional Surveyor in the State of Ohio; where is also certified as a Building Official, Plans Examiner, Mechanical Inspector, Plumbing Inspector and Electrical Safety Inspector. Bob previously served as the Chief Engineer with the State of Ohio Health Department where he supervised the Plumbing Inspection program, was the Chairman of the Plumbing Advisory Board and was a member of the Ohio Board of Building Standards. Bob instructs nationally and internationally for the International Code Council (ICC), as well as for OCR on Mechanical, Fuel Gas, Plumbing and Building codes.

Ohio Certificate Renewal
"Since 1994"

Raceway Fill & Corrections

Conductors & Raceways

How Many, Type, & Size

NEC 310

Chapter 9, Tables

310.15(B)(5) Neutral Conductors

- Here is what NEC says about Neutrals being a current carrying conductor:

- A) If Conducting only the Unbalanced Portion - NO
- B) If 3W 1Ø of a 4W Wye System - YES
- C) If more than 50% of load is Non-Linear - YES

310.15(B)(16) Conductor Ampacity

- First Note regarding this Table,
  - Conductors at rated for a 30°C Installation.
- Second Note, the conductor material CU or AL is same all Temp Ratings
  - The difference is the Insulations ability to withstand various temperatures
- Third Note, Ampacity of conductor is first part of a three part equation
  - Chart Amps X Ambient Correction X Raceway Fill
- Fourth Note, 90C is for Dry/Damp, unless -2 then 90C Dry/Damp/Wet
  - Such as THW-2, THWN-2, USE-2, XHHW-2

Understanding 90°C Value

- For Most part 75C will be the limitation for terminations
- Start with 90C, however final connection cannot exceed 75C Value
- Say #2CU THHN is 130A in 90C, 94F, 3Cond = 130X0.96X1 = 124.8A
  - At 75C good for 115A, but can round up to next Std Rating = 125A

Insulation Rating & Conductor Rating

- Insulation Ratings
  - Often thought of as Conductor Ratings Only.

	60°C (140°F)	75°C (167°F)	90°C (194°F)
Size AWG or kcmil	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2
	COPPER		
18**	—	—	14
16**	—	—	18
14**	15	20	25
12**	20	25	30
10**	30	35	40
8	40	50	55
6	55	65	75
4	70	85	95
3	85	100	115
2	95	115	130
1	110	130	145

310.15(B)(2) Ambient Correction

- Conductors at rated for a 30ºC Installation.
- There are two tables on for 30C and one for 40C
- Please highlight the 30C, so you don't forget
  - Table 310.15(B)(16) states conductors for 30C installation
- What if More than one Ambient Temp Zone for conductor installation?
  - If more than 10% conductor length in higher ambient temp, then that would apply to entire conductor length.
- Copy of Table on next slide

Table 310.15(B)(2)

- Temps below 69F are 100% plus
- Temps above 86F are less than 100%
- The # 2 from previous
  - 130A X 50F 130x1.15 = 149.5A
  - 130A X 116F 130X0.82 = 106.6A
- Chose column to match conductor

NEC Table 310.15(B)(2) based on 30°C				
	Temperature Rating of Conductors			
Ambient Temperature (°C)	60°C	75°C	90°C	Ambient Temperature (°F)
10 or less	1.29	1.2	1.15	50 or less
11-15	1.22	1.15	1.12	51-59
16-20	1.15	1.11	1.08	60-68
21-25	1.08	1.05	1.04	69-77
26-30	1	1	1	78-86
31-35	0.91	0.94	0.96	87-95
36-40	0.82	0.88	0.91	96-104
41-45	0.71	0.82	0.87	105-113
46-50	0.58	0.75	0.82	114-122
51-55	0.41	0.67	0.76	123-131
56-60	—	0.58	0.71	132-140
61-65	—	0.47	0.65	141-149
66-70	—	0.33	0.58	150-158
71-75	—	—	0.5	159-167
76-80	—	—	0.41	168-176
81-85	—	—	0.29	177-185

310.15(B)(3)(a) Raceway Fill

- Conductors need to dissipate Heat
  - When more than 3 Current Carrying Conductors
  - Ability to dissipate heat is reduced
- Therefore, Conductors cannot conduct same Amps
- Same chart is applied to NM, AC, & MC Cables

NEC Table 310.15(B)(3)(a)	
Number of Conductors	Percent of Conductor Ampacity
4–6	80
7–9	70
10–20	50
21–30	45
31–40	40
41 and above	35

Standard Amperage Calculation

- For all conductors, a standard calculation is required.
  - Chart Amps X Ambient Temp X Raceway Fill
- Simplified Formula
  - Chart X Temp X Fill
- Failure to properly calculate conductor ampacity is second only to Grounding Violations.
- Adopt this practice

310.104(A) Conductors

- To learn more about conductor application this is the table to refer to.

					Thickness of Insulation			
Trade Name	Type Letter	Maximum Operating Temperature	Application Provisions	Insulation	AWG or kcmil	mm	mils	Outer Covering[2]
Heat-resistant thermoplastic	THHN	90°C	Dry and damp locations	Flame-retardant, heat-resistant thermoplastic	14–12	0.38	15	Nylon jacket or equivalent
		(194°F)			10	0.51	20	
					8–6	0.76	30	
					4–2	1.02	40	
					1–4/0	1.27	50	
					250–500	1.52	60	
					501–1000	1.78	70	
Moisture- and heat-resistant thermoplastic	THHW	75°C	Wet location	Flame-retardant, moisture- and heat-resistant thermoplastic	14–10	0.76	30	None
		(167°F)			8	1.14	45	
					6–2	1.52	60	
					1–4/0	2.03	80	
		90°C	Dry location		213–500	2.41	95	
		(194°F)			501–1000	2.79	110	
					1001–2000	3.18	125	

Chapter 9 Note #1

1	See Informative Annex C for the maximum number of conductors and fixture wires, all of the same size (total cross-sectional area including insulation) permitted in trade sizes of the applicable conduit or tubing.

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Chapter 9 Note #2

2	Table 1 applies only to complete conduit or tubing systems and is not intended to apply to sections of conduit or tubing used to protect exposed wiring from physical damage.

Chapter 9 Note #3

3	Equipment grounding or bonding conductors, where installed, shall be included when calculating conduit or tubing fill. The actual dimensions of the equipment grounding or bonding conductor (insulated or bare) shall be used in the calculation.

Chapter 9 Note #4

4	Where conduit or tubing nipples having a maximum length not to exceed 600 mm (24 in.) are installed between boxes, cabinets, and similar enclosures, the nipples shall be permitted to be filled to 60 percent of their total cross-sectional area, and 310.15(B)(3)(a) adjustment factors need not apply to this condition.

Chapter 9 Note #5

5	For conductors not included in Chapter 9, such as multiconductor cables and optical fiber cables, the actual dimensions shall be used.

Chapter 9 Note #6

6	For combinations of conductors of different sizes, use actual dimensions or Table 5 and Table 5A for dimensions of conductors and Table 4 for the applicable conduit or tubing dimensions.

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"Since 1994"

Chapter 9 Note #7

7	When calculating the maximum number of conductors or cables permitted in a conduit or tubing, all of the same size (total cross-sectional area including insulation), the next higher whole number shall be used to determine the maximum number of conductors permitted when the calculation results in a decimal greater than or equal to 0.8. When calculating the size for conduit or tubing permitted for a single conductor, one conductor shall be permitted when the calculation results in a decimal greater than or equal to 0.8.

Chapter 9 Note #8

8	Where bare conductors are permitted by other sections of this Code, the dimensions for bare conductors in Table 8 shall be permitted.

Chapter 9 Note #9

9	A multiconductor cable, optical fiber cable, or flexible cord of two or more conductors shall be treated as a single conductor for calculating percentage conduit or tubing fill area. For cables that have elliptical cross sections, the cross-sectional area calculation shall be based on using the major diameter of the ellipse as a circle diameter. Assemblies of single insulated conductors without an overall covering shall not be considered a cable when determining conduit or tubing fill area. The conduit or tubing fill for the assemblies shall be calculated based upon the individual conductors.

Chapter 9 Note #10

10	The values for approximate conductor diameter and area shown in Table 5 are based on worst-case scenario and indicate round concentric-lay-stranded conductors. Solid and round concentric-lay-stranded conductor values are grouped together for the purpose of Table 5. Round compact-stranded conductor values are shown in Table 5A. If the actual values of the conductor diameter and area are known, they shall be permitted to be used.

Chapter 9 Informational Note #1

Informational Note No. 1:		
Table 1 is based on common conditions of proper cabling and alignment of conductors where the length of the pull and the number of bends are within reasonable limits. It should be recognized that, for certain conditions, a larger size conduit or a lesser conduit fill should be considered.		

Chapter 9 Informational Note #2

Informational Note No. 2:		
When pulling three conductors or cables into a raceway, if the ratio of the raceway (inside diameter) to the conductor or cable (outside diameter) is between 2.8 and 3.2, jamming can occur. While jamming can occur when pulling four or more conductors or cables into a raceway, the probability is very low.		

Chapter 9 Table #1

Table 1 Percent of Cross Section of Conduit and Tubing for Conductors and Cables	
Number of Conductors and/or Cables	Cross-Sectional Area (%)
1	53
2	31
3 or More	40
Nipples	60

- I add the Nipple fill of 60% to my chart
- If not, I end up looking for it.

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Chapter 9 Table #4 Raceways

Chapter 9, Table 4 EMT

Trade Size	Nominal Internal Diameter		Over 2 Wires 40%		Nipples 60%		1 Wire 53%		2 Wires 31%		Total Area 100%	
	mm	in.	mm^2	$in.^2$	mm^2	$in.^2$	mm^2	$in.^2$	mm^2	$in.^2$	mm^2	$in.^2$
1/2	15.8	0.622	78	0.122	118	0.182	104	0.161	61	0.094	196	0.304
3/4	20.9	0.824	137	0.213	206	0.320	182	0.282	106	0.165	343	0.533
1	26.6	1.049	222	0.346	334	0.518	295	0.458	172	0.268	556	0.864
1-1/4	35.1	1.380	387	0.598	581	0.898	513	0.793	300	0.464	968	1.496
1-1/2	40.9	1.610	526	0.814	788	1.222	696	1.079	407	0.631	1,314	2.036
2	52.5	2.067	866	1.342	1,299	2.014	1,147	1.779	671	1.040	2,165	3.356
2-1/2	69.4	2.731	1,513	2.343	2,270	3.515	2,005	3.105	1,173	1.816	3,783	5.858
3	85.2	3.356	2,280	3.538	3,421	5.308	3,022	4.688	1,767	2.742	5,701	8.846
3-1/2	97.4	3.834	2,980	4.618	4,471	6.927	3,949	6.119	2,310	3.579	7,451	11.545
4	110.1	4.334	3,808	5.901	5,713	8.852	5,046	7.819	2,952	4.573	9,521	14.753

Chapter 9 Table #4 Raceways

Chapter 9, Table 4 RMC

Trade Size	Nominal Internal Diameter		Over 2 Wires 40%		Nipples 60%		1 Wire 53%		2 Wires 31%		Total Area 100%	
	mm	in.	mm^2	$in.^2$	mm^2	$in.^2$	mm^2	$in.^2$	mm^2	$in.^2$	mm^2	$in.^2$
1/2	16.1	0.632	82	0.126	122	0.188	108	0.166	63	0.097	204	0.314
3/4	21.2	0.836	141	0.22	212	0.329	187	0.291	109	0.17	353	0.549
1	27	1.063	229	0.355	344	0.532	304	0.47	178	0.275	573	0.887
1-1/4	35.4	1.394	394	0.61	590	0.916	522	0.809	305	0.473	984	1.526
1-1/2	41.2	1.624	533	0.828	800	1.243	706	1.098	413	0.642	1,333	2.071
2	52.9	2.083	879	1.363	1,319	2.045	1,165	1.806	681	1.056	2,198	3.408
2-1/2	63.2	2.489	1,255	1.946	1,882	2.92	1,663	2.579	972	1.508	3,137	4.866
3	78.5	3.09	1,936	3	2,904	4.499	2,565	3.974	1,500	2.325	4,840	7.499
3-1/2	90.7	3.57	2,584	4.004	3,877	6.006	3,424	5.305	2,003	3.103	6,461	10.01
4	102.9	4.05	3,326	5.153	4,990	7.729	4,407	6.827	2,578	3.993	8,316	12.882
5	128.9	5.073	5,220	8.085	7,830	12.127	6,916	10.712	4,046	6.266	13,050	20.212
6	154.8	6.093	7,528	11.663	11,293	17.495	9,975	15.454	5,835	9.039	18,821	29.158

Chapter 9 Table #4 Raceways

Chapter 9, Table 4 PVC Schedule 40

Trade Size	Nominal Internal Diameter		Over 2 Wires 40%		Nipples 60%		1 Wire 53%		2 Wires 31%		Total Area 100%	
	mm	in.	mm^2	$in.^2$	mm^2	$in.^2$	mm^2	$in.^2$	mm^2	$in.^2$	mm^2	$in.^2$
1/2	15.3	0.602	74	0.114	110	0.171	98	0.151	57	0.088	184	0.285
3/4	20.4	0.804	131	0.203	196	0.305	173	0.269	101	0.157	327	0.508
1	26.1	1.029	214	0.333	321	0.499	284	0.441	166	0.258	535	0.832
1-1/4	34.5	1.36	374	0.581	561	0.872	496	0.77	290	0.45	935	1.453
1-1/2	40.4	1.59	513	0.794	769	1.192	679	1.053	397	0.616	1,282	1.986
2	52	2.047	850	1.316	1,274	1.975	1,126	1.744	658	1.02	2,124	3.291
2-1/2	62.1	2.445	1,212	1.878	1,817	2.817	1,605	2.488	939	1.455	3,029	4.695
3	77.3	3.042	1,877	2.907	2,816	4.361	2,487	3.852	1,455	2.253	4,693	7.268
3-1/2	89.4	3.521	2,511	3.895	3,766	5.842	3,327	5.161	1,946	3.018	6,277	9.737
4	101.5	3.998	3,236	5.022	4,855	7.532	4,288	6.654	2,508	3.892	8,091	12.554
5	127.4	5.016	5,099	7.904	7,649	11.857	6,756	10.473	3,952	6.126	12,748	19.761
6	153.2	6.031	7,373	11.427	11,060	17.14	9,769	15.141	5,714	8.856	18,433	28.567

Chapter 9 Table #4 Conductors

THHN, THWN, & THWN-2				
Size (AWG or kcmil)	Approximate Diameter		Approximate Area	
	mm	in.	mm^2	$in.^2$
#14	2.819	0.111	6.258	0.0097
#12	3.302	0.13	8.581	0.0133
#10	4.166	0.164	13.61	0.0211
#8	5.486	0.216	23.61	0.0366
#6	6.452	0.254	32.71	0.0507
#4	8.23	0.324	53.16	0.0824
#3	8.941	0.352	62.77	0.0973
#2	9.754	0.384	74.71	0.1158
#1	11.33	0.446	100.8	0.1562
1/0	12.34	0.486	119.7	0.1855
2/0	13.51	0.532	143.4	0.2223
3/0	14.83	0.584	172.8	0.2679
4/0	16.31	0.642	208.8	0.3237
250	18.06	0.711	256.1	0.3970
300	19.46	0.766	297.3	0.4608
350	20.75	0.817	338.2	0.5242
400	21.95	0.864	378.3	0.5863
500	24.1	0.949	456.3	0.7073
600	26.7	1.051	559.7	0.8676

XHHW & XHHW-2				
Size (AWG or kcmil)	Approximate Diameter		Approximate Area	
	mm	in.	mm^2	$in.^2$
#14	3.378	0.133	8.968	0.0139
#12	3.861	0.152	11.68	0.0181
#10	4.47	0.176	15.68	0.0243
#8	5.994	0.236	28.19	0.0437
#6	6.96	0.274	38.06	0.059
#4	8.179	0.322	52.52	0.0814
#3	8.89	0.35	62.06	0.0962
#2	9.703	0.382	73.94	0.1146
#1	11.23	0.442	98.97	0.1534
1/0	12.24	0.482	117.7	0.1825
2/0	13.41	0.528	141.3	0.219
3/0	14.73	0.58	170.5	0.2642
4/0	16.21	0.638	206.3	0.3197
250	17.91	0.705	251.9	0.3904
300	19.3	0.76	292.6	0.4536
350	20.6	0.811	333.3	0.5166
400	21.79	0.858	373	0.5782
500	23.95	0.943	450.6	0.6984
600	26.75	1.053	561.9	0.8709

Chapter 9 Table #4 Conductors

- For each conductor type/size
- Focus on the Area.
- This is the only number which matters.
- Say you have 4 #8 & 1 #10
  - 4x0.0366=0.1464+0.0211 = 0.1675
  - 3/4" EMT@40% = 0.213
  - 3/4" RMC@40% = 0.220
  - 3/4" PVC@40% = 0.203

THHN, THWN, & THWN-2				
Size (AWG or kcmil)	Approximate Diameter		Approximate Area	
	mm	in.	mm^2	$in.^2$
#14	2.819	0.111	6.258	0.0097
#12	3.302	0.13	8.581	0.0133
#10	4.166	0.164	13.61	0.0211
#8	5.486	0.216	23.61	0.0366
#6	6.452	0.254	32.71	0.0507
#4	8.23	0.324	53.16	0.0824
#3	8.941	0.352	62.77	0.0973
#2	9.754	0.384	74.71	0.1158
#1	11.33	0.446	100.8	0.1562

Annex C Raceways & Conductors

CONDUIT FILL TABLES – NEC TABLE C CONDUCTOR SIZE – AWG / kcmil – THHN / THWN																
SIZE		14	12	10	8	6	4	3	2	1	1/0	2/0	3/0	4/0	250	300
1/2	EMT	12	9	5	3	2	1	1	1	1	1					
	RMC	13	9	6	3	2	1	1	1	1	1					
	IMC	14	10	6	3	2	1	1	1	1	1	1				
	40	11	8	5	3	1	1	1	1	1	1					
	80	9	6	4	2	1	1	1	1							
	FMC	13	9	6	3	2	1	1	1	1	1					
	LT	13	9	6	3	2	1	1	1	1	1					
3/4	EMT	22	16	10	6	4	2	1	1	1	1	1	1	1		
	RMC	22	16	10	6	4	2	1	1	1	1	1	1	1		
	IMC	24	17	11	6	4	3	2	1	1	1	1	1	1		
	40	21	15	9	5	4	2	1	1	1	1	1	1	1		
	80	17	12	7	4	3	1	1	1	1	1	1	1			
	FMC	22	16	10	6	4	2	1	1	1	1	1	1	1		
	LT	22	16	10	6	4	2	1	1	1	1	1	1	1		

- Annex C is based on all conductors being the same size.
- Many times, it is a great double check with multiple sizes.
- What size if all are the largest, and what size if all are the smallest?

How Many are Too Many...

- Annex C shows how many of a particular type and size will fit.
- This is the number which will fit per tables #4 & #5 Math Values Only
- This does not indicate how many can be legally install unless Signal/Control
- In Fact, there is no guarantee, you would be able to pull them in a long run
- In most situations 9 conductors at 70% is the point to add another raceway
- Example 9-#12, 30A@70% = 21A which will work for 20A OCPD
- Example 12-#12, 30A@50% = 15A which will NOT work for 20A OCPD
- Example 9-#10, 40A@70% = 28A which will work for 30A OCPD
- Example 12-#10, 40A@50% = 20A which will NOT work for 30A OCPD

Questions

By JD White

Jd.white2000@gmail.com

File Attachments for Item:

EC-3 2020 NEC Changes and Updates Article 230 through Chapter 4 (Labriola)

All certifications except plumbing and NRIUI (8 hours)

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: John M. Labriola (Contact Name)

Organization: Training Agency #191 (Organization/Company)

Address: 150 Maplecrest St. SW (Include Room Number, Suite, etc.)

City: North Canton State: Ohio Zip: 44720

E-Mail: john@ta191.com

Telephone: 330.497.6309 Fax:

Course Sponsor: None

COURSE INFORMATION:

Course Title: 2020 National Electrical Code Changes & Updates - Articles 230 - Chapter 4

New Course Submittal: ☒ Update Course: ☐ Prior Approval Number:

Purpose and Objective:
To provide BBS certified personnel a better understanding of the changes & Updates to the 2020 National electrical Code.
by utilizing a power-point presentation and real-life examples, for no charge to attendees.

Number of Instructional Contact Hours that can be obtained upon completion: 8 Hours

If Multi-Session, Number of Instructional Contact Hours Per Session:

Program Applicable for the Following Participants:

Building Official ☒ Master Plans Examiner ☒ Building Inspector ☒ Fire Protection Inspector ☒ Mechanical Inspector ☒
Plumbing Plans Exam. ☐ Plumbing Inspector ☐
Electrical Plans Exam. ☒ Non-Res IU Inspector ☐
Mechanical Plans Exam. ☒

Res Building Official ☒ Res Plans Examiner ☒ Res Building Inspector ☒ Res Mechanical Inspector ☒ Res IU Inspector ☒

Electrical Safety Inspectors [X]
Location of ESI Course: Various locations Date(s) of ESI Course(s): TBD

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

Form 1526 BBS 5102320

RECEIVED
MAY 04 2022
BOARD OF BUILDING STANDARDS

October 16, 2020

John M. Labriola
150 Maplecrest St. SW
North Canton, Ohio 44720

330.497.6309 Home 330.606.8098 Cell

Professional Bio'

Education

2012- 1984	Akron University, Stark State College: Continuing Education
1975	St. Thomas Aquinas High School; Louisville, Ohio
1971	Fairmount Elementary; Canton, Ohio

Building Department Experience

2017 – 2009	Summit County, Ohio; Chief Building Official (retired)
2009 – 2006	City of Canton, Ohio; Chief Building Official
2008 – 1997	City of Alliance, Ohio; Back-up Building and Electrical Inspector
2006 – 1997	City of North Canton, Ohio; Building and Electrical Inspector
1997 – 1986	Stark County, Ohio; Chief Electrical Inspector
1988 – 1984	City of Louisville, Ohio; Part-time Electrical Inspector

Current Certifications Held

International Code Council (ICC)

Accessibility Inspector/ Plans Examiner, Building Inspector, Building Plans Examiner, Certified Building Code Official, Certified Building Official, Certified Electrical Code Official, Certified Mechanical Code Official, Commercial Electrical Inspector, Commercial Mechanical Inspector, Commercial Plumbing Inspector, Electrical Inspector, Electrical Plans Examiner, Fire Plans Examiner, Master Code Professional, Mechanical Inspector, Mechanical Plans Examiner, Property Maintenance and Housing Inspector, Residential Electrical Inspector, Residential Energy Inspector / Plans Examiner, Residential Mechanical Inspector and Residential Plumbing Inspector.

State of Ohio:

Building Inspector, Building Official, Building Plans Examiner, Electrical Plans Examiner, Electrical Safety Inspector, Fire Protection Plans Examiner, Mechanical Plans Examiner and Residential Building Official.

Construction Experience

2007 – 1986	President; Electrical Design and Construction Co.
2004 – Present	State of South Carolina; Licensed Commercial Contractor
1992 – Present	State of Ohio; Licensed Electrical Contractor
1986 – 1981	Owner; Labriola Electric
1981 – 1975	Pedersen Electric; Helper / Apprentice / Journeyman Electrician
1980 – Present	Journeyman Electrician; City of Canton, Ohio

Professional Organization Memberships

2010 – 2017	American Institute of Architects - Akron Chapter (AIA-Akron)
2009 – 2017	Building Officials Code Officials of Northeast Ohio (BOCONEO)
2009 – 2017	National Fire Protection Association (NFPA)
1997 – 2017	Five County Building Officials Association (FBOA)
1997 – 2017	Ohio Building Officials Association (OBOA)
1986 – Present	International Association of Electrical Inspectors (IAEI)

Appointments (Director Positions)

2011 – 2017	Air-Conditioning Contractors Association of Akron / Canton
2011 – 2017	Home Builders Association of Summit and Portage Counties

Teaching Experience

2012 – 2017	Instructor; Home Builders Association of Greater Cleveland
2012 – 2017	Instructor; Home Builders Association of Summit and Portage Counties
2012 – Present	Instructor; National Electrical Contractors Association (NECA); Greater Cleveland, Ohio Division
2011 – Present	Instructor; Northeast Ohio Electrical Contractors Association (NOECA)
2005	Instructor; Clemson University; Clemson, South Carolina
2004 – Present	Instructor; Electrical League of Ohio; Cleveland, Ohio
2000 – 2016	Instructor; Stark State College of Technology: North Canton, Ohio
1999 – Present	Instructor; National Electrical Contractors Association (NECA); Akron, Ohio Division
1991 – 2009	OCILB Approved Contractor Training Agency
1990 – Present	State of Ohio; Approved Electrical Safety Inspector, Instructor

Respectfully,
John M. Labriola
John M. Labriola
OBBS ID #815
john@ta191.com

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May 02, 2022

Labriola Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720

Ohio Board of Building Standards
6606 Tussing Road – PO Box 4009
Reynoldsburg, Ohio 43068 – 9009

Course Submittal #8 – 8 Hours

Code Sections to be discussed in detail Article 230 – Chapter 4

Split-bus type panels no longer permitted

Dwelling Unit- Surge Protective Device (SPD) requirements

Meter mounted transfer switches

Exterior Emergency SE Disconnects (1- 2 Family Dwellings)

Smart Meters (Power Co's)

Paralleling Transformers

Steel Structures

GEC Protection (Schedule 80 PVC)

Sizing EGC's

Raceways exposed to different raceways

Exit Enclosures (Stairwells)

Table 310.12

Medium Voltage Conductors & Cables

Box Fill Calculations

MC & AC Cables Installed in Enclosed Areas

Class "P" Cable

Replacement Receptacles that Requirement AFCI Protection

Appliance GFCI Protection (Dishwashers)

Adjustable-speed Drives (Conductor Types)

Emergency Generator Shutdown (Dwelling Unit)

1 ☐ **OCILB LICENSE INFORMATION**

2 ☐ **CURRENT ADOPTED CODES**

3 ☐ **2019 RESIDENTIAL CODE OF OHIO**

4 ☐

5 ☐

THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

6 ☐ **"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)**

Subject to the local or State adoption authority

64 ☐ **ARTICLE 230**
SERVICES

230.1 Scope

This article covers service conductors and equipment for control and protection of services and their installation requirements.

For Informational Purposes Only

65 ☐ **ARTICLE 230 - SERVICES**

General Safety Issues Addressed

Panelboards with 6 SE disconnects *no longer permitted*. (MLO & split-bus panels)

Firefighter exterior SE disconnects for one- and two- family dwellings.

Line-side barriers to SE equipment to extend beyond panelboards only.

Arc-reduction for 1200 amps and greater to incorporate this technology (1/1/2020).

SCCR identification for pressure connectors and devices as *"suitable for use on the line side of SE equipment" (2017 NEC "PDB's).*

Surge protective devices *(SPD's)* now required for *all* dwelling units.

66 ☐ **230.46 SPLICED AND *TAPPED* CONDUCTORS**

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 (PDB's), pressure connectors, and devices for splices and taps shall be listed. PDB's installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.*

Effective 01.01.2023; pressure connectors and devices for splices and taps installed on service conductors shall be marked "suitable for use on the line side of service equipment" or equivalent.

IE: Protective covers

67 ☐ ***N* 230.62 (C) BARRIERS**

Relocated from 408.3(A)

Barriers shall be placed in *SE* 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.

Now applies to all SE Equipment

Exception Removed:

68 ☐ ***N* 230.67 SURGE PROTECTION**

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

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

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

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

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

69 ☐ ***N* 230.67**

SURGE PROTECTION FOR DWELLING UNITS

All services supplying dwelling units shall be provided with a surge protection device (SPD). Designed to protect against surges to electrical systems.

New Construction and Upgrades

Type 1 or Type 2 SPD

Not Current Code in Ohio

70 ☐ **230.71 MAXIMUM NUMBER OF DISCONNECTS**

Each service shall have only one disconnecting means unless the requirements of 230.71(B) are met.

230.71(B) Two to six service disconnects shall be permitted *for each service permitted by 230.2 or for each set of SE conductors permitted by 230.40, Ex. 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, each with a main SE disconnect.*
2. *Panelboards with a main SE disconnect.*
3. *Vertical switchboard sections that have separate SE disc.*
4. *SE disconnect in meter mods where each disconnect is located in a separate compartment.*

Refer to Informational Notes 1 & 2

71 ☐

72 ☐ **Δ 230.82 EQUIPMENT CONNECTED TO THE SUPPLY-SIDE OF SERVICE DISCONNECT**

Revision

(6) Solar PV, fuel cells, wind electric, energy storage, or interconnected electric power production systems, *if provided with a disconnecting means listed as SUSE rated and overcurrent protection as specified in Part VII of Article 230.*

(10) Emergency disconnects in accordance to 230.85, if all metal housings and SE enclosures are grounded (Part VII) and bonded in accordance with Article 250 (Part V).

(11) Meter mounted transfer switches, rated < 1000-v, have appropriate SCCR equal to or greater than the AFC. The transfer switch shall be listed and be capable of transferring the load served.

Identified on its exterior with both:
(a) Meter-mounted transfer switch
(b) Not service equipment.

74 ☐

75 ☐

230.85 "NEW" EXTERIOR EMERGENCY "SE" DISCONNECT
Applies to 1- and 2-Family Dwelling Units

All service conductors to terminate in a SUSE rated disconnecting means, with adequate SCCR, in a readily accessible *outdoor* location. Grouping is required.

Intent to protect firefighters / other emergency personnel.
For Informational Purposes Only

76 ☐ **230.85 EMERGENCY DISCONNECTS**
Each emergency disconnect shall be one of the following:

(1) Service disconnects marked:

"EMERGENCY DISCONNECT,
SERVICE DISCONNECT"

(2) Meter disconnects installed per 230.82(3) & marked:

"EMERGENCY DISCONNECT,
METER DISCONNECT,
NOT SERVICE DISCONNECT"

(3) Other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are suitable for use as service equipment & marked:

"EMERGENCY DISCONNECT,
NOT SERVICE EQUIPMENT"

77 ☐ ***NEWS***

09.20.2020

FIRST ENERGY ANNOUNCES
SMART METER CONVERSION; INDICATES 700K TO BE INSTALLED IN OHIO

78 ☐ **AEP SMART METER FLYER 01.18.2020**

79 ☐ **SMART METER**
RESIDENTIAL APPLICATION

80 ☐ **SMART METER UTILIZED FOR MULTIPLE VOLTAGES / PHASES**

81 ☐ **240.67(C) & 240.87(C) PERFORMANCE TESTING (NEW)**
ARC-ENERGY REDUCTION (FUSES / CKT. BRKRS)
2017 NEC Effective Date: 01.01.2020 (Fuses)

(A) Documentation
(B) Method to Reduce clearing Time
(C) *Performance Testing (NEW)*

AER Protection System – Tested when 1st installed
Qualified person, primary current injection & manufacturer test
Written record made available to AHJ

82 ☐ **240.88 RECONDITIONED EQUIPMENT (NEW)**
(A) Circuit Breakers

(1) Molded-case circuit breakers *shall not* be reconditioned
(2) Low-and medium-voltage circuit breakers *shall be permitted* to be reconditioned.
(3) High-voltage circuit breakers *shall be permitted* to be reconditioned.

(B) Components

(1) Low-voltage power circuit breaker electronic trip units *shall not* be reconditioned.
(2) Electromechanical protective relays and c/t's *shall be permitted* to be reconditioned.

83 ☐ **ARTICLE 242 (NEW) OVERVOLTAGE PROTECTION**
Discusses overvoltage connection requirements. Permanently installed surge-protective devices (SPD's) not more than 1000-v and permanently installed surge arresters over 1000-v.

(Relocated information from Articles 280 & 285)

Type 1 SPD- Connected at the Service- line or load
Type 2 SPD- Connected on load Side of Service Disc.
Type 3 SPD- Connected to load side of Branch OCD

Each SE Disc. Should be Protected!

84 ☐ **ARTICLE 250 GROUNDING & BONDING**

250.4(A)(1) Electrical System Grounding

Electrical systems that are grounded shall be connected to earth in a manner that will limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operation.

250.4(A)(5) Effective Ground-Fault Path.

Installed in a manner that creates a low-impedance path that facilitates the operation of the OCD in a safe manner.

85 ☐ ***N*** **250.25**

(NEW GROUNDING SYSTEMS PERMITTED TO BE CONNECTED ON THE SUPPLY-SIDE OF THE SE DISCONNECT)

The intent is that supply-side equipment [*whether considered a service or not*] needs to be properly grounded to a grounding electrode system. In order to create an effective fault current path. [Refer to 250.92 250.102(C)].

Systems such as wind, solar, fuel cells, and interconnected power production.

Note: 250.24(D) GEC Sized per Table 250.66

86 ☐ ***N*** **250.25(A) SUPPLY-SIDE SE GROUNDING INSTALLED IN SEPARATE ENCLOSURES FROM SE EQUIPMENT**

87 ☐ **MANUAL TRANSFER SWITCHES**

1 •

200a 2-pole 240-v 1ø

2

200a 3-pole 480-v 3ø

88 ☐ ***N*** **250.30(A)(1) EX. (3)(B)EXCEPTION**

GROUNDING SEPARATELY DERIVED SYSTEMS

System Bonding Jumper

N Ex. Separately derived systems consisting of multiple sources of the same type that are connected in parallel shall be permitted to have the system bonding jumper installed at the paralleling switchgear, switchboard, or other paralleling connection point instead of at the disconnecting means located at each separate source.

89 ☐ **PARALLELING OF TRANSFORMERS**

Transformers operating in parallel

Occurs in installations that have their primary windings of the *paralleled* transformers connected to the same voltage supply and the secondary windings are connected to a common load.

Note: Transformers need to have the same Kva rating, turn ratios, and impedance characteristics. This would create equal load sharing between the source transformers, without creating circulating currents in the windings (heat loss).

90 ☐ ***N*** **250.30(A)(6) EX. #3 GEC MULTIPLE SEPARATELY DERIVED SYSTEMS**

Relocated from 250.30(A)(6) Ex. 2(B) Ex. Tap Conductor Size

Now Expanded for all GEC, Multiple Separately Derived Systems

If the source of a separately derived system is located within equipment listed and identified as suitable for use as service equipment (SUSE), the grounding electrode conductor from the service or feeder equipment to the grounding electrode shall be permitted as the grounding electrode conductor for the separately derived system, if the grounding electrode conductor is of sufficient size for the separately derived system. If the equipment grounding bus internal to the equipment is not smaller than the required grounding electrode conductor for the separately derived system, the grounding electrode connection for the separately derived system shall be permitted to be made to the bus

Not Current Code in Ohio

91 ☐ **GROUNDING TRIANGLE / FOUNDATION**

250.50 All Electrodes present shall be bonded together (1-7)

250.52 Permitted Electrodes (1-8)

Focus:

1. Metal UG Water Pipe
2. Building Steel
3. Concrete-Encased
4. Rod / Pipe

92 ☐ ***N 2017*** **NEC 250.52(A)(2)**
METAL IN-GROUND SUPPORT STRUCTURES

93 ☐ **EFFECTIVELY GROUNDED STEEL STRUCTURE**

94 ☐ **250.64(A) GEC INSTALLATION**
AL OR COPPER-CLAD AL CONDUCTORS

[1] 2020 NEC

[2]

Revised / Expanded Details

(1) Conductors w/o an extruded polymeric covering shall not be installed in corrosive conditions or in direct contact with *concrete*

(2) Outdoor locations in listed & identified enclosures, OK! Within 18" of bottom of enclosure.

(3) AL / CU-AL external to buildings shall not terminate within 18" of the earth.

3 2017 NEC

4

(A)Bare aluminum or copper-clad aluminum grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum grounding electrode conductors shall not be permitted within 18" of the earth.

95 ☐ **250.64(B)(2) EXPOSED TO PHYSICAL DAMAGE**

Intent / Clarification

Any / all references for physical protection of grounding electrode conductors enclosed in PVC conduit will now require the use of Schedule 80 rigid polyvinyl chloride conduit.

Whether smaller than #6 AWG or larger

96 ☐

97 ☐ **GROUNDING / BONDING FITTINGS**

1

Servit Fitting

2 Parallel Body Connector aka: Split Bolt

98 ☐

100 ☐ **250.98 BONDING LOOSELY JOINTED METAL RACEWAYS**

Added: Expansion-deflection and Deflection Fittings

Expansion, *expansion-deflection, or deflection* fittings and telescoping sections of metal raceway shall be made electrically continuous by equipment bonding jumpers or other means.

Not Current

Code in Ohio

101 ☐ **250.120(B) EQUIPMENT GROUNDING CONDUCTOR INSTALLATION**

Expanded Revisions

Aluminum and Copper-Clad Aluminum Conductors. EGC's of bare, covered, or insulated aluminum or copper-clad aluminum shall comply with the following:

1. Unless *part of a suitable Chapter 3 cable wiring method*, bare or covered conductors shall not be installed in corrosive conditions or be installed in direct contact with *concrete*, masonry, or the earth.
2. Terminations are permitted in *outdoor listed and identified* for the environment enclosures within 18" of the bottom of the enclosure.
3. External to buildings shall not be terminated within 18" of the earth, *unless terminated within a listed wire connector system.*

102 ☐ **250.121(B)**
RESTRICTED USE OF EGC'S

Metal frame of a building or structure

Proposal would ***prohibit*** the structural metal frame of a building or structure from being used as an equipment grounding conductor (egc).

Clarification of 250.136(A), equipment secured to grounded metal structure. Acceptable to be used as a GEC, but not egc.

Relocated from 250.136(A)

103 ☐

104 ☐ **250.122**
SIZING EQUIPMENT GROUNDING CONDUCTORS

(C) Multiple Circuits – Revision

A single equipment grounding conductor *shall be permitted to be installed for multiple circuits that are installed* in the same raceway, cable, *trench*, or cable tray.

Separate raceways = separate EGC's

EGC Size based on Table 250.122

105 ☐ **250.122(B) SIZING EQUIPMENT GROUNDING CONDUCTORS**

N Increased in Size

If ungrounded conductors are increased in size for any reason other than as required in 310.15(B) or 310.15(C), wire-type equipment grounding conductors, if installed, shall be increased in size proportionately to the increase in circular mil area of the ungrounded

conductors.
310.15(B) – Ambient Temperature Correction Factors.
310.15(C) – Adjustment Factors

All conductors shall be increased in order to lower the overall voltage drop & impedance (of the GF current path) in order to open the OCD during a phase to ground fault.

106 ☐

107 ☐ **250.136 EQUIPMENT SECURED TO GROUNDED METAL SUPPORTS**
Clarification

Electrical equipment secured to and *in* electrical contact with a metal rack or structure provided for its support *shall* be permitted to be considered as being connected to an equipment grounding conductor *if the metal rack or structure is connected to an equipment grounding conductor by one of the means indicated in 250.134.*

108 ☐ **CHAPTER 3**
Wiring Methods and Materials

Article 300 – General Requirements for Wiring Methods & Materials

Article 310 – Conductors for General Wiring

N Article 311 – Medium Voltage Conductors and Cable

Article 314 – Outlet, Device, Pull & Junction Boxes, Conduit Bodies, Fittings & Handholes

N Article 337 – Type "P" Cable

109 ☐ **300.4(G) FITTINGS.**
PROTECTION FROM PHYSICAL DAMAGE
Revised, Clarified and Expanded.

Where raceways contain #4 AWG and larger insulated circuit conductors, and these conductors enter a cabinet, box, enclosure, or raceway shall be protected by any of the following:

1. Identified fitting, with smooth, identified, insulating surface
2. A listed metal fitting with smooth, rounded edges
3. Separation from raceway by a fitting secured in place

4. Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure or raceway with a smooth rounded edge or flared entry *(2017 NEC exception)*

110 ☐ **300.7**
RACEWAYS EXPOSED TO DIFFERENT TEMPERATURES
Expanded Requirement

(A) Sealing. Where portions of a raceway or sleeve are known to be subjected to different temperatures, and where condensation is known to be a problem, *(cold storage areas, interior to exterior locations)* shall be sealed to prevent the circulation of warm air to a colder section of the raceway. *Sealants shall be identified for use with the cable or conductor insulation, bare conductor, shield, or other components.*

Now reads similar to 300.5

111 ☐ **300.22(D) INFORMATION TECHNOLOGY EQUIPMENT**
Revised

Where the installation complies with the special requirements in *645.4*, electrical wiring in air-handling areas beneath raised floors, shall be permitted in accordance with *645.5(E)*.

112 ☐ ***N*** **300.25**
EXIT ENCLOSURES (STAIR TOWERS)
Where an exit enclosure is required to be separated from the building, *only* electrical wiring methods serving equipment permitted by the authority having jurisdiction in the exit enclosure shall be installed within the exit enclosure.

113 ☐ **300.45 DANGER SIGNS**

Requirements for over 1000-volts Nominal
Revised
Danger signs shall be conspicuously posted at points of access to conductors in all raceway and cable systems. The signs shall meet the requirements in 110.21(B), shall be readily visible, and shall read:
Danger – High Voltage – Keep Out
ANSI Z535.4 2011 (R2017)

114 ☐ **ARTICLE 310**
CONDUCTORS FOR GENERAL WIRING
This Article has been extensively re-organized

Most Tables were updated with additional conductor types:

PFA – Perfluoroalkoxy (High Temp- Teflon Conductors) Appl. & Elec.
XHHN – Flame Retardant Thermoset (90°C Dry & Damp) Bldg. Wire

XHWN – FR, Moisture Resistant Thermoset (75°C Dry & Wet)
XHWN-2 – FR, Moisture Resistant Thermoset (90°C Dry & Wet)

All tables now refer to Ampacities was "Allowable Ampacities"

For Informational Purposes Only

115 ☐ **ARTICLE 310**
CONDUCTORS FOR GENERAL WIRING
Re-organization Continued

1. 310.3 Conductors – 2017 NEC 310.160
2.
2. 310.4 Construction Applications – 2017 NEC 310.104
3.
3. 310.12 1ø Dwelling Services & Feeders – 2017 NEC 310.15
4.
4. 310.16 Ampacities of Insulated Conductors, Single-Insulated Conductors in Free Air, Insulated Conductors in Raceway or Cable, Single-Insulated Conductors in Free Air, Conductors Supported on a Messenger, Bare or Covered Conductors in Free Air, – 2017 NEC 310.15

116 ☐ **310.12 TABLE**
SINGLE-PHASE 120/240-V DWELLING SERVICES
& FEEDERS + 208Y/120-V SYSTEMS
Relocated 310.15(7)

The table is back for

100a – 400a Services & Feeders

83% Ampacity remains

Removed Table in 2014

117 ☐

118 ☐ **ARTICLE 311 (NEW)**
MEDIUM VOLTAGE CONDUCTORS AND CABLE
Covers construction, use installation and ampacities for medium voltage conductors and cables (MV).

Relocated from Article 310 & 328

2001v – 35kv ratings
Both shielded & non-shielded

119 ☐ **ARTICLE 314.16(B)(5)**
REVISION
EGC Conductor Fill

Where up to "4" egc's / ebc's enter a box, a *single* volume allowance shall be made based on the largest egc / ebc entering the box. *A ¼" volume allowance for each additional egc / ebc installed in a box shall be calculated.*
Applies to all cable methods
Not Current Code in Ohio

120 ☐ **314.27(C) REVISION**
BOXES AT CEILING-SUSPENDED
(PADDLE) FAN OUTLETS
Revision to this section will now require *all* outlet boxes in *habitable room locations* designed for future paddle fan installation, shall require the box to be listed as sole support of ceiling-suspended (paddle) fans or supported by structural framing members.

Removed spare or separate switch referenced locations!

121 ☐ **320.80 AMPACITY; ARMORED CABLE (AC CABLE)**
When Installed in Thermal Insulation / 2nd Paragraph *N*

(A) Thermal Insulation. Conductors installed shall be rated 90°C. Their ampacity shall not exceed the 60°C rating, 90°C shall be used to determine the adjustment / correction factors only.

Where more than 2 Type AC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

122 ☐ **330.80 AMPACITY; METAL CLAD CABLE (MC CABLE)**
When Installed in Thermal Insulation *N*

Where more than 2 Type MC cables containing two or more

current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

123 ☐ ***N*** **330.130 HAZARDOUS (CLASSIFIED) LOCATIONS**

N Where required to be marked MC-HL, the cable shall be listed and shall have a gas / vapor tight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor.

125 ☐ **ARTICLE 337 (NEW)**
CLASS P CABLE

Hazardous location cable up to 600-v, both armored and unarmored.

Typically, tinned copper conductor with a polyester tape separator. Insulation is chemically cross-linked polyolefin and the jacket is Arctic Neoprene.

Used for power, control, signaling and instrumentation for offshore drilling rigs. Severe cold durability, flame retardant and oil resistant

Cable tray installation and high strand count

Approved for Class I Div. 1 / Div. 2 locations

Class II Div. 1 / Div. 2 Locations

ANSI / UL 1309-2017 Marine Shipyard Cable

126 ☐ **TYPE "P" CABLE DESIGNED FOR THE OIL AND GAS INDUSTRY**

Numerous manufacturer's offer Type "P" cable.

Designed for harsh environments:

Oil and moisture resistant, severe temperature conditions, mechanical stress and drilling mud.
Uses include, drilling rigs, marine both onshore and offshore platform sites.
Available in both armored and sheathed

127 ☐ **CHAPTER 4**

Equipment for General Use

Article 404 – Switches

Article 406 – Receptacles, Cord Connectors, & Attachment Plugs

Article 408 – Switchboards, Switchgear & Panelboards

Article 410 – Luminaires, Lampholders, & Lamps

Article 422 – Appliances

Article 430 – Motors, Motor Circuits, & Controllers

Article 440 – A/C and Refrigeration Equipment

Article 445- Generators

128 ☐ **404.2(C) SWITCHES CONTROLLING LIGHTING LOADS**

Further Clarification

The grounded circuit conductor for controlled lighting circuit shall be installed at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit serving bathrooms, hallway stairways, *and habitable rooms or occupiable spaces* as defined in the applicable building code.

2019 RCO – Habitable Space. A space in a building for living, sleeping, eating or cooking.

129 ☐ **404.2(C) EXCEPTION**

Exception: The connection requirement shall become effective on January 1, 2020. *It shall not apply* to replacement or retrofit switches installed in locations prior to local adoption of *404.2(C) and where the grounded conductor cannot be extended without removing finish materials*. *The number of electronic control switches on a branch circuit shall not exceed 5, and the number connected to any feeder on the load side of a system or main bonding jumper shall not exceed 25*. For the purpose of this exception, a neutral busbar, in compliance with 200.2(B) and to which a main or system bonding jumper is connected shall not be limited as to the number of electronic lighting control switches connected.

2017 NEC Code Change Remains / when grounded conductor not able to be extended

130 ☐ **406.4 RECEPTACLE REPLACEMENTS. GROUNDING (D)(1); NON-GROUNDING (D)(2); GFCI (D)(3); AND AFCI (D)(4);**

Reference to 210.12 (A), (B) & (C) Required "AFCI" Locations

2020 NEC 406.4(D) Arc-Fault Circuit-Interrupter (AFCI); Replacement Types

(1) Listed outlet branch-circuit AFCI type receptacle
(2) Receptacle protected by listed outlet branch-circuit type AFCI receptacle
(3) A receptacle protected by a listed combination type AFCI circuit breaker

210.12(D) Ex: *Branch Circuit Extensions or Modifications* – Dwelling Units, Dormitory Units, and Guest Rooms and Guest Suites locations only.

(1) 210.12 (A) Dwelling Units. (1-6)
(2) Listed outlet branch-circuit type AFCI at 1st outlet of existing circuit

131 ☐

132 ☐ **AFCI TYPE DEVICES**
[1] AFCI "TR" Outlet
[2] AFCI / GFCI "TR" Outlet

133 ☐ **AFCI TYPE DEVICES**
[1] AFCI "Deadfront"
[2] 20a Hospital Grade AFCI / GFCI "TR" Outlet (Red)

134 ☐ **406.5(G)(2) NEW**
RECEPTACLE ORIENTATION UNDER SINKS

Receptacle outlets are prohibited from being installed face-up in or on countertop surfaces, unless they are listed for such installations.

The proposal will include prohibiting face-up installations in under sink locations as well.

Readily Accessible?

135 ☐ **406.9(C)**
BATHTUB & SHOWER SPACE
EXPANDED DETAILS

Receptacles shall *not* be installed *within a zone measured 3' horizontally and 8' vertically from the top of the bathtub rim or shower stall threshold.* The identified zone is all-encompassing and *shall include* the space directly over the tub or shower stall.

Exception: In bathrooms with less than the required zone, the receptacle(s) shall be permitted to be installed opposite the bathtub rim or shower stall threshold on the farthest wall within

the room.

Same as light fixtures 410.10(D)

136 ☐ **406.12 TAMPER RESISTANT RECEPTACLES**

Additional Location Requirements

All 15- and 20-ampere, 125-v and 250-v nonlocking type receptacles in the areas specified 406.12(1) through *(8)* shall be listed
tamper-resistant receptacles.

(1) Dwelling units, *including attached & detached garages accessory buildings to dwelling units, & common areas of multifamily dwellings specified in 210.52 & 550.13.*
(2) Guest rooms & guest suites of hotels, *motels & common areas.*
(6) Assembly areas; including places *awaiting transportation...*
(7) Dormitory *units*
(*8*) *Assisted living facilities (NEW)*

137 ☐ ***N*** **406.13 RECEPTACLES, CORD CONNECTORS, AND CAPS**

Single-Pole Separable-Connector Type.

Single-pole separable connectors shall be listed and labeled and shall comply with 406.13(A) – (D).

(A) Locking or Latching Type
(B) Identification
(C) Interchangeability
(D) Connecting and Disconnecting

138 ☐ **408.4**
CIRCUIT DIRECTORY OR CIRCUIT IDENTIFICATION

Revision

Currently, the legible circuit directory is required to be located inside the panel door or face of the panelboard. New revision text states "*inside of, or in an approved location adjacent to*" the panel door.

Due to other information located on the panel, energy compliance certificate, AFC, inspection stickers, energy management info, etc..
2019 Residential Code of Ohio – 1101.14 Certificate

139 ☐ ***N*** **408.6 SWITCHBOARDS, SWITCHGEAR AND PANELBOARDS**

Short-Circuit Current Rating

Switchboards, switchgear & panelboards *shall* have a SCCR not less than the available fault current in other than one- and two-family dwellings, the available fault current and the date the calculation was performed shall be field marked on the enclosure at the point of supply. The marking shall comply with 110.21(B)(3). ***ANSI Z535.4 2011 (R2017)***

140

141 **ALL ABOUT SAFETY!**

110.10 – Short Circuit Current Ratings. The equipment short-circuit current ratings and other characteristics of the circuit to be protected shall be selected and coordinated to permit the circuit protective devices used to clear a fault, to do so without extensive damage to the electrical equipment of the circuit. *SCCR is Not overcurrent protection.*

Installing Properly Rated Overcurrent Protective Devices

Overcurrent protective devices (breakers or fuses) shall be rated greater than the maximum available fault current available at the line side terminals of the equipment *(load)* served.

142 **408.43 PANELBOARD ORIENTATION**

The intent is to prohibit mounting panelboards from being installed in the face-up position.

Debris can accumulate and damage to the bus and OCD's can occur.
For Informational Purposes Only

143 ***N*** **PART XVI. SPECIAL PROVISIONS FOR HORTICULTURAL LIGHTING EQUIPMENT**

410.172 Listing
410.174 Installation and Use
410.176 Locations Not Permitted
410.184 Ground-Fault Circuit-Interrupter Protection

Damp or Wet Location Listed / Labeled? / Light Spectrum
Fruits / Vegetables / Cannabis

144 ☐ **422.5(A)**
GFCI REQUIREMENTS FOR APPLIANCES
Revised

Removed the requirement "*provided for public use*" for both vacuum and tire inflation machines, GFCI protection is required.

Applies to all locations!

145 ☐ **ARTICLE 422 APPLIANCES**

GROUND-FAULT CIRCUIT-INTERRUPTER (GFCI) PROTECTION FOR PERSONNEL
422.5 General.

(1) Automotive Vacuum machines
(2) Drinking water coolers and bottle fill stations
(3) Cord-and-plug connected high-pressure spray washing machines
(4) Tire inflation machines
(5) Vending Machines
(6) Sump pumps
(7) Dishwashers

N Informational Note: Section 210.8 specifies requirements for GFCI protection for the branch-circuit outlet where the covered location warrants such protection.

146 ☐ **ARTICLE 430 – MOTORS, MOTOR CIRCUITS & CONTROLLERS**
New Terminology – Electronically Protected

430.32 (A) Thermal Protector or "*Electronically Protected*" (designed for fractional motors).

An electronically protected motor shall be approved for use on the basis that it will prevent dangerous overheating due to the failure of the *electronic control*, overload, or failure to start the motor.
Terminology throughout Article 430

147 ☐ **430.122**
CONDUCTORS – MINIMUM SIZE & AMPACITY
New Informational Note No. 2

Relates to adjustable-speed drive systems

Circuit conductors on the output of an adjustable-speed drive system are susceptible to

breakdown under certain conditions due to the characteristics of the output waveform of the drive. Factors affecting the conductors include but not limited to the output voltage, frequency, & current, the length of the conductors, the spacing between the conductors, and *the dielectric strength of the conductor insulation*. Methods to mitigate breakdown include consideration of one or more of these factors.

ie: XHHW / XHHN Type Conductors

148 ☐ **440.9 A/C & REFRIGERATION EQUIPMENT**

Clarification

All A/C & Refrigeration equipment installed outdoors on a roof, in a metallic raceway that utilizes *compression-type* fittings/connectors require a wire type equipment grounding conductor.

Was non-threaded fittings

149 ☐

445.18(D) NEW EMERGENCY SHUTDOWN IN 1- & 2-FAMILY DWELLING UNITS

Generators

Generators other than cord-and-plug connected portable type, *shall be provided* with an emergency shutdown device, located on the *outside* of 1- and 2-family dwelling units.

Not Current Code in Ohio

150 ☐ **PORTABLE GENERATOR SET-UP**

1 GE 50a Twist Lock Power Inlet

2 50a Twist Lock Power Cord

248 ☐ **2020 NEC COMMERCIAL OVERVIEW**

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems

- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

249 ☐ **2020 NEC RESIDENTIAL OVERVIEW**

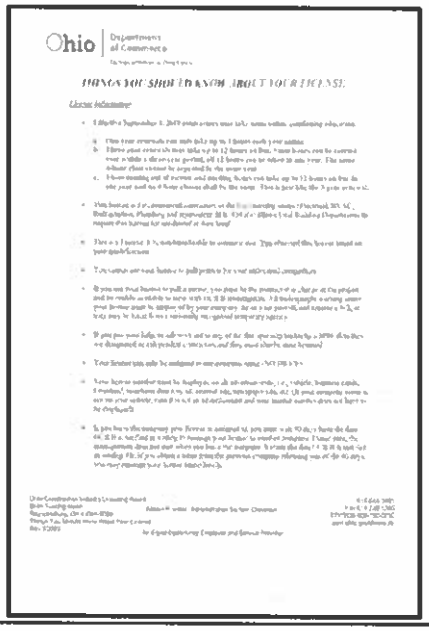
- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

250 ☐

2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Thank You!

OCILB LICENSE INFORMATION

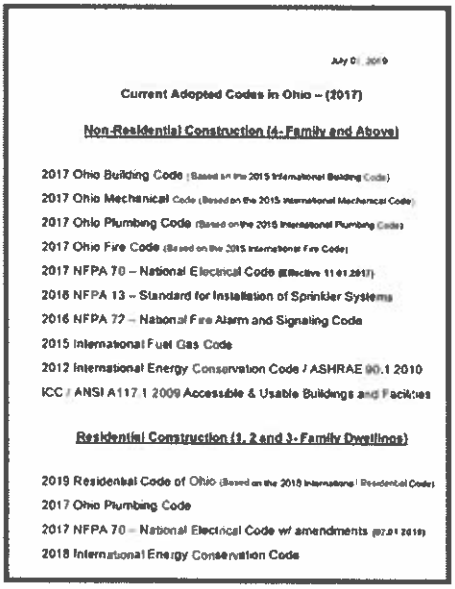

Ohio | Department of Commerce

THINGS YOU SHOULD KNOW ABOUT YOUR LICENSE:

License Information

1

CURRENT ADOPTED CODES


July 01, 2019

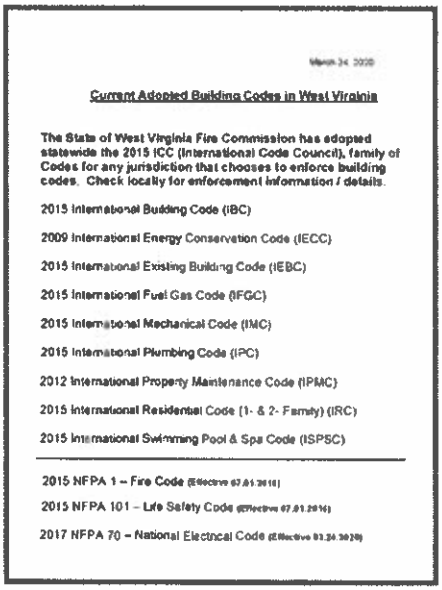
Current Adopted Codes in Ohio – (2017)

Non-Residential Construction (4- Family and Above)

2017 Ohio Building Code (Based on the 2015 International Building Code)
2017 Ohio Mechanical Code (Based on the 2015 International Mechanical Code)
2017 Ohio Plumbing Code (Based on the 2015 International Plumbing Code)
2017 Ohio Fire Code (Based on the 2015 International Fire Code)
2017 NFPA 70 – National Electrical Code (Effective 11 01 2017)
2016 NFPA 13 – Standard for Installation of Sprinkler Systems
2016 NFPA 72 – National Fire Alarm and Signaling Code
2015 International Fuel Gas Code
2012 International Energy Conservation Code / ASHRAE 90.1 2010
ICC / ANSI A117.1 2009 Accessible & Usable Buildings and Facilities

Residential Construction (1, 2 and 3- Family Dwellings)

2019 Residential Code of Ohio (Based on the 2018 International Residential Code)
2017 Ohio Plumbing Code
2017 NFPA 70 – National Electrical Code w/ amendments (07 01 2018)
2018 International Energy Conservation Code


March 24, 2020

Current Adopted Building Codes in West Virginia

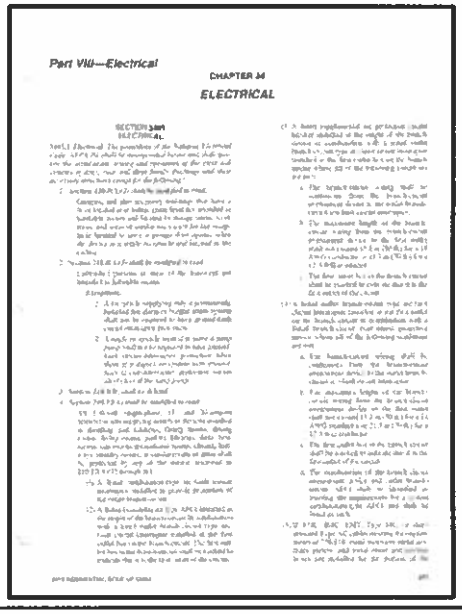
The State of West Virginia Fire Commission has adopted statewide the 2015 ICC (International Code Council), family of Codes for any jurisdiction that chooses to enforce building codes. Check locally for enforcement information / details.

2015 International Budding Code (IBC)
2009 International Energy Conservation Code (IECC)
2015 International Existing Building Code (IEBC)
2015 International Fuel Gas Code (IFGC)
2015 International Mechanical Code (IMC)
2015 International Plumbing Code (IPC)
2012 International Property Maintenance Code (IPMC)
2015 International Residential Code (1- & 2- Family) (IRC)
2015 International Swimming Pool & Spa Code (ISPSC)

2015 NFPA 1 – Fire Code (Effective 07 01 2018)
2015 NFPA 101 – Life Safety Code (Effective 07 01 2018)
2017 NFPA 70 – National Electrical Code (Effective 01 24 2020)

2

2019 RESIDENTIAL CODE OF OHIO


Part VIII—Electrical

CHAPTER 34

ELECTRICAL

3

www.ta191.com

2020 "Proposed" National Electrical Code (NEC) Changes & Updates

Training Agency #191

150 Maplecrest Street SW
North Canton, Ohio 44720
330.497.6309 Phone

John M. Labriola

www.ta191.com

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THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

2020

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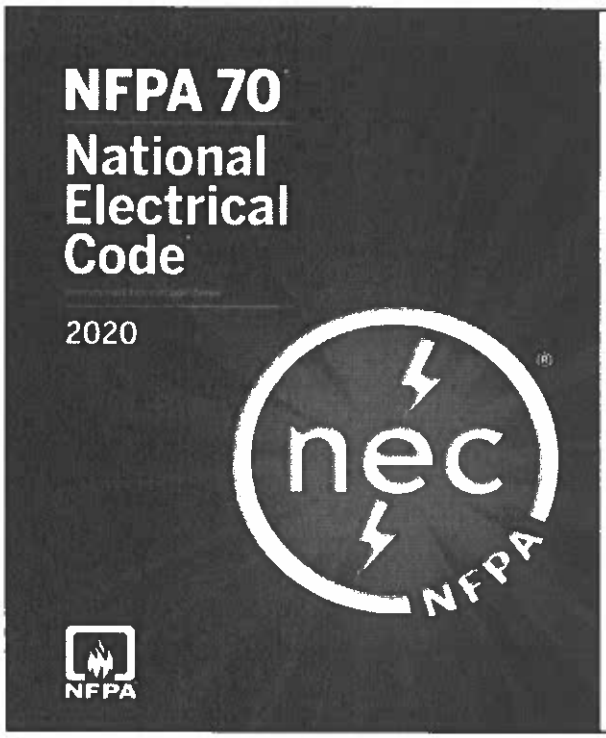

"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)

Subject to the local or State adoption authority

2020

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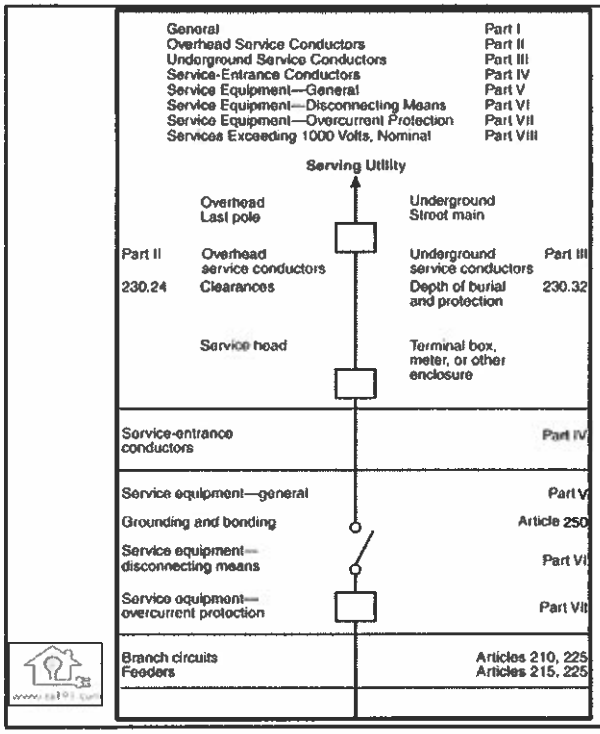

ARTICLE 230 SERVICES

230.1 Scope

This article covers service conductors and equipment for control and protection of services and their installation requirements.

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2020

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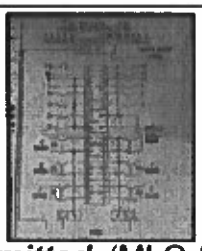
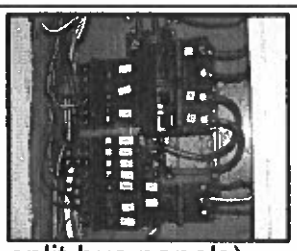
ARTICLE 230 - SERVICES

General Safety Issues Addressed





Panelboards with 6 SE disconnects ***no longer permitted***. (MLO & split-bus panels)

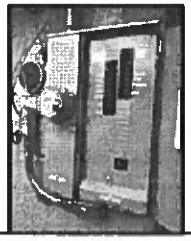
Firefighter exterior SE disconnects for one- and two- family dwellings.

Line-side barriers to SE equipment to extend beyond panelboards only.

Arc-reduction for 1200 amps and greater to incorporate this technology (1/1/2020).

SCCR identification for pressure connectors and devices as ***"suitable for use on the line side of SE equipment"*** *(2017 NEC "PDB's)*.

Surge protective devices ***(SPD's)*** now required for ***all*** dwelling units.



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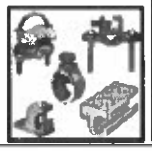
230.46 SPLICED AND *TAPPED* CONDUCTORS

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 (PDB's), pressure connectors, and devices for splices and taps shall be listed. PDB's installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.***

Effective 01.01.2023; pressure connectors and devices for splices and taps installed on service conductors shall be marked "suitable for use on the line side of service equipment" or equivalent.

IE: Protective covers



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2020

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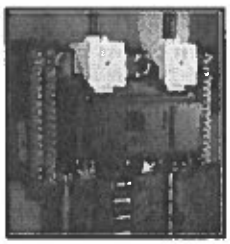
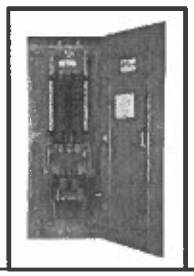
N 230.62 (C) BARRIERS



Relocated from 408.3(A)

Barriers shall be placed in *SE* 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.



Now applies to all SE Equipment

Exception Removed:

Not Current Code in Ohio

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N 230.67 SURGE PROTECTION

(A) *N* SPD Device. All services supplying dwelling units shall be provided with a surge-protective device (SPD).

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

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

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

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

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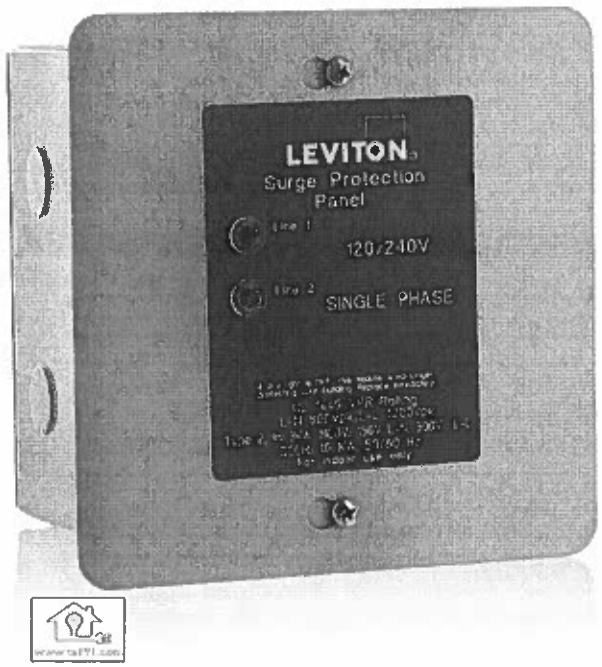

N 230.67 SURGE PROTECTION FOR DWELLING UNITS

All services supplying dwelling units shall be provided with a surge protection device (SPD). Designed to protect against surges to electrical systems.

New Construction and Upgrades

Type 1 or Type 2 SPD

Not Current Code in Ohio

2020

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230.71 MAXIMUM NUMBER OF DISCONNECTS

Each service shall have only <u>one</u> disconnecting means unless the requirements of 230.71(B) are met.

230.71(B) Two to six service disconnects shall be permitted ***for each service permitted by 230.2 or for each set of SE conductors permitted by 230.40, Ex. 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, each with a <u>main</u> SE disconnect.***
2. ***Panelboards with a <u>main</u> SE disconnect.***
3. ***Vertical switchboard sections that have <u>separate</u> SE disc.***
4. ***<u>SE disconnect</u> in meter mods where each disconnect is located in a separate compartment.***

<u>Refer to Informational Notes 1 & 2</u>

<u>For Informational Purposes Only</u>

2020

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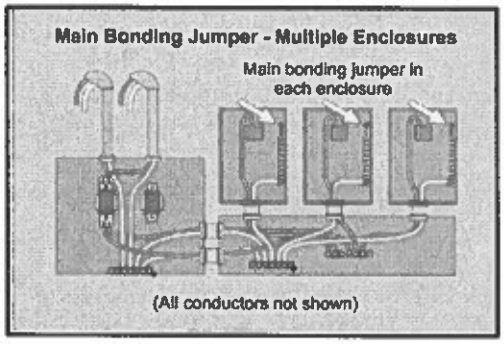

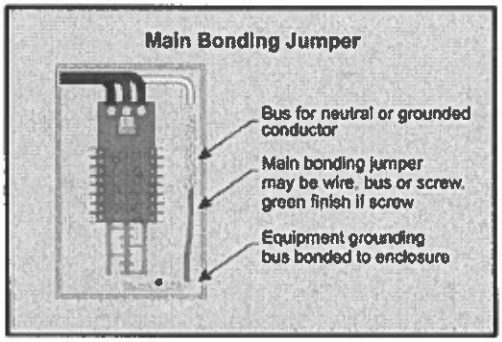

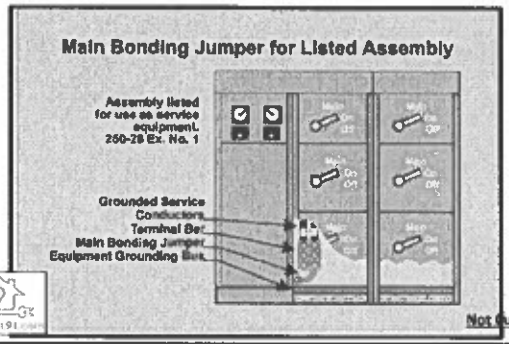

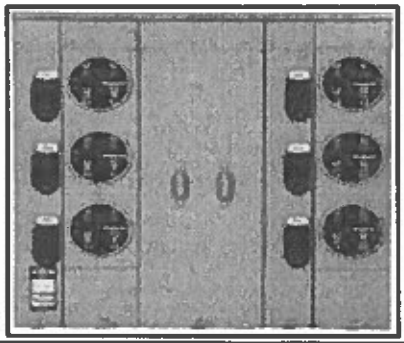

2020

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Δ 230.82 EQUIPMENT CONNECTED TO THE SUPPLY-SIDE OF SERVICE DISCONNECT

Revision

(6) Solar PV, fuel cells, wind electric, energy storage, or interconnected electric power production systems, ***if provided with a disconnecting means listed as SUSE rated and overcurrent protection as specified in Part VII of Article 230.***

(10) Emergency disconnects in accordance to 230.85, if all metal housings and SE enclosures are grounded (Part VII) and bonded in accordance with Article 250 (Part V).

(11) Meter mounted transfer switches, rated <1000-v, have appropriate SCCR equal to or greater than the AFC. The transfer switch shall be listed and be capable of transferring the load served. Identified on its exterior with both:
(a) Meter-mounted transfer switch
(b) Not service equipment.

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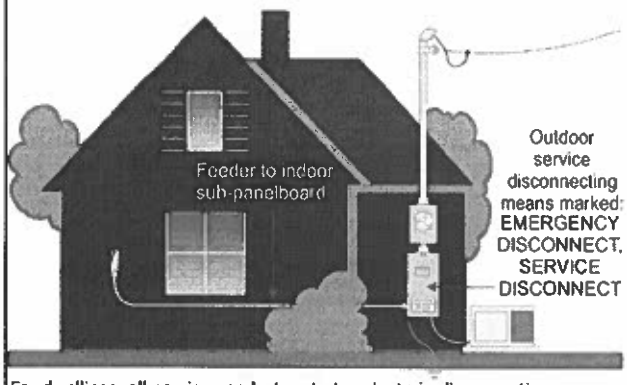
230.85 Exterior Emergency Disconnect(s)



For dwellings, all service conductors to 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

230.85 "NEW" EXTERIOR EMERGENCY "SE" DISCONNECT

Applies to 1- and 2-Family Dwelling Units

All **service conductors to terminate in a SUSE rated disconnecting means, with adequate SCCR, in a readily accessible *outdoor* location. Grouping is required.**

Intent to protect firefighters / other emergency personnel.

For Informational Purposes Only

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230.85 EMERGENCY DISCONNECTS

Each emergency disconnect shall be one of the following:

(1) Service disconnects marked:

"EMERGENCY DISCONNECT, SERVICE DISCONNECT"

(2) Meter disconnects installed per 230.82(3) & marked:

"EMERGENCY DISCONNECT, METER DISCONNECT, NOT SERVICE DISCONNECT"

(3) Other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are suitable for use as service equipment & marked:

"EMERGENCY DISCONNECT, NOT SERVICE EQUIPMENT"

Not Current Code in Ohio

2020

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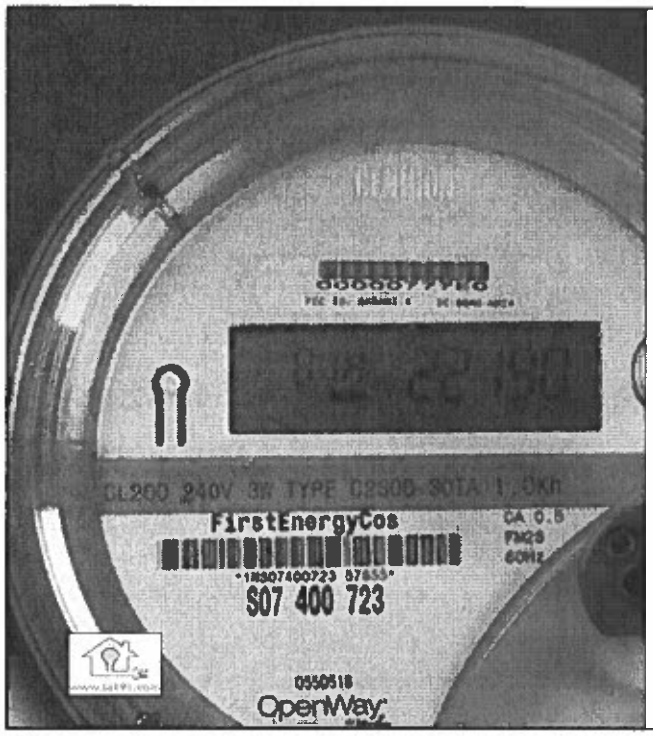

NEWS

09.20.2020
FIRST ENERGY ANNOUNCES SMART METER CONVERSION; INDICATES 700K TO BE INSTALLED IN OHIO

2020

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AEP SMART METER FLYER 01.18.2020

AEP AMERICAN ELECTRIC POWER

IMPORTANT NEWS
ABOUT YOUR
SMART METER

For Informational Purposes Only

2020

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SMART METER RESIDENTIAL APPLICATION

2020

Not Current Code in Ohio

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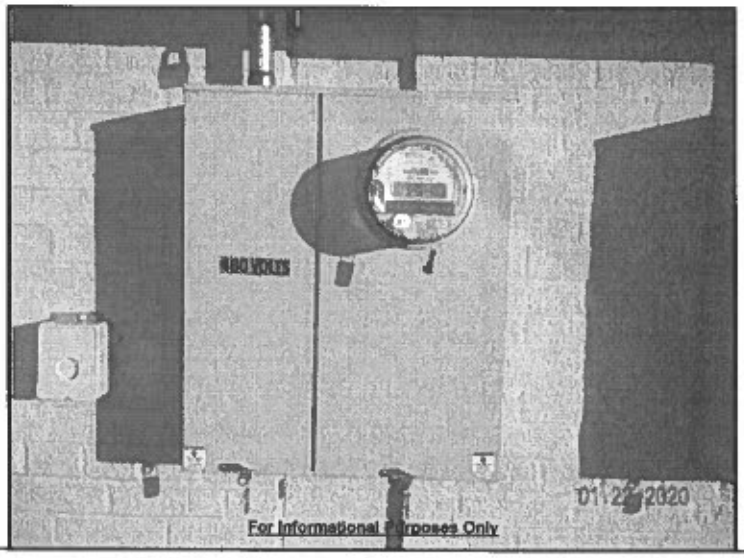
SMART METER UTILIZED FOR MULTIPLE VOLTAGES / PHASES



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240.67(C) & 240.87(C) PERFORMANCE TESTING (NEW) ARC-ENERGY REDUCTION (FUSES / CKT. BRKRS)

2017 NEC Effective Date: 01.01.2020 (Fuses)

(A) Documentation
(B) Method to Reduce clearing Time
(C) *Performance Testing (NEW)*

AER Protection System – Tested when 1st installed
Qualified person, primary current injection & manufacturer test
Written record made available to AHJ

For Informational Purposes Only

2020

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240.88 RECONDITIONED EQUIPMENT (NEW)

(A) Circuit Breakers

(1) Molded-case circuit breakers ***shall not*** be reconditioned
(2) Low-and medium-voltage circuit breakers ***shall be permitted*** to be reconditioned.
(3) High-voltage circuit breakers ***shall be permitted*** to be reconditioned.

(B) Components

(1) Low-voltage power circuit breaker electronic trip units ***shall not*** be reconditioned.
(2) Electromechanical protective relays and c/t's ***shall be permitted*** to be reconditioned.

Not Current Code in Ohio

2020

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ARTICLE 242 (NEW) OVERVOLTAGE PROTECTION

Discusses overvoltage connection requirements. Permanently installed surge-protective devices (SPD's) not more than 1000-v and permanently installed surge arresters over 1000-v.

(Relocated information from Articles 280 & 285)

Type 1 SPD- Connected at the Service- line or load
Type 2 SPD- Connected on load Side of Service Disc.
Type 3 SPD- Connected to load side of Branch OCD

Each SE Disc. Should be Protected!

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2020

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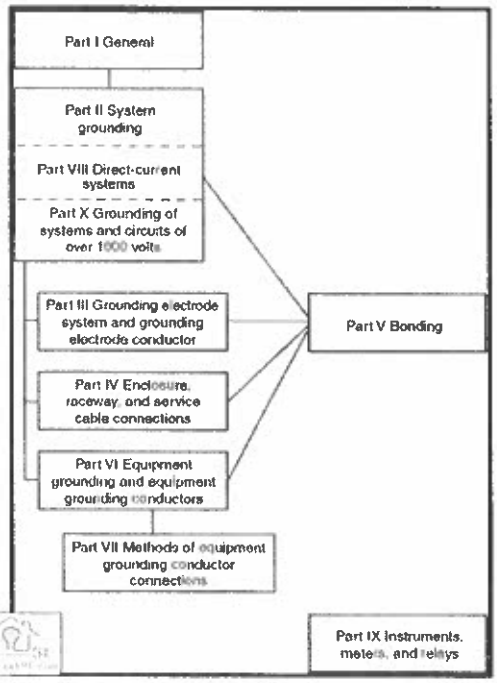

ARTICLE 250 GROUNDING & BONDING

250.4(A)(1) Electrical System Grounding

Electrical systems that are grounded shall be connected to earth in a manner that will limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operation.

250.4(A)(5) Effective Ground-Fault Path.

Installed in a manner that creates a low-impedance path that facilitates the operation of the OCD in a safe manner.

Not Current Code in Ohio

2020

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N 250.25

(NEW GROUNDING SYSTEMS PERMITTED TO BE CONNECTED ON THE SUPPLY-SIDE OF THE SE DISCONNECT)

The intent is that supply-side equipment [***whether considered a service or not***] needs to be properly grounded to a grounding electrode system. In order to create an effective fault current path. [Refer to 250.92 250.102(C)].
Systems such as wind, solar, fuel cells, and interconnected power production.

Note: 250.24(D) GEC Sized per Table 250.66

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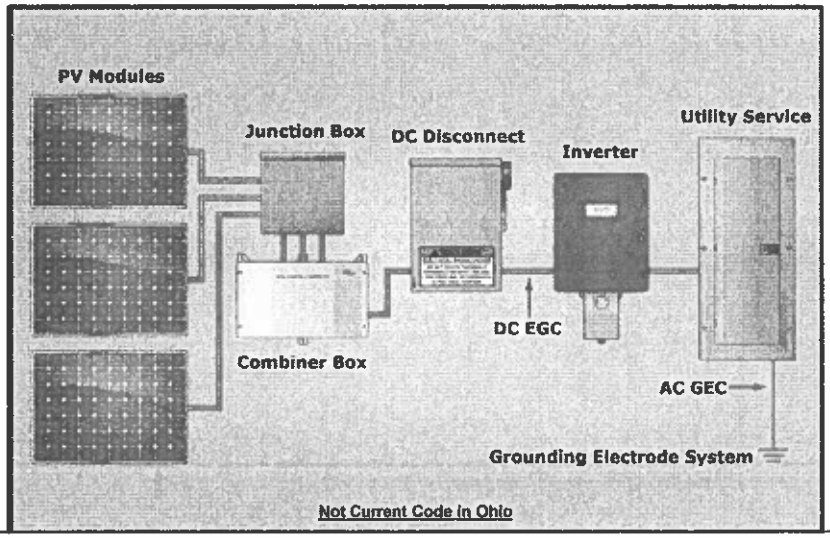
N 250.25(A) SUPPLY-SIDE SE GROUNDING INSTALLED IN SEPARATE ENCLOSURES FROM SE EQUIPMENT



2020

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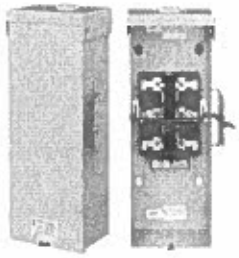
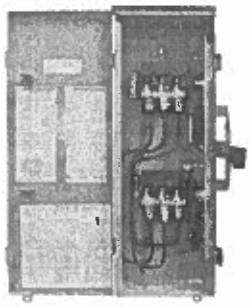
MANUAL TRANSFER SWITCHES

200a 2-pole 240-v 1ø



200a 3-pole 480-v 3ø



2020

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N 250.30(A)(1) EX. (3)(B)EXCEPTION GROUNDING SEPARATELY DERIVED SYSTEMS

System Bonding Jumper

N Ex. *Separately derived systems consisting of multiple sources of the same type that are connected in parallel shall be permitted to have the system bonding jumper installed at the paralleling switchgear, switchboard, or other paralleling connection point instead of at the disconnecting means located at each separate source.*

Not Current Code in Ohio

2020

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PARALLELING OF TRANSFORMERS

Transformers operating in parallel

Occurs in installations that have their primary windings of the ***paralleled*** transformers connected to the same voltage supply and the secondary windings are connected to a common load.

***Note*: Transformers need to have the same Kva rating, turn ratios, and impedance characteristics. This would create equal load sharing between the source transformers, without creating circulating currents in the windings (heat loss).**

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N 250.30(A)(6) EX. #3 GEC MULTIPLE SEPARATELY DERIVED SYSTEMS

Relocated from 250.30(A)(6) Ex. 2(B) Ex. Tap Conductor Size

Now Expanded for all GEC, Multiple Separately Derived Systems

If the source of a separately derived system is located within equipment listed and identified as suitable for use as service equipment (SUSE), the grounding electrode conductor from the service or feeder equipment to the grounding electrode shall be permitted as the grounding electrode conductor for the separately derived system, if the grounding electrode conductor is of sufficient size for the separately derived system. If the equipment grounding bus internal to the equipment is not smaller than the required grounding electrode conductor for the separately derived system, the grounding electrode connection for the separately derived system shall be permitted to be made to the bus

Not Current Code in Ohio

2020

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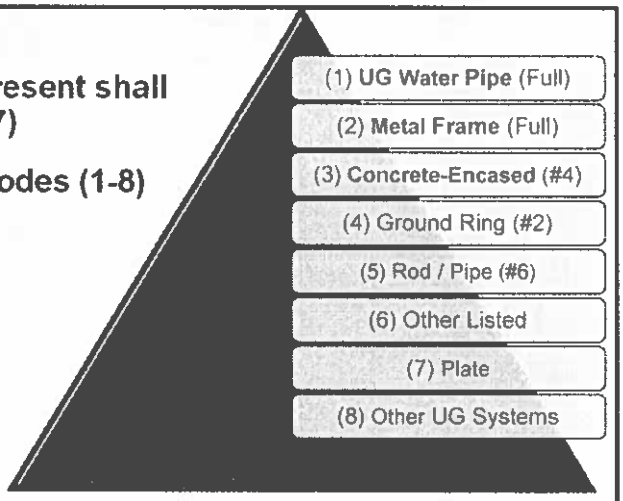
GROUNDING TRIANGLE / FOUNDATION

250.50 All Electrodes present shall be bonded together (1-7)

250.52 Permitted Electrodes (1-8)

Focus:

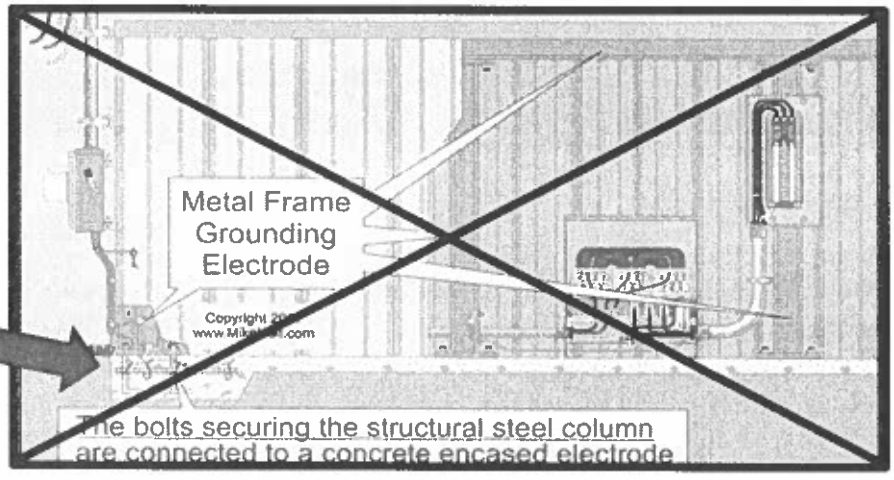
1. Metal UG Water Pipe
2. Building Steel
3. Concrete-Encased
4. Rod / Pipe



2020

91

N 2017 NEC 250.52(A)(2) METAL IN-GROUND SUPPORT STRUCTURES



2020

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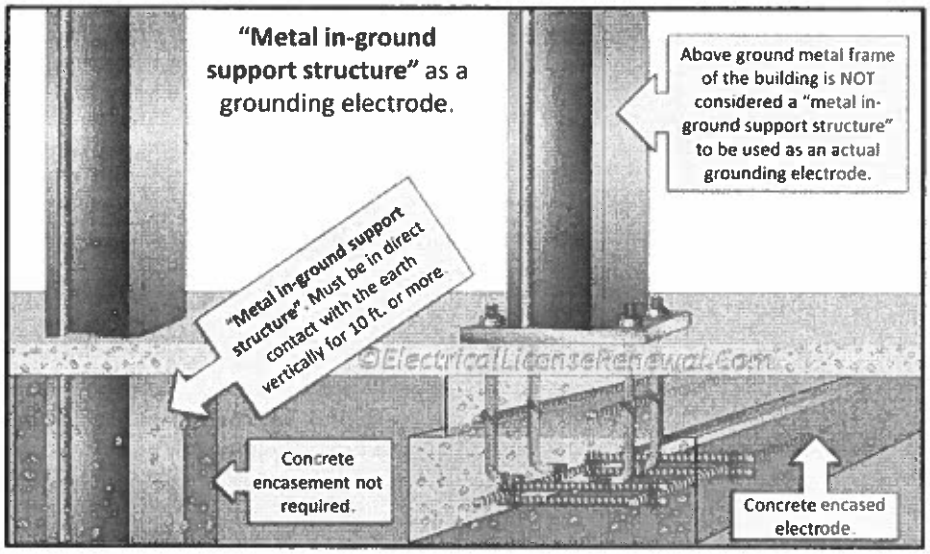
EFFECTIVELY GROUNDED STEEL STRUCTURE



2020

93

250.64(A) GEC INSTALLATION AL OR COPPER-CLAD AL CONDUCTORS

2020 NEC	2017 NEC
Revised / Expanded Details (1) Conductors w/o an extruded polymeric covering shall not be installed in corrosive conditions or in direct contact with ***concrete*** (2) Outdoor locations in listed & identified enclosures, OK! Within 18" of bottom of enclosure. (3) AL / CU-AL external to buildings shall not terminate within 18" of the earth.	(A) Bare aluminum or copper-clad aluminum grounding electrode conductors shall **not** be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum grounding electrode conductors shall not be permitted within 18" of the earth.

For Informational Purposes Only

2020

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250.64(B)(2) EXPOSED TO PHYSICAL DAMAGE

Intent / Clarification

Any / all references for physical protection of grounding electrode conductors enclosed in PVC conduit will now require the use of Schedule 80 rigid polyvinyl chloride conduit.

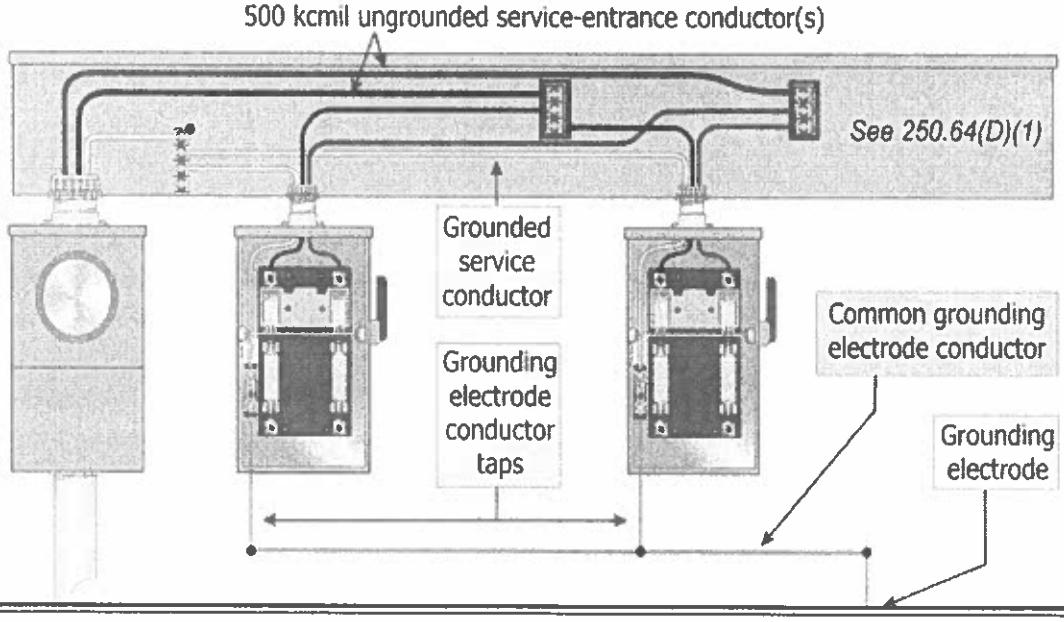
Whether smaller than #6 AWG or larger

Not Current Code in Ohio

2020

95

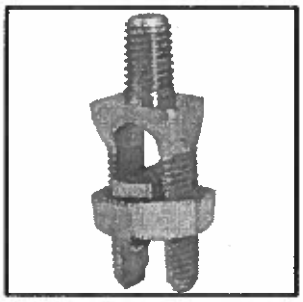
Taps to Common Grounding Electrode Conductor



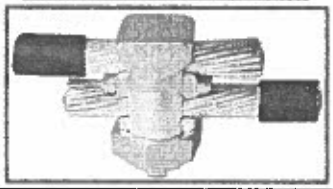
96

GROUNDING / BONDING FITTINGS

Servit Fitting



Parallel Body Connector
aka: Split Bolt



2020

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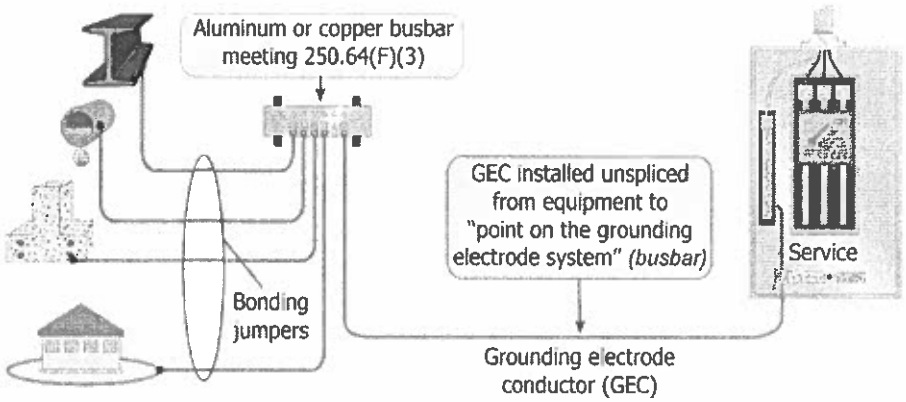
250.64(F) Installation to Electrode(s)



Bonding jumper(s) from grounding electrodes and grounding electrode conductors are permitted to be connected to copper or aluminum busbars to form the grounding electrode system

Connection to be made by a listed connector or by the exothermic welding process

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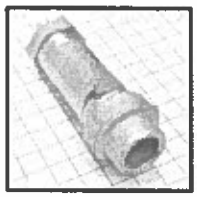
250.98 BONDING LOOSELY JOINTED METAL RACEWAYS

Added: Expansion-deflection and Deflection Fittings

Expansion, ***expansion-deflection, or deflection*** fittings and telescoping sections of metal raceway shall be made electrically continuous by equipment bonding jumpers or other means.



Not Current Code in Ohio

2020

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250.120(B) EQUIPMENT GROUNDING CONDUCTOR INSTALLATION

Expanded Revisions

Aluminum and Copper-Clad Aluminum Conductors. EGC's of bare, covered, or insulated aluminum or copper-clad aluminum shall comply with the following:

1. Unless ***part of a suitable Chapter 3 cable wiring method***, bare or covered conductors shall not be installed in corrosive conditions or be installed in direct contact with ***concrete***, masonry, or the earth.
2. Terminations are permitted in ***outdoor listed and identified*** for the environment enclosures within 18" of the bottom of the enclosure.
3. External to buildings shall not be terminated within 18" of the earth, ***unless terminated within a listed wire connector system***.

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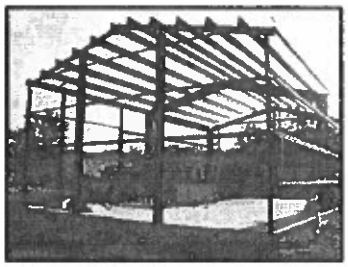
250.121(B) RESTRICTED USE OF EGC'S



Metal frame of a building or structure

Proposal would *prohibit* the structural metal frame of a building or structure from being used as an equipment grounding conductor (egc).

Clarification of 250.136(A), equipment secured to grounded metal structure. Acceptable to be used as a GEC, but not egc.

Relocated from 250.136(A)

Not Current Code in Ohio

2020

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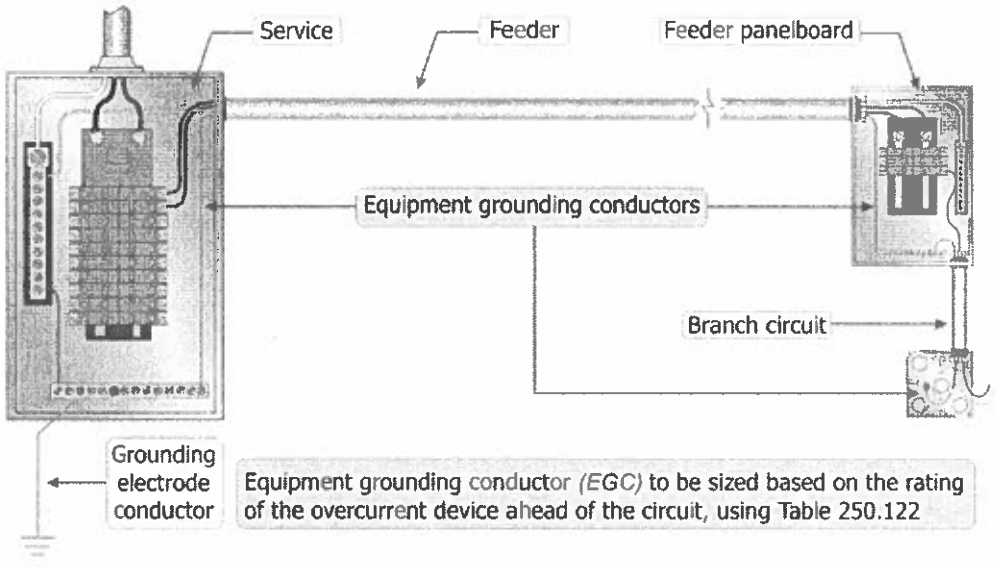
250.122(A) Sizing Equipment Grounding Conductors *(EGC)*



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250.122
SIZING EQUIPMENT GROUNDING CONDUCTORS

(C) Multiple Circuits – Revision

A single equipment grounding conductor ***shall be permitted to be installed for multiple circuits that are installed*** in the same raceway, cable, ***trench,*** or cable tray.

Separate raceways = separate EGC's

EGC Size based on Table 250.122

2020

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250.122(B) SIZING EQUIPMENT GROUNDING CONDUCTORS

N **Increased in Size**

If ungrounded conductors are increased in size for any reason other than as required in 310.15(B) or 310.15(C), wire-type equipment grounding conductors, if installed, shall be increased in size proportionately to the increase in circular mil area of the ungrounded conductors.

310.15(B) – Ambient Temperature Correction Factors.

310.15(C) – Adjustment Factors

All conductors shall be increased in order to lower the overall voltage drop & impedance (of the GF current path) in order to open the OCD during a phase to ground fault.

Not Current Code in Ohio

2020

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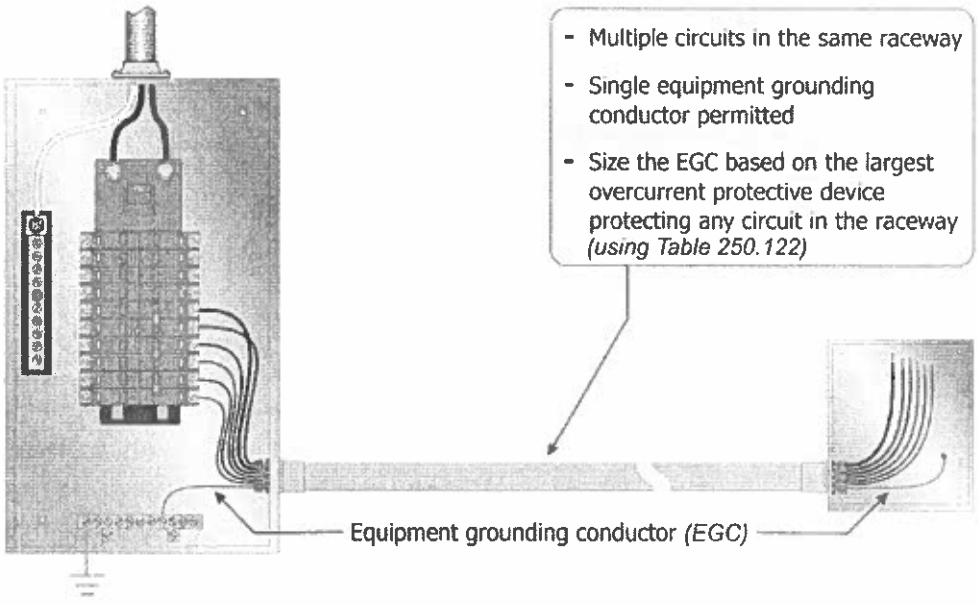
250.122(C) Multiple Circuits in the Same Raceway



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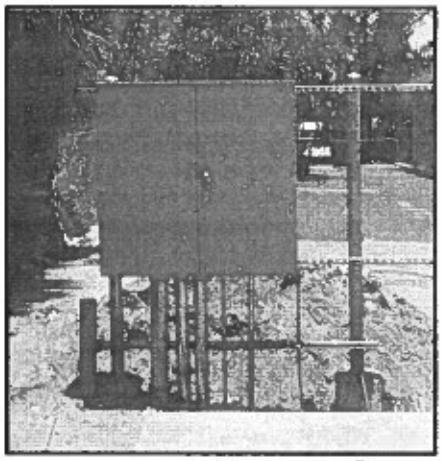
250.136 EQUIPMENT SECURED TO GROUNDED METAL SUPPORTS

Clarification

Electrical equipment secured to and ***in*** electrical contact with a metal rack or structure provided for its support ***shall*** be permitted to be considered as being connected to an equipment grounding conductor ***if the metal rack or structure is connected to an equipment grounding conductor by one of the means indicated in 250.134.***



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CHAPTER 3

Wiring Methods and Materials

Article 300 – General Requirements for Wiring Methods & Materials

Article 310 – Conductors for General Wiring

N **Article 311 – Medium Voltage Conductors and Cable**

Article 314 – Outlet, Device, Pull & Junction Boxes, Conduit Bodies, Fittings & Handholes

N **Article 337 – Type "P" Cable**

2020

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300.4(G) FITTINGS. PROTECTION FROM PHYSICAL DAMAGE

Revised, Clarified and Expanded.

Where raceways contain #4 AWG and larger insulated circuit conductors, and these conductors enter a cabinet, box, enclosure, or raceway shall be protected by any of the following:

1. Identified fitting, with smooth, identified, insulating surface
2. A listed metal fitting with smooth, rounded edges
3. Separation from raceway by a fitting secured in place
4. Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure or raceway with a smooth rounded edge or flared entry ***(2017 NEC exception)***

Not Current Code in Ohio

2020

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300.7 RACEWAYS EXPOSED TO DIFFERENT TEMPERATURES

Expanded Requirement

(A) Sealing. Where portions of a raceway or sleeve are known to be subjected to different temperatures, and where condensation is known to be a problem, *(cold storage areas, interior to exterior locations)* shall be sealed to prevent the circulation of warm air to a colder section of the raceway. ***Sealants shall be identified for use with the cable or conductor insulation, bare conductor, shield, or other components.***

Now reads similar to 300.5

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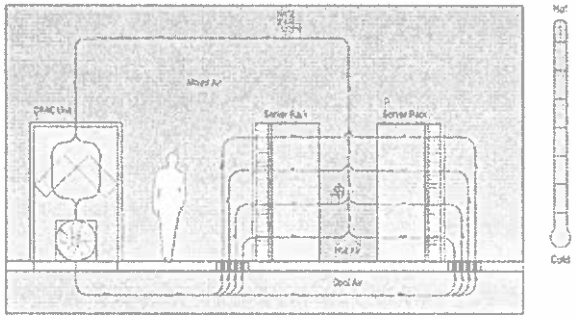
300.22(D) INFORMATION TECHNOLOGY EQUIPMENT

Revised

Where the installation complies with the special requirements in ***645.4***, electrical wiring in air-handling areas beneath raised floors, shall be permitted in accordance with ***645.5(E).***

Traditional Cooling Diagram



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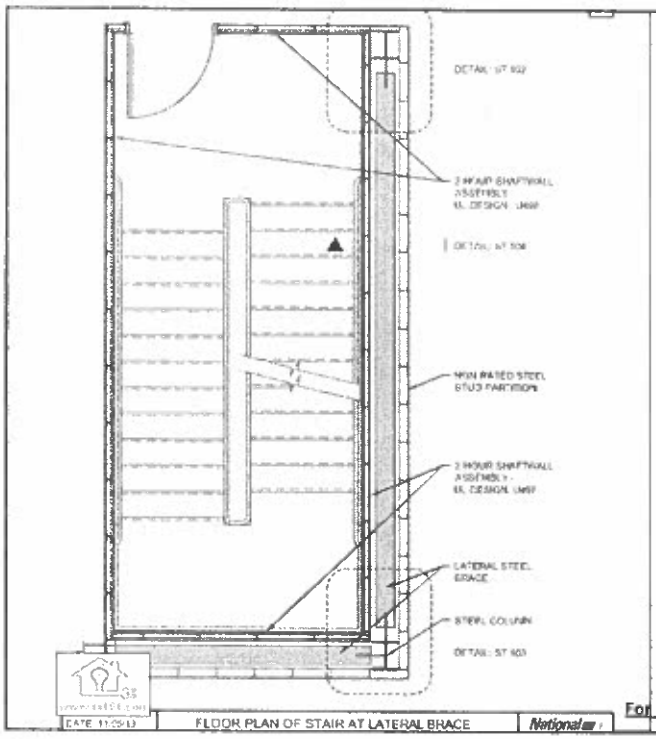

N 300.25 EXIT ENCLOSURES (STAIR TOWERS)

Where an exit enclosure is required to be separated from the building, ***only*** electrical wiring methods serving equipment permitted by the authority having jurisdiction in the exit enclosure shall be installed within the exit enclosure.

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300.45 DANGER SIGNS

Requirements for over 1000-volts Nominal

Revised

Danger signs shall be conspicuously posted at points of access to conductors in all raceway and cable systems. The signs shall meet the requirements in 110.21(B), shall be readily visible, and shall read:

Danger – High Voltage – Keep Out

*****ANSI Z535.4 2011 (R2017)*****

Not Current Code in Ohio

2020

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ARTICLE 310
CONDUCTORS FOR GENERAL WIRING

This Article has been extensively re-organized

Most Tables were updated with additional conductor types:

PFA – Perfluoroalkoxy (High Temp- Teflon Conductors) Appl. & Elec.
XHHN – Flame Retardant Thermoset (90°C Dry & Damp) Bldg. Wire
XHWN – FR, Moisture Resistant Thermoset (75°C Dry & Wet)
XHWN-2 – FR, Moisture Resistant Thermoset (90°C Dry & Wet)

All tables now refer to Ampacities was "Allowable Ampacities"

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ARTICLE 310
CONDUCTORS FOR GENERAL WIRING

Re-organization Continued

1. 310.3 Conductors – 2017 NEC 310.160
2. 310.4 Construction Applications – 2017 NEC 310.104
3. 310.12 1ø Dwelling Services & Feeders – 2017 NEC 310.15
4. 310.16 Ampacities of Insulated Conductors, Single-Insulated Conductors in Free Air, Insulated Conductors in Raceway or Cable, Single-Insulated Conductors in Free Air, Conductors Supported on a Messenger, Bare or Covered Conductors in Free Air, – 2017 NEC 310.15

Not Current Code in Ohio

2020

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310.12 TABLE
SINGLE-PHASE 120/240-V DWELLING SERVICES & FEEDERS + 208Y/120-V SYSTEMS

Relocated 310.15(7)

The table is back for

100a – 400a Services & Feeders

83% Ampacity remains

Removed Table in 2014

Amperes	Copper	Alum
100	4	2
110	3	1
125	2	1/0
150	1	2/0
175	1/0	3/0
200	2/0	4/0
225	3/0	250
250	4/0	300
300	250	350
350	350	500
400	400	600

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Table 310.16 Ampacities of Insulated Conductors with Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried)

Size AWG or kcmil	Temperature Rating of Conductor (See Table 310.4(A))						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)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, XHWN, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, PFA, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, XHHN, Z, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, XHWN, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, XHHN	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
18*	—	—	14	—	—	—	—
16*	—	—	18	—	—	—	—
14*	15	20	25	—	—	—	—
12*	20	25	30	15	20	25	12*
10*	30	35	40	25	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	115	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	145	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	195	230	250	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	350	420	475	285	340	385	600
700	385	460	520	315	375	425	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	445	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	525	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	555	665	750	470	560	630	2000

2020

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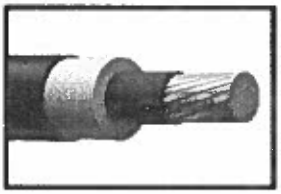
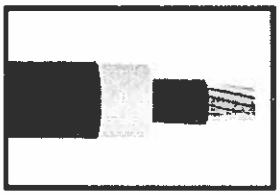
ARTICLE 311 (NEW) MEDIUM VOLTAGE CONDUCTORS AND CABLE

Covers construction, use installation and ampacities for medium voltage conductors and cables (MV).

Relocated from Article 310 & 328

2001v – 35kv ratings
Both shielded & non-shielded





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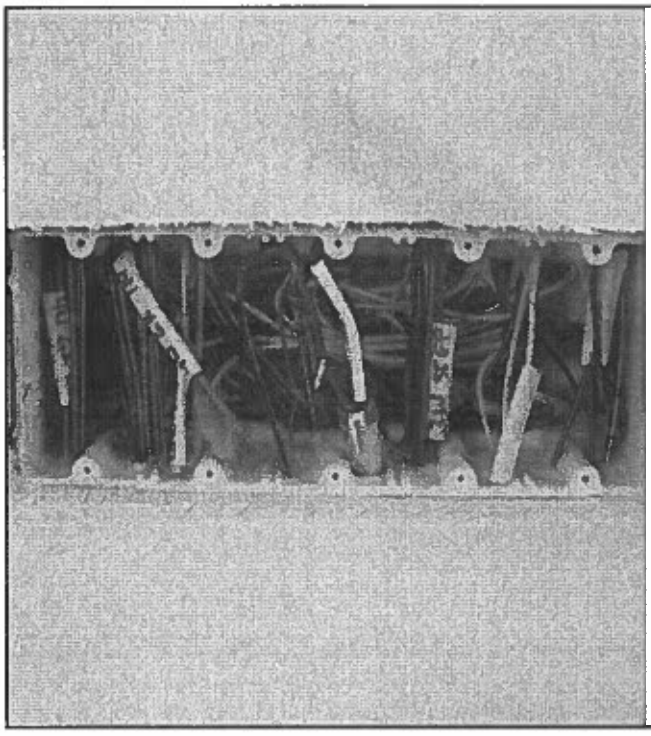

ARTICLE 314.16(B)(5) REVISION

EGC Conductor Fill

Where up to "4" egc's / ebc's enter a box, a ***single*** volume allowance shall be made based on the largest egc / ebc entering the box. ***A ¼" volume allowance for each additional egc / ebc installed in a box shall be calculated.***

Applies to all cable methods

Not Current Code in Ohio

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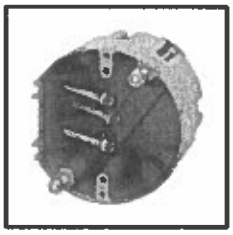
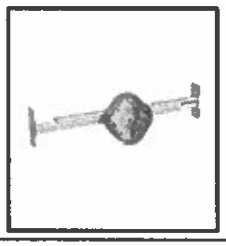
314.27(C) REVISION BOXES AT CEILING-SUSPENDED (PADDLE) FAN OUTLETS

Revision to this section will now require ***all*** outlet boxes in ***habitable room locations*** designed for future paddle fan installation, shall require the box to be listed as sole support of ceiling-suspended (paddle) fans or supported by structural framing members.



Removed spare or separate switch referenced locations!



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320.80 AMPACITY; ARMORED CABLE (AC CABLE)

When Installed in Thermal Insulation / 2nd Paragraph *N*

(A) Thermal Insulation. Conductors installed shall be rated 90°C. Their ampacity shall not exceed the 60°C rating, 90°C shall be used to determine the adjustment / correction factors only.

Where more than 2 Type AC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

Not Current Code in Ohio

2020

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330.80 AMPACITY; METAL CLAD CABLE (MC CABLE)

When Installed in Thermal Insulation *N*

Where more than 2 Type MC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

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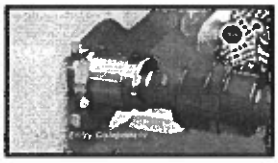
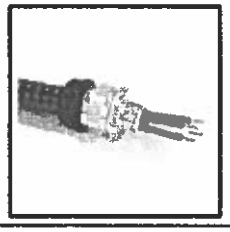
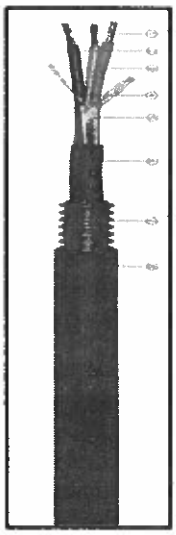
N 330.130 HAZARDOUS (CLASSIFIED) LOCATIONS

N ***Where required to be marked MC-HL, the cable shall be listed and shall have a gas / vapor tight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor.***







Not Current Code in Ohio

2020

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ARTICLE 337 (NEW) CLASS P CABLE

Hazardous location cable up to 600-v, both armored and unarmored.

Typically, tinned copper conductor with a polyester tape separator. Insulation is chemically cross-linked polyolefin and the jacket is Arctic Neoprene.

Used for power, control, signaling and instrumentation for offshore drilling rigs. Severe cold durability, flame retardant and oil resistant

Cable tray installation and high strand count

Approved for Class I Div. 1 / Div. 2 locations

Class II Div. 1 / Div. 2 Locations

ANSI / UL 1309-2017 Marine Shipyard Cable

Not Current Code in Ohio

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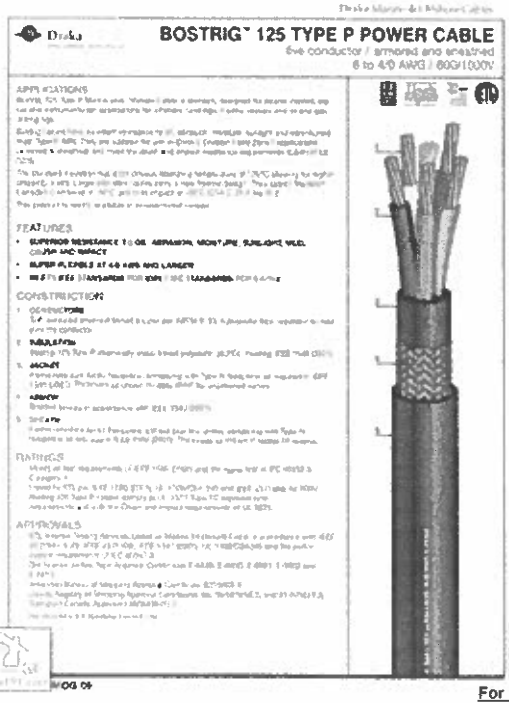
BOSTRIG™ 125 TYPE P POWER CABLE

TYPE "P" CABLE DESIGNED FOR THE OIL AND GAS INDUSTRY

Numerous manufacturer's offer Type "P" cable.

Designed for harsh environments:

Oil and moisture resistant, severe temperature conditions, mechanical stress and drilling mud.

Uses include, drilling rigs, marine both onshore and offshore platform sites.

Available in both armored and sheathed

2020

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CHAPTER 4

Equipment for General Use

Article 404 – Switches

Article 406 – Receptacles, Cord Connectors, & Attachment Plugs

Article 408 – Switchboards, Switchgear & Panelboards

Article 410 – Luminaires, Lampholders, & Lamps

Article 422 – Appliances

Article 430 – Motors, Motor Circuits, & Controllers

Article 440 – A/C and Refrigeration Equipment

Article 445- Generators

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404.2(C) SWITCHES CONTROLLING LIGHTING LOADS

Further Clarification

The grounded circuit conductor for controlled lighting circuit shall be installed at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit serving bathrooms, hallway stairways, ***and habitable rooms or occupiable spaces*** as defined in the applicable building code.

2019 RCO – Habitable Space. **A space in a building for living, sleeping, eating or cooking.**

Not Current Code in Ohio

2020

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404.2(C) EXCEPTION

Exception: The connection requirement shall become effective on January 1, 2020. ***It shall not apply*** to replacement or retrofit switches installed in locations prior to local adoption of ***404.2(C) and where the grounded conductor cannot be extended without removing finish materials***. ***The number of electronic control switches on a branch circuit shall not exceed 5, and the number connected to any feeder on the load side of a system or main bonding jumper shall not exceed 25***. For the purpose of this exception, a neutral busbar, in compliance with **200.2(B)** and to which a main or system bonding jumper is connected shall not be limited as to the number of electronic lighting control switches connected.

2017 NEC Code Change Remains / when grounded conductor not able to be extended

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406.4 RECEPTACLE REPLACEMENTS. GROUNDING (D)(1); NON-GROUNDING (D)(2); GFCI (D)(3); AND AFCI (D)(4);

Reference to 210.12 (A), (B) & (C) Required **"AFCI"** Locations

2020 NEC 406.4(D) Arc-Fault Circuit-Interrupter (AFCI); Replacement Types

(1) Listed outlet branch-circuit AFCI type receptacle
(2) Receptacle protected by listed outlet branch-circuit type AFCI receptacle
(3) A receptacle protected by a listed combination type AFCI circuit breaker

210.12(D) Ex*: Branch Circuit Extensions or Modifications* – Dwelling Units, Dormitory Units, and Guest Rooms and Guest Suites locations only.

(1) 210.12 (A) Dwelling Units. (1-6)
(2) Listed outlet branch-circuit type AFCI at 1st outlet of existing circuit

Not Current Code in Ohio

2020

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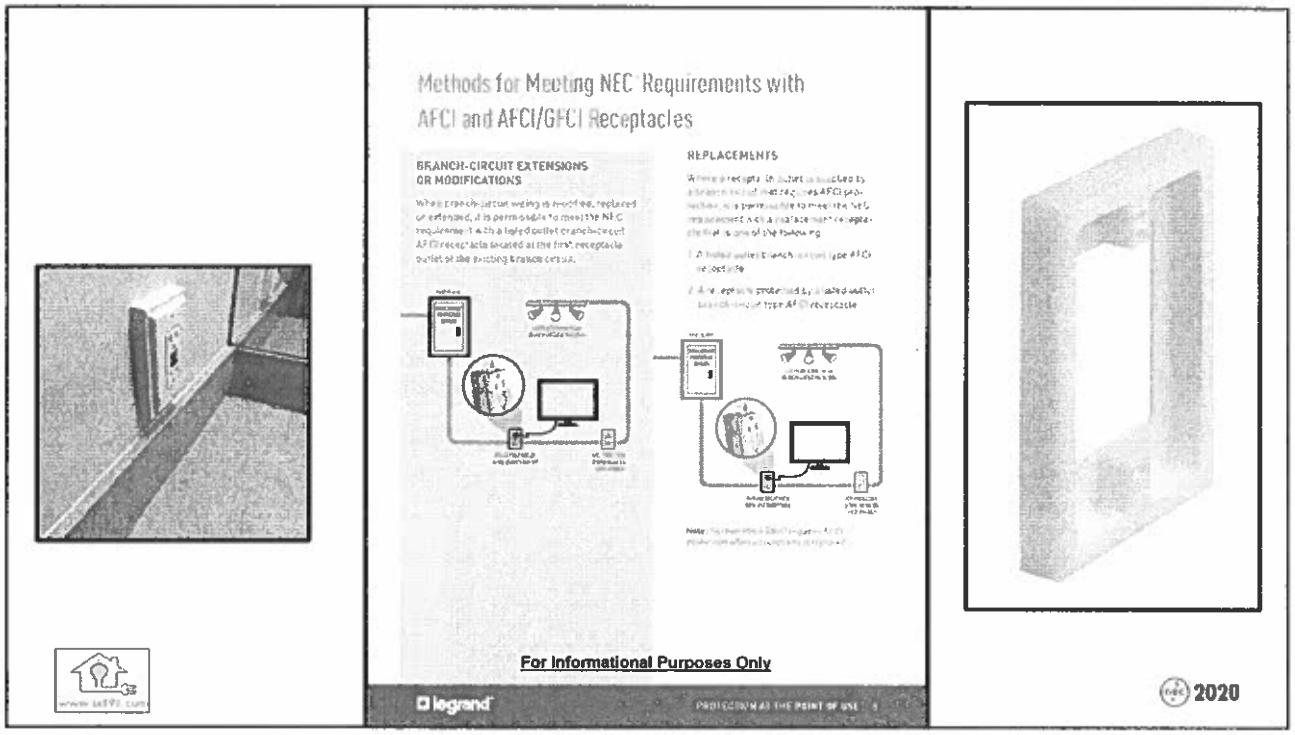
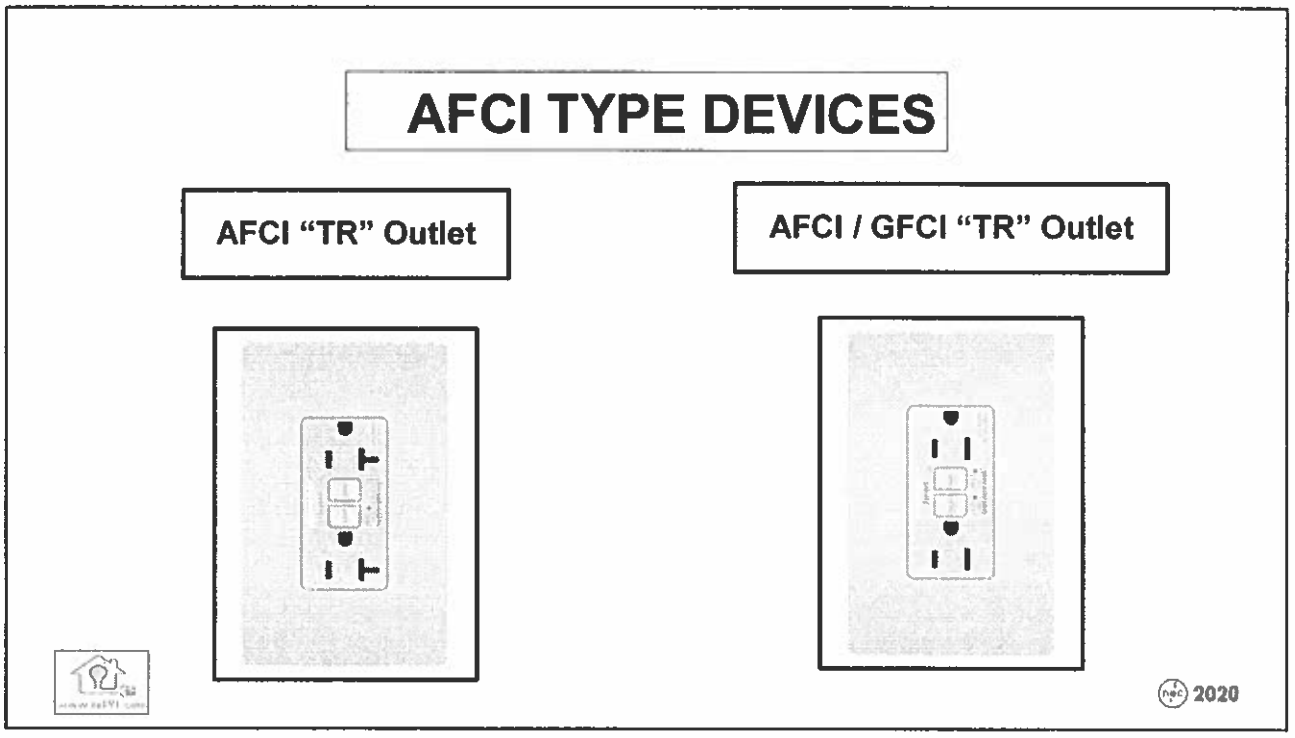

Methods for Meeting NEC Requirements with
AFCI and AFCI/GFCI Receptacles
BRANCH-CIRCUIT EXTENSIONS OR MODIFICATIONS
REPLACEMENTS
For Informational Purposes Only
legrand
2020

131


AFCI TYPE DEVICES
AFCI "TR" Outlet
AFCI / GFCI "TR" Outlet
2020

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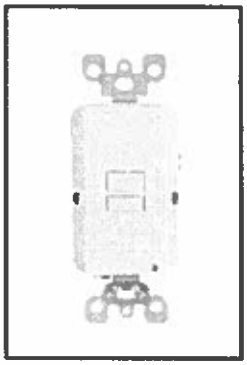
AFCI TYPE DEVICES

AFCI "Deadfront"



20a Hospital Grade AFCI / GFCI "TR" Outlet (Red)

2020

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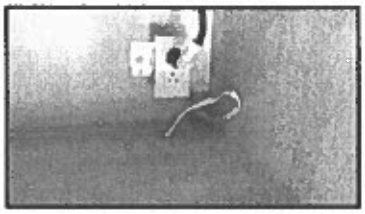
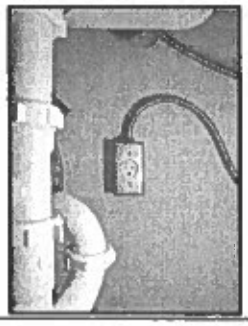
406.5(G)(2) NEW RECEPTACLE ORIENTATION UNDER SINKS

Receptacle outlets are prohibited from being installed face-up in or on countertop surfaces, unless they are listed for such installations.

The proposal will include prohibiting face-up installations in under sink locations as well.

Readily Accessible?





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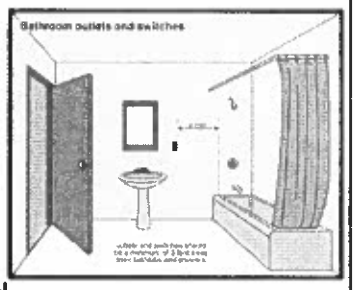
406.9(C) BATHTUB & SHOWER SPACE EXPANDED DETAILS



Receptacles shall ***not*** be installed ***within a zone measured 3' horizontally and 8' vertically from the top of the bathtub rim or shower stall threshold.*** The identified zone is all-encompassing and ***shall include*** the space directly over the tub or shower stall.

Exception: In bathrooms with less than the required zone, the receptacle(s) shall be permitted to be installed opposite the bathtub rim or shower stall threshold on the farthest wall within the room.

Same as light fixtures 410.10(D)

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2020

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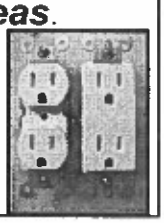
406.12 TAMPER RESISTANT RECEPTACLES

Additional Location Requirements

All 15- and 20-ampere, 125-v and 250-v nonlocking type receptacles in the areas specified 406.12(1) through ***(8)*** shall be listed tamper-resistant receptacles.

(1) Dwelling units, ***including attached & detached garages accessory buildings to dwelling units, & common areas of multifamily dwellings specified in 210.52 & 550.13.***
(2) Guest rooms & guest suites of hotels, ***motels & common areas***.
(6) Assembly areas; including places ***awaiting*** *transportation…*
(7) Dormitory ***units***
(***8***) ***Assisted living facilities (NEW)***



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2020

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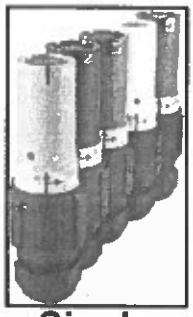
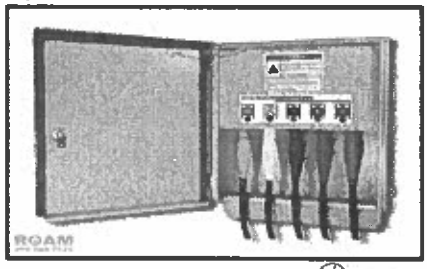


N 406.13 RECEPTACLES, CORD CONNECTORS, AND CAPS

Single-Pole Separable-Connector Type.

Single-pole separable connectors shall be listed and labeled and shall comply with 406.13(A) – (D).

- **(A) Locking or Latching Type**
- **(B) Identification**
- **(C) Interchangeability**
- **(D) Connecting and Disconnecting**



Not Current Code in Ohio

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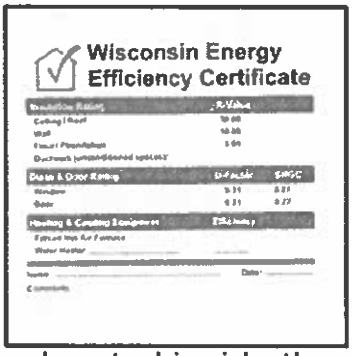
408.4 CIRCUIT DIRECTORY OR CIRCUIT IDENTIFICATION



Revision

Currently, the legible circuit directory is required to be located inside the panel door or face of the panelboard. **New revision text states "*inside of, or in an approved location adjacent to*"** the panel door.

Due to other information located on the panel, energy compliance certificate, AFC, inspection stickers, energy management info, etc..

2019 Residential Code of Ohio – 1101.14 Certificate

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N 408.6 SWITCHBOARDS, SWITCHGEAR AND PANELBOARDS

Short-Circuit Current Rating

Switchboards, switchgear & panelboards *shall* have a SCCR not less than the available fault current in other than one- and two-family dwellings, the available fault current and the date the calculation was performed shall be field marked on the enclosure at the point of supply. The marking shall comply with 110.21(B)(3). **ANSI Z535.4 2011 (R2017)**

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2020

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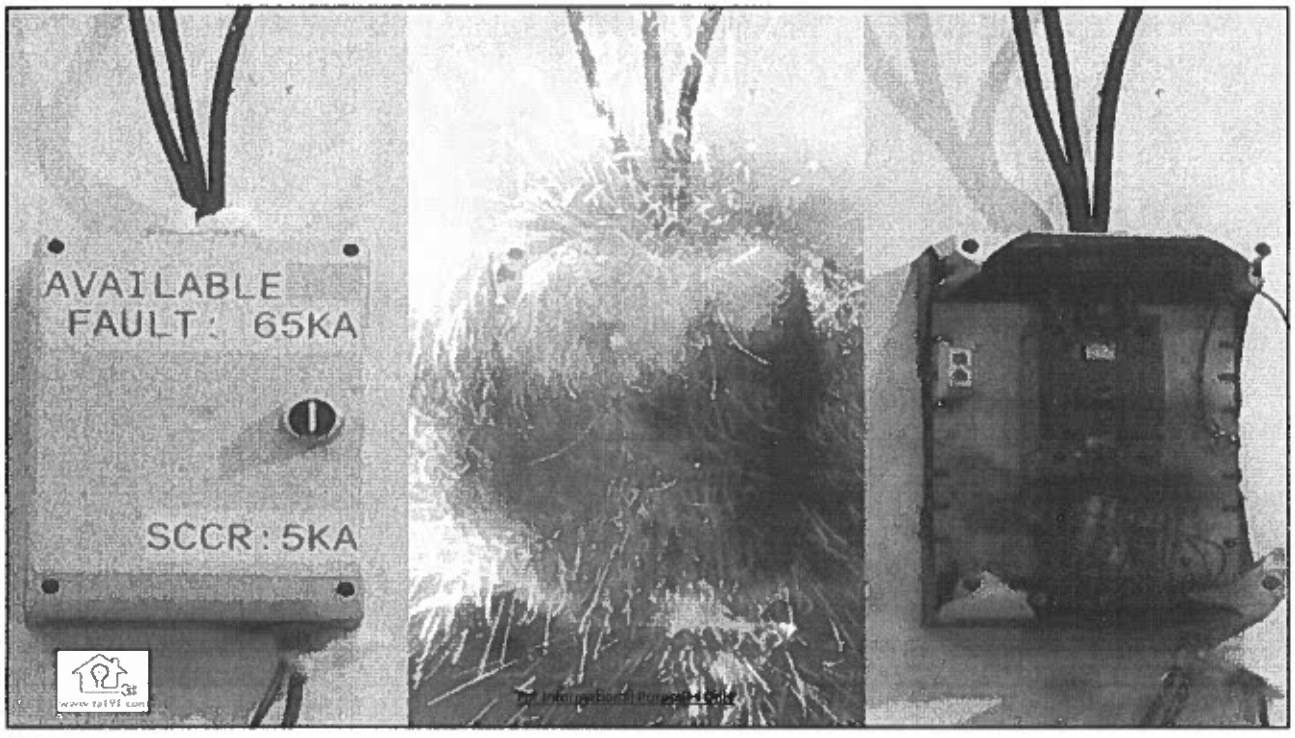

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ALL ABOUT SAFETY!

110.10 – Short Circuit Current Ratings. The equipment short-circuit current ratings and other characteristics of the circuit to be protected **shall be selected and coordinated** to permit the circuit protective devices used to clear a fault, to do so without extensive damage to the electrical equipment of the circuit. ***SCCR is Not overcurrent protection.***

Installing Properly Rated Overcurrent Protective Devices

Overcurrent protective devices (breakers or fuses) shall be rated greater than the maximum available fault current available at the line side terminals of the equipment ***(load)*** served.

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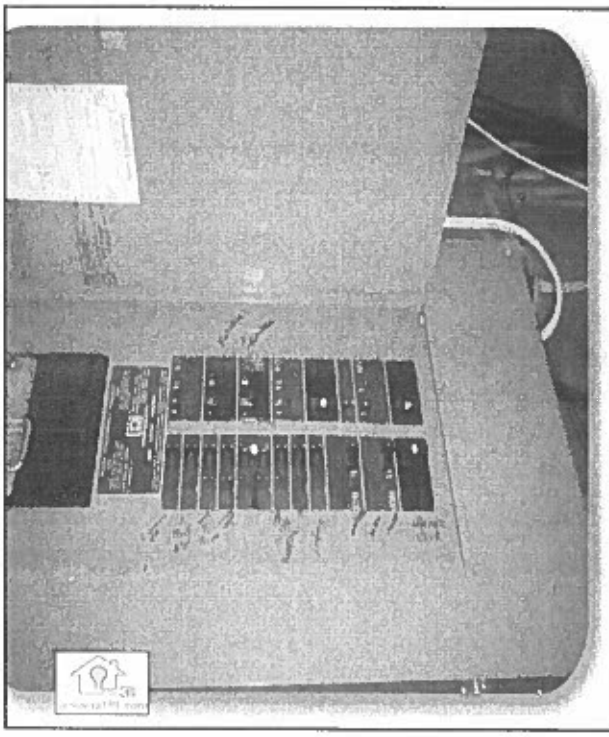

408.43 PANELBOARD ORIENTATION

The intent is to prohibit mounting panelboards from being installed in the face-up position.

Debris can accumulate and damage to the bus and OCD's can occur.

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N PART XVI. SPECIAL PROVISIONS FOR HORTICULTURAL LIGHTING EQUIPMENT

410.172 Listing
410.174 Installation and Use
410.176 Locations Not Permitted
410.184 Ground-Fault Circuit-Interrupter Protection



Damp or Wet Location Listed / Labeled? / Light Spectrum
Fruits / Vegetables / Cannabis

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2020

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422.5(A) GFCI REQUIREMENTS FOR APPLIANCES

Revised

Removed the requirement "***provided for public use***" for both vacuum and tire inflation machines, GFCI protection is required.

Applies to all locations!

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ARTICLE 422 APPLIANCES

GROUND-FAULT CIRCUIT-INTERRUPTER (GFCI) PROTECTION FOR PERSONNEL

422.5 General.

(1) Automotive Vacuum machines
(2) Drinking water coolers **and bottle fill stations**
(3) **Cord-and-plug connected high**-pressure spray washing machines
(4) Tire inflation machines
(5) Vending Machines
(6) **Sump pumps**
(7) **Dishwashers**

***N* Informational Note: Section 210.8 specifies requirements for GFCI protection for the branch-circuit outlet where the covered location warrants such protection.**

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2020

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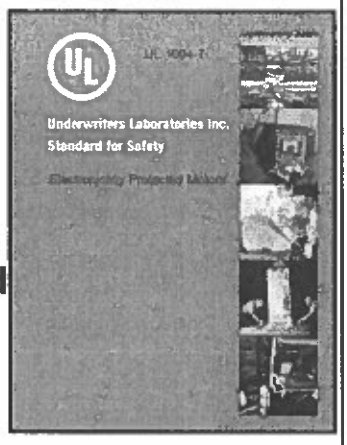
ARTICLE 430 – MOTORS, MOTOR CIRCUITS & CONTROLLERS

New Terminology – Electronically Protected



430.32 (A) Thermal Protector or "*Electronically Protected*" (designed for fractional motors).

An electronically protected motor shall be approved for use on the basis that it will prevent dangerous overheating due to the failure of the *electronic control*, overload, or failure to start the motor.

Terminology throughout Article 430

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430.122
CONDUCTORS – MINIMUM SIZE & AMPACITY

New Informational Note No. 2

Relates to adjustable-speed drive systems

Circuit conductors on the output of an adjustable-speed drive system are susceptible to breakdown under certain conditions due to the characteristics of the output waveform of the drive. Factors affecting the conductors include but not limited to the output voltage, frequency, & current, the length of the conductors, the spacing between the conductors, and *the dielectric strength of the conductor insulation*. Methods to mitigate breakdown include consideration of one or more of these factors.

ie: XHHW / XHHN Type Conductors

Not Current Code in Ohio

2020

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440.9 A/C & REFRIGERATION EQUIPMENT

Clarification

All A/C & Refrigeration equipment installed outdoors on a roof, in a metallic raceway that utilizes ***compression-type*** fittings/connectors require a wire type equipment grounding conductor.

Was non-threaded fittings

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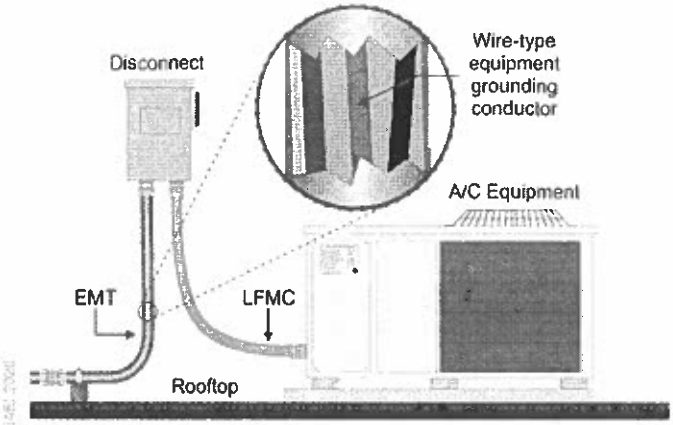
440.9 Grounding and Bonding-Rooftop Equipment



Where ~~multimotor and combination-load~~ equipment is installed outdoors on a roof, an equipment grounding conductor of the wire type shall be installed in outdoor portions of metallic raceway systems that use ~~non-threaded~~ compression-type fittings

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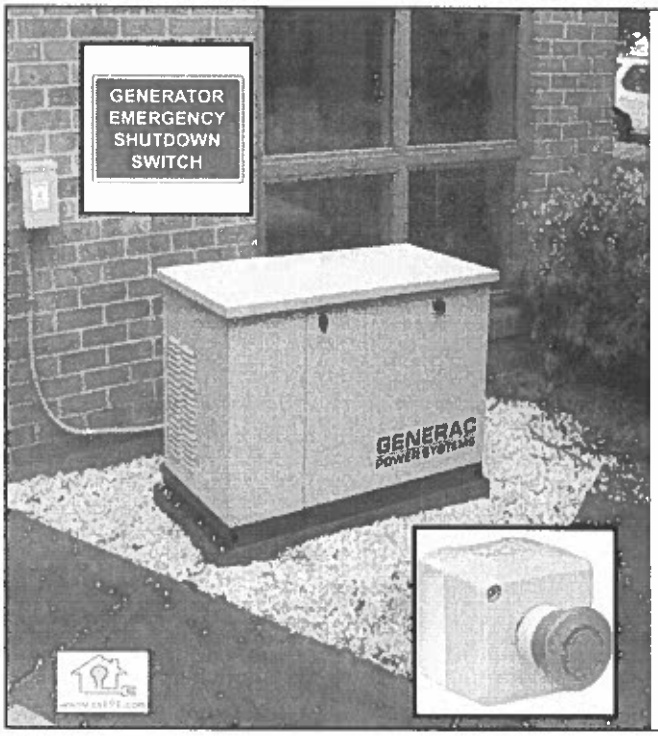

445.18(D) NEW EMERGENCY SHUTDOWN IN 1- & 2-FAMILY DWELLING UNITS

Generators

Generators other than cord-and-plug connected portable type, ***shall be provided*** with an emergency shutdown device, located on the ***outside*** of 1- and 2-family dwelling units.

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2020

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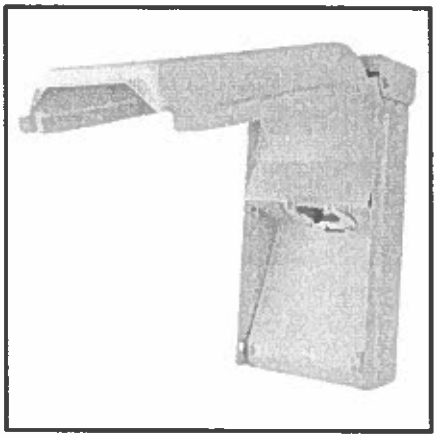
PORTABLE GENERATOR SET-UP

GE 50a Twist Lock Power Inlet



50a Twist Lock Power Cord

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2020 NEC COMMERCIAL OVERVIEW

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

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2020 NEC RESIDENTIAL OVERVIEW

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

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2020

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2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Labriola Training Agency #191
www.ta191.com

John M. Labriola
Principal

150 Maplecrest Street SW
North Canton, Ohio 44720

330.497.6309 Phone
330.606.8098 Cell
john@ta191.com

www.ta191.com

Thank You!

250

File Attachments for Item:

EC-4 2020 NEC Changes and Updates Article 90 through Chapter 8 (Labriola)

All commercial certifications except plumbing; RBO, RPE, RIUI (24 hours)

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: John M. Labriola (Contact Name)

Organization: Training Agency #191 (Organization/Company)

Address: 150 Maplecrest St. SW (Include Room Number, Suite, etc.)

City: North Canton State: Ohio Zip: 44720

E-Mail: john@ta191.com

Telephone: 330.497.6309 Fax:

Course Sponsor: None

COURSE INFORMATION:

Course Title: 2020 National Electrical Code Updates & Changes (Article 90 - Chapter 8)

New Course Submittal: ■ Update Course: ☐ Prior Approval Number:

Purpose and Objective:

To provide BBS certified and approved trainees a better understanding of the changes & updates to the 2020 National Electrical Code

by utilizing a detailed power-point presentation and real-life examples, for no charge to attendees

Number of Instructional Contact Hours that can be obtained upon completion: 24 Hours

If Multi-Session, Number of Instructional Contact Hours Per Session: (6) - 4 Hour Sessions

Program Applicable for the Following Participants:

Building Official ■	Master Plans Examiner ■	Building Inspector ■	Fire Protection Inspector ■	Mechanical Inspector ■
	Plumbing Plans Exam. ☐			Plumbing Inspector ☐
	Electrical Plans Exam. ■			Non-Res IU Inspector ■
	Mechanical Plans Exam. ■			

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ☐ Res Mechanical Inspector ☐ Res IU Inspector ■

Electrical Safety Inspectors ☐

Location of ESI Course: Various Locations Date(s) of ESI Course(s): TBD

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

RECEIVED

MAY 04 2022

BOARD OF BUILDING STANDARDS

Form 4526

BBS 5103210

October 16, 2020

John M. Labriola
150 Maplecrest St. SW
North Canton, Ohio 44720

330.497.6309 Home 330.606.8098 Cell

Professional Bio'

Education

2012- 1984	Akron University, Stark State College: Continuing Education
1975	St. Thomas Aquinas High School; Louisville, Ohio
1971	Fairmount Elementary; Canton, Ohio

Building Department Experience

2017 – 2009	Summit County, Ohio; Chief Building Official (retired)
2009 – 2006	City of Canton, Ohio; Chief Building Official
2008 – 1997	City of Alliance, Ohio; Back-up Building and Electrical Inspector
2006 – 1997	City of North Canton, Ohio; Building and Electrical Inspector
1997 – 1986	Stark County, Ohio; Chief Electrical Inspector
1988 – 1984	City of Louisville, Ohio; Part-time Electrical Inspector

Current Certifications Held

International Code Council (ICC)

Accessibility Inspector/ Plans Examiner, Building Inspector, Building Plans Examiner, Certified Building Code Official, Certified Building Official, Certified Electrical Code Official, Certified Mechanical Code Official, Commercial Electrical Inspector, Commercial Mechanical Inspector, Commercial Plumbing Inspector, Electrical Inspector, Electrical Plans Examiner, Fire Plans Examiner, Master Code Professional, Mechanical Inspector, Mechanical Plans Examiner, Property Maintenance and Housing Inspector, Residential Electrical Inspector, Residential Energy Inspector / Plans Examiner, Residential Mechanical Inspector and Residential Plumbing Inspector.

State of Ohio:

Building Inspector, Building Official, Building Plans Examiner, Electrical Plans Examiner, Electrical Safety Inspector, Fire Protection Plans Examiner, Mechanical Plans Examiner and Residential Building Official.

Construction Experience

2007 – 1986	President; Electrical Design and Construction Co.
2004 – Present	State of South Carolina; Licensed Commercial Contractor
1992 – Present	State of Ohio; Licensed Electrical Contractor
1986 – 1981	Owner; Labriola Electric
1981 – 1975	Pedersen Electric; Helper / Apprentice / Journeyman Electrician
1980 – Present	Journeyman Electrician; City of Canton, Ohio

Professional Organization Memberships

2010 – 2017	American Institute of Architects - Akron Chapter (AIA-Akron)
2009 – 2017	Building Officials Code Officials of Northeast Ohio (BOCONEO)
2009 – 2017	National Fire Protection Association (NFPA)
1997 – 2017	Five County Building Officials Association (FBOA)
1997 – 2017	Ohio Building Officials Association (OBOA)
1986 – Present	International Association of Electrical Inspectors (IAEI)

Appointments (Director Positions)

2011 – 2017	Air-Conditioning Contractors Association of Akron / Canton
2011 – 2017	Home Builders Association of Summit and Portage Counties

Teaching Experience

2012 – 2017	Instructor; Home Builders Association of Greater Cleveland
2012 – 2017	Instructor; Home Builders Association of Summit and Portage Counties
2012 – Present	Instructor; National Electrical Contractors Association (NECA); Greater Cleveland, Ohio Division
2011 – Present	Instructor; Northeast Ohio Electrical Contractors Association (NOECA)
2005	Instructor; Clemson University; Clemson, South Carolina
2004 – Present	Instructor; Electrical League of Ohio; Cleveland, Ohio
2000 – 2016	Instructor; Stark State College of Technology: North Canton, Ohio
1999 – Present	Instructor; National Electrical Contractors Association (NECA); Akron, Ohio Division
1991 – 2009	OCILB Approved Contractor Training Agency
1990 – Present	State of Ohio; Approved Electrical Safety Inspector, Instructor

Respectfully,
John M. Labriola
John M. Labriola
OBBS ID #815
john@ta191.com

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May 02, 2022

Labriola Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720

Ohio Board of Building Standards
6606 Tussing Road – PO Box 4009
Reynoldsburg, Ohio 43068 – 9009

Course Submittal #10 – 24 Hours

Code Sections to be discussed in detail Articles 90 – 220

2020 NEC Code Adoption Process in Ohio

Highlights of the class will include Article 100 (Definitions)

Article 210 – Branch Circuits (GFCI & AFCI Protection) Requirements

Outdoor Outlets (Split systems)

Common Area Branch-Circuits

Island & Peninsular Outlets

Meeting Rooms

General Lighting Loads

Load Calculations

Chapters 5 / 6 / 7 / & 8

Hazardous Classified Locations

NFPA Codes and Standards

GFCI Protection for Repair / Storage Garages / Aircraft Hangars

Motor Fuel Dispensing Facilities

Healthcare Facilities

Essential Electrical Systems

Resistance / Reactor-Type Dimmer Boards

Agricultural Buildings

Relocated Manufactured Buildings

Electrical Shock Drowning (ESD)

Temporary Installations

Elevator Sump Pump Pit Locations

Electric Vehicle Charging Stations

Ford Lighting Vehicle

Swimming Pool Motors

Storable / Immersion Pools

Solar Photovoltaic (PV) Systems

Emergency Systems

Remote-Control Signaling & Power Limited Circuits

Transmission of Power and Data

Power over Ethernet (PoE)

Communication Systems

October 16, 2020

John M. Labriola
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330.497.6309 Home 330.606.8098 Cell

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2012- 1984	Akron University, Stark State College: Continuing Education
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1971	Fairmount Elementary; Canton, Ohio

Building Department Experience

2017 – 2009	Summit County, Ohio; Chief Building Official (retired)
2009 – 2006	City of Canton, Ohio; Chief Building Official
2008 – 1997	City of Alliance, Ohio; Back-up Building and Electrical Inspector
2006 – 1997	City of North Canton, Ohio; Building and Electrical Inspector
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1988 – 1984	City of Louisville, Ohio; Part-time Electrical Inspector

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International Code Council (ICC)

Accessibility Inspector/ Plans Examiner, Building Inspector, Building Plans Examiner, Certified Building Code Official, Certified Building Official, Certified Electrical Code Official, Certified Mechanical Code Official, Commercial Electrical Inspector, Commercial Mechanical Inspector, Commercial Plumbing Inspector, Electrical Inspector, Electrical Plans Examiner, Fire Plans Examiner, Master Code Professional, Mechanical Inspector, Mechanical Plans Examiner, Property Maintenance and Housing Inspector, Residential Electrical Inspector, Residential Energy Inspector / Plans Examiner, Residential Mechanical Inspector and Residential Plumbing Inspector.

State of Ohio:

Building Inspector, Building Official, Building Plans Examiner, Electrical Plans Examiner, Electrical Safety Inspector, Fire Protection Plans Examiner, Mechanical Plans Examiner and Residential Building Official.

Construction Experience

2007 – 1986	President; Electrical Design and Construction Co.
2004 – Present	State of South Carolina; Licensed Commercial Contractor
1992 – Present	State of Ohio; Licensed Electrical Contractor
1986 – 1981	Owner; Labriola Electric
1981 – 1975	Pedersen Electric; Helper / Apprentice / Journeyman Electrician
1980 – Present	Journeyman Electrician; City of Canton, Ohio

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2005	Instructor; Clemson University; Clemson, South Carolina
2004 – Present	Instructor; Electrical League of Ohio; Cleveland, Ohio
2000 – 2016	Instructor; Stark State College of Technology: North Canton, Ohio
1999 – Present	Instructor; National Electrical Contractors Association (NECA); Akron, Ohio Division
1991 – 2009	OCILB Approved Contractor Training Agency
1990 – Present	State of Ohio; Approved Electrical Safety Inspector, Instructor

Respectfully,
John M. Labriola
John M. Labriola
OBBS ID #815
john@ta191.com

1 ☐ **OCILB LICENSE INFORMATION**

2 ☐ **CURRENT ADOPTED CODES**

3 ☐ **2019 RESIDENTIAL CODE OF OHIO**

4 ☐

5 ☐

THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

6 ☐ **"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)**

Subject to the local or State adoption authority

7 ☐ **OHIO LEGISLATION 3783.02**

- Ohio Revised Code Section 3783.02 Exemptions. Effective: November 3, 1989 Legislation: House Bill 222 - 118th General Assembly Nothing in sections 3783.01 to 3783.08 of the Revised Code shall apply to inspection of the design, construction, maintenance, or replacement of any of the following: (A) Installations in ships, watercraft, railway rolling stock, aircraft, or automotive vehicles; (B) Installations underground in mines; (C) Installations of railways for the generation, transformation, transmission, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communication purposes; (D) Installations of communication equipment under control of communication utilities, located outdoors or in building spaces used for such installations; (E) Installations under the control of electric utilities for the purpose of communication, metering, or for the generation, control, transformation, transmission, and distribution of electric energy located in building spaces used by utilities for such purposes or located on property owned or leased by the utility or on public highways, streets, roads, etc., or by established rights on private property; (F) Installations of elevators, dumbwaiters, and escalators as regulated by the bureau of workers' compensation.

8 ☐ **2020 NATIONAL ELECTRICAL CODE (NEC) PROPOSED CHANGES AND UPDATE INFORMATION DETAILS**

Based on the 2020 National Electrical Code (NFPA 70) as published by the National Fire Protection Association (NFPA).

All information contained within this presentation is my personal and professional opinion, based upon over 43 years in the construction industry.

9 **2020 NATIONAL ELECTRICAL CODE**

Identifying Changes throughout the Code

Over 3,700 public inputs / 1,900 comments

New Revision Symbols

Δ before a section number = words in section deleted

Δ to left of table or figure = revision to table or figure

Δ throughout chapter = heavy revision to entire chapter

10

11

12 **NFPA STATE UPDATE MAP**

13 **NFPA STATE UPDATE MAP**

14 **2023 NEC WILL BE HERE SOON!!**

15 **ADDITIONAL USEFUL NFPA PUBLICATIONS**

16 **POWER CO. SERVICE GUIDES**

17 **(4) "*NEW*" ARTICLES**

Article 242 Overvoltage Protection

Article 311 Medium Voltage Conductors and Cable

Article 337 Type "P" Cable (Hazardous Locations)

Article 805 General Requirements for Communication Systems

18 **CHAPTER 1**

General

Article 100 – Definitions

Article 110 – Requirements for Electrical Installations

19 ☐

ARTICLE 100- DEFINITIONS

If a definition is utilized in two or more Articles
the definition will be in Article 100

Now Three Subparts

Part I. – General
Part II. – Over 1000 Volts. Nominal
Part III. – Hazardous Classified Locations. (CMP-14)

20 ☐ **ARTICLE 100**
DEFINITIONS

Available Fault Current

Fault Current:
The current delivered at a point on the system during a short-circuit condition. (CMP-10)

Available Fault Current:
The largest amount of current capable of being delivered at a point on the system during a short-circuit condition. (CMP-10)

Note: AFC is calculated at load-side terminals of the source and line-side terminals of OCPD and all other load locations.

Not Current Code in Ohio

21 ☐ **110.14(D) TERMINAL TIGHTENING 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 Notes: 1, 2 & 3
Shear bolts, breakaway-style devices with visual indicators
NFPA 70(B)-Electrical Equipment Maintenance

22 ☐ **110.22(A) IDENTIFICATION OF DISCONNECTING MEANS - GENERAL**

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. Re: ***ANSI Z535.4 2011 (R2017)***

23 ☐ **110.24(A) AVAILABLE FAULT CURRENT - FIELD MARKING**

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 of the calculation was performed and be of sufficient durability to withstand the environment involved.

Information Note 1 – Recognizes NFPA 70E- 2018

N Informational Note 2 – Values of AFC current for use in determining appropriate minimum SCCR of SE equipment is available from electric utilities in published or other forms.

Assistance from the local electrical utility

24 ☐ **110.26(A)(3) HEIGHT OF WORKING SPACE**

Revision

The work space shall be clear and extend from the grade, floor or platform to a height of 78" or the height of equipment, whichever is greater. Within the height requirements of this section, other equipment *or support structures, such as concrete pads shall not extend more than 6" beyond the front of the electrical equipment.*

25 ☐ **110.26(C)(2) LARGE EQUIPMENT – RATED 1200 AMPERES OR GREATER**

Large Equipment is defined as follows:

(1) For equipment rated 1200 amperes or more and over 6' wide.

(2) For SE disconnecting means installed in accordance with 230.71 where the combined ampere rating is 1200 amperes or more and over 6' wide.

26 ☐ **ARTICLE 110.26(C)(2)**

The one entrance requirement has been 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 24" wide & 78" high at *each end of the working space*.

27 ☐ **CHAPTER 2**

Wiring and Protection

Article 210 – Branch Circuits

Article 220 – Branch-Circuit, Feeder, and Service Load Calculations

Article 230 – Services

Article 240 – Overcurrent Protection

N Article 242 – Overvoltage Protection

Article 250 – Grounding

28 ☐

210.8 GFCI PROTECTION FOR PERSONNEL

1 2017 NEC

(A) Dwelling Units
(B) Other Than Dwelling Units
(C) Boat Hoists
(D) Kitchen D/W Branch Ckt.
(E) Crawl Space Lighting Ckt.

2 2020 NEC

(A) Dwelling Units
(B) Other than Dwelling Units
(C) Crawl Space Ltg. Ckts.
(D) Specific Appliances
(E) Equip. Requiring Servicing
(F) Outdoor Outlets

29 ☐ **ARTICLE 100 - DEFINITIONS**

1 Receptacle
2 A contact device installed at the outlet for the connection of an attachment plug or for direct connection of electrical utilization equipment designed to mate with the corresponding contact device. A single receptacle is a single contact device with no other contact device on the same yoke *or strap*. A multiple receptacle is two or more contact devices on the same yoke *or strap*. (CMP-18)
210.8(A) & (B)
3 Outlet
4

A point on the wiring system at which current is taken to supply utilization equipment. (CMP-1)
210.8(C) – Crawl Space Ltg. Outlets
N 210.8(D) Specific Appliances *N* 210.8(E) Equip. Requiring Servicing *N* 210.8(F) Outdoor Outlets

30 ☐ **210.8(A) GFCI PROTECTION FOR PERSONNEL- DWELLING UNITS**

Significant Expanded Requirements:

This change will now require that *all* 125-v through 250-v *"receptacles"* installed in the locations specified in 210.8(A)(1) through 210.8(A)(11) and supplied by 1ø branch circuits rated 150-v or less to ground shall have GFCI protection for personnel (no maximum amperage noted)

Previous NEC editions were limited to 15- and 20-amp 125-v receptacles.

Bathrooms, *garages*, outdoors, crawl spaces, *basements*, *kitchens*, sinks, boathouses, bathtubs or shower stalls, *laundry areas* or indoor damp and wet locations.

11 Locations / Type "A" GFCI Protection 4 – 6 mA

31 ☐ **210.8(A)(5) DWELLING UNIT GFCI PROTECTION**

Basements – Changes the Intent

Removed: "unfinished portions or areas of the basement not intended as habitable rooms".

This change will now require *all* receptacles installed in basements will require GFCI protection.

Exception remains for fire alarm / burglar alarm systems.

All receptacles in dwelling unit basements are subject to dampness, moisture and conductive floors, whether finished or unfinished.

32 ☐ **210.8(A)(6) DWELLING UNIT**
KITCHENS

Receptacles rated 125-v to 250-v located to "*serve countertop surfaces*" in kitchens will now be required to be provided with GFCI protection.

No Max. Amperage noted!
Not Current Code in Ohio

33 ☐ **210.8(A)(7) GROUND-FAULT CIRCUIT-INTERRUPTER PROTECTION FOR PERSONNEL**
Clarification of Intent

Re: Sinks where receptacles are installed within 6' from the top inside edge of the bowl of the sink.

This change *deletes referenced text* in the last paragraph to this section, which was new in the 2017 NEC. "*the shortest path the 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*".

2020 Removes the 6' cord without passing through a "door or doorway"!

ie: Garbage Disposal / Dishwasher / Instant Hot / Compactor receptacle

GFCI / AFCI protection required if within the 6' measurement

34 ☐ **210.8(A)(7)**

REVISION

Regarding all 125-v through 250-v 1ø, 150-v to ground or less, receptacles installed *within 6' from the top inside edge of a sink.*

Removed reference to all doors (cabinet, personnel or other) and doorway.

35 ☐ **210.8(A) GFCI PROTECTION (CONT'D)**
1 Bathroom Locations
2 Kitchen Locations

36 ☐ **210.8(A)(10) DWELLING UNIT**

LAUNDRY AREAS
(ROOMS)

Receptacles rated 125-v to 250-v (1ø 150-v to ground or less) located in laundry area(s) will now be required to be provided with GFCI protection.

No Max. Amperage Noted!
Not Current Code in Ohio

37 ☐ **210.8(A) DWELLING UNIT – GFCI PROTECTION**

NEW – Exception

Exception to #1-3, 5-8 and 10: Listed locking support & mounting receptacles utilized in combinations with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not require GFCI protection. (Safety Quick Ltg. & Fans Corp)

If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

Applies to: Bathrooms, Garages, Outdoors, Basements,
Kitchens, Sinks, Boathouses and Laundry Areas

38 ☐ **210.8(B) GFCI PROTECTION FOR**

PERSONNEL- OTHER THAN DWELLING UNITS

Expanded Requirements:

The change will require that *all* 125-v through 250-v "*receptacles*" supplied by 1ø branch circuits rated 150-v to ground or less, 50a or less and "*all receptacles*" supplied by 3ø branch circuits rated 150-v to ground, 100a or less, installed in the locations in areas specified in 210.8(B)(1) through 210.8(B)(12) will now require GFCI protection for personnel.

Bathrooms, kitchens, rooftops, outdoors, sinks, indoor *damp and* wet locations, locker rooms with associated showering facilities, garages, *accessory buildings*, service bays, crawl spaces, unfinished *areas of basements*, *laundry areas*, and *bathtubs and shower stalls*.

12 Locations / Type "A" GFCI Protection 4 – 6 mA

39 ☐

210.8(B)(2)
GFCI PROTECTION

OTHER THAN DWELLING UNITS

KITCHENS / *FOOD PREP*

Expanded Requirement

Kitchens *or areas with a sink "and" permanent provisions for either food preparation* or cooking.
For Informational Purposes Only

40 ☐ **210.8(B)(5)**
OTHER THAN DWELLING UNITS - SINKS
Ex. #2 – Health Care Facility locations – Clarification

Receptacles located in patient bed locations of Category 2 (*general care*) or Category 1 (*critical care*) spaces of health care facilities *shall be permitted to comply with 517.21*

517.21: Ground-fault circuit-interrupter protection for personnel *shall not* be required for receptacles installed in those critical care (*Category 1*) spaces where the toilet and basin are installed within the patient room.

Prevent patient from being exposed to additional hazards!

41 ☐ **210.8(B) OTHER THAN DWELLING UNITS – GFCI PROTECTION**
NEW – Exception

Exception to #1-5, 8 and 10: Listed locking support & mounting receptacles utilized in combinations with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not require GFCI protection. (Safety Quick Ltg. & Fans Corp)

If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

Applies to: Bathrooms, Kitchens, Rooftops, Outdoors, Sinks, Garages and unfinished portions of Basements

42 ☐ **210.8(C) CRAWL SPACE LIGHTING OUTLETS**
210.8(D) SPECIFIC APPLIANCES
210.8(E) EQUIPMENT REQUIRING SERVICING
210.8(F) OUTDOOR OUTLETS

(C) Crawl Space Lighting Outlets- 120-v or less

N (D) Specific Appliances- 422.5 all dishwasher *outlets*

N (E) Equipment Requiring Servicing- 210.63

N (F) Outdoor Outlets- all outdoor *outlets* for dwellings, 1ø branch circuits, 150-v or to ground or less, 50a or less

43 ☐

210.8(C) BOAT HOISTS

Removed / Re-directed

2017 NEC – GFCI protection is required per 555.3

2020 NEC – GFCI Protection will be 555.9

Type "A" Protection 4-6mA

44 ☐ **210.8(D) SPECIFIC APPLIANCES; WAS KITCHEN D/W BRANCH CIRCUIT - DWELLING UNIT**

Expanded Requirement

2020 NEC - *Specific Appliances* (now will apply to all dishwasher locations, both *residential /commercial*). GFCI protection for personnel:

Refer to 422.5(A) & (B)

Type "A" Protection 4 – 6mA

Crawl Space Lighting – GFCI Requirements 2017 NEC 210.8(E) / 2020 NEC 210.8(C)

45 ☐ ***N*** **210.8(F) OUTDOOR OUTLETS**

NEW Requirement – Dwelling Units

All outdoor *outlets* for dwellings, other than those covered in 210.8(A)(3), exception to (3), that are applied to single-phase branch circuits rated 150-v to ground or less, *50* amps or less, shall have ground-fault circuit-interrupter protection for personnel. (*Exception; Lighting Outlets*)

46 ☐ **PROPOSED 08.20.2021 OBBS UPDATE RE: OUTDOOR OUTLETS**

Posted 09.02.2021 OBBS Proposed Amendment

Amendment 20-01 to NFPA 70 210.8(F) to exempt certain HVAC equipment from the GFCI requirement.

- (VSD's) Variable speed drive motors (peak load conditions)
- ECM motors are energy efficient; (electronically commutated motor) (variable / multi-speed, auto reversing motors); typically provided with 20 - 30 SEER equipment (split systems).

Note: These devices are not compatible with GFCI devices

-

47 ☐ **OBBS *DRAFT* 4101:1-35-01**
CHAPTER 35
REFERENCED STANDARDS

Proposed Amendment to 2020 NFPA 70

National Electrical Code (except that section 210.8(F) does not apply to HVAC units employing power conversion equipment (variable speed drive) as a means to control compressor speed).

48 ☐ ***N*** **210.8(F) OUTDOOR OUTLETS**

NEW Requirement – Dwelling Units

All outdoor *outlets* for dwellings, other than those covered in 210.8(A)(3), exception to (3), that are applied to single-phase branch circuits rated 150-v to ground or less, 50 amps or less, shall have ground-fault circuit-interrupter protection for personnel. (*Exception; Lighting Outlets*)

49 ☐ **210.12 ARC-FAULT CIRCUIT PROTECTION**

(A) Dwelling Units – Clarified Wiring Method / Revision

(5) Metal raceway, *metal wireways, metal auxiliary gutters, or* Type MC or Type AC *cable* meeting the *applicable* requirements of 250.118, *with* metal *boxes*, metal *conduit bodies*, and metal *enclosures* are installed for the portion of the branch-circuit between the OCD and the 1st outlet, it shall be permitted to install a listed outlet branch-circuit type AFCI at the 1st outlet to provide protection for the remaining portion of the branch-circuit.

Clarified AFCI receptacle wiring method / use

(A)

50 ☐ **210.12(C) & (D) ARC-FAULT CIRCUIT-INTERRUPTER PROTECTION (AFCI)**

Additional Required Locations

(C) Guest Rooms, Guest Suites (added to 2017 NEC), *and Patient Sleeping Rooms in Nursing Homes and Limited-Care Facilities.* All 120-v 15- and 20-ampere branch circuits supplying outlets *and devices* installed in guest rooms 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).

(D) Branch circuit Extensions or Modifications. – Dwelling Units, Dormitory units, *and Guest Rooms and Suites.*

51 ☐

52 ☐ **210.15 RECONDITIONED EQUIPMENT (NEW)**

The following shall not be reconditioned:

(1) Equipment that provides GFCI protection for personnel
(2)
(2) Equipment that provides AFCI protection
(3)
(3) Equipment that provides GFPE

53 ☐ **210.25(B) COMMON AREA BRANCH CIRCUITS**

Branch circuits installed for lighting, central alarm, signal, communications, or other purposes for public or common areas of two-family dwellings, a multifamily dwelling, or multi-occupancy building shall not be supplied from equipment that supplies an individual dwelling unit or tenant space.

N New Informational Note

Informational Note: Examples of public or common areas include, but are not limited to, lobbies, corridors, stairways, laundry rooms, roofs, elevators, washrooms, store rooms, driveways (parking), and mechanical rooms.

54 ☐

210.52(C)(2) REVISION TO
ISLAND & PENINSULAR COUNTERTOPS

2017 NEC required (1) receptacle outlet, no matter the size of peninsular *(wall outlet)*.

2020 NEC will require (1) receptacle outlet for the 1st
9 ft^2 of countertop space. A receptacle outlet is required for every additional 18 ft^2 or fraction thereof, of countertop space (+ within 2' of outer end for peninsular locations).

55 ☐ **210.52(E)(3) BALCONIES, DECKS, & PORCHES**

Balconies, decks, and porches that are *within 4" horizontally of the dwelling unit* shall have at least *one* receptacle outlet accessible from the balcony, deck or porch.

Clarification / Self-supporting deck

56 ☐ **210.63 EQUIPMENT REQUIRING SERVICING**

A 125-v single-phase, 15- or 20-a rated receptacle outlet shall be installed at an accessible location *within 25' of the equipment* as specified in 210.63(A) and (B). *(in same room, area and level)*

N 210.63(A) Heating, A/C, and refrigeration equipment

210.63(B) Other Electrical Equipment (other than 1- and 2-family)

N 210.63(B)(1) Indoor Service Equipment (located in same room)

N 210.63(B)(2) Indoor Equip. Requiring Dedicated Equip. Spaces

Not connected on load side of disconnecting means!

57 ☐ **210.65 MEETING ROOMS**

Rooms 1000 ft^2 or less – Easier to Understand

210.65(A) – General

210.65(B) – Receptacle Outlets Required; 2' / 6' / 12' (per 210.52)

1. Receptacle outlets; in fixed walls.
2. Floor outlets; applies to rooms greater than 12' in any direction and floor area of 215 ft^2 shall have at least *one floor receptacle outlet, or at least one floor outlet to serve receptacle(s). Located at a distance of not less than 6' from any fixed wall for each 215 ft^2 or major portion of floor space.*

N 2017 NEC / 210.71

58 ☐ **210.70 LIGHTING OUTLETS REQUIRED**

Revised

210.70(A)(1) Habitable Rooms. 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.*

210.70(A)(2) *Additional Locations. – Remains Same*
210.70(B) *Guest Rooms or Guest Suites. – Remains same*
210.70(C) *All Occupancies. – Remains Same*

Control device = switch / occ. sensor / other device

59 ☐ **215.9**
GROUND FAULT CIRCUIT INTERRUPTER PROTECTION FOR PERSONNEL (FEEDERS)

Proposed revisions to *update* this section to allow GFCI protection of feeders to correlate with both 210.8 GFCI protection for personnel and 590.6 Temporary Installations.

Was limited to 15- and 20a branch circuits.
(i.e.: electric dryers and ranges)

60 ☐ **215.10 GROUND-FAULT**
PROTECTION OF EQUIPMENT

New Exception

N 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.

AT+T Switching Facility

61 ☐ **TABLE 220.12 GENERAL LIGHTING LOADS BY OCCUPANCY**

Due to lighting system technology (LED) specifically and energy code compliance requirements, *ASHRAE 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings*, designers around the Country utilize these requirements and the NEC is updating their requirements.

Reducing lighting minimums

62 ☐ ***N*** **220.12**
LIGHTING LOADS FOR NON-DWELLING OCCUPANCIES

Added (B) Energy Code / Revised / #4 is new

(A) General. Lighting loads shall be not less than specified in Table 220.12. Motors less than 1/8 HP and connected to a lighting circuit are considered general lighting load.

(B) Energy Code. 2017 NEC, was exception, now revised to positive code language.

1. Power monitoring system installed for general lighting system.
2. Provided with alarm values.
3. Demand factors are not applicable
4. *Continuous load of 125% shall be applied.*

63 ☐ **TABLE 220.12**
GENERAL LTG. LOADS

Revised / Enlarged Table

[a]Armories & Auditoriums = *gyms*
[b]Lodge rooms = *hotels / motels*
[c]Industrial Comm. = *manufacturing / factory*
[d]Banks = *offices*
[e]Storage garages = *parking garages*
[f]Clubs = *restaurants*
[g]/[H] Barber / Beauty shops / Stores = *retail*

Not Current Code in Ohio

64 ☐ **ARTICLE 230**
SERVICES

230.1 Scope

This article covers service conductors and equipment for control and protection of services and their installation requirements.

For Informational Purposes Only

65 ☐ **ARTICLE 230 - SERVICES**

General Safety Issues Addressed

Panelboards with 6 SE disconnects *no longer permitted*. (MLO & split-bus panels)

Firefighter exterior SE disconnects for one- and two- family dwellings.

Line-side barriers to SE equipment to extend beyond panelboards only.

Arc-reduction for 1200 amps and greater to incorporate this technology (1/1/2020).

SCCR identification for pressure connectors and devices as *"suitable for use on the line side of SE equipment" (2017 NEC "PDB's).*

Surge protective devices *(SPD's)* now required for *all* dwelling units.

66 ☐ **230.46 SPLICED AND *TAPPED* CONDUCTORS**

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 (PDB's), pressure connectors, and devices for splices and taps shall be listed. PDB's installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.*

Effective 01.01.2023; pressure connectors and devices for splices and taps installed on service conductors shall be marked "suitable for use on the line side of service equipment" or equivalent.

IE: Protective covers

67 ☐ ***N* 230.62 (C) BARRIERS**

Relocated from 408.3(A)

Barriers shall be placed in *SE* 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.

Now applies to all SE Equipment

Exception Removed:

68 ☐ ***N* 230.67 SURGE PROTECTION**

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

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

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

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

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

69 ☐ ***N* 230.67**
SURGE PROTECTION FOR DWELLING UNITS

All services supplying dwelling units shall be provided with a surge protection device (SPD). Designed to protect against surges to electrical systems.
New Construction and Upgrades
Type 1 or Type 2 SPD

Not Current Code in Ohio

70 ☐ **230.71 MAXIMUM NUMBER OF DISCONNECTS**

Each service shall have only one disconnecting means unless the requirements of 230.71(B) are met.

230.71(B) Two to six service disconnects shall be permitted *for each service permitted by 230.2 or for each set of SE conductors permitted by 230.40, Ex. 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, each with a main SE disconnect.*
2. *Panelboards with a main SE disconnect.*
3. *Vertical switchboard sections that have separate SE disc.*
4. *SE disconnect in meter mods where each disconnect is located in a separate compartment.*

Refer to Informational Notes 1 & 2

71 ☐

72 ☐ **Δ 230.82 EQUIPMENT CONNECTED TO THE SUPPLY-SIDE OF SERVICE DISCONNECT**
Revision

(6) Solar PV, fuel cells, wind electric, energy storage, or interconnected electric power production systems, *if provided with a disconnecting means listed as SUSE rated and overcurrent protection as specified in Part VII of Article 230.*

(10) Emergency disconnects in accordance to 230.85, if all metal housings and SE enclosures are grounded (Part VII) and bonded in accordance with Article 250 (Part V).

(11) Meter mounted transfer switches, rated < 1000-v, have appropriate SCCR equal to or greater than the AFC. The transfer switch shall be listed and be capable of transferring the load served.

Identified on its exterior with both:

(a) Meter-mounted transfer switch

(b) Not service equipment.

73 ☐ **METER MOUNTED TRANSFER SWITCHES**

[1] Gener Link w/ 75kA
Surge Protection per phase

[2] For Portable Generators

74 ☐

75 ☐

230.85 "NEW" EXTERIOR EMERGENCY "SE" DISCONNECT

Applies to 1- and 2-Family Dwelling Units

All service conductors to terminate in a SUSE rated disconnecting means, with adequate SCCR, in a readily accessible *outdoor* location. Grouping is required.

Intent to protect firefighters / other emergency personnel.

For Informational Purposes Only

76 ☐ **230.85 EMERGENCY DISCONNECTS**

Each emergency disconnect shall be one of the following:

(1) Service disconnects marked:

"EMERGENCY DISCONNECT,
SERVICE DISCONNECT"

(2) Meter disconnects installed per 230.82(3) & marked:

"EMERGENCY DISCONNECT,
METER DISCONNECT,
NOT SERVICE DISCONNECT"

(3) Other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are suitable for use as service equipment & marked:

"EMERGENCY DISCONNECT,
NOT SERVICE EQUIPMENT"

77 ☐ ***NEWS***

09.20.2020
FIRST ENERGY ANNOUNCES
SMART METER CONVERSION; INDICATES 700K TO BE INSTALLED IN OHIO

78 ☐ **AEP SMART METER FLYER 01.18.2020**

79 ☐ **SMART METER**
RESIDENTIAL APPLICATION

80 ☐ **SMART METER UTILIZED FOR MULTIPLE VOLTAGES / PHASES**

81 ☐ **240.67(C) & 240.87(C) PERFORMANCE TESTING (NEW)**
ARC-ENERGY REDUCTION (FUSES / CKT. BRKRS)
2017 NEC Effective Date: 01.01.2020 (Fuses)

(A) Documentation
(B) Method to Reduce clearing Time
(C) *Performance Testing (NEW)*

AER Protection System – Tested when 1st installed

Qualified person, primary current injection & manufacturer test
Written record made available to AHJ

82 ☐ **240.88 RECONDITIONED EQUIPMENT (NEW)**

(A) Circuit Breakers

(1) Molded-case circuit breakers *shall not* be reconditioned
(2) Low-and medium-voltage circuit breakers *shall be permitted* to be reconditioned.
(3) High-voltage circuit breakers *shall be permitted* to be reconditioned.

(B) Components

(1) Low-voltage power circuit breaker electronic trip units *shall not* be reconditioned.
(2) Electromechanical protective relays and c/t's *shall be permitted* to be reconditioned.

83 ☐ **ARTICLE 242 (NEW) OVERVOLTAGE PROTECTION**

Discusses overvoltage connection requirements. Permanently installed surge-protective devices (SPD's) not more than 1000-v and permanently installed surge arresters over 1000-v.

(Relocated information from Articles 280 & 285)

Type 1 SPD- Connected at the Service- line or load
Type 2 SPD- Connected on load Side of Service Disc.
Type 3 SPD- Connected to load side of Branch OCD

Each SE Disc. Should be Protected!

84 ☐ **ARTICLE 250 GROUNDING & BONDING**

250.4(A)(1) Electrical System Grounding
Electrical systems that are grounded shall be connected to earth in a manner that will limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operation.

250.4(A)(5) Effective Ground-Fault Path.
Installed in a manner that creates a low-impedance path that facilitates the operation of the OCD in a safe manner.

85 ☐ ***N*** **250.25**

(NEW GROUNDING SYSTEMS PERMITTED TO BE CONNECTED ON THE SUPPLY-SIDE OF THE SE DISCONNECT)

The intent is that supply-side equipment [*whether considered a service or not*] needs to be properly grounded to a grounding electrode system. In order to create an effective fault

current path. [Refer to 250.92 250.102(C)].
Systems such as wind, solar, fuel cells, and interconnected power production.

Note: 250.24(D) GEC Sized per Table 250.66

86 ☐ ***N*** **250.25(A) SUPPLY-SIDE SE GROUNDING INSTALLED IN SEPARATE ENCLOSURES FROM SE EQUIPMENT**

87 ☐ **MANUAL TRANSFER SWITCHES**

1 ▪

200a 2-pole 240-v 1ø

2

200a 3-pole 480-v 3ø

88 ☐ ***N*** **250.30(A)(1) EX. (3)(B)EXCEPTION**

GROUNDING SEPARATELY DERIVED SYSTEMS

System Bonding Jumper

N Ex. Separately derived systems consisting of multiple sources of the same type that are connected in parallel shall be permitted to have the system bonding jumper installed at the paralleling switchgear, switchboard, or other paralleling connection point instead of at the disconnecting means located at each separate source.

89 ☐ **PARALLELING OF TRANSFORMERS**

Transformers operating in parallel

Occurs in installations that have their primary windings of the *paralleled* transformers connected to the same voltage supply and the secondary windings are connected to a common load.

Note: Transformers need to have the same Kva rating, turn ratios, and impedance characteristics. This would create equal load sharing between the source transformers, without creating circulating currents in the windings (heat loss).

90 ☐ ***N*** **250.30(A)(6) EX. #3 GEC MULTIPLE SEPARATELY DERIVED SYSTEMS**

Relocated from 250.30(A)(6) Ex. 2(B) Ex. Tap Conductor Size
Now Expanded for all GEC, Multiple Separately Derived Systems
If the source of a separately derived system is located within equipment listed and identified as suitable for use as service equipment (SUSE), the grounding electrode conductor from the service or feeder equipment to the grounding electrode shall be permitted as the grounding electrode conductor for the separately derived system, if the grounding electrode conductor is of sufficient size for the separately derived system. If the equipment grounding bus internal to the equipment is not smaller than the required grounding electrode conductor for the separately derived system, the grounding electrode connection for the separately derived system shall be permitted to be made to the bus

Not Current Code in Ohio

91 ☐ **GROUNDING TRIANGLE / FOUNDATION**

250.50 All Electrodes present shall be bonded together (1-7)
250.52 Permitted Electrodes (1-8)

Focus:

1. Metal UG Water Pipe
2. Building Steel
3. Concrete-Encased
4. Rod / Pipe

92 ☐ ***N 2017* NEC 250.52(A)(2)**
METAL IN-GROUND SUPPORT STRUCTURES

93 ☐ **EFFECTIVELY GROUNDED STEEL STRUCTURE**

94 ☐ **250.64(A) GEC INSTALLATION**
AL OR COPPER-CLAD AL CONDUCTORS

1 2020 NEC
2

Revised / Expanded Details

(1)Conductors w/o an extruded polymeric covering shall not be installed in corrosive conditions or in direct contact with *concrete*
(2)Outdoor locations in listed & identified enclosures, OK! Within 18" of bottom of enclosure.
(3)AL / CU-AL external to buildings shall not terminate within 18" of the earth.

3 2017 NEC
4

(A)Bare aluminum or copper-clad aluminum grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum grounding electrode conductors shall not be permitted within 18" of the earth.

95 ☐ **250.64(B)(2) EXPOSED TO PHYSICAL DAMAGE**

Intent / Clarification

Any / all references for physical protection of grounding electrode conductors enclosed in PVC conduit will now require the use of Schedule 80 rigid polyvinyl chloride conduit.

Whether smaller than #6 AWG or larger

96 ☐

97 ☐ **GROUNDING / BONDING FITTINGS**

1

Servit Fitting
2 Parallel Body Connector aka: Split Bolt

98

99 **250.68(C)(3)**
GROUNDING ELECTRODE CONDUCTOR CONNECTIONS
Clarification of Intent

The intent is that the steel rebar system installed within the footing or foundation is *not* suitable as a conductor to interconnect other grounding electrodes of the system.

Rebar has not been tested to be a conductor.

Also corrosion protection

100 **250.98 BONDING LOOSELY JOINTED METAL RACEWAYS**

Added: Expansion-deflection and Deflection Fittings

Expansion, *expansion-deflection, or deflection* fittings and telescoping sections of metal raceway shall be made electrically continuous by equipment bonding jumpers or other means.

Not Current
Code in Ohio

101 **250.120(B) EQUIPMENT GROUNDING CONDUCTOR INSTALLATION**
Expanded Revisions

Aluminum and Copper-Clad Aluminum Conductors. EGC's of bare, covered, or insulated aluminum or copper-clad aluminum shall comply with the following:

1. Unless *part of a suitable Chapter 3 cable wiring method*, bare or covered conductors shall

not be installed in corrosive conditions or be installed in direct contact with *concrete*, masonry, or the earth.

2. Terminations are permitted in *outdoor listed and identified* for the environment enclosures within 18" of the bottom of the enclosure.
3. External to buildings shall not be terminated within 18" of the earth, *unless terminated within a listed wire connector system.*

102 ☐ **250.121(B)**
RESTRICTED USE OF EGC'S
Metal frame of a building or structure

Proposal would *prohibit* the structural metal frame of a building or structure from being used as an equipment grounding conductor (egc).

Clarification of 250.136(A), equipment secured to grounded metal structure. Acceptable to be used as a GEC, but not egc.

Relocated from 250.136(A)

103 ☐

104 ☐ **250.122**
SIZING EQUIPMENT GROUNDING CONDUCTORS

(C) Multiple Circuits – Revision

A single equipment grounding conductor *shall be permitted to be installed for multiple circuits that are installed* in the same raceway, cable, *trench,* or cable tray.

Separate raceways = separate EGC's

EGC Size based on Table 250.122

105 ☐ **250.122(B) SIZING EQUIPMENT GROUNDING CONDUCTORS**
N Increased in Size
If ungrounded conductors are increased in size for any reason other than as required in 310.15(B) or 310.15(C), wire-type equipment grounding conductors, if installed, shall be increased in size proportionately to the increase in circular mil area of the ungrounded conductors.
310.15(B) – Ambient Temperature Correction Factors.
310.15(C) – Adjustment Factors

All conductors shall be increased in order to lower the overall voltage drop & impedance (of the GF current path) in order to open the OCD during a phase to ground fault.

106 ☐

107 ☐ **250.136 EQUIPMENT SECURED TO GROUNDED METAL SUPPORTS**

Clarification

Electrical equipment secured to and *in* electrical contact with a metal rack or structure provided for its support *shall* be permitted to be considered as being connected to an equipment grounding conductor *if the metal rack or structure is connected to an equipment grounding conductor by one of the means indicated in 250.134.*

108 ☐ **CHAPTER 3**

Wiring Methods and Materials

Article 300 – General Requirements for Wiring Methods & Materials

Article 310 – Conductors for General Wiring

N Article 311 – Medium Voltage Conductors and Cable

Article 314 – Outlet, Device, Pull & Junction Boxes, Conduit Bodies, Fittings & Handholes

N Article 337 – Type "P" Cable

109 ☐ **300.4(G) FITTINGS.**
PROTECTION FROM PHYSICAL DAMAGE

Revised, Clarified and Expanded.

Where raceways contain #4 AWG and larger insulated circuit conductors, and these conductors enter a cabinet, box, enclosure, or raceway shall be protected by any of the following:

1. Identified fitting, with smooth, identified, insulating surface
2. A listed metal fitting with smooth, rounded edges
3. Separation from raceway by a fitting secured in place
4. Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure or raceway with a smooth rounded edge or flared entry *(2017 NEC exception)*

110 ☐ **300.7**
RACEWAYS EXPOSED TO DIFFERENT TEMPERATURES

Expanded Requirement

(A) Sealing. Where portions of a raceway or sleeve are known to be subjected to different temperatures, and where condensation is known to be a problem, *(cold storage areas, interior to exterior locations)* shall be sealed to prevent the circulation of warm air to a colder section of the raceway. *Sealants shall be identified for use with the cable or conductor insulation, bare conductor, shield, or other components.*

Now reads similar to 300.5

111 ☐ **300.22(D) INFORMATION TECHNOLOGY EQUIPMENT**

Revised

Where the installation complies with the special requirements in *645.4*, electrical wiring in air-handling areas beneath raised floors, shall be permitted in accordance with *645.5(E)*.

112 ☐ ***N*** **300.25**

EXIT ENCLOSURES (STAIR TOWERS)

Where an exit enclosure is required to be separated from the building, *only* electrical wiring methods serving equipment permitted by the authority having jurisdiction in the exit enclosure shall be installed within the exit enclosure.

113 ☐ **300.45 DANGER SIGNS**

Requirements for over 1000-volts Nominal

Revised

Danger signs shall be conspicuously posted at points of access to conductors in all raceway and cable systems. The signs shall meet the requirements in 110.21(B), shall be readily visible, and shall read:

Danger – High Voltage – Keep Out

ANSI Z535.4 2011 (R2017)

114 ☐ **ARTICLE 310**

CONDUCTORS FOR GENERAL WIRING

This Article has been extensively re-organized

Most Tables were updated with additional conductor types:

PFA – Perfluoroalkoxy (High Temp- Teflon Conductors) Appl. & Elec.
XHHN – Flame Retardant Thermoset (90°C Dry & Damp) Bldg. Wire
XHWN – FR, Moisture Resistant Thermoset (75°C Dry & Wet)
XHWN-2 – FR, Moisture Resistant Thermoset (90°C Dry & Wet)

All tables now refer to Ampacities was "Allowable Ampacities"

For Informational Purposes Only

115 ☐ **ARTICLE 310**
CONDUCTORS FOR GENERAL WIRING
Re-organization Continued

1. 310.3 Conductors – 2017 NEC 310.160
2.
2. 310.4 Construction Applications – 2017 NEC 310.104
3.
3. 310.12 1ø Dwelling Services & Feeders – 2017 NEC 310.15
4.
4. 310.16 Ampacities of Insulated Conductors, Single-Insulated Conductors in Free Air, Insulated Conductors in Raceway or Cable, Single-Insulated Conductors in Free Air, Conductors Supported on a Messenger, Bare or Covered Conductors in Free Air, – 2017 NEC 310.15

116 ☐ **310.12 TABLE**
SINGLE-PHASE 120/240-V DWELLING SERVICES
& FEEDERS + 208Y/120-V SYSTEMS
Relocated 310.15(7)

The table is back for

100a – 400a Services & Feeders

83% Ampacity remains

Removed Table in 2014

117 ☐

118 ☐ **ARTICLE 311 (NEW)**
MEDIUM VOLTAGE CONDUCTORS AND CABLE
Covers construction, use installation and ampacities for medium voltage conductors and cables (MV).

Relocated from Article 310 & 328

2001v – 35kv ratings
Both shielded & non-shielded

119 ☐ **ARTICLE 314.16(B)(5)**

REVISION

EGC Conductor Fill

Where up to "4" egc's / ebc's enter a box, a *single* volume allowance shall be made based on the largest egc / ebc entering the box. *A ¼" volume allowance for each additional egc / ebc installed in a box shall be calculated.*

Applies to all cable methods

Not Current Code in Ohio

120 ☐ **314.27(C) REVISION**
BOXES AT CEILING-SUSPENDED
(PADDLE) FAN OUTLETS

Revision to this section will now require *all* outlet boxes in *habitable room locations* designed for future paddle fan installation, shall require the box to be listed as sole support of ceiling-suspended (paddle) fans or supported by structural framing members.

Removed spare or separate switch referenced locations!

121 ☐ **320.80 AMPACITY; ARMORED CABLE (AC CABLE)**

When Installed in Thermal Insulation / 2nd Paragraph *N*

(A) Thermal Insulation. Conductors installed shall be rated 90°C. Their ampacity shall not exceed the 60°C rating, 90°C shall be used to determine the adjustment / correction factors only.

Where more than 2 Type AC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

122 ☐ **330.80 AMPACITY; METAL CLAD CABLE (MC CABLE)**

When Installed in Thermal Insulation *N*

Where more than 2 Type MC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

123 ☐ ***N*** **330.130 HAZARDOUS (CLASSIFIED)**

LOCATIONS

N Where required to be marked MC-HL, the cable shall be listed and shall have a gas / vapor tight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor.

124 ☐ **NON-METALLIC-SHEATHED CABLE (NM) 334.30 SECURING AND SUPPORTING**

Revised / Relaxing the Rules

NM cable shall be supported and secured by staples, cable ties listed and identified for securement and support, or straps, hangers, or similar fittings every 4½' and within 12" of every enclosure. *The cable length between the cable entry and the closest cable support shall not exceed 18".*

125 ☐ **ARTICLE 337 (NEW)**
CLASS P CABLE

Hazardous location cable up to 600-v, both armored and unarmored.

Typically, tinned copper conductor with a polyester tape separator. Insulation is chemically cross-linked polyolefin and the jacket is Arctic Neoprene.

Used for power, control, signaling and instrumentation for offshore drilling rigs. Severe cold durability, flame retardant and oil resistant

Cable tray installation and high strand count

Approved for Class I Div. 1 / Div. 2 locations

Class II Div. 1 / Div. 2 Locations

ANSI / UL 1309-2017 Marine Shipyard Cable

126 ☐ **TYPE "P" CABLE DESIGNED FOR THE OIL AND GAS INDUSTRY**

Numerous manufacturer's offer Type "P" cable.

Designed for harsh environments:

Oil and moisture resistant, severe temperature conditions, mechanical stress and drilling mud.
Uses include, drilling rigs, marine both onshore and offshore platform sites.
Available in both armored and sheathed

127 ☐ **CHAPTER 4**

Equipment for General Use

Article 404 – Switches

Article 406 – Receptacles, Cord Connectors, & Attachment Plugs

Article 408 – Switchboards, Switchgear & Panelboards

Article 410 – Luminaires, Lampholders, & Lamps

Article 422 – Appliances

Article 430 – Motors, Motor Circuits, & Controllers

Article 440 – A/C and Refrigeration Equipment

Article 445- Generators

128 ☐ **404.2(C) SWITCHES CONTROLLING LIGHTING LOADS**

Further Clarification

The grounded circuit conductor for controlled lighting circuit shall be installed at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit serving bathrooms, hallway stairways, *and habitable rooms or occupiable spaces* as defined in the applicable building code.

2019 RCO – Habitable Space. A space in a building for living, sleeping, eating or cooking.

129 ☐ **404.2(C) EXCEPTION**

Exception: The connection requirement shall become effective on January 1, 2020. *It shall not apply* to replacement or retrofit switches installed in locations prior to local adoption of *404.2(C) and where the grounded conductor cannot be extended without removing finish materials*. *The number of electronic control switches on a branch circuit shall not exceed 5, and the number connected to any feeder on the load side of a system or main bonding jumper shall not exceed 25*. For the purpose of this exception, a neutral busbar, in compliance with 200.2(B) and to which a main or system bonding jumper is connected shall not be limited as to the number of electronic lighting control switches connected.

2017 NEC Code Change Remains / when grounded conductor not able to be extended

130 ☐ **406.4 RECEPTACLE REPLACEMENTS. GROUNDING (D)(1); NON-GROUNDING (D)(2); GFCI (D)(3); AND AFCI (D)(4);**

Reference to 210.12 (A), (B) & (C) Required "AFCI" Locations

2020 NEC 406.4(D) Arc-Fault Circuit-Interrupter (AFCI); Replacement Types

(1) Listed outlet branch-circuit AFCI type receptacle
(2) Receptacle protected by listed outlet branch-circuit type AFCI receptacle
(3) A receptacle protected by a listed combination type AFCI circuit breaker

210.12(D) Ex: *Branch Circuit Extensions or Modifications* – Dwelling Units, Dormitory Units, and Guest Rooms and Guest Suites locations only.

(1) 210.12 (A) Dwelling Units. (1-6)
(2) Listed outlet branch-circuit type AFCI at 1st outlet of existing circuit

131 ☐

132 ☐ **AFCI TYPE DEVICES**
1 AFCI "TR" Outlet
2 AFCI / GFCI "TR" Outlet

133 ☐ **AFCI TYPE DEVICES**
1 AFCI "Deadfront"
2 20a Hospital Grade AFCI / GFCI "TR" Outlet (Red)

134 ☐ **406.5(G)(2) NEW**
RECEPTACLE ORIENTATION UNDER SINKS

Receptacle outlets are prohibited from being installed face-up in or on countertop surfaces, unless they are listed for such installations.

The proposal will include prohibiting face-up installations in under sink locations as well.

Readily Accessible?

135 ☐ **406.9(C)**
BATHTUB & SHOWER SPACE
EXPANDED DETAILS

Receptacles shall *not* be installed *within a zone measured 3' horizontally and 8' vertically from the top of the bathtub rim or shower stall threshold.* The identified zone is all-encompassing and *shall include* the space directly over the tub or shower stall.

Exception: In bathrooms with less than the required zone, the receptacle(s) shall be permitted to be installed opposite the bathtub rim or shower stall threshold on the farthest wall within

the room.

Same as light fixtures 410.10(D)

136 ☐ **406.12 TAMPER RESISTANT RECEPTACLES**

Additional Location Requirements

All 15- and 20-ampere, 125-v and 250-v nonlocking type receptacles in the areas specified 406.12(1) through *(8)* shall be listed
tamper-resistant receptacles.

(1) Dwelling units, *including attached & detached garages accessory buildings to dwelling units, & common areas of multifamily dwellings specified in 210.52 & 550.13.*
(2) Guest rooms & guest suites of hotels, *motels & common areas.*
(6) Assembly areas; including places *awaiting transportation...*
(7) Dormitory *units*
(*8*) *Assisted living facilities (NEW)*

137 ☐ ***N*** **406.13 RECEPTACLES, CORD CONNECTORS, AND CAPS**

Single-Pole Separable-Connector Type.

Single-pole separable connectors shall be listed and labeled and shall comply with 406.13(A) – (D).

(A) Locking or Latching Type
(B) Identification
(C) Interchangeability
(D) Connecting and Disconnecting

138 ☐ **408.4**
CIRCUIT DIRECTORY OR CIRCUIT IDENTIFICATION

Revision

Currently, the legible circuit directory is required to be located inside the panel door or face of the panelboard. New revision text states "*inside of, or in an approved location adjacent to*" the panel door.

Due to other information located on the panel, energy compliance certificate, AFC, inspection stickers, energy management info, etc..
2019 Residential Code of Ohio – 1101.14 Certificate

139 ☐ ***N*** **408.6 SWITCHBOARDS, SWITCHGEAR AND PANELBOARDS**

Short-Circuit Current Rating

Switchboards, switchgear & panelboards *shall* have a SCCR not less than the available fault current in other than one- and two-family dwellings, the available fault current and the date the calculation was performed shall be field marked on the enclosure at the point of supply. The marking shall comply with 110.21(B)(3). ***ANSI Z535.4 2011 (R2017)***

140 ☐

141 ☐ **ALL ABOUT SAFETY!**

110.10 – Short Circuit Current Ratings. The equipment short-circuit current ratings and other characteristics of the circuit to be protected shall be selected and coordinated to permit the circuit protective devices used to clear a fault, to do so without extensive damage to the electrical equipment of the circuit. *SCCR is Not overcurrent protection.*

Installing Properly Rated Overcurrent Protective Devices

Overcurrent protective devices (breakers or fuses) shall be rated greater than the maximum available fault current available at the line side terminals of the equipment *(load)* served.

142 ☐ **408.43 PANELBOARD ORIENTATION**

The intent is to prohibit mounting panelboards from being installed in the face-up position.

Debris can accumulate and damage to the bus and OCD's can occur.
For Informational Purposes Only

143 ☐ ***N*** **PART XVI. SPECIAL PROVISIONS FOR HORTICULTURAL LIGHTING EQUIPMENT**

410.172 Listing
410.174 Installation and Use
410.176 Locations Not Permitted
410.184 Ground-Fault Circuit-Interrupter Protection

Damp or Wet Location Listed / Labeled? / Light Spectrum
Fruits / Vegetables / Cannabis

144 ☐ **422.5(A)**
GFCI REQUIREMENTS FOR APPLIANCES
Revised

Removed the requirement "*provided for public use*" for both vacuum and tire inflation machines, GFCI protection is required.

Applies to all locations!

145 ☐ **ARTICLE 422 APPLIANCES**

GROUND-FAULT CIRCUIT-INTERRUPTER (GFCI) PROTECTION FOR PERSONNEL
422.5 General.

(1) Automotive Vacuum machines
(2) Drinking water coolers and bottle fill stations
(3) Cord-and-plug connected high-pressure spray washing machines
(4) Tire inflation machines
(5) Vending Machines
(6) Sump pumps
(7) Dishwashers

N Informational Note: Section 210.8 specifies requirements for GFCI protection for the branch-circuit outlet where the covered location warrants such protection.

146 ☐ **ARTICLE 430 – MOTORS, MOTOR CIRCUITS & CONTROLLERS**
New Terminology – Electronically Protected

430.32 (A) Thermal Protector or "*Electronically Protected*" (designed for fractional motors).

An electronically protected motor shall be approved for use on the basis that it will prevent dangerous overheating due to the failure of the *electronic control*, overload, or failure to start the motor.
Terminology throughout Article 430

147 ☐ **430.122**
CONDUCTORS – MINIMUM SIZE & AMPACITY
New Informational Note No. 2

Relates to adjustable-speed drive systems

Circuit conductors on the output of an adjustable-speed drive system are susceptible to

breakdown under certain conditions due to the characteristics of the output waveform of the drive. Factors affecting the conductors include but not limited to the output voltage, frequency, & current, the length of the conductors, the spacing between the conductors, and *the dielectric strength of the conductor insulation*. Methods to mitigate breakdown include consideration of one or more of these factors.

ie: XHHW / XHHN Type Conductors

148 ☐ **440.9 A/C & REFRIGERATION EQUIPMENT**

Clarification

All A/C & Refrigeration equipment installed outdoors on a roof, in a metallic raceway that utilizes *compression-type* fittings/connectors require a wire type equipment grounding conductor.

Was non-threaded fittings

149 ☐

445.18(D) NEW EMERGENCY SHUTDOWN IN 1- & 2-FAMILY DWELLING UNITS

Generators

Generators other than cord-and-plug connected portable type, *shall be provided* with an emergency shutdown device, located on the *outside* of 1- and 2-family dwelling units.

Not Current Code in Ohio

150 ☐ **PORTABLE GENERATOR SET-UP**

1 GE 50a Twist Lock Power Inlet

2 50a Twist Lock Power Cord

151 ☐ **CHAPTER 5**

Special Occupancies

Article 500 – Hazardous (Classified) Locations, Classes I, II, III, Divisions 1 & 2

Article 511 – Commercial Garages, Repair and Storage

Article 517 – Healthcare Facilities

Article 545 – Manufactured Buildings & Relocatable Structures

Article 555 – Marinas, Boatyards / Commercial and Noncommercial Docking Facilities

Article 590 – Temporary Installations

152 ☐ **ARTICLE 500.4 DOCUMENTATION**

Updated Current NFPA / API Standard References

All areas designated as hazardous (classified) locations shall be properly documented. This documentation shall be available to those authorized to design, install, inspect, maintain, or operate electrical equipment at the location.

NFPA 30-2018 NFPA 32-2016 NFPA 33-2018 NFPA 34-2018
NFPA 35-2016 NFPA 36-2017 NFPA 45-2019 NFPA 55-2016
NFPA 497-2017 NFPA 499-2017 NFPA 820-2016 API 500-2012

153 ☐ **NFPA CODES AND STANDARDS**

NFPA 30- Flammable & Combustible Liquids
NFPA 32- Standard for Drycleaning Plants
NFPA 33- Standard for Spray Application Using Flammable or Combustible Materials
NFPA 34- Standard for Dipping, Coating, & Printing Processes Using Flammable or Combustible Liquids
NFPA 35- Standard for Manufacture of Organic Coatings
NFPA 36- Standard for Solvent Extraction Plants
NFPA 45- Standard on Fire Protection for Laboratories Using Chemicals
NFPA 55- Compressed Gases & Cyrogenic Fluids Code
NFPA 497- Classification of Combustible Liquids, Gases, & Vapors in Chemical Process Areas
NFPA 499- Classification of Combustible Dusts & Hazardous (Classified) Locations in Chemical Process Areas
NFPA 820- Fire Protection in Wastewater Treatment & Collection Facilities
API 500- Classifications of Locations of Electrical Installations at Petroleum Facilities

154 ☐ **501.10 CLASS I & CLASS II LOCATIONS**

1 Listed MC-HL / TC-ER-HL

2

Metal Clad / Tray Cable
MC-HL; Flame resistant cable
TC-ER-HL; Flame resistant tray cable
Gas & vapor-tight provided with metal sheath & polymeric material with separate egc, and proper fittings.
For use in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installations.

3 Listed Type "P" Cable

4

Marine Shipyard Cable
Type "P" – Metal braid armor, with an overall jacket, and terminated with proper fittings.

For use in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installations.

155 ☐ **511.2 (REMOVED / RELOCATED)**
COMMERCIAL GARAGE REPAIR & STORAGE
Revision (Relocated to 210.8(B)(8)

GFCI Protection for Personnel

Removed reference to areas "*where diagnostic equipment, electrical hand tools, or portable lighting equipment*" are to be used (2017 NEC; was limited to 125-v 15- & 20-a receptacles).

Now Reads as indicated in 210.8(B)(1-12)

1ø 50amp and 3ø 100amp 150-v to ground or less receptacles

156 ☐ **513.12 (REMOVED / RELOCATED)**
AIRCRAFT HANGARS
Revision (Relocated to 210.8(B)

GFCI Protection for Personnel

Now Reads as indicated in 210.8(B)(1-12)

1ø 50amp and 3ø 100amp 150-v to ground or less receptacles

157 ☐ **514.11 MOTOR FUEL DISPENSING FACILITIES**
514.11 Circuit Disconnects

(A) Emergency Electrical Disconnects

The emergency shutoff device shall disconnect simultaneously from the source of supply, all conductors of the circuits, including the grounded conductor, if any. *Equipment grounding conductors shall remain connected*.

Switch neutral breaker required including data circuits!

158 ☐ **517.10(B) HEALTH CARE FACILITIES – NOT COVERED**

Not Covered

Proposed changes are intended to clarify that portions of health care facilities used for *intermuscular injections* (drug store flu shots), *psychiatry and psychotherapy*, *alternative medicine and optometry* are *not* required to
comply with Part II of 517.

Redundant Ground wiring!

159 ☐ **517.17 GROUND-FAULT PROTECTION *OF EQUIPMENT***

(D) Testing. Expanded Intent

When ground-fault protection *of equipment* is first installed, each level shall be performance tested to ensure compliance with 517.17(C). *The testing shall be conducted by a qualified person(s) using a test process in accordance with the instruction provided with the equipment. A written record of this testing shall be made and shall be available to the authority having jurisdiction.*

160 ☐ **517.21 HEALTHCARE FACILITIES- GFCI PROTECTION FOR PERSONNEL**

Revision

Category 2 (General Care) & Category 1 (Critical Care) spaces

Receptacles shall *not* be required in bathrooms or toilet rooms. {99:6.3.2.2.2(D)}. Receptacles located in patient bathrooms and toilet rooms in Category 2 (general care) spaces shall have ground-fault circuit-interrupter protection in accordance with 210.8(B)(1).

161 ☐ **517.30 ESSENTIAL ELECTRICAL SYSTEMS**

517.30 Sources of Power

(A) Two Independent Power Sources
(B)
(B) Types of Power Sources
(C)
(1) Generating Units
(2)
(2) Fuel Cell Systems – NEW in 2017 NEC

(3)
N (3) Battery Systems shall be permitted to serve as the alternate source for all or part of an essential electrical system

Lead Acid Batteries in Series

Not Current Code in Ohio

162 ☐ **517.31 REQUIREMENTS FOR THE ESSENTIAL ELECTRICAL SYSTEM**

517.31(A) Separate Branches

517.31(B) Transfer Switches

517.31(C) Separation from Other Circuits

517.31(D) Capacity of Systems

517.31(E) Receptacle Identification

517.31(F) Feeders from Alternate Power Source

517.31(G) Coordination

163 ☐ **517.31(B) TRANSFER SWITCHES**

1 Greater than 150 kVA

2 150 kVA or less

164 ☐ **517.31(C)(1) SEPARATION FROM OTHER CIRCUITS**

Δ Revision D & E Are NEW

(d) Where category 2 (general care) locations are served from *two* separate transfer switches on the essential electrical system in accordance with 517.18(A), Exception No. 3, the category 2 (general care) circuits from the two separate systems *shall* be kept independent of each other.

(e) Where Category 1 (critical care) locations are served from *two* separate transfer switches on the essential electrical system in accordance with 517.19(A), Exception No.2, the critical care circuits from the two separate systems *shall* be kept independent of each other.

165 ☐ **ARTICLE 520**
THEATERS & SIMILAR LOCATIONS

520.25 Resistance- or Reactor-Type Dimmers

Deleted these types of dimmers, as they are outdated and potential fire hazards.

Historical Theaters may have some of these antiquated systems.

166 ☐ **ARTICLE 520**
THEATERS & SIMILAR LOCATIONS

520.68 Conductors for Portable Stage Equipment

Previous editions of the NEC only permitted extra hard usage cords or cables

N (2) Protected Applications. Listed, hard usage (junior hard service) cord or cable shall be permitted where all of the following conditions are met:

(1) Protected from physical damage
(2) Not over 20a overcurrent protective device
(3) Cord or cable is 100' or less in length

For Informational Purposes Only

167 ☐ **ARTICLE 525**
CARNIVALS, CIRCUSES, FAIRS & SIMILAR EVENTS
When open to the Public

Δ 525.20(G) Protection. Shall be arranged to minimize tripping hazards.
Secured to walkway surface or protected in another cable protection method.

Reduce the Hazard!

168 ☐

525.23 WHERE GFCI PROTECTION IS REQUIRED

(A) Where GFCI Protection is Required. *In addition to the requirements of 210.8(B)*, GFCI protection for personnel shall be provided for the following:

(1) All 125-v, 1ø, 15- & 20-a non-locking receptacles readily accessible to the public.

(2) Equipment that is readily accessible to the general public and supplied from a 125-v, 1ø, 15- & 20- ampere branch circuit.
GFCI is permitted to be an integral part of the attachment plug or located in the power-supply

cord within 12" of the plug.

169 ☐ **ARTICLE 545**
MANUFACTURED BUILDINGS AND RELOCATABLE STRUCTURES
Part II - NEW

Relocatable Structures

Mobile offices, classrooms, training areas and similar structures are now part of Article 545, rather than Article 550 (dwelling units).

170 ☐ **ARTICLE 547 – AGRICULTURAL BUILDINGS**
547.5 Wiring Methods.

Δ (G) Receptacles. *Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B). GFCI protection shall not be required* for other than the 125-v, 15- and 20-ampere receptacles installed *within* the following areas:

1. Areas having an equipotential plane
2. Outdoors
3. Damp or wet locations
4. Dirt confinement areas for livestock

171 ☐ **ARTICLE 550 – MOBILE HOMES, MANUFACTURED HOMES & M/H PARKS**
Δ 550.12(B) Ground-Fault Circuit Interrupters (GFCI).

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(A). GFCI protection shall not be required for other than the 125-v, 15- and 20-ampere receptacles installed *within a mobile or manufactured home* in the following areas:

1. Compartments accessible from outside the unit
2. Bathrooms, including receptacles in luminaires
3. Kitchens, where receptacle are installed to serve countertop surfaces
4. Sinks, where receptacles are installed within 6' *from the top inside* edge of the sink
5. Dishwashers

Δ 550.32(D) Additional Receptacles. – Receptacles located outside a mobile or manufactured home, shall be provided with GFCI protection as specified by 210.8(A).

Receptacles that provide unit power shall not require GFCI protection

172 ☐ **ARTICLE 551 – RV'S & RV PARKS**
N 551.40(D) Reverse Polarity Device.

A reverse polarity indicating device that provides a continuous visible or audible signal shall be installed in the RV in accordance with the installation instructions and shall respond to the reversal of the ungrounded and the grounded conductors in the 120-v ac system.

173 ☐ **"NEW" SOUTHWIRE RV SPD PRODUCTS**

174 ☐ **RV SURGE PROTECTIVE DEVICES**

175 ☐ **MARINAS, BOATYARDS, & COMMERCIAL & NON-COMMERCIAL DOCKING FACILITIES**

N 555.13 Bonding of Non-Current Carrying Metal Parts

All metal parts in contact with the water, all metal piping, and all non-current carrying metal parts that are likely to become energized shall be connected to the grounding bus in the panelboard using solid copper conductors, insulated, covered, or bare, not smaller than #8 AWG. Connections to bonded parts shall be made in accordance with 250.8.

Sounds Like 680.26 Equipotential Bonding Grid

176 ☐ **ARTICLE 555**

MARINAS, BOATYARDS AND COMMERCIAL AND NON-COMMERCIAL DOCKING FACILITIES

Ground-Fault Protection - 555.35 (NEW)

(A)(1)- GFPE shore power receptacles- *30mA (Type "B")*

(A)(2)- GFCI 15a & 20a other than shore power receptacles
(Type "A")

(A)(3)- GFPE Protection of feeders and branch circuits
installed on docking facilities - *100mA (Type "C+"?)*

177 ☐ ***N*** **555.35(B) BOAT SHORE POWER**

Leakage Current Measurement Device

Where more than 3 receptacles supply shore power to boats, a leakage current measurement device shall be available and be used to determine leakage current from each boat that will utilize shore power.

Equipment Leakage Circuit Interrupter (ELCI)

Marine Safety to Prevent ESD; (Electric shock drowning)

178 ☐ **DAMAGED BOAT WIRING CAN CAUSE CURRENT FLOW INTO THE BOAT'S BONDING SYSTEM**

[1] Damaged power cord can expose users to hazards

[2] Limits potential of energizing water around the boat's frame

179 ☐ **590.8 (NEW) TEMPORARY INSTALLATIONS**
OVERCURRENT PROTECTIVE DEVICES

(A) Where Reused. Where overcurrent protective devices that have been previously used are installed in a temporary installation, these overcurrent protective devices *shall be examined* to ensure these devices have been properly installed, maintained and there is *no evidence* of impending failure.

(B)

(B) Service Overcurrent Protective Devices. Overcurrent protective devices for solidly grounded wye electrical services of more than 150-v to ground but not exceeding 1000-v phase-to-phase shall be current limiting *(fuses)*.

180 ☐ **CHAPTER 6**

Special Equipment

Article 620 – Elevators, Dumbwaiters, Escalators....

Article 625 – Electric Vehicle Power Transfer System

Article 645 – Information Technology Equipment

Article 680 – Swimming Pools, Fountains, & Similar Installations

Article 690 – Solar Photovoltaic (PV) Systems

Article 695 – Fire Pumps

181 ☐ ***N* 620.6 GFCI PROTECTION FOR PERSONNEL**

New Section

Ground- Fault Circuit- Interrupter Protection for Personnel

Each 125-v, 1ø, 15 and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters, ... shall be of the GFCI type. Re: 620.85
2017 NEC

Added *machinery spaces* / to have GFCI protection of 125-v receptacles

A permanently installed sump pump *shall* be permanently wired or shall be supplied by a single receptacle that is GFCI protected.

Hardwired sump pumps; GFCI protection not required!

182 ☐ ***N* 620.65 SELECTIVE COORDINATION "SIGNAGE"**

Equipment enclosures containing selectively coordinated overcurrent devices shall be legibly marked in the field to indicate that the overcurrent devices are selectively coordinated. The marking shall meet the requirements of 110.21(B), shall be readily visible, and shall state the following:

"CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED"

Applies to where more than one driving machine disconnect is supplied by the same source!

183 ☐ **08.05.2021 PRESIDENT JOE BIDEN SIGNS EXECUTIVE ORDER**

-
-
-
-
- August 05, 2021

President Biden signs executive order (goal), that 50% of vehicles sold in the US to be EV's by 2030. Intended to cut carbon emissions.
Currently 2%

184 ☐ **NEW - EV CHARGING STATIONS**

Federal Government Initiative – Infrastructure Plan

Construct 500,000 new charging stations throughout the USA

DOE Goal: 40 Level 2 charging ports / 1000 EVs

3.4 DC fast charging ports / 1000 EVs
5 Billion Dollars / 10,000 For each State
5,000,000,000 / 500,000 = 10,000 each
By the year 2030 number of EVs expected to be 35 million

185 ☐ **ARTICLE 625 – ELECTRIC VEHICLE POWER TRANSFER EQUIPMENT**

N 625.2 Definitions

Electric Vehicle Connector. – A device that, when electrically coupled (conductive or inductive) to an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of power transfer and informational exchange.

Electric Vehicle Power Export Equipment (EVPE). – The equipment, including the outlet on the vehicle, that is used to provide electrical power at voltages greater than or equal to 30Vac or 60Vdc to loads external to the vehicle, using the vehicle as the source of supply.

186 ☐ **Δ 625.54 GFCI PROTECTION FOR PERSONNEL**

In addition to the requirements in 210.8, all receptacles installed for the connection of electric vehicle charging shall have ground-fault circuit-interrupter protection for personnel. (Type A)

187 ☐ **P&S LEGRAND EV CHARGING STATION**

188 ☐ **GE CHARGING STATION DETAILS**

189 ☐ **GE EV WIRING DIAGRAM**

190 ☐ **CHARGING STATION 1-LINE DRAWING**

191 ☐

192 ☐

193 ☐ **EV CHARGING STATIONS**

Manufactured Charging Stations

Inherent (Built-In) GFCI protection
20mA CCID "Type C" Protection

CCID = Charge Current Interrupting Device

194 ☐

195 ☐ **ELECTRIC VEHICLE RECEPTACLE ROUGH-IN**

196 ☐ **ARTICLE 625 ELECTRIC VEHICLE POWER TRANSFER SYSTEM**

1 30 Minute Charge

2 Estimated Charging Cost:

3 Charging Station Fees

- Fast Charge $1.50 minute
- Approximately .30 minute for Level 1 or Level 2
-
- Typically, a Tesla vehicle will require a separate adapter or specific Tesla charging station

197 ☐ **PUBLIC EVSE STATIONS / PORTS BY STATE (DOE)**
US / LEVEL 1 – 1,331 / LEVEL 2 – 86,095 / DC FAST 18,895

1 •
- Ohio – 770 / 1,680
- West Virginia – 88 / 254
- Virginia – 898 / 2,471
- Pennsylvania – 1,008 / 2,377
- Kentucky – 163 / 388
- Indiana – 294 /810
- Illinois – 875 / 2,192
- North Carolina – 918 / 2,158
- Tennessee – 584 / 1,334

2 •
- California – 13,088 / 33,461
- New York – 2,563 / 6,235
- Florida – 2,256 / 5,529
- Texas – 2,077 / 4,849
- Massachusetts – 1,771 / 3,916
- Washington – 1,518 / 3,716
- Georgia – 1,483 / 3,669
- Colorado – 1,363 / 3,208
- Entire US – 43,413 / 106,321

198 ☐ **TOTAL STATION LOCATIONS COUNTS IN US**

Alternative Fuel Types:
- Biodiesel – 313
- CNG – 851
- E85 – 3,905
- Electric – 43,413 / 106,321
- Hydrogen – 49
- LNG – 55
- Propane – 1,233 Primary / 1,243 Secondary / Total 2,576

Total 114,070

199 ☐ ***N* 625.60 AC RECEPTACLE OUTLETS USED FOR EVPE**

EVPE = Electric Vehicle Power Export Equipment

AC receptacles installed in electric vehicles and intended to allow for connection of off-board utilization equipment shall comply with 625.60 (A) – (D).

(A) Type. The receptacle shall be listed

(B) Rating. Outlet shall be rated 250-v max, 1ø, 50a max

(C) Overcurrent Protection. Integral to power export system

(D) GFCI Protection for Personnel. All receptacles shall be GFCI protected, indication and reset shall be accessible

200 ☐ **2022 FORD F-150 LIGHTNING PICK-UP**

All-Electric. All F-150

Available features include Backup Power that can provide full-home power for up to 3 days, on a fully charge battery and 80-amp Ford Charge station Pro. *When home is properly equipped & home transfer switch disconnects home from the grid*. Based on 30 kWh used per day. Turn your truck into a generator. Pro Power Onboard offers an available 9.6kw max power provided through 11 outlets. (4) 120v outlets in front trunk, (2) in the cab (4) in the bed, and (1) 240-v outlet for tougher tasks.

201 ☐ **ARTICLE 645**
INFORMATION TECHNOLOGY EQUIPMENT

645.5 Supply Circuits and Interconnecting Cables

Δ 645.5 (E) Under Raised Floors. Where the area under the floor is accessible and openings minimize the entrance of debris beneath the floor, power cables, *communications cables,* connection cables, interconnecting cables, cord-and-plug connections and receptacles with the IT equipment. *Typically protected with a Halon (clean agent) fire suppression system or Fm200 system.*

202 ☐ **THERE ARE "8" PARTS TO**
ARTICLE 680

Part 1 General (Page 564)
Part 2 Permanently Installed Pools (Page 567)
Part 3 Storable Pools, Spas, Hot Tubs (Page 573)
Part 4 Spas, Hot Tubs & Immersion Pools (Page 574)
Part 5 Fountains (Page 576)
Part 6 Pools and Tubs for Therapeutic Use (Page 578)
Part 7 Hydromassage Bathtubs (Page 578)
Part 8 Electrically Powered Pool Lifts (Page 579)

203 ☐ **680.2 NEW DEFINITIONS**

N Corrosive Environment. Areas where pool sanitation chemicals are stored, handled, or dispensed, and confined areas under decks adjacent to such areas, as well as areas with

circulation pumps, automatic chlorinators, filters, open areas under decks adjacent to or abutting the pool structure, and similar locations. (Refer to 680.14)

N Immersion Pool. A pool for ceremonial or ritual immersion of users, which is designed and intended to have its contents drained or discharged.

N Splash Pad. A fountain with a pool depth of 1" or less, intended for recreational use by pedestrians. This definition does not include showers intended for hygienic rinsing prior to use of a pool, spa, or other water feature.

204 ☐ **680.2 / 680.50 SPLASH PAD**

NEW Definition / Requirements

Definition: A fountain with a pool depth of 1" or less, intended for recreational use by pedestrians.

Requirements of splash pads will need to comply with Parts I (*general*), II (*permanently installed pools*), and V (*fountains*) of Article 680

205 ☐ ***N* 680.4 INSPECTION AFTER INSTALLATION**

N Section

The authority having jurisdiction shall be permitted to require periodic inspection and testing.

206 ☐ **680.21 MOTORS**

Δ 680.21 Wiring Methods. The wiring to a pool motor shall comply with 680.21(A)(1) unless modified for specific circumstances to (A)(2) or (A)(3).

Δ 680.21 (A)(1) General.
Wiring methods installed in a corrosive environment shall comply with (680.14) or shall be Type MC cable listed for the location, wiring methods in these locations shall include an insulated equipment grounding conductor, sized per Table (250.122), but not smaller than 12 AWG.

Where installed in noncorrosive environments, the wiring methods of branch circuits shall comply with the general requirements of Chapter 3.

2017 NEC Removed Interior of 1-Family

207 ☐ **ARTICLE 680.21(C) – PART II.**

PERMANENTLY INSTALLED POOLS

Expanded GFCI Protection of Pool Motors

Outlets supplying *all* pool *motors on branch circuits rated 150-v or less to ground and 60 amperes or less, single or 3-phase shall be provided with Class "A"* ground-fault circuit-interrupter protection.

Was 120-v through 240-v motors / + added 3-phase Motors

208 ☐ **ARTICLE 680.22**
RECEPTACLE OUTLET LOCATIONS

2020 NEC; 15 and 20- ampere 125-v Outlets

680.22 (A)(1) – Required Outlet; (1) <6' – >20'
680.22 (A)(2) – Circulation pump; <6'
680.22 (A)(3) – Other Receptacles; – <6'
680.22 (A)(4) – GFCI Protection; – All 15 & 20a; within 20'
N 680.22(A)(5) – Pool Equipment Room; (1) GFCI outlet
680.34 – Storable pool, Spa, & Hot Tub outlets; – 6'
680.43 (A) – Indoor Spa & Hot Tub outlets; <6' – >10'
680.62 (E) – Therapeutic Tubs and pools – 6'
680.71 – Hydromassage Bathtubs – 30a or less; 6'

Type "A" GFCI Protection Required

209 ☐ **680.23(F) UNDERWATER LUMINAIRES**

Branch Circuit Wiring for Underwater Luminaires

Branch circuits supplying underwater luminaires (Refer to 680.2) *shall include an insulated equipment grounding conductor, minimum size #12 CU. (Only permitted wiring methods are RMC, IMC, PVC and RTRC. (Refer to 680.14)*

Relaxing the requirements; Only the portion of the branch circuit in the "corrosive environment" requires an insulated equipment grounding conductor.

210 ☐ **680.26 EQUIPOTENTIAL BONDING**
(B)(2) PERIMETER SURFACES.

Copper Ring. Was alternative means.

(1) Minimum #8 bare solid CU conductor.
(2) Follow contour of pool perimeter surface
(3) Listed *splicing devices or exothermic welding*
(4) 18" – 24" from the inside wall of the pool
(5) Secured under 4" – 6" below the subgrade

(C) Copper Grid.

(1) #8 bare solid CU conductor
(2) Follow contour of pool; 3' horizontally beyond pool
(3) Only listed splicing devices or exothermic welding

(4) Secured under 4" to 6" below the subgrade

211 ☐ **"VOLTAGE GRADIENTS"**

- Corrected the wording regarding the performance and design of the Equipotential Bonding Grid.
- Replaced the word *eliminate* (which may be impossible to achieve) to the realistic term of *"reduce"* voltage gradients.
- *The goal would be to keep the pool and all surrounding areas at or near the same potential.*

212 ☐ **680.31 / 32 STORABLE POOLS**

Manufacturer Requirement

Cord-connected pool filter pumps "shall" be provided with a ground-fault circuit interrupter that is an integral part of the attachment plug or located in the power supply cord within 12" of the attachment plug.

Contractors Note: You are responsible to provide GFCI protection for the filter pump as well, if you add a new circuit, or replace a device on an existing circuit! Homeowners can and will plug the filter pump into a non-GFCI protected outlet.

213 ☐ **680.35 STORABLE & PORTABLE IMMERSION POOLS**

N New Section / Requirements

(A) Cord Connection
(B) Pumps
(C) Heaters
(D) Audio Equipment
(E) Luminaires, Lighting Outlets & Fans
(F) Switches
(G) Receptacles

214 ☐ **680.45 IMMERSION POOLS**

N New Section / Requirements

(A) Cord and Plug Connections
(B) Pumps
(C) Heaters
(D) Audio Equipment

215 ☐ **680.35 / 680.45**
IMMERSION POOLS
NEW / & Clarification Info

680.35 Storable / portable immersion pools.

680.45 Permanently installed immersion pools

Addressing both custom built (on-site) and pre-packaged units.

216 ☐ **680.59 GFCI PROTECTION FOR PERMANENTLY INSTALLED NON-SUBMERSIBLE PUMPS**

Re: Fountains / New Section

Outlets supplying all permanently installed non-submersible pump motors rated 250-v or less and 60a or less, 1ø or 3ø, shall be provided with ground-fault circuit interrupter protection.

217 ☐ **680.74(A) BONDING**

Re: Hydromassage Bathtubs

(3) Added metal raceways within 5'
(3)
(5) Non-current-carrying metal parts of electrical devices and controls that are not associated with the hydromassage tubs within 5'.

218 ☐ **SOLAR PHOTOVOLTAIC (PV) SYSTEMS**
690.1 Scope
This article applies to solar PV systems, other than those covered by Article 691, including the array circuit(s), inverter(s), & controller(s) for such systems. The systems covered by this article *include those* interactive with *electric* power production sources or stand-alone, *or both.* These PV systems may have ac or dc output for utilization.

219 ☐ **TESLA POWERWALL HOME BATTERY SYSTEM**

220 ☐ **TESLA POWER WALL**

221 ☐ **690.8 CIRCUIT SIZING AND CURRENT**

N 690.8(A)(2)

Circuits Connected to the Input of Electronic Power Converters

Where a circuit is protected with an overcurrent device not exceeding the conductor ampacity, the maximum current shall be permitted to be the rated input current of the electronic power converter input to which it is connected. *(Significant change for commercial installations)*

8.62 x 125% = 10.775a x (6) = 64.65a
#4 CU 2017 NEC

Input 33a x 125% = 41.25a

(6) 250-watt modules = (the string)

24 kW Inverter
75°C terminals
#8 CU / 50a ocd
41.25amps = Continuous duty

222 ☐ **ARTICLE 690**
SOLAR PHOTOVOLTAIC (PV) SYSTEMS

This Article has been extensively revised and updated

690.13(A) – The PV system disconnecting means shall be located in a readily accessible location. *Where disconnecting means of systems above 30-v are readily accessible to "unqualified" persons, any enclosure door or hinged cover that exposes live parts when open shall be "locked" or require a tool to open.*

Limit unintentional contact

690.15(A) Reads the same for Isolating PV Equipment

223 ☐ **690.12 RAPID SHUTDOWN OF PV SYSTEMS ON BUILDINGS**

PV system circuits *installed on or in buildings* shall include a rapid shutdown *function to reduce shock hazard for firefighters* in accordance with 690.12(A) through (D). UL3741

224 ☐ **690.12(B)(1)(2) RAPID SHUTDOWN FOR PV SYSTEMS *ON OR IN* BUILDINGS FOR FIREFIGHTERS**

Outside the boundary = >3' from the array, from point of entry, requires rapid shutdown.
Inside the boundary = <1 from array, requires rapid shutdown.
PV Hazard Control System / <80v in 30seconds / or integrated roof shingles / UL 3741 Standard

225 ☐ **LABEL FOR ROOF MOUNTED PV SYSTEMS WITH RAPID SHUTDOWN**

226 ☐ **FIRE PUMPS**
695.3(C)(2) SELECTIVE COORDINATION

Expanded Requirement (Revised)

Overcurrent protective device(s) shall be selectively coordinated with *all* supply-side overcurrent protective devices(s).

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, maintain, and operate the system.

Similar to 700.32 Emergency Systems

227 ☐ **CHAPTER 7**

Special Conditions

Article 700 – Emergency Systems

Article 725 – Class 1, 2, & 3 Power Limiting Cables

Article – 760 Fire Alarm Systems

228 ☐ **700.2 EMERGENCY SYSTEMS**

N Emergency Systems. *This definition shall apply within this article and throughout the Code.*

Informational Note: Emergency systems are generally installed in places of assembly where artificial illumination is required for safe exiting and for panic control in buildings subject to occupancy by large numbers of persons, such as hotels theaters, sports arenas, healthcare facilities, and similar installations. Emergency systems may also provide power for such functions as ventilation where essential to maintain life, fire detection and *alarm systems*, elevators, fire pumps, public safety communications systems, industrial processes where current interruption would produce serious life-safety or health hazards, and similar functions.

Definition Modified / Clarified!

229 ☐ **ARTICLE 700 – PART 4**
EMERGENCY SYSTEM CIRCUITS
FOR LIGHTING AND POWER

700.16 Emergency Illumination – Rewritten (Clarification)

N (B) *System Reliability*. Emergency lighting systems shall be designed and installed *so that*

the failure of any illumination source cannot leave in total darkness any space that requires emergency illumination. Control devices in the emergency lighting system shall be listed for use in emergency system. Listed unit equipment in accordance with 700.12(F) shall be considered as meeting the provisions of this section.

Removed reference to burning out of a lamp
(due to the use of LED's luminaires)

230 ☐ ***N* 700.32 SELECTIVE COORDINATION**
INFORMATIONAL NOTE

Informational Note: See Informational Note Figure Note 701.32 for an example of how legally required standby system overcurrent protective devices (OCPDs) selectively coordinate with all supply-side OCPDs.

OCPD "D" selectively coordinates with OCPD's C, F, E, B, and A.

OCPD "C" selectively coordinates with OCPD's F, E, B, and A.

OCPD "F" selectively coordinates with OCPD E.

OCPD "B" is not required to selectively coordinate with OCPD A because OCPD B is not a legally required standby system OCPD.

231 ☐ **ARTICLE 720 – CIRCUITS & EQUIPMENT OPERATING AT LESS THAN 50 VOLTS**

720.1 Scope. This article covers installations operating at less than 50 volts, direct current or alternating current.

720.2 Other Articles. Direct current or alternating-current installations operating at less than 50 volts, as covered in Articles 411, 517, 551, 552, 650, 669, 690 and 760.... "Parts I, II, and III of Article 725, *shall not be required to comply with this article*".

232 ☐ **ARTICLE 725 CLASS 1, 2, & 3 REMOTE CONTROL, SIGNALING & POWER LIMITED CIRCUITS**

There are two types of Class 1 circuits:

1. Power-limited; supplied by a transformer, limited to 30v and 1000VA, have a current limiter (OCPD) that limits the amount of supply current on the circuit, due to an overload, short-circuit or ground-fault.

2. Remote-control & signaling; maximum voltage is 600 and limited on the power output of the source.

Note: Class 1 circuits are permitted to occupy the same cable, raceway or enclosure of power and lighting circuits (whether A/C or D/C), when installed in associated equipment, and conductors are properly insulated. (watch de-rating).

233 ☐ **CLASS 2 & 3 CIRCUITS**

Both Class 2 & 3 circuits have power limitations as identified in Chapter 9 of the 2020 National Electrical Code;

Table 11(a) Alternating Current Limitations

Table 11(b) Direct Current Limitations

Class 2 Note: Typical operating voltage is 48v, not exceeding 100VA, with a listed power supply. (limited in length due to voltage drop)

Class 3 Note: Have higher current thresholds than Class 2 circuits, therefore have additional requirements. (can run longer lengths than Class 2 circuits)

234 ☐ **725.144 TRANSMISSION OF POWER & DATA**

New in 2017 NEC

Typically, referred as Power over Ethernet (PoE). A common use is for video cameras, that have a class 2 power supply, that will also utilize conductors within the same cable for video transmission (network cable).

Ampacity ratings of these cables are based on 86°F. As current flow in these bundled or bunched cables can increase the temperature and therefore can degrade the insulation of the cables (overheating).

Generally operating @ 48v / connectors rated @ 1.3 amperes maximum

235 ☐ **POE TERMINOLOGY**

- IEEE 802.3 PoE Standard; *(48v and up to 15.4W)*

Typically, Cat 5 Cable contains 8 wires; as 4 twisted pairs of conductors 2 pairs are used for data (data pairs), 1 pair can be used for power 48v DC

PSE = Power Sourcing Equipment; Equipment that provides power to the cable. (WAP); Wired Access Points (IP); Security Cameras

PD = Powered Device; Device that receives power from the cable

PSE = Power Sourcing Equipment; Devices that send power and data over ethernet cable to a connected PD. (midpoint, endpoint or span); no additional power source required.

VOIP = Voice over internet phone; PoE is needed to power the phone, via the network.

236 ☐ **POWER OVER ETHERNET (POE) NEW IN THE 2017 NEC**

Applies to both Class 2 & Class 3 Circuits

IN #1 – Applies to *CCTV cameras*
IN #2 – Used in Powered *Communication systems*
IN #3 – 4 Pair copper balanced twisted conductors
IN #4 – Guidelines for supporting power delivery over balanced twisted conductors
IN #5 – Minimum Requirements for *PoE lighting systems*
IN #6 – Rated current for power sources; designed to deliver

237 ☐ **725.144 TRANSMISSION OF POWER & DATA**

Power over Ethernet (PoE)

Section 725.144(A) & (B) shall apply to Class 2 & Class 3 circuits that transmit power and data to a powered device. Section 300.11 and Parts I and III of Article 725 shall apply to Class 2 & Class 3 circuits that transmit power and data. Conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

238 ☐ **NETWORK CABLES THAT CARRY ELECTRIC POWER**

239 ☐

240 ☐

241 ☐ **ADDITIONAL USES**

Integrating Building Systems

Heating, Ventilation & A/C Systems (VAV Boxes)
Lighting System Sensors
Security Camera Systems
Automation, Control Systems & Energy Savings
Refer to Chapter 9 Tables 11(a) & (b)

242 ☐ **CLASS 2 & CLASS 3 NETWORK CABLING**

Data and Power Circuits

1.Cable Listing & Compliance
2. Structured Cabling
3. Data Centers
4. Power over Ethernet (PoE)
5. Uses Cat 5 or Cat 6 Cable

243 ☐ **EXAMPLES OF CAT 5 / 6 CABLES / USES**

244 ☐ **CHAPTER 8**

Communications Systems

N Article 805 – Communication Circuits

245 ☐ **ARTICLE 805 (NEW)**
GENERAL REQUIREMENTS FOR COMMUNICATION SYSTEMS
General info for Articles;

800, 820, 830 and 840 combined in one location.

800 – Communication Circuits
820 – CATV & Radio Dist. Systems
830 – Network Powered Broadband Comm. Systems
840 – Premises-Powered Broadband Comm. Systems

246 ☐ **CHAPTER 9**
Tables

Table 1 – Conduit Fill

Informative Annex I – Recommended Tightening Torque Tables from UL Standard 486A – 486B

247 ☐ **CHAPTER 9 – TABLES**
Table 1

Conduit Fill / Cross Sectional Area (%)

1 Conductor = 53% Cross Sectional Fill
2 Conductors = 31% Cross Sectional Fill
Over 2 Conductors = 40% Cross Sectional Fill

Notes to Tables:

(3) EGC's / bonding conductors *to be included* in calculating conduit fill

(4) Where conduit or tubing nipples having a maximum length not to exceed *24"* are installed between boxes, cabinets, and similar enclosures, the nipples shall be permitted to be filled to *60%* of their cross-sectional area, and 310.15(C)(1) adjustment factors need not apply to this condition. *(no de-rating required)*

248 ☐ **2020 NEC COMMERCIAL OVERVIEW**

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

249 ☐ **2020 NEC RESIDENTIAL OVERVIEW**

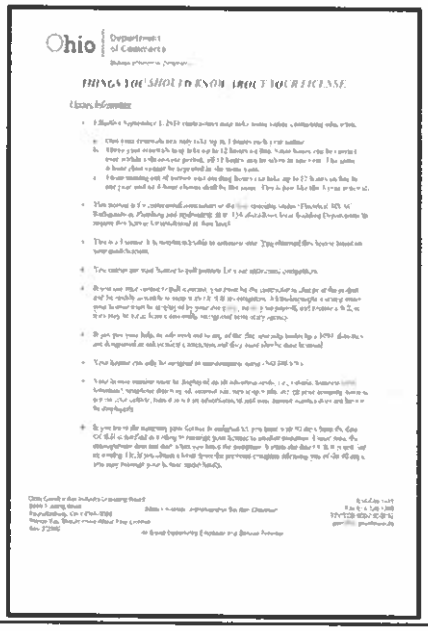
- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

250 ☐

2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

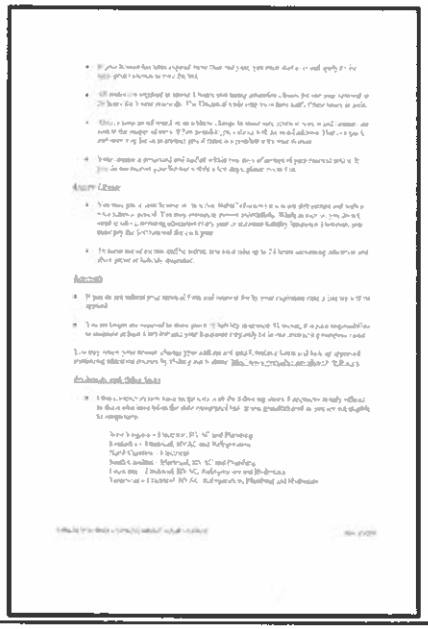
Thank You!

OCILB LICENSE INFORMATION



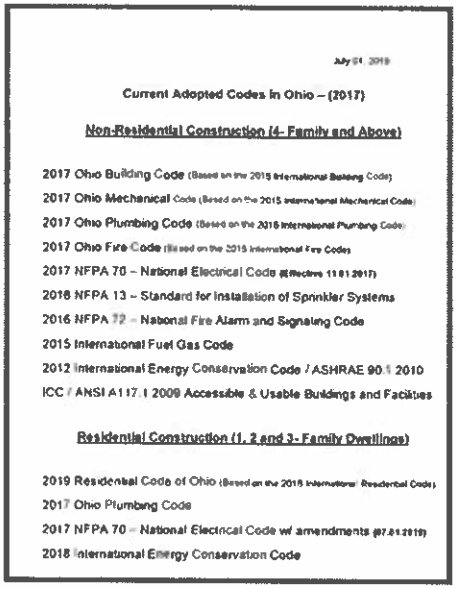
Ohio | Department of Commerce

THINGS YOU SHOULD KNOW ABOUT YOUR LICENSE



1

CURRENT ADOPTED CODES



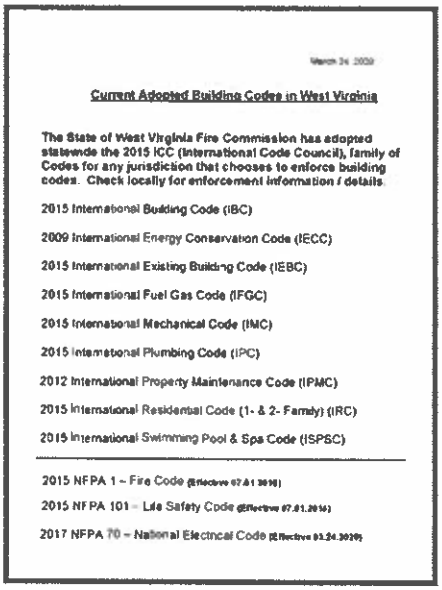
Current Adopted Codes in Ohio – (2017)

Non-Residential Construction (4- Family and Above)

2017 Ohio Building Code (Based on the 2015 International Building Code)
2017 Ohio Mechanical Code (Based on the 2015 International Mechanical Code)
2017 Ohio Plumbing Code (Based on the 2015 International Plumbing Code)
2017 Ohio Fire Code (Based on the 2015 International Fire Code)
2017 NFPA 70 – National Electrical Code (Effective 11 01 2017)
2016 NFPA 13 – Standard for Installation of Sprinkler Systems
2016 NFPA 72 – National Fire Alarm and Signaling Code
2015 International Fuel Gas Code
2012 International Energy Conservation Code / ASHRAE 90.1 2010
ICC / ANSI A117.1 2009 Accessible & Usable Buildings and Facilities

Residential Construction (1, 2 and 3- Family Dwellings)

2019 Residential Code of Ohio (Based on the 2015 International Residential Code)
2017 Ohio Plumbing Code
2017 NFPA 70 – National Electrical Code w/ amendments (07.01.2019)
2018 International Energy Conservation Code



Current Adopted Building Codes in West Virginia

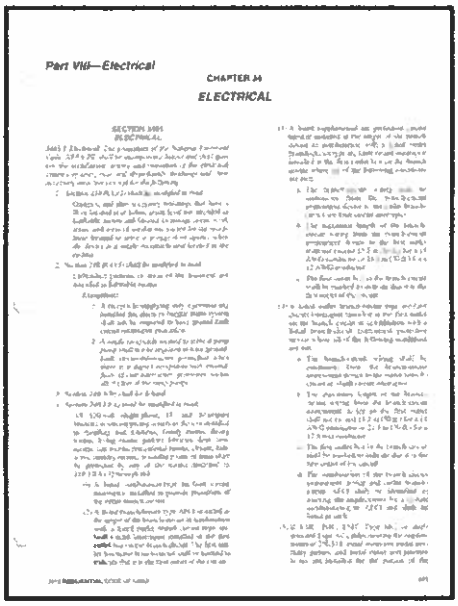
The State of West Virginia Fire Commission has adopted statewide the 2015 ICC (International Code Council), family of Codes for any jurisdiction that chooses to enforce building codes. Check locally for enforcement information / details.

2015 International Building Code (IBC)
2009 International Energy Conservation Code (IECC)
2015 International Existing Building Code (IEBC)
2015 International Fuel Gas Code (IFGC)
2015 International Mechanical Code (IMC)
2015 International Plumbing Code (IPC)
2012 International Property Maintenance Code (IPMC)
2015 International Residential Code (1- & 2- Family) (IRC)
2015 International Swimming Pool & Spa Code (ISPSC)

2015 NFPA 1 – Fire Code (Effective 07.01.2016)
2015 NFPA 101 – Life Safety Code (Effective 07.01.2016)
2017 NFPA 70 – National Electrical Code (Effective 01.24.2020)

2

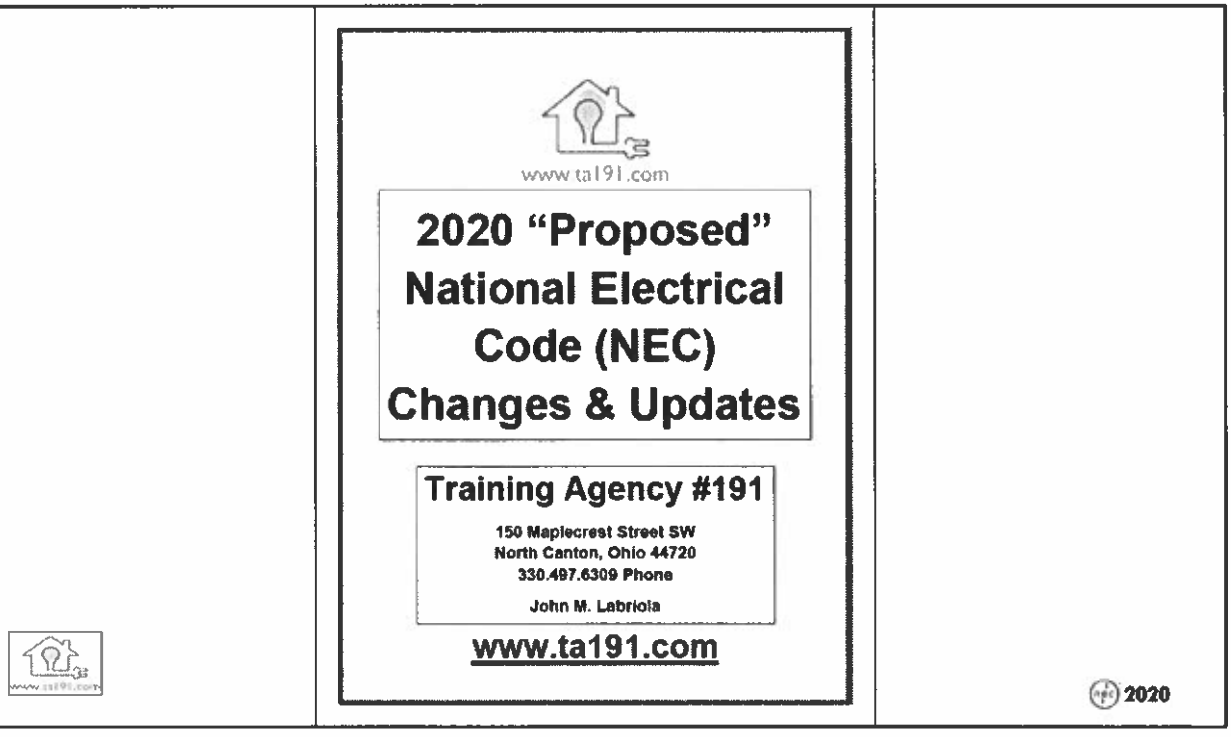
2019 RESIDENTIAL CODE OF OHIO


Part VIII—Electrical

CHAPTER 34

ELECTRICAL

3



4

THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

2020

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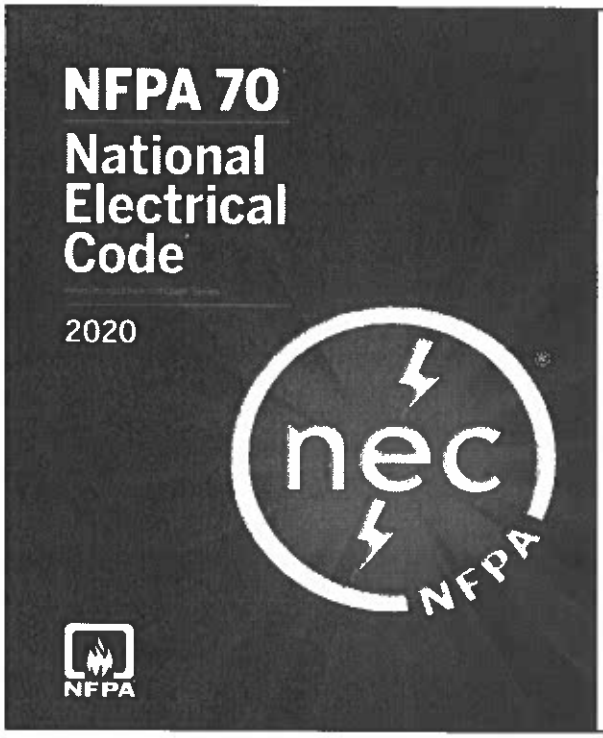

"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)

Subject to the local or State adoption authority

2020

6

OHIO LEGISLATION 3783.02

- Ohio Revised Code Section 3783.02 Exemptions. Effective: November 3, 1989 Legislation: House Bill 222 - 118th General Assembly Nothing in sections 3783.01 to 3783.08 of the Revised Code shall apply to inspection of the design, construction, maintenance, or replacement of any of the following: (A) Installations in ships, watercraft, railway rolling stock, aircraft, or automotive vehicles; (B) Installations underground in mines; (C) Installations of railways for the generation, transformation, transmission, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communication purposes; (D) Installations of communication equipment under control of communication utilities, located outdoors or in building spaces used for such installations; (E) Installations under the control of electric utilities for the purpose of communication, metering, or for the generation, control, transformation, transmission, and distribution of electric energy located in building spaces used by utilities for such purposes or located on property owned or leased by the utility or on public highways, streets, roads, etc., or by established rights on private property; (F) Installations of elevators, dumbwaiters, and escalators as regulated by the bureau of workers' compensation.

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2020 NATIONAL ELECTRICAL CODE (NEC) PROPOSED CHANGES AND UPDATE INFORMATION DETAILS

NFPA MEMBER

Based on the 2020 National Electrical Code (NFPA 70) as published by the National Fire Protection Association (NFPA).

All information contained within this presentation is my personal and professional opinion, based upon over 43 years in the construction industry.

Not Current Code in Ohio

2020

8

2020 NATIONAL ELECTRICAL CODE

Identifying Changes throughout the Code

Over 3,700 public inputs / 1,900 comments

New Revision Symbols

Δ before a section number = words in section deleted

Δ to left of table or figure = revision to table or figure

Δ throughout chapter = heavy revision to entire chapter

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2020

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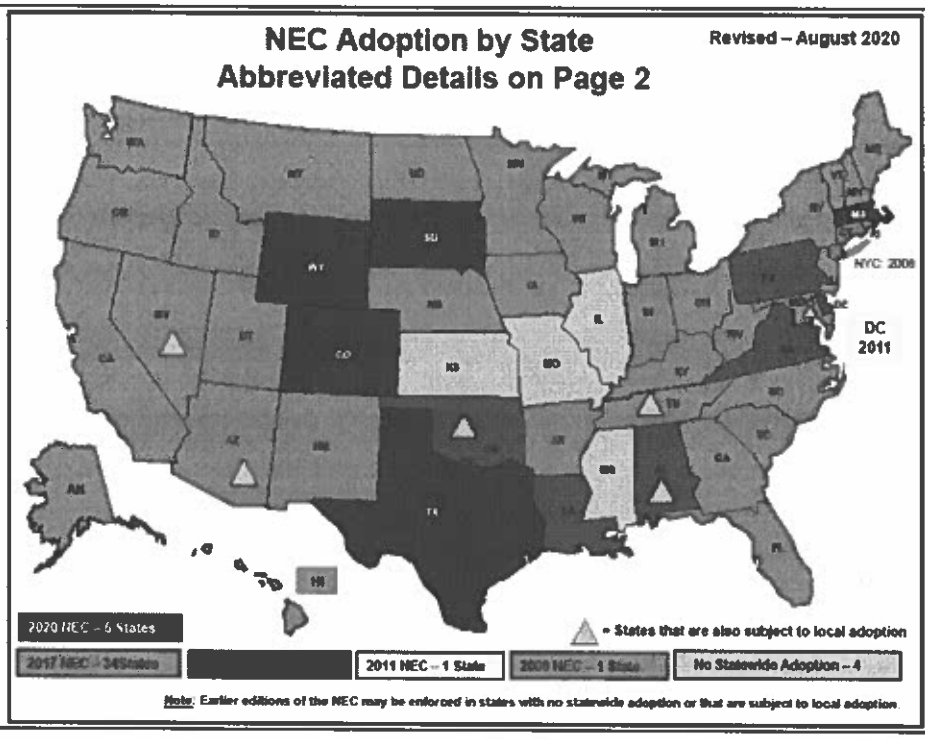

2020

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State	Adoption	Implementation		State	Adoption	Implementation	
Alabama	7.1.16	See Adoption Report		Montana	12.7.19	12.7.19	
Alaska	5.9.16	5.9.16		Nebraska	5.1.17	8.1.17	
Arizona	Local Adoption	See Adoption Report		Nevada	2.5.19	Local	Majority
Arkansas	9.19.17	1.1.18		New Hampshire	3.1.17	1.1.18	
California	January 2019	1.1.20		New Jersey	9.3.19	9.3.19	
Colorado	5.27.2020	8.1.20		New Mexico	11.15.17	2.1.18	
Connecticut	7.25.18	10.1.18		New York	12.1.19	5.15.20	Ex. NYC
Delaware	3.11.16	3.11.16		North Carolina	12.12.17	6.12.18	
Florida	9.2.20	12.31.20		North Dakota	3.14.17	7.1.17	
Georgia	11.15.17	1.1.18		Ohio	5.25.17	11.1.17	
Hawaii	7.26.18	1.1.19		Oklahoma	8.8.15	11.1.15	
Idaho	7.1.17	7.1.17		Oregon	10.1.17	10.1.17	
Illinois	Local Adoption	See Adoption Report		Pennsylvania	5.1.18	10.1.18	
Indiana	August 2008	9.26.09		Rhode Island	8.1.19	8.1.19	
Iowa	11.3.17	1.1.18		South Carolina	8.22.18	1.1.20	
Kansas	Local Adoption	See Adoption Report		South Dakota	8.9.20	7.1.20	
Kentucky	8.22.18	1.1.19		Tennessee	3.19.18	10.1.18	
Louisiana	12.12.17	2.1.18		Texas	10.1.20	11.1.20	
Maine	11.6.17	11.6.17		Utah	5.8.17	7.1.18	
Maryland	See Adoption Report	Local	State	Vermont	10.1.17	10.1.17	
Massachusetts	12.5.19	1.1.20		Virginia	4.30.18	9.4.18	
Michigan	1/4/19	1.4.19		Washington	7.1.17	7.1.17	
Minnesota	6/1/17	7.1.17		West Virginia	3.24.20	3.24.20	
Mississippi	Local Adoption	See Adoption Report		Wisconsin	4.1.18	8.1.18	
Missouri	Local Adoption	See Adoption Report		Wyoming	2.1.20	7.1.20	

2020

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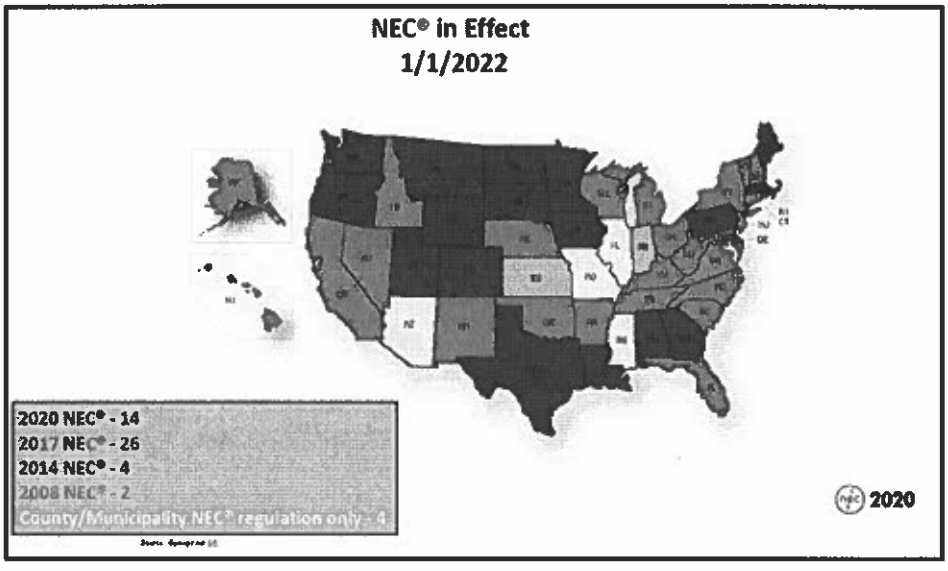
NFPA STATE UPDATE MAP



2020

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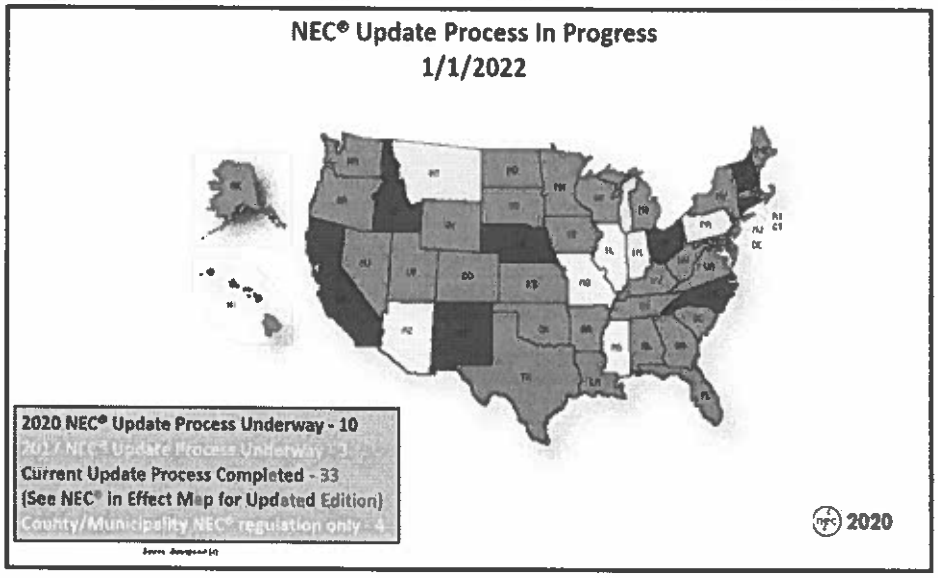
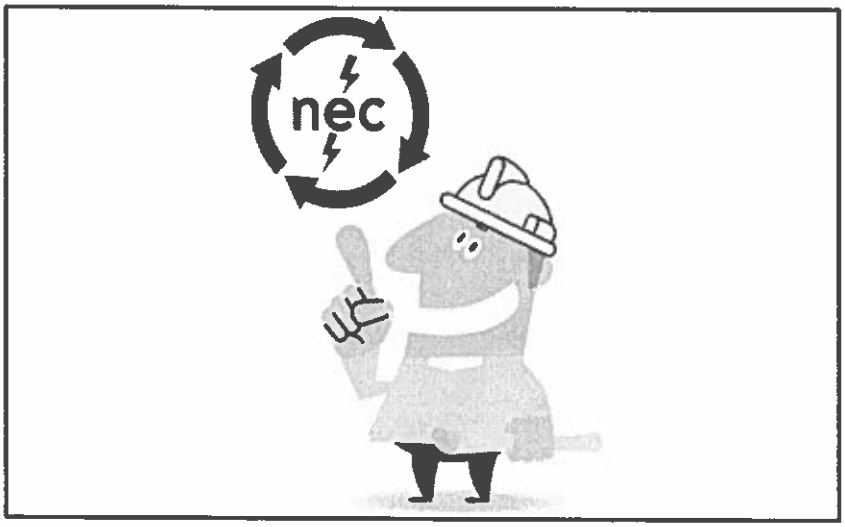
NFPA STATE UPDATE MAP



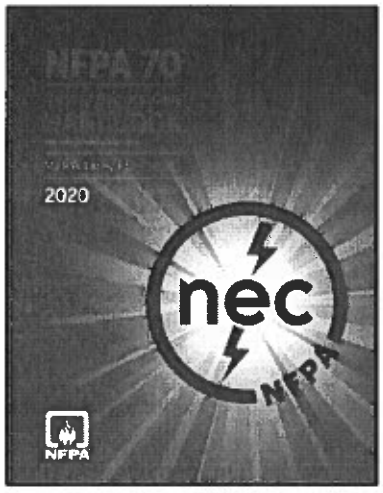
13

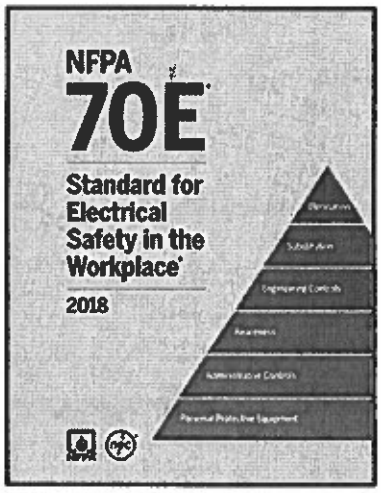
2023 NEC WILL BE HERE SOON!!



14

ADDITIONAL USEFUL NFPA PUBLICATIONS





2020

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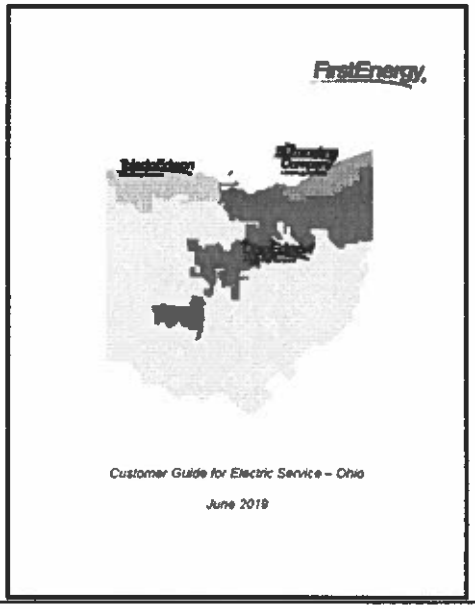
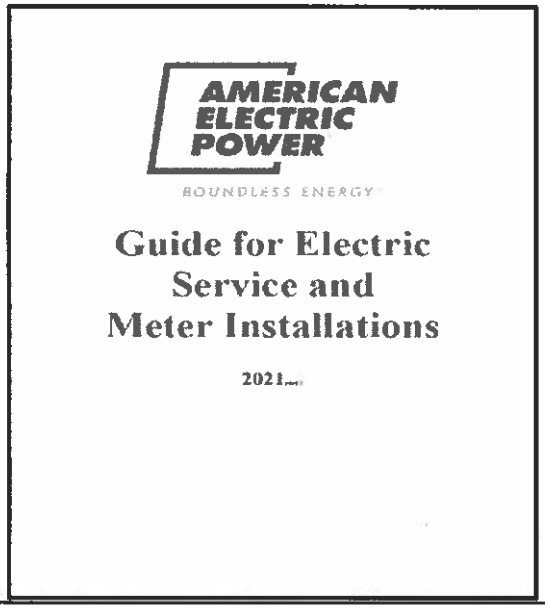
POWER CO. SERVICE GUIDES





2020

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(4) "*NEW*" ARTICLES

Article 242 Overvoltage Protection

Article 311 Medium Voltage Conductors and Cable

Article 337 Type "P" Cable (Hazardous Locations)

Article 805 General Requirements for Communication Systems

For Informational Purposes Only

2020

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CHAPTER 1

General

Article 100 – Definitions

Article 110 – Requirements for Electrical Installations

Not Current Code in Ohio

2020

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ARTICLE 100- DEFINITIONS

If a definition is utilized in two or more Articles the definition will be in Article 100

Now Three Subparts

Part I. – General
Part II. – Over 1000 Volts. Nominal
Part III. – Hazardous Classified Locations. (CMP-14)

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2020

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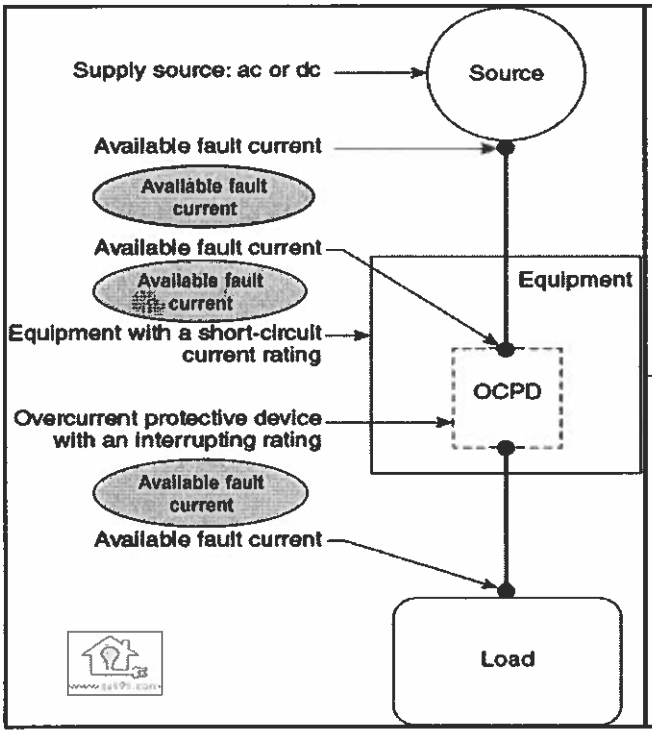

ARTICLE 100 DEFINITIONS

Available Fault Current

Fault Current:

The current delivered at a point on the system during a short-circuit condition. **(CMP-10)**

Available Fault Current:

The largest amount of current capable of being delivered at a point on the system during a short-circuit condition. **(CMP-10)**

Note: AFC is calculated at load-side terminals of the source and line-side terminals of OCPD and all other load locations.

Not Current Code in Ohio

2020

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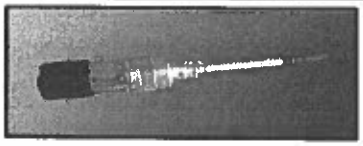
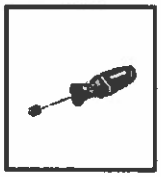
110.14(D) TERMINAL TIGHTENING TORQUE





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 Notes: 1, 2 & 3
Shear bolts, breakaway-style devices with visual indicators
NFPA 70(B)-Electrical Equipment Maintenance

For Informational Purposes Only

2020

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110.22(A) IDENTIFICATION OF DISCONNECTING MEANS - GENERAL

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. **Re: **_ANSI Z535.4 2011 (R2017)_****

Not Current Code in Ohio

2020

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110.24(A) AVAILABLE FAULT CURRENT - FIELD MARKING

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 of the calculation was performed and be of sufficient durability to withstand the environment involved.

Information Note 1 – **Recognizes NFPA 70E- 2018**

N Informational Note 2 – Values of AFC current for use in determining appropriate minimum SCCR of SE equipment is available from electric utilities in published or other forms.

Assistance from the local electrical utility

For Informational Purposes Only

2020

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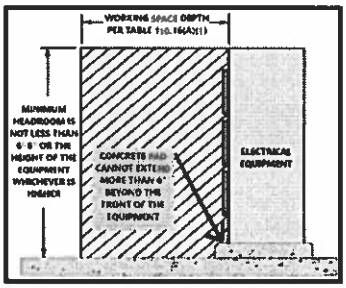
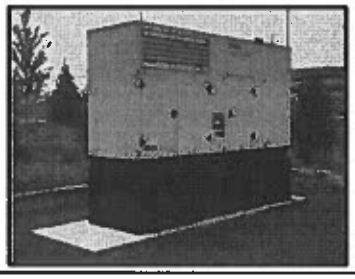
110.26(A)(3) HEIGHT OF WORKING SPACE

Revision

The work space shall be clear and extend from the grade, floor or platform to a height of 78" or the height of equipment, whichever is greater. Within the height requirements of this section, other equipment ***or support structures, such as concrete pads shall not extend more than 6" beyond the front of the electrical equipment.***





Not Current Code in Ohio

2020

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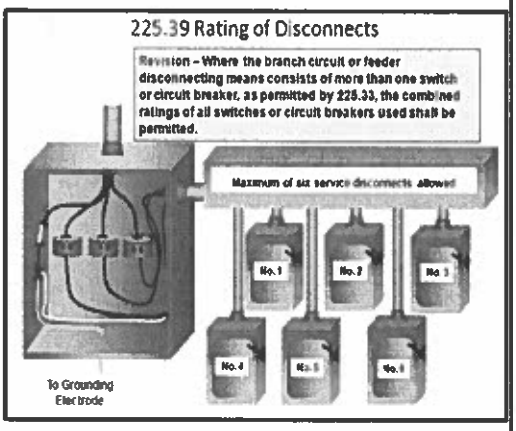
110.26(C)(2) LARGE EQUIPMENT – RATED 1200 AMPERES OR GREATER

Large Equipment is defined as follows:

(1) For equipment rated 1200 amperes or more and over 6' wide.

(2) For SE disconnecting means installed in accordance with 230.71 where the combined ampere rating is 1200 amperes or more and over 6' wide.



For Informational Purposes Only

2020

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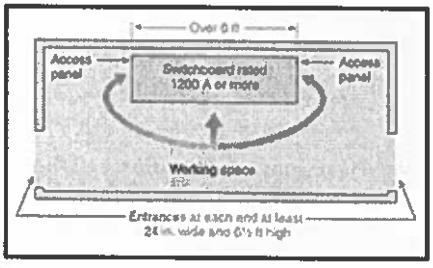
ARTICLE 110.26(C)(2)

The one entrance requirement has been 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 24" wide & 78" high at ***each end of the working space***.



Not Current Code in Ohio

2020

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CHAPTER 2

Wiring and Protection

Article 210 – Branch Circuits

Article 220 – Branch-Circuit, Feeder, and Service Load Calculations

Article 230 – Services

Article 240 – Overcurrent Protection

N **Article 242 – Overvoltage Protection**

Article 250 – Grounding

Not Current Code in Ohio

2020

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210.8 GFCI PROTECTION FOR PERSONNEL

2017 NEC	2020 NEC
(A) Dwelling Units	(A) Dwelling Units
(B) Other Than Dwelling Units	(B) Other than Dwelling Units
(C) Boat Hoists	(C) Crawl Space Ltg. Ckts.
(D) Kitchen D/W Branch Ckt.	(D) Specific Appliances
(E) Crawl Space Lighting Ckt.	(E) Equip. Requiring Servicing
	(F) Outdoor Outlets

Not Current Code in Ohio

2020

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ARTICLE 100 - DEFINITIONS

Receptacle

A contact device installed at the outlet for the connection of an attachment plug or for direct connection of electrical utilization equipment designed to mate with the corresponding contact device. A single receptacle is a single contact device with no other contact device on the same yoke ***or strap***. A multiple receptacle is two or more contact devices on the same yoke ***or strap.*** (CMP-18)

210.8(A) & (B)

Outlet

A point on the wiring system at which current is taken to supply utilization equipment. (CMP-1)

210.8(C) – Crawl Space Ltg. Outlets

N **210.8(D) Specific Appliances**
N **210.8(E) Equip. Requiring Servicing**
N **210.8(F) Outdoor Outlets**

For Informational Purposes Only

2020

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210.8(A) GFCI PROTECTION FOR PERSONNEL- DWELLING UNITS

Significant Expanded Requirements:

This change will now require that *all* 125-v through 250-v "*receptacles*" installed in the locations specified in 210.8(A)(1) through 210.8(A)(11) and supplied by 1ø branch circuits rated 150-v or less to ground shall have GFCI protection for personnel (no maximum amperage noted)

Previous NEC editions were limited to 15- and 20-amp 125-v receptacles.

Bathrooms, *garages*, outdoors, crawl spaces, *basements*, *kitchens*, sinks, boathouses, bathtubs or shower stalls, *laundry areas* or indoor damp and wet locations.

11 Locations / Type "A" GFCI Protection 4 – 6 mA

Not Current Code in Ohio

2020

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210.8(A)(5) DWELLING UNIT GFCI PROTECTION

Basements – Changes the Intent

Removed: "unfinished portions or areas of the basement not intended as habitable rooms".

This change will now require ***all*** receptacles installed in basements will require GFCI protection.

Exception remains for fire alarm / burglar alarm systems.

All **receptacles in dwelling unit basements are subject to dampness, moisture and conductive floors, whether finished or unfinished.**

For Informational Purposes Only

2020

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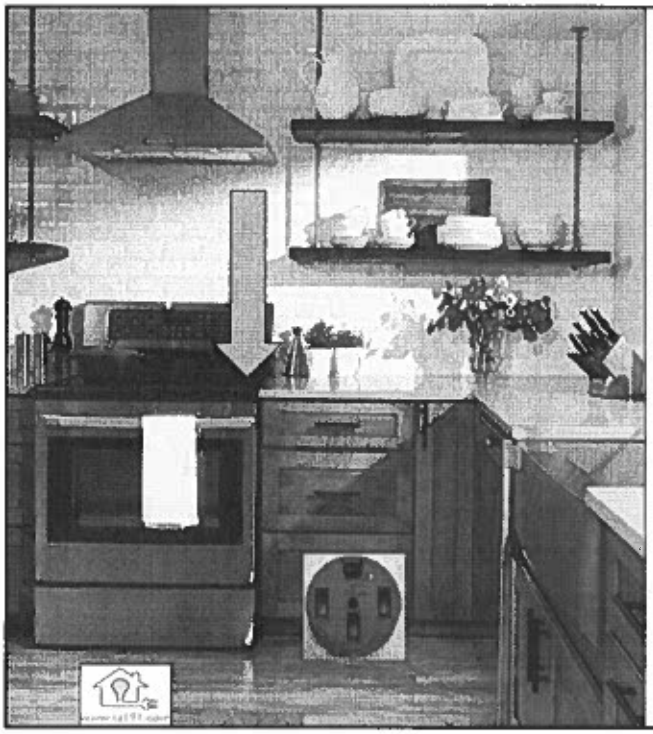

210.8(A)(6) DWELLING UNIT KITCHENS

Receptacles rated 125-v to 250-v located to "*serve countertop surfaces*" in kitchens will now be required to be provided with GFCI protection.

No Max. Amperage noted!

Not Current Code in Ohio

2020

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210.8(A)(7) GROUND-FAULT CIRCUIT-INTERRUPTER PROTECTION FOR PERSONNEL

Clarification of Intent

Re: Sinks where receptacles are installed within 6' from the top inside edge of the bowl of the sink.

This change ***deletes referenced text*** in the last paragraph to this section, which was new in the 2017 NEC. "***the shortest path the 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***".

2020 Removes the 6' cord without passing through a "door or doorway"!

ie: Garbage Disposal / Dishwasher / Instant Hot / Compactor receptacle

GFCI / AFCI protection required if within the 6' measurement

2020

For Informational Purposes Only

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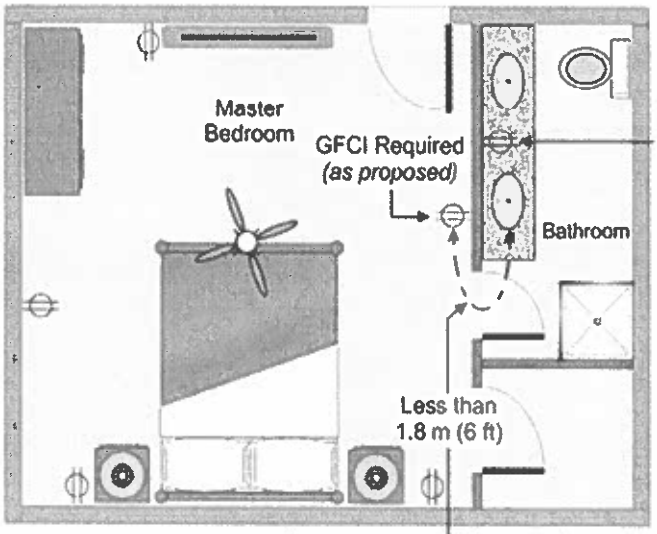
210.8(A)(7) REVISION

Regarding all 125-v through 250-v 1ø, 150-v to ground or less, receptacles installed *within 6' from the top inside edge of a sink.*

Removed reference to all doors (cabinet, personnel or other) and doorway.

210.8 Measurements for GFCI Protection



All 125-volt through 250-volt receptacles installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink requires GFCI protection. *[210.8(A)(7)]*

For the purposes of this section, when determining the distance from receptacles the distance shall be measured as the shortest path the cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or passing through a ~~door, doorway, or~~ window. *[210.8]*

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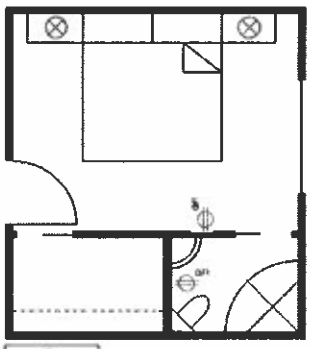
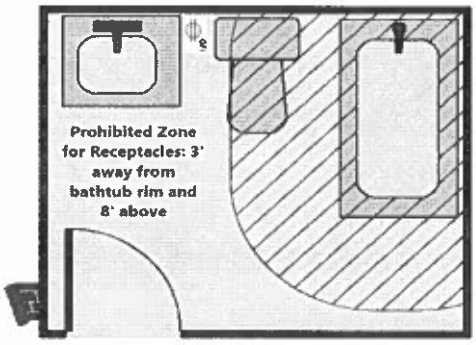
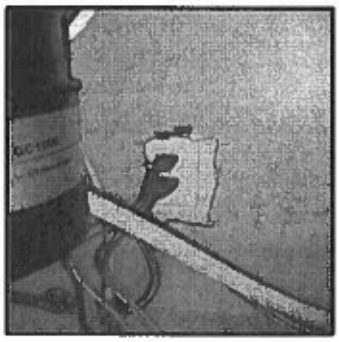
210.8(A) GFCI PROTECTION (CONT'D)

Bathroom Locations





Kitchen Locations



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210.8(A)(10) DWELLING UNIT LAUNDRY AREAS (ROOMS)

Receptacles rated 125-v to 250-v (1ø 150-v to ground or less) located in laundry area(s) will now be required to be provided with GFCI protection.

No Max. Amperage Noted!

Not Current Code in Ohio

2020

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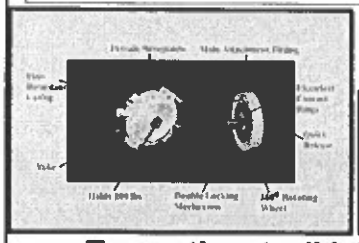
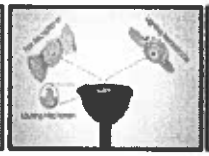
210.8(A) DWELLING UNIT – GFCI PROTECTION



NEW – Exception

***Exception** to #1-3, 5-8 and 10: **Listed locking** support & mounting receptacles utilized in combinations with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not require GFCI protection.* (Safety Quick Ltg. & Fans Corp)

If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

***Applies to**: Bathrooms, Garages, Outdoors, Basements, Kitchens, Sinks, Boathouses and Laundry Areas*

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210.8(B) GFCI PROTECTION FOR PERSONNEL- OTHER THAN DWELLING UNITS

Expanded Requirements:

The change will require that *all* 125-v through 250-v "*receptacles*" supplied by 1ø branch circuits rated 150-v to ground or less, 50a or less and "*all receptacles*" supplied by 3ø branch circuits rated 150-v to ground, 100a or less, installed in the locations in areas specified in 210.8(B)(1) through 210.8(B)(12) will now require GFCI protection for personnel.

Bathrooms, kitchens, rooftops, outdoors, sinks, indoor *damp and* wet locations, locker rooms with associated showering facilities, garages, *accessory buildings*, service bays, crawl spaces, unfinished *areas of basements*, *laundry areas*, and *bathtubs and shower stalls*.

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12 Locations / Type "A" GFCI Protection 4 – 6 mA

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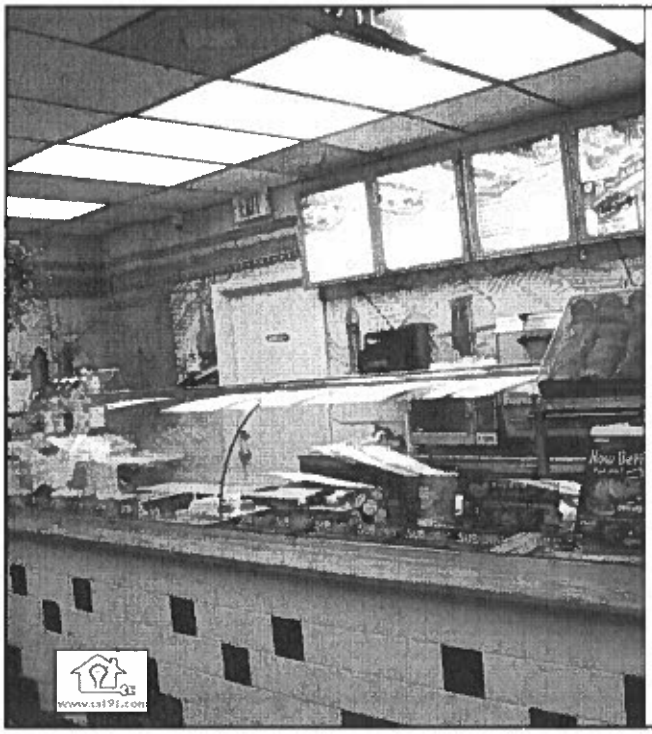

210.8(B)(2) GFCI PROTECTION

OTHER THAN DWELLING UNITS

KITCHENS / *FOOD PREP*

Expanded Requirement

Kitchens ***or areas with a sink "and" permanent provisions for either food preparation*** or cooking.

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210.8(B)(5) OTHER THAN DWELLING UNITS - SINKS

Ex. #2 – Health Care Facility locations – Clarification

Receptacles located in patient bed locations of Category 2 (*general care*) or Category 1 (*critical care*) spaces of health care facilities ***shall be permitted to comply with 517.21***

517.21: Ground-fault circuit-interrupter protection for personnel ***shall not*** be required for receptacles installed in those critical care (*Category 1*) spaces where the toilet and basin are installed within the patient room.

Prevent patient from being exposed to additional hazards!

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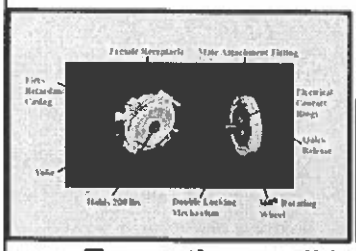
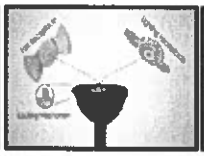
210.8(B) OTHER THAN DWELLING UNITS – GFCI PROTECTION

NEW – Exception





***Exception** to #1-5, 8 and 10: **Listed locking** support & mounting receptacles utilized in combinations with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not require GFCI protection.* (Safety Quick Ltg. & Fans Corp)

If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

Applies to: Bathrooms, Kitchens, Rooftops, Outdoors, Sinks, Garages and unfinished portions of Basements

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210.8(C) CRAWL SPACE LIGHTING OUTLETS
210.8(D) SPECIFIC APPLIANCES
210.8(E) EQUIPMENT REQUIRING SERVICING
210.8(F) OUTDOOR OUTLETS

(C) Crawl Space Lighting Outlets- 120-v or less

N (D) Specific Appliances- 422.5 all dishwasher *outlets*

N (E) Equipment Requiring Servicing- 210.63

N (F) Outdoor Outlets- all outdoor *outlets* for dwellings, 1ø branch circuits, 150-v or to ground or less, 50a or less

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210.8(C) BOAT HOISTS

Removed / Re-directed

2017 NEC – GFCI protection is required per 555.3

2020 NEC – GFCI Protection will be 555.9

Type "A" Protection 4-6mA

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210.8(D) SPECIFIC APPLIANCES; WAS KITCHEN D/W BRANCH CIRCUIT - DWELLING UNIT

Expanded Requirement

2020 NEC - *Specific Appliances* (now will apply to all dishwasher locations, both ***residential /commercial***). GFCI protection for personnel:

Refer to 422.5(A) & (B)

Type "A" Protection 4 – 6mA

Crawl Space Lighting – GFCI Requirements 2017 NEC 210.8(E) / 2020 NEC 210.8(C)

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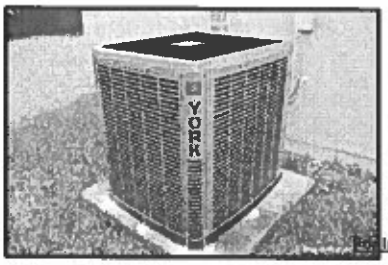
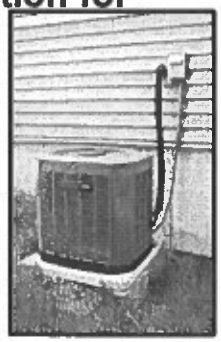
N 210.8(F) OUTDOOR OUTLETS

NEW Requirement – Dwelling Units

All outdoor outlets for dwellings, other than those covered in 210.8(A)(3), exception to (3), that are applied to single-phase branch circuits rated 150-v to ground or less, 50 amps or less, shall have ground-fault circuit-interrupter protection for personnel. (Exception; Lighting Outlets)





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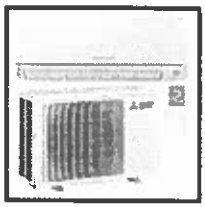
PROPOSED 08.20.2021 OBBS UPDATE RE: OUTDOOR OUTLETS

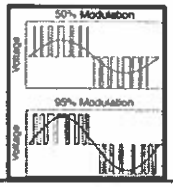
Posted 09.02.2021 OBBS Proposed Amendment

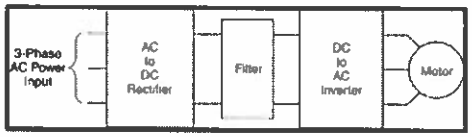


Amendment 20-01 to NFPA 70 210.8(F) to exempt certain HVAC equipment from the GFCI requirement.

- **(VSD's) Variable speed drive motors (peak load conditions)**
- **ECM motors are energy efficient; (electronically commutated motor) (variable / multi-speed, auto reversing motors); typically provided with 20 - 30 SEER equipment (split systems).**

Note: These devices are not compatible with GFCI devices





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OBBS *DRAFT* 4101:1-35-01 CHAPTER 35 REFERENCED STANDARDS

Proposed Amendment to 2020 NFPA 70

National Electrical Code (except that section 210.8(F) does not apply to HVAC units employing power conversion equipment (variable speed drive) as a means to control compressor speed).

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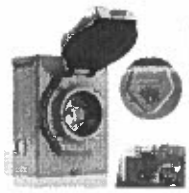
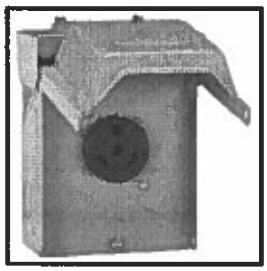


N 210.8(F) OUTDOOR OUTLETS

NEW Requirement – Dwelling Units

All **outdoor** ***outlets*** **for dwellings, other than those covered in 210.8(A)(3), exception to (3), that are applied to single-phase branch circuits rated 150-v to ground or less, 50 amps or less, shall have ground-fault circuit-interrupter protection for personnel. (*Exception; Lighting Outlets*)**



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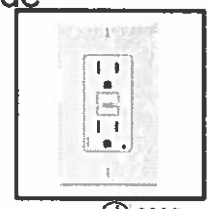
210.12 ARC-FAULT CIRCUIT PROTECTION

(A) Dwelling Units – Clarified Wiring Method / Revision

(5) Metal raceway, ***metal wireways, metal auxiliary gutters, or*** Type MC or Type AC ***cable*** meeting the ***applicable*** requirements of 250.118, ***with*** metal ***boxes***, metal ***conduit bodies***, and metal ***enclosures*** are installed for the portion of the branch-circuit between the OCD and the 1st outlet, it shall be permitted to install a listed outlet branch-circuit type AFCI at the 1st outlet to provide protection for the remaining portion of the branch-circuit.

Clarified AFCI receptacle wiring method / use



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210.12(C) & (D) ARC-FAULT CIRCUIT-INTERRUPTER PROTECTION (AFCI)

Additional Required Locations

(C) Guest Rooms, Guest Suites (added to 2017 NEC), ***and Patient Sleeping Rooms in Nursing Homes and Limited-Care Facilities.*** All 120-v 15- and 20-ampere branch circuits supplying outlets ***and devices*** installed in guest rooms 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).

(D) Branch circuit Extensions or Modifications. – Dwelling Units, Dormitory units, ***and Guest Rooms and Suites.***

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Fire Estimate Summary

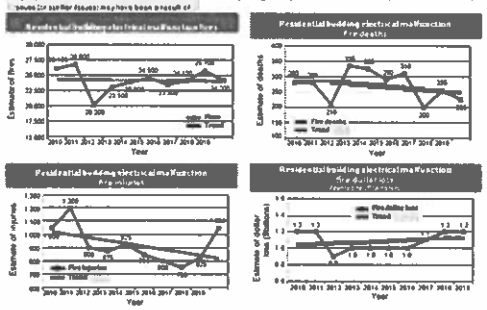
Residential Building Electrical Malfunction Fire Trends (2010-2019)

The 2019 national estimates for residential building electrical malfunction fires and losses show that there were

- 24,200 fires
- 225 deaths
- 1,050 injuries
- $1,208,300,000 in dollar loss

Overall trends for residential building electrical malfunction fires and losses for the 10-year period of 2010 to 2019 show the following

- A 0.8% decrease in fires
- A 19% decrease in deaths
- A 20% decrease in injuries
- A 9% increase in dollar loss. In 2018 and 2019, there were 32 and 14 incidents, respectively, with a reported dollar loss of $1,000,000 or more, which may have contributed to the continued increase in fire dollar loss. The 2019 high dollar loss fires included a $26,400,000 hotel fire in New Orleans, Louisiana. (Note: The overall constant dollar-loss trend takes inflation into account by adjusting each year's dollar loss to its equivalent 2019 value.)



FEMA

National Fire Data Center
16825 S. Seton Ave
Emmitsburg, MD 21727
usfa.fema.gov

2020

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210.15 RECONDITIONED EQUIPMENT (NEW)

The following shall not be reconditioned:

(1) Equipment that provides GFCI protection for personnel

(2) Equipment that provides AFCI protection

(3) Equipment that provides GFPE

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210.25(B) COMMON AREA BRANCH CIRCUITS

Branch circuits installed for lighting, central alarm, signal, communications, or other purposes for public or common areas of two-family dwellings, a multifamily dwelling, or multi-occupancy building shall not be supplied from equipment that supplies an individual dwelling unit or tenant space.

***N* New Informational Note**

***Informational Note*: Examples of public or common areas include, but are not limited to, lobbies, corridors, stairways, laundry rooms, roofs, elevators, washrooms, store rooms, driveways (parking), and mechanical rooms.**

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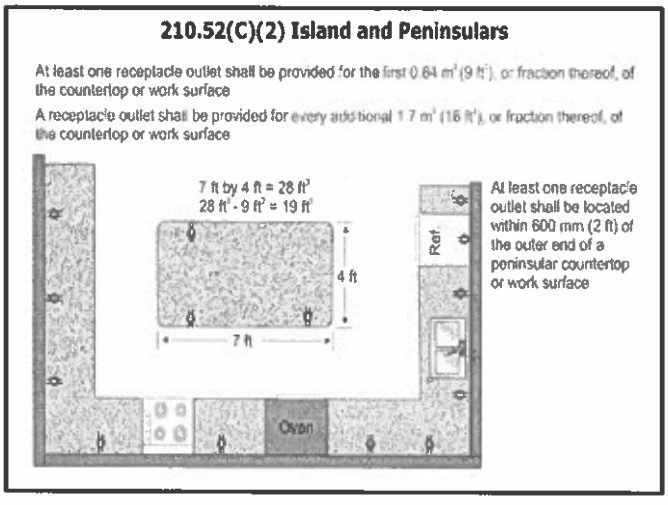
210.52(C)(2) REVISION TO ISLAND & PENINSULAR COUNTERTOPS

2017 NEC required (1) receptacle outlet, no matter the size of peninsular ***(wall outlet)***.

***2020 NEC* will require (1) receptacle outlet for the 1st 9 ft² of countertop space. A receptacle outlet is required for every additional 18 ft² or fraction thereof, of countertop space (+ within 2' of outer end for peninsular locations).**



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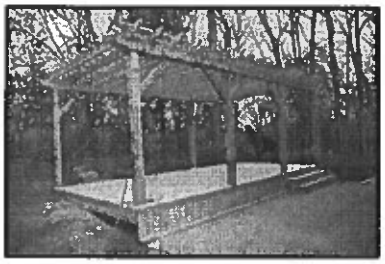
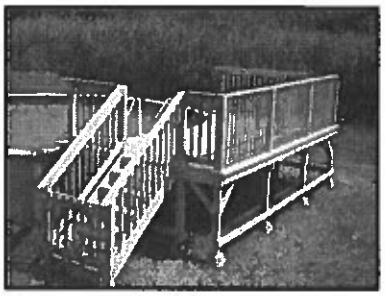
210.52(E)(3) BALCONIES, DECKS, & PORCHES

Balconies, decks, and porches that are ***within 4" horizontally of the dwelling unit*** shall have at least ***one*** receptacle outlet accessible from the balcony, deck or porch.

Clarification / Self-supporting deck





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210.63 EQUIPMENT REQUIRING SERVICING

A 125-v single-phase, 15- or 20-a rated receptacle outlet shall be installed at an accessible location ***within 25' of the equipment*** as specified in 210.63(A) and (B). ***(in same room, area and level)***

N 210.63(A) **Heating, A/C, and refrigeration equipment**

210.63(B) Other Electrical Equipment **(other than 1- and 2-family)**

N 210.63(B)(1) Indoor Service Equipment (located in same room)

N 210.63(B)(2) Indoor Equip. Requiring Dedicated Equip. Spaces

Not connected on load side of disconnecting means!

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210.65 MEETING ROOMS

Rooms 1000 ft² or less – Easier to Understand

210.65(A) – General

210.65(B) – Receptacle Outlets Required; 2' / 6' / 12' (per 210.52)

1. Receptacle outlets; in fixed walls.
2. Floor outlets; applies to rooms greater than 12'

in any direction and floor area of 215 ft² shall have at least ***one floor receptacle outlet, or at least one floor outlet to serve receptacle(s). Located at a distance of not less than 6' from any fixed wall for each 215 ft² or major portion of floor space.***

***N* 2017 NEC / 210.71**

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210.70 LIGHTING OUTLETS REQUIRED

Revised

210.70(A)(1) Habitable Rooms. 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.***

210.70(A)(2) ***Additional Locations. – Remains Same***
210.70(B) ***Guest Rooms or Guest Suites. – Remains same***
210.70(C) ***All Occupancies. – Remains Same***

Control device = switch / occ. sensor / other device

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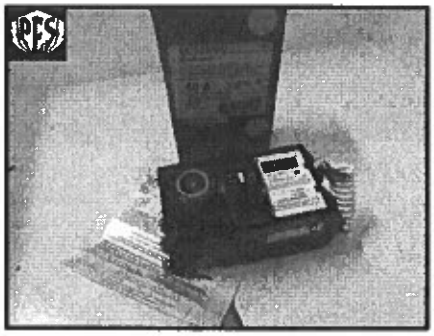
215.9 GROUND FAULT CIRCUIT INTERRUPTER PROTECTION FOR PERSONNEL (FEEDERS)

Proposed revisions to ***update*** this section to allow GFCI protection of feeders to correlate with both 210.8 GFCI protection for personnel and 590.6 Temporary Installations.

Was limited to 15- and 20a branch circuits. (i.e.: electric dryers and ranges)



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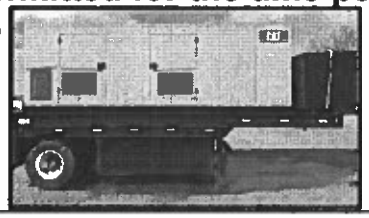
215.10 GROUND-FAULT PROTECTION OF EQUIPMENT

New Exception

N **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.**



AT+T Switching Facility

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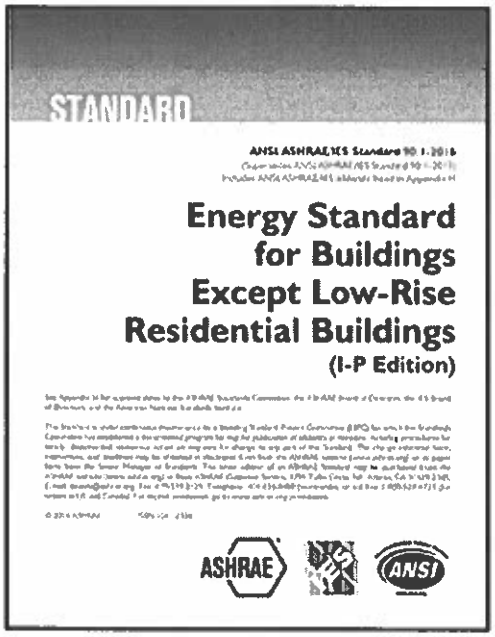
TABLE 220.12 GENERAL LIGHTING LOADS BY OCCUPANCY

Due to lighting system technology (LED) specifically and energy code compliance requirements, ***ASHRAE 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings,*** designers around the Country utilize these requirements and the NEC is updating their requirements.

Reducing lighting minimums



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N 220.12 LIGHTING LOADS FOR NON-DWELLING OCCUPANCIES

Added (B) Energy Code / Revised / #4 is new

(A) General. Lighting loads shall be not less than specified in Table 220.12. Motors less than 1/8 HP and connected to a lighting circuit are considered general lighting load.

(B) Energy Code. 2017 NEC, was exception, now revised to positive code language.

1. **Power monitoring system installed for general lighting system.**
2. **Provided with alarm values.**
3. **Demand factors are not applicable**
4. ***Continuous load of 125% shall be applied.***

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Table 220.12 General Lighting Loads by Non-Dwelling Occupancy

Type of Occupancy	Unit Load Volt-amperes/ m^2	Unit Load Volt-amperes/ ft^2
Automotive facility	16	1.5
Convention center	15	1.4
Courthouse	15	1.4
Dormitory	16	1.5
Exercise center	15	1.4
Fire station	14	1.3
Gymnasium[a]	18	1.7
Health care clinic	17	1.6
Hospital	17	1.6
Hotels and motels, including apartment houses without provisions for cooking by tenants[b]	18	1.7
Library	16	1.5
Manufacturing facility[c]	24	2.2
Motion picture theater	17	1.6
Museum	17	1.6
Office[d]	14	1.3
Parking garage[e]	3	0.3
Penitentiary	13	1.2
Performing arts theater	16	1.5
Police station	14	1.3
Post office	17	1.6
Religious facility	24	2.2
Restaurant[f]	16	1.5
Retail[g,h]	20	1.9
School/university	33	3
Sports arena	33	3
Town hall	15	1.4
Transportation	13	1.2
Warehouse	13	1.2
Workshop	18	1.7

TABLE 220.12 GENERAL LTG. LOADS

Revised / Enlarged Table

[a]Armories & Auditoriums = ***gyms***

[b]Lodge rooms = ***hotels / motels***

[c]Industrial Comm. = ***manufacturing / factory***

[d]Banks = ***offices***

[e]Storage garages = ***parking garages***

[f]Clubs = ***restaurants***

[g/H] Barber / Beauty shops / Stores = ***retail***

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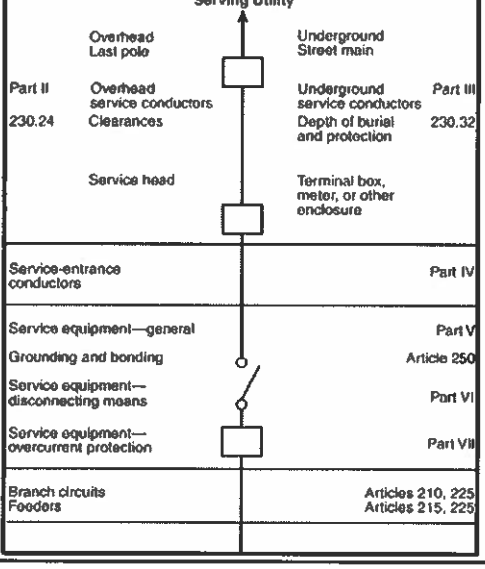
General			Part I
Overhead Service Conductors			Part II
Underground Service Conductors			Part III
Service-Entrance Conductors			Part IV
Service Equipment—General			Part V
Service Equipment—Disconnecting Means			Part VI
Service Equipment—Overcurrent Protection			Part VII
Services Exceeding 1000 Volts, Nominal			Part VIII



ARTICLE 230 SERVICES

230.1 Scope

This article covers service conductors and equipment for control and protection of services and their installation requirements.

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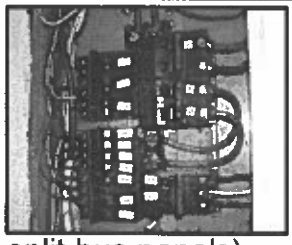
ARTICLE 230 - SERVICES



General Safety Issues Addressed

Panelboards with 6 SE disconnects ***no longer permitted***. (MLO & split-bus panels)

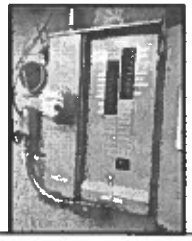
Firefighter exterior SE disconnects for one- and two- family dwellings.

Line-side barriers to SE equipment to extend beyond panelboards only.

Arc-reduction for 1200 amps and greater to incorporate this technology (1/1/2020).

SCCR identification for pressure connectors and devices as ***"suitable for use on the line side of SE equipment"*** *(2017 NEC "PDB's).*

Surge protective devices ***(SPD's)*** now required for ***all*** dwelling units.



Not Current Code in Ohio

2020

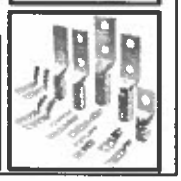
65

230.46 SPLICED AND *TAPPED* CONDUCTORS

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 (PDB's), pressure connectors, and devices for splices and taps shall be listed. PDB's installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.***

Effective 01.01.2023; pressure connectors and devices for splices and taps installed on service conductors shall be marked "suitable for use on the line side of service equipment" or equivalent.

IE: Protective covers

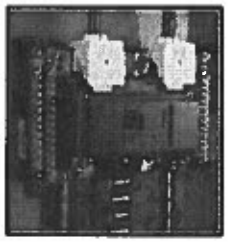


For Informational Purposes Only

2020

66

N 230.62 (C) BARRIERS

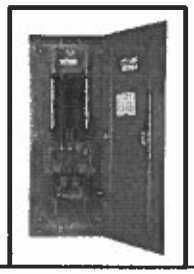


Relocated from 408.3(A)

Barriers shall be placed in *SE* 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.

Now applies to all SE Equipment

Exception Removed:



Not Current Code in Ohio

2020

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N 230.67 SURGE PROTECTION

***(A) N* SPD Device. All services supplying dwelling units shall be provided with a surge-protective device (SPD).**

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

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

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

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

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2020

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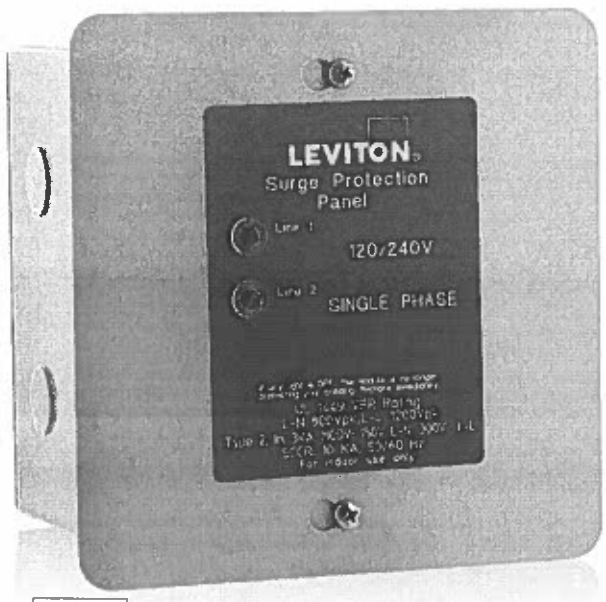

N 230.67 SURGE PROTECTION FOR DWELLING UNITS

All services supplying dwelling units shall be provided with a surge protection device (SPD). Designed to protect against surges to electrical systems.

New Construction and Upgrades

Type 1 or Type 2 SPD

Not Current Code in Ohio

2020

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230.71 MAXIMUM NUMBER OF DISCONNECTS

Each service shall have only one disconnecting means unless the requirements of 230.71(B) are met.

230.71(B) Two to six service disconnects shall be permitted ***for each service permitted by 230.2 or for each set of SE conductors permitted by 230.40, Ex. 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, each with a main SE disconnect.***
2. ***Panelboards with a main SE disconnect.***
3. ***Vertical switchboard sections that have separate SE disc.***
4. ***SE disconnect in meter mods where each disconnect is located in a separate compartment.***

Refer to Informational Notes 1 & 2

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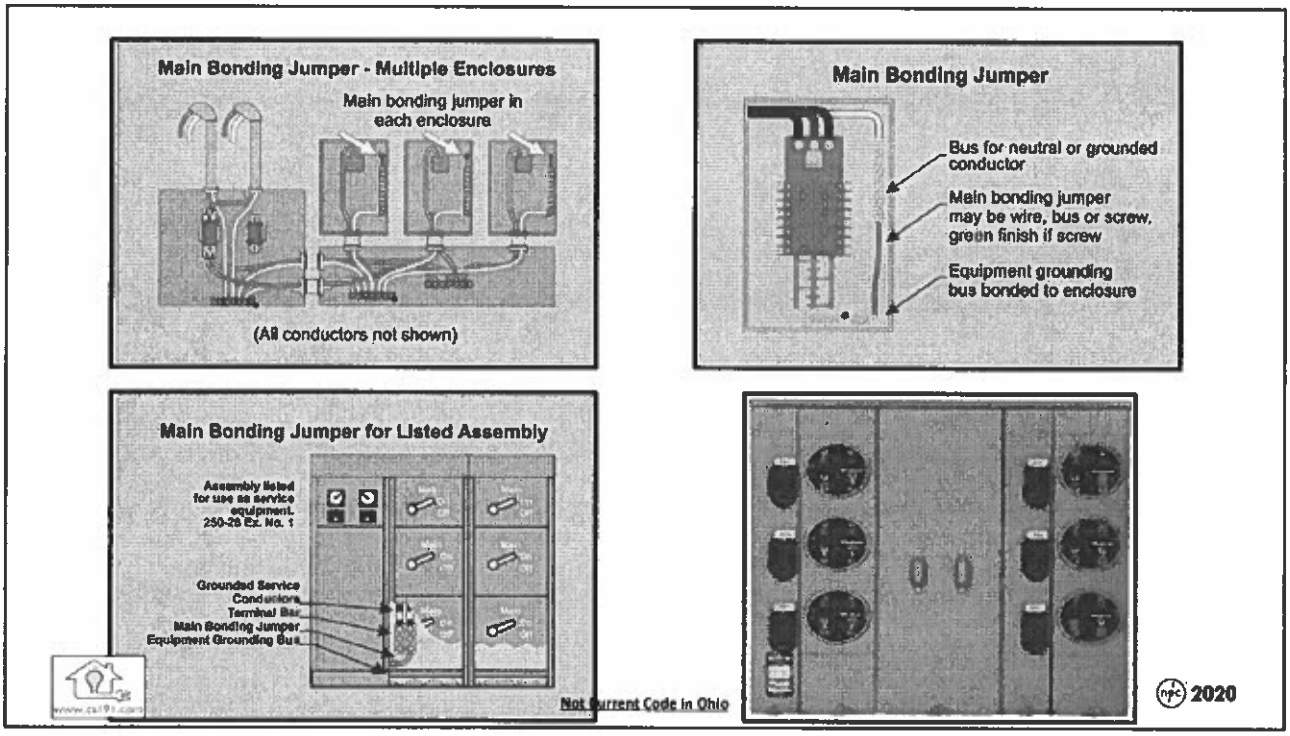

71

Δ 230.82 EQUIPMENT CONNECTED TO THE SUPPLY-SIDE OF SERVICE DISCONNECT

Revision

(6) Solar PV, fuel cells, wind electric, energy storage, or interconnected electric power production systems, ***if provided with a disconnecting means listed as SUSE rated and overcurrent protection as specified in Part VII of Article 230.***

(10) Emergency disconnects in accordance to 230.85, if all metal housings and SE enclosures are grounded (Part VII) and bonded in accordance with Article 250 (Part V).

(11) Meter mounted transfer switches, rated <1000-v, have appropriate SCCR equal to or greater than the AFC. The transfer switch shall be listed and be capable of transferring the load served. Identified on its exterior with both:
(a) Meter-mounted transfer switch
(b) Not service equipment.

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2020

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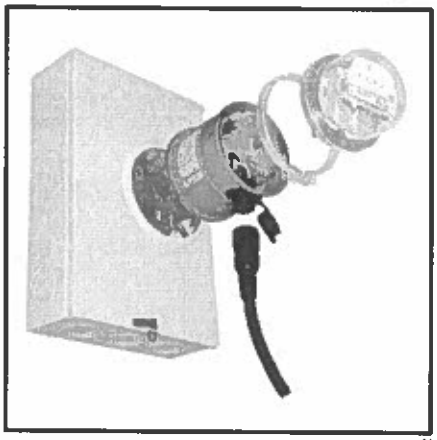
METER MOUNTED TRANSFER SWITCHES

Gener Link w/ 75kA Surge Protection per phase



For Portable Generators

Not Current Code in Ohio

2020

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2020

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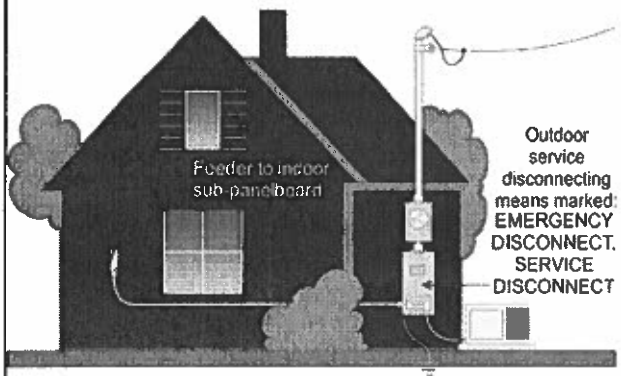
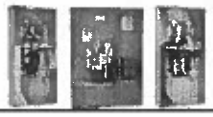
230.85 Exterior Emergency Disconnect(s)



For dwellings, all service conductors to 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



230.85 "NEW" EXTERIOR EMERGENCY "SE" DISCONNECT

Applies to 1- and 2-Family Dwelling Units

All **service conductors to terminate in a SUSE rated disconnecting means, with adequate SCCR, in a readily accessible *outdoor* location. Grouping is required.**

Intent to protect firefighters / other emergency personnel.

For Informational Purposes Only

2020

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230.85 EMERGENCY DISCONNECTS

Each emergency disconnect shall be one of the following:

(1) Service disconnects marked:

"EMERGENCY DISCONNECT, SERVICE DISCONNECT"

(2) Meter disconnects installed per 230.82(3) & marked:

"EMERGENCY DISCONNECT, METER DISCONNECT, NOT SERVICE DISCONNECT"

(3) Other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are suitable for use as service equipment & marked:

"EMERGENCY DISCONNECT, NOT SERVICE EQUIPMENT"

Not Current Code in Ohio

2020

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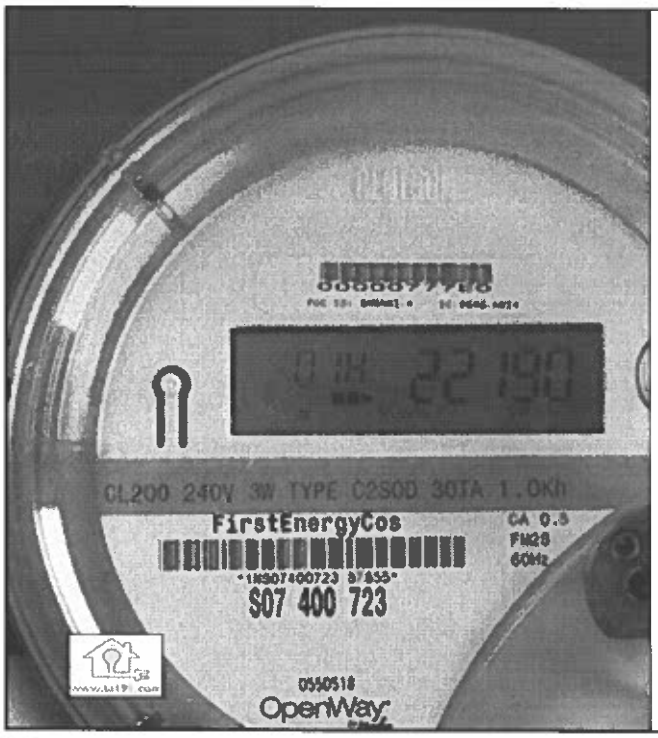

NEWS

09.20.2020
FIRST ENERGY
ANNOUNCES
SMART METER
CONVERSION;
INDICATES 700K TO BE
INSTALLED IN OHIO

2020

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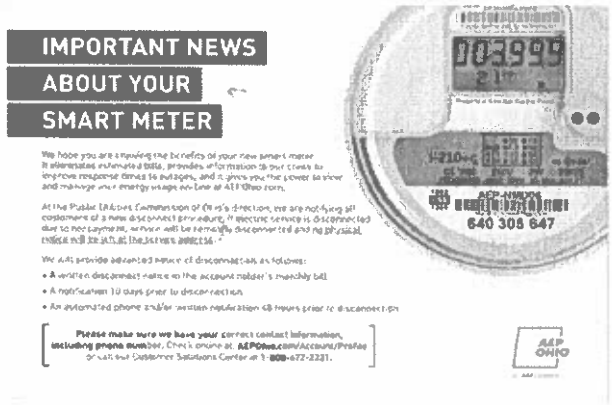
AEP SMART METER FLYER 01.18.2020



AEP AMERICAN ELECTRIC POWER

For Informational Purposes Only

2020

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SMART METER RESIDENTIAL APPLICATION

Not Current Code in Ohio

2020

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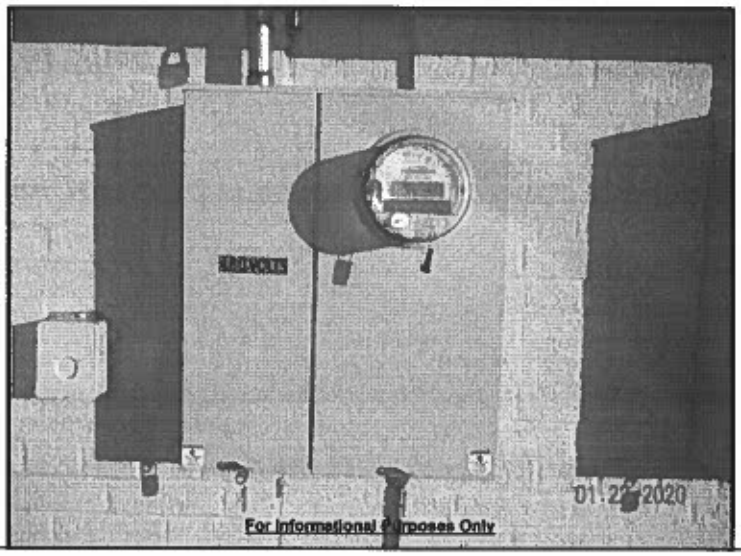
SMART METER UTILIZED FOR MULTIPLE VOLTAGES / PHASES



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2020

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240.67(C) & 240.87(C) PERFORMANCE TESTING (NEW) ARC-ENERGY REDUCTION (FUSES / CKT. BRKRS)

2017 NEC Effective Date: 01.01.2020 (Fuses)

(A) Documentation
(B) Method to Reduce clearing Time
(C) *Performance Testing (NEW)*

AER Protection System – Tested when 1st installed
Qualified person, primary current injection & manufacturer test
Written record made available to AHJ

For Informational Purposes Only

2020

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240.88 RECONDITIONED EQUIPMENT (NEW)

(A) Circuit Breakers

(1) Molded-case circuit breakers ***shall not*** be reconditioned
(2) Low-and medium-voltage circuit breakers ***shall be permitted*** to be reconditioned.
(3) High-voltage circuit breakers ***shall be permitted*** to be reconditioned.

(B) Components

(1) Low-voltage power circuit breaker electronic trip units ***shall not*** be reconditioned.
(2) Electromechanical protective relays and c/t's ***shall be permitted*** to be reconditioned.

Not Current Code in Ohio

2020

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ARTICLE 242 (NEW) OVERVOLTAGE PROTECTION

Discusses overvoltage connection requirements. Permanently installed surge-protective devices (SPD's) not more than 1000-v and permanently installed surge arresters over 1000-v.

(Relocated information from Articles 280 & 285)

Type 1 SPD- Connected at the Service- line or load
Type 2 SPD- Connected on load Side of Service Disc.
Type 3 SPD- Connected to load side of Branch OCD

Each SE Disc. Should be Protected!

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2020

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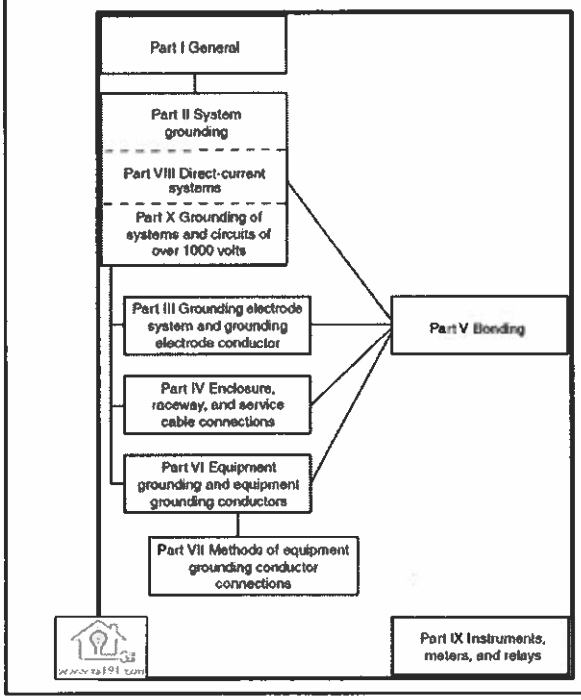

ARTICLE 250 GROUNDING & BONDING

250.4(A)(1) Electrical System Grounding

Electrical systems that are grounded shall be connected to earth in a manner that will limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operation.

250.4(A)(5) Effective Ground-Fault Path.

Installed in a manner that creates a low-impedance path that facilitates the operation of the OCD in a safe manner.

Not Current Code in Ohio

2020

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N 250.25

(NEW GROUNDING SYSTEMS PERMITTED TO BE CONNECTED ON THE SUPPLY-SIDE OF THE SE DISCONNECT)

The intent is that supply-side equipment [***whether considered a service or not***] needs to be properly grounded to a grounding electrode system. In order to create an effective fault current path. [Refer to 250.92 250.102(C)].
Systems such as wind, solar, fuel cells, and interconnected power production.

Note: 250.24(D) GEC Sized per Table 250.66

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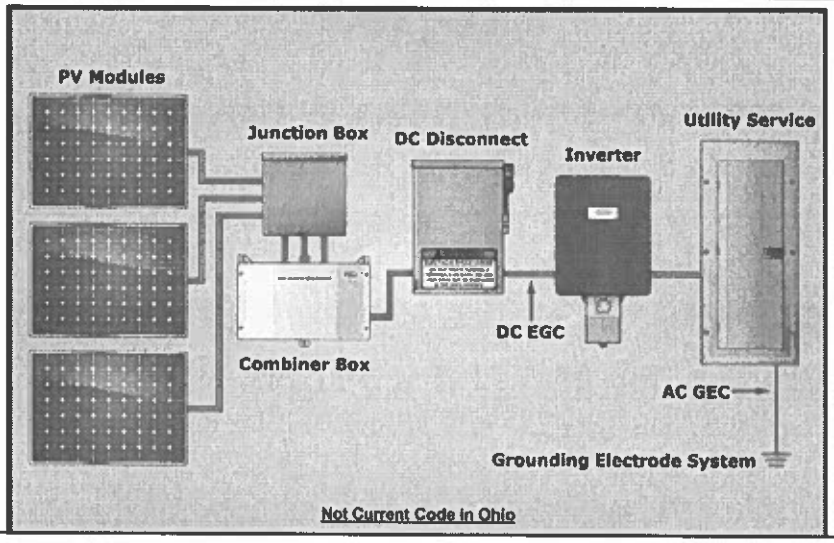
2020

85

N 250.25(A) SUPPLY-SIDE SE GROUNDING INSTALLED IN SEPARATE ENCLOSURES FROM SE EQUIPMENT



2020

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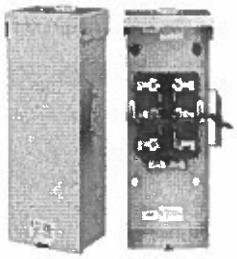
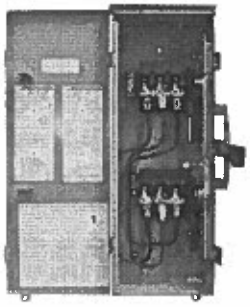
MANUAL TRANSFER SWITCHES

200a 2-pole 240-v 1ø



200a 3-pole 480-v 3ø



2020

87

N 250.30(A)(1) EX. (3)(B)EXCEPTION GROUNDING SEPARATELY DERIVED SYSTEMS

System Bonding Jumper

N* Ex. *Separately derived systems consisting of multiple sources of the same type that are connected in parallel shall be permitted to have the system bonding jumper installed at the paralleling switchgear, switchboard, or other paralleling connection point instead of at the disconnecting means located at each separate source.

Not Current Code in Ohio

2020

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PARALLELING OF TRANSFORMERS

Transformers operating in parallel

Occurs in installations that have their primary windings of the ***paralleled*** transformers connected to the same voltage supply and the secondary windings are connected to a common load.

***Note*: Transformers need to have the same Kva rating, turn ratios, and impedance characteristics. This would create equal load sharing between the source transformers, without creating circulating currents in the windings (heat loss).**

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2020

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N 250.30(A)(6) EX. #3 GEC MULTIPLE SEPARATELY DERIVED SYSTEMS

Relocated from 250.30(A)(6) Ex. 2(B) Ex. Tap Conductor Size

Now Expanded for all GEC, Multiple Separately Derived Systems

If the source of a separately derived system is located within equipment listed and identified as suitable for use as service equipment (SUSE), the grounding electrode conductor from the service or feeder equipment to the grounding electrode shall be permitted as the grounding electrode conductor for the separately derived system, if the grounding electrode conductor is of sufficient size for the separately derived system. If the equipment grounding bus internal to the equipment is not smaller than the required grounding electrode conductor for the separately derived system, the grounding electrode connection for the separately derived system shall be permitted to be made to the bus

Not Current Code in Ohio

2020

90

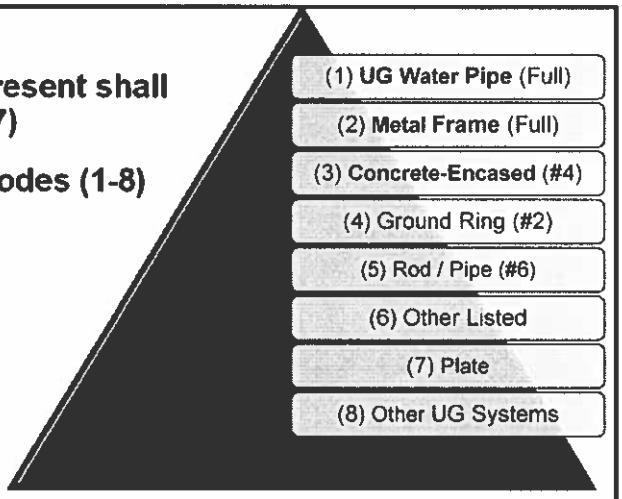
GROUNDING TRIANGLE / FOUNDATION

250.50 All Electrodes present shall be bonded together (1-7)

250.52 Permitted Electrodes (1-8)

Focus:

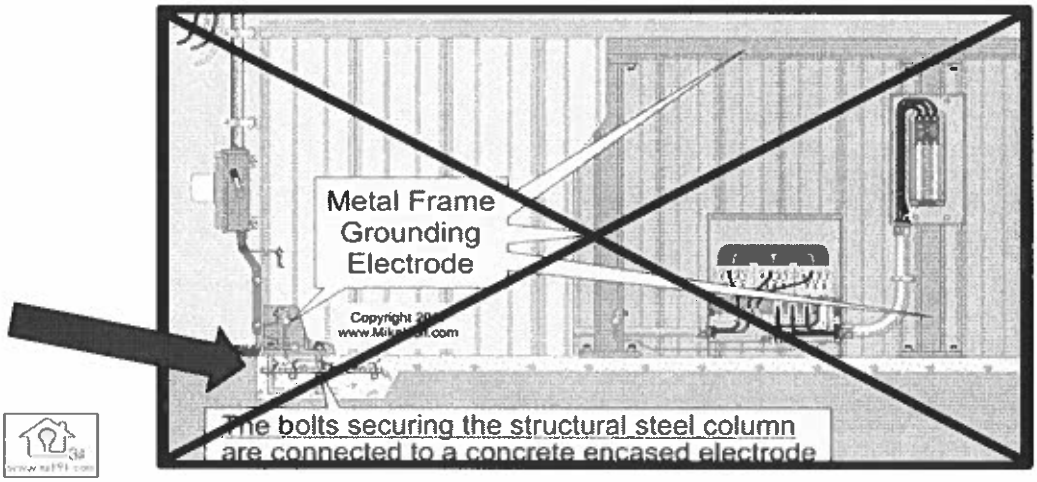
1. Metal UG Water Pipe
2. Building Steel
3. Concrete-Encased
4. Rod / Pipe



2020

91

N 2017 NEC 250.52(A)(2) METAL IN-GROUND SUPPORT STRUCTURES



2020

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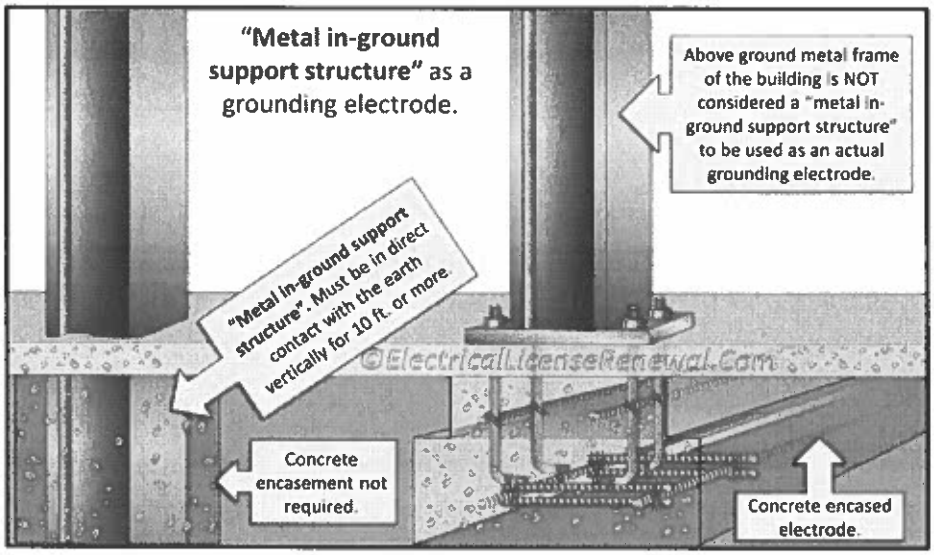
EFFECTIVELY GROUNDED STEEL STRUCTURE



93

250.64(A) GEC INSTALLATION AL OR COPPER-CLAD AL CONDUCTORS

2020 NEC	2017 NEC
Revised / Expanded Details (1) Conductors w/o an extruded polymeric covering shall not be installed in corrosive conditions or in direct contact with ***concrete*** (2) Outdoor locations in listed & identified enclosures, OK! Within 18" of bottom of enclosure. (3) AL / CU-AL external to buildings shall not terminate within 18" of the earth.	(A) Bare aluminum or copper-clad aluminum grounding electrode conductors shall **not** be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum grounding electrode conductors shall not be permitted within 18" of the earth.

For Informational Purposes Only

2020

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250.64(B)(2) EXPOSED TO PHYSICAL DAMAGE

Intent / Clarification

Any / all references for physical protection of grounding electrode conductors enclosed in PVC conduit will now require the use of Schedule 80 rigid polyvinyl chloride conduit.

Whether smaller than #6 AWG or larger

Not Current Code in Ohio

2020

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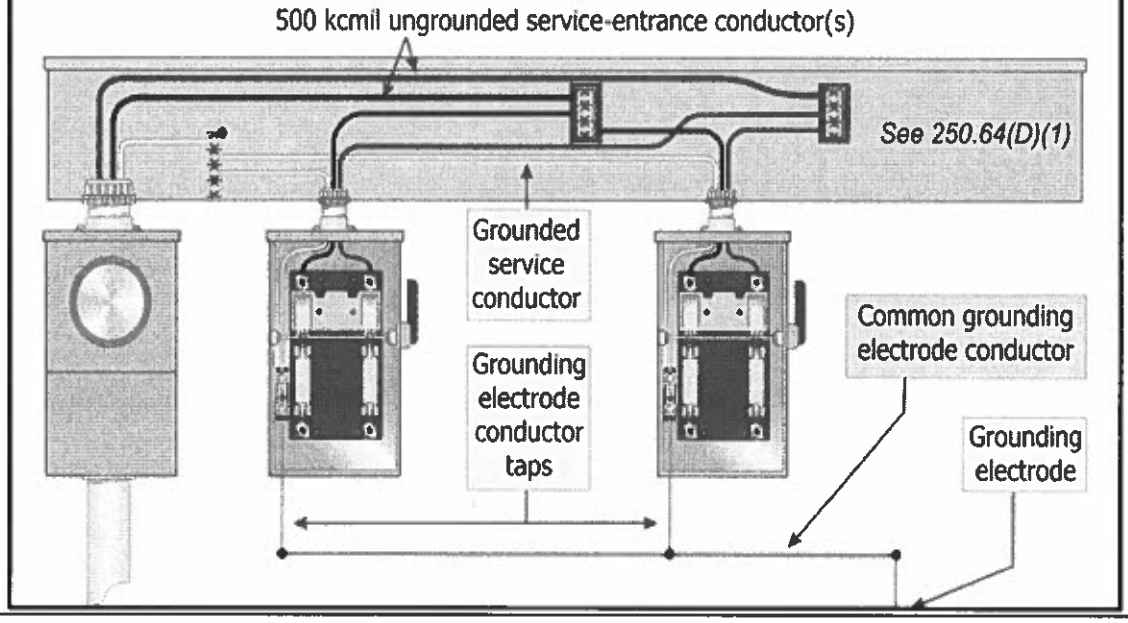
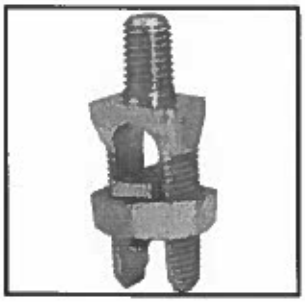
Taps to Common Grounding Electrode Conductor



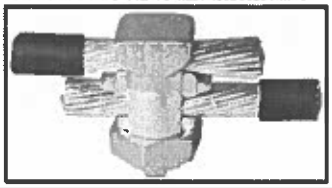
96

GROUNDING / BONDING FITTINGS

Servit Fitting



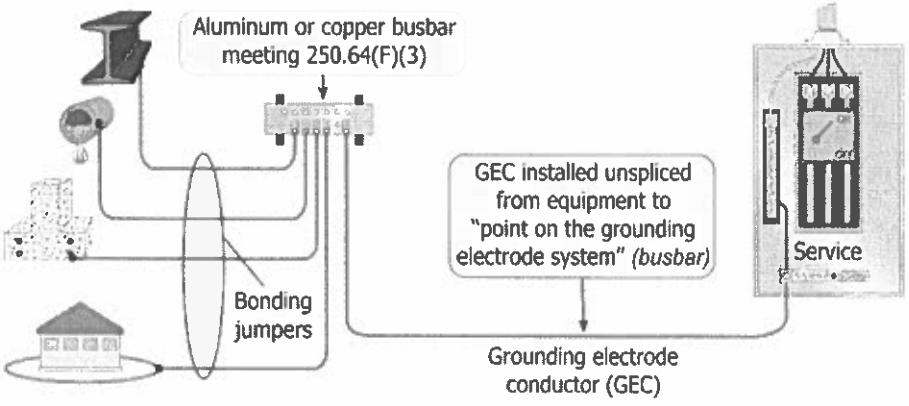
Parallel Body Connector aka: Split Bolt



2020

97

250.64(F) Installation to Electrode(s)



Bonding jumper(s) from grounding electrodes and grounding electrode conductors are permitted to be connected to copper or aluminum busbars to form the grounding electrode system

Connection to be made by a listed connector or by the exothermic welding process

98

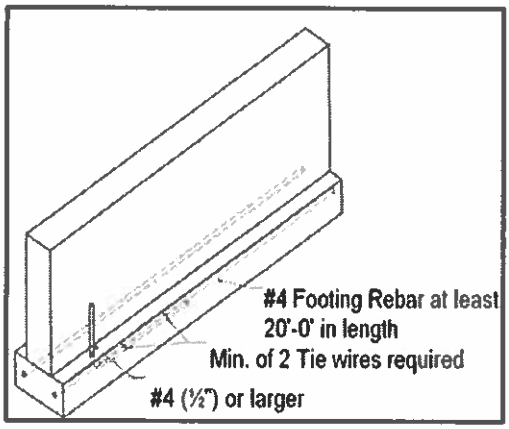
250.68(C)(3) GROUNDING ELECTRODE CONDUCTOR CONNECTIONS

Clarification of Intent

The intent is that the steel rebar system installed within the footing or foundation is *not* suitable as a conductor to interconnect other grounding electrodes of the system.

Rebar has not been tested to be a conductor.

****Also corrosion protection****



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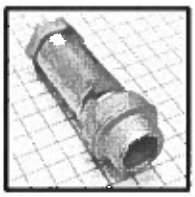
2020

99

250.98 BONDING LOOSELY JOINTED METAL RACEWAYS

Added: Expansion-deflection and Deflection Fittings

Expansion, ***expansion-deflection, or deflection*** fittings and telescoping sections of metal raceway shall be made electrically continuous by equipment bonding jumpers or other means.



Not Current Code in Ohio

2020

100

250.120(B) EQUIPMENT GROUNDING CONDUCTOR INSTALLATION

Expanded Revisions

Aluminum and Copper-Clad Aluminum Conductors. EGC's of bare, covered, or insulated aluminum or copper-clad aluminum shall comply with the following:

1. Unless ***part of a suitable Chapter 3 cable wiring method***, bare or covered conductors shall not be installed in corrosive conditions or be installed in direct contact with ***concrete***, masonry, or the earth.
2. Terminations are permitted in ***outdoor listed and identified*** for the environment enclosures within 18" of the bottom of the enclosure.
3. External to buildings shall not be terminated within 18" of the earth, ***unless terminated within a listed wire connector system***.

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2020

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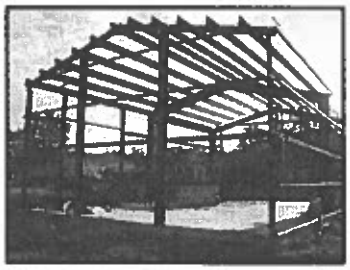
250.121(B) RESTRICTED USE OF EGC'S



Metal frame of a building or structure

Proposal would *prohibit* the structural metal frame of a building or structure from being used as an equipment grounding conductor (egc).

Clarification of 250.136(A), equipment secured to grounded metal structure. Acceptable to be used as a GEC, but not egc.

Relocated from 250.136(A)

Not Current Code in Ohio

2020

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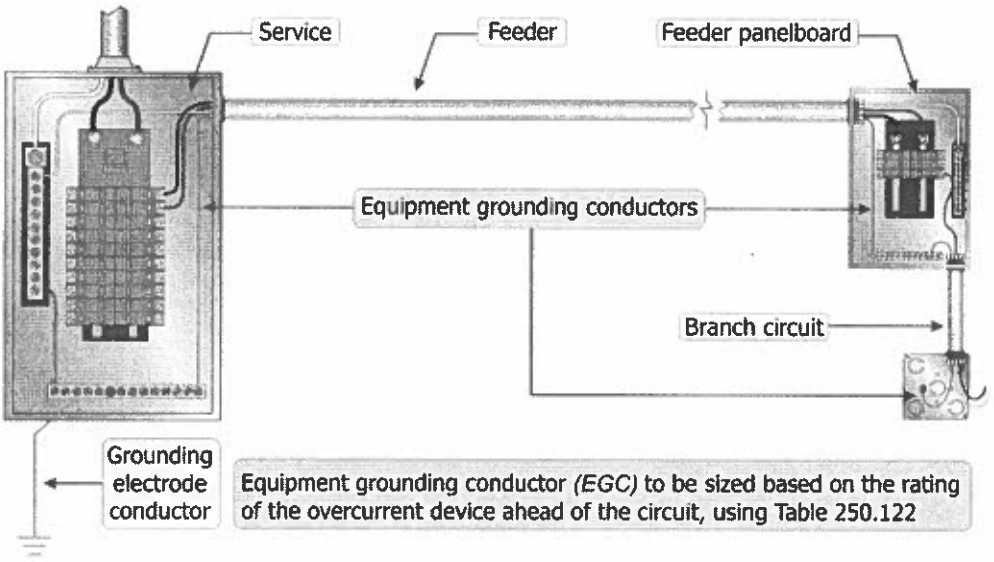
250.122(A) Sizing Equipment Grounding Conductors *(EGC)*



103

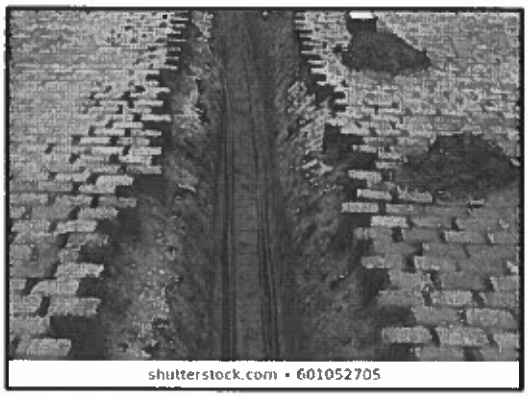
250.122
SIZING EQUIPMENT GROUNDING CONDUCTORS

(C) Multiple Circuits – Revision

A single equipment grounding conductor ***shall be permitted to be installed for multiple circuits that are installed*** in the same raceway, cable, ***trench,*** or cable tray.

Separate raceways = separate EGC's

EGC Size based on Table 250.122



2020

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250.122(B) SIZING EQUIPMENT GROUNDING CONDUCTORS

N Increased in Size

If ungrounded conductors are increased in size for any reason other than as required in 310.15(B) or 310.15(C), wire-type equipment grounding conductors, if installed, shall be increased in size proportionately to the increase in circular mil area of the ungrounded conductors.

310.15(B) – Ambient Temperature Correction Factors.

310.15(C) – Adjustment Factors

All conductors shall be increased in order to lower the overall voltage drop & impedance (of the GF current path) in order to open the OCD during a phase to ground fault.

Not Current Code in Ohio

2020

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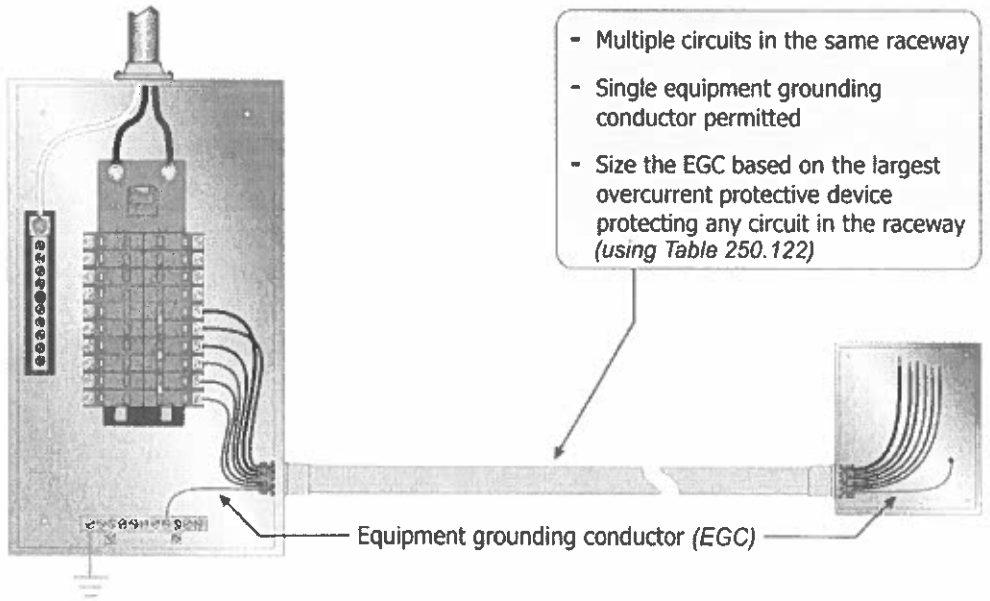
250.122(C) Multiple Circuits in the Same Raceway



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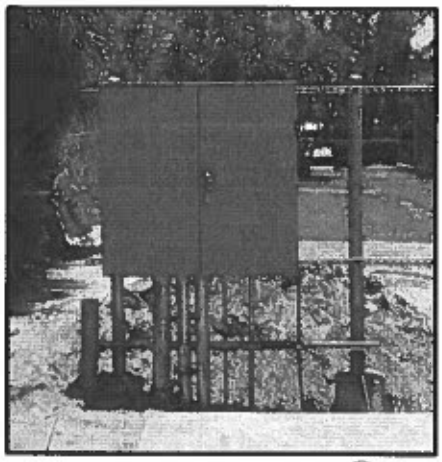
250.136 EQUIPMENT SECURED TO GROUNDED METAL SUPPORTS

Clarification

Electrical equipment secured to and ***in*** electrical contact with a metal rack or structure provided for its support ***shall*** be permitted to be considered as being connected to an equipment grounding conductor ***if the metal rack or structure is connected to an equipment grounding conductor by one of the means indicated in 250.134.***



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CHAPTER 3

Wiring Methods and Materials

Article 300 – General Requirements for Wiring Methods & Materials

Article 310 – Conductors for General Wiring

N **Article 311 – Medium Voltage Conductors and Cable**

Article 314 – Outlet, Device, Pull & Junction Boxes, Conduit Bodies, Fittings & Handholes

N **Article 337 – Type "P" Cable**

2020

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300.4(G) FITTINGS. PROTECTION FROM PHYSICAL DAMAGE

Revised, Clarified and Expanded.

Where raceways contain #4 AWG and larger insulated circuit conductors, and these conductors enter a cabinet, box, enclosure, or raceway shall be protected by any of the following:

1. Identified fitting, with smooth, identified, insulating surface
2. A listed metal fitting with smooth, rounded edges
3. Separation from raceway by a fitting secured in place
4. Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure or raceway with a smooth rounded edge or flared entry ***(2017 NEC exception)***

Not Current Code in Ohio

2020

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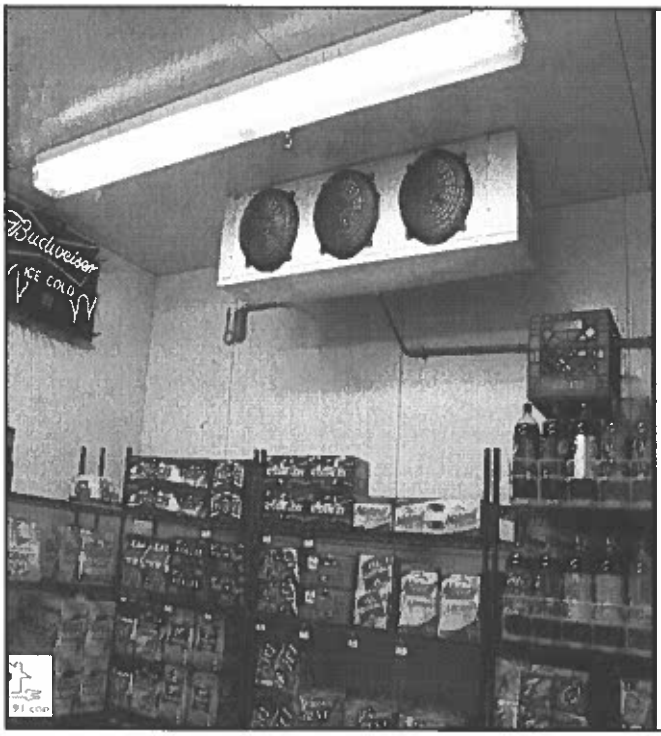

300.7 RACEWAYS EXPOSED TO DIFFERENT TEMPERATURES

Expanded Requirement

(A) Sealing. Where portions of a raceway or sleeve are known to be subjected to different temperatures, and where condensation is known to be a problem, *(cold storage areas, interior to exterior locations)* shall be sealed to prevent the circulation of warm air to a colder section of the raceway. ***Sealants shall be identified for use with the cable or conductor insulation, bare conductor, shield, or other components.***

Now reads similar to 300.5

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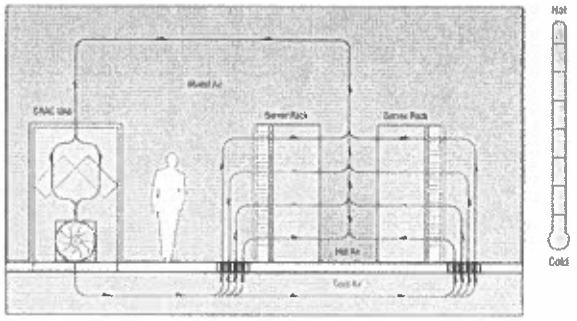
300.22(D) INFORMATION TECHNOLOGY EQUIPMENT

Revised

Where the installation complies with the special requirements in ***645.4***, electrical wiring in air-handling areas beneath raised floors, shall be permitted in accordance with ***645.5(E).***

Traditional Cooling Diagram



Not Current Code in Ohio

2020

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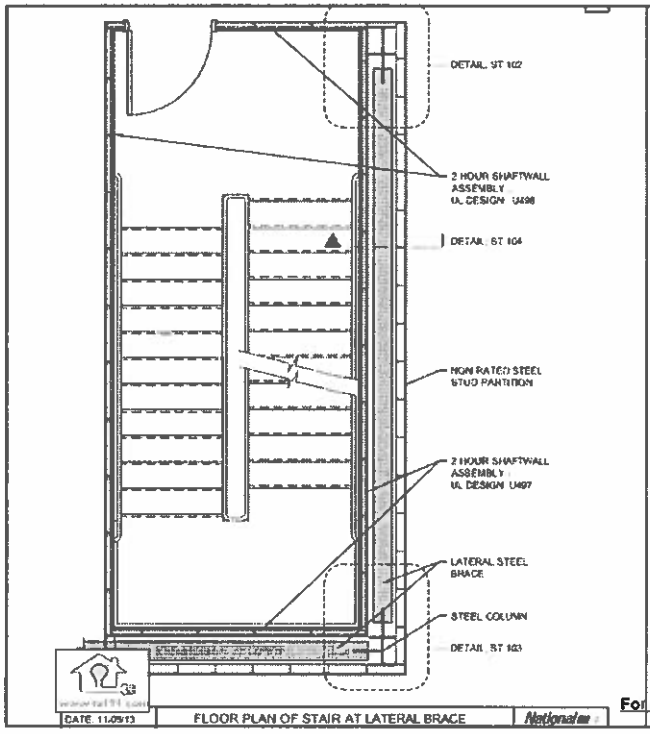

N 300.25 EXIT ENCLOSURES (STAIR TOWERS)

Where an exit enclosure is required to be separated from the building, ***only*** electrical wiring methods serving equipment permitted by the authority having jurisdiction in the exit enclosure shall be installed within the exit enclosure.

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300.45 DANGER SIGNS

Requirements for over 1000-volts Nominal

Revised

Danger signs shall be conspicuously posted at points of access to conductors in all raceway and cable systems. The signs shall meet the requirements in 110.21(B), shall be readily visible, and shall read:

Danger – High Voltage – Keep Out

****ANSI Z535.4 2011 (R2017)****

Not Current Code in Ohio

2020

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ARTICLE 310
CONDUCTORS FOR GENERAL WIRING

This Article has been extensively re-organized

Most Tables were updated with additional conductor types:

PFA – Perfluoroalkoxy (High Temp- Teflon Conductors) Appl. & Elec.
XHHN – Flame Retardant Thermoset (90°C Dry & Damp) Bldg. Wire
XHWN – FR, Moisture Resistant Thermoset (75°C Dry & Wet)
XHWN-2 – FR, Moisture Resistant Thermoset (90°C Dry & Wet)

All tables now refer to Ampacities was "Allowable Ampacities"

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ARTICLE 310
CONDUCTORS FOR GENERAL WIRING

Re-organization Continued

1. 310.3 Conductors – 2017 NEC 310.160
2. 310.4 Construction Applications – 2017 NEC 310.104
3. 310.12 1ø Dwelling Services & Feeders – 2017 NEC 310.15
4. 310.16 Ampacities of Insulated Conductors, Single-Insulated Conductors in Free Air, Insulated Conductors in Raceway or Cable, Single-Insulated Conductors in Free Air, Conductors Supported on a Messenger, Bare or Covered Conductors in Free Air, – 2017 NEC 310.15

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2020

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310.12 TABLE
SINGLE-PHASE 120/240-V DWELLING SERVICES & FEEDERS + 208Y/120-V SYSTEMS

Relocated 310.15(7)

The table is back for

100a – 400a Services & Feeders

83% Ampacity remains

Removed Table in 2014

Amperes	Copper	Alum
100	4	2
110	3	1
125	2	1/0
150	1	2/0
175	1/0	3/0
200	2/0	4/0
225	3/0	250
250	4/0	300
300	250	350
350	350	500
400	400	600

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Table 310.16 Ampacities of Insulated Conductors with Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried)

Size AWG or kcmil	Temperature Rating of Conductor [See Table 310.4(A)]						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)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, PFA, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, XHHN, Z, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, XHWN, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, XHHN	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
18*	—	—	14	—	—	—	—
16*	—	—	18	—	—	—	—
14*	15	20	25	—	—	—	—
12*	20	25	30	15	20	25	12*
10*	30	35	40	25	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	115	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	145	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	195	230	260	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	350	420	475	285	340	385	600
700	385	460	520	315	375	425	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	445	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	525	625	705	435	520	585	1500
1750	545	650	735	455	545	616	1750
2000	555	665	750	470	560	630	2000

2020

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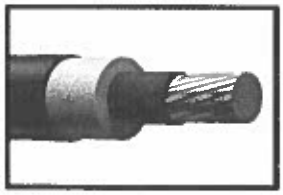
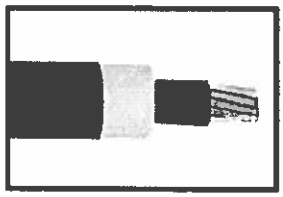
ARTICLE 311 (NEW) MEDIUM VOLTAGE CONDUCTORS AND CABLE

Covers construction, use installation and ampacities for medium voltage conductors and cables (MV).

Relocated from Article 310 & 328

2001v – 35kv ratings
Both shielded & non-shielded





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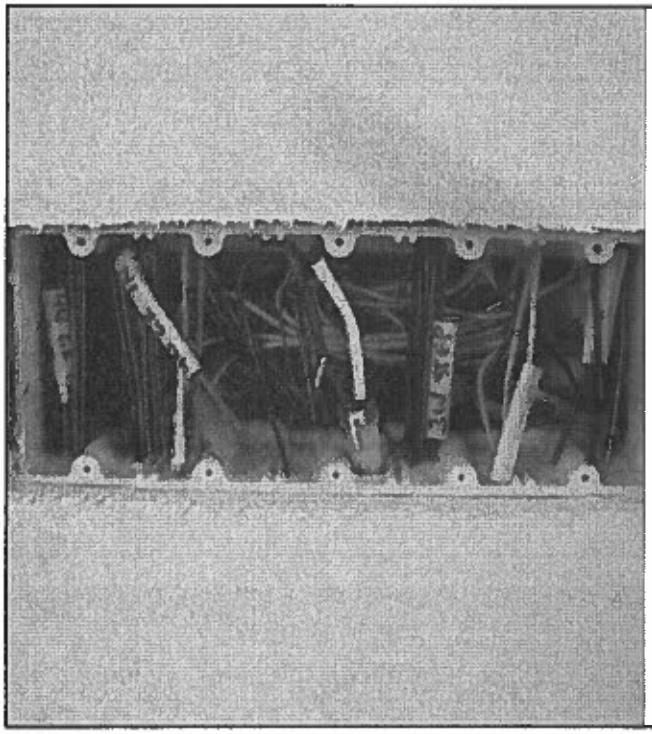

ARTICLE 314.16(B)(5) REVISION

EGC Conductor Fill

Where up to "4" egc's / ebc's enter a box, a ***single*** volume allowance shall be made based on the largest egc / ebc entering the box. ***A ¼" volume allowance for each additional egc / ebc installed in a box shall be calculated.***

Applies to all cable methods

Not Current Code in Ohio

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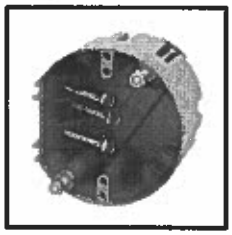
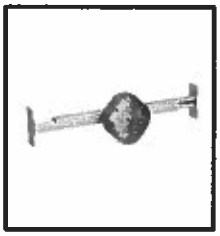
314.27(C) REVISION BOXES AT CEILING-SUSPENDED (PADDLE) FAN OUTLETS

Revision to this section will now require ***all*** outlet boxes in ***habitable room locations*** designed for future paddle fan installation, shall require the box to be listed as sole support of ceiling-suspended (paddle) fans or supported by structural framing members.



Removed spare or separate switch referenced locations!



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320.80 AMPACITY; ARMORED CABLE (AC CABLE)

When Installed in Thermal Insulation / 2nd Paragraph *N*

(A) Thermal Insulation. Conductors installed shall be rated 90°C. Their ampacity shall not exceed the 60°C rating, 90°C shall be used to determine the adjustment / correction factors only.

Where more than 2 Type AC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

Not Current Code in Ohio

2020

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330.80 AMPACITY; METAL CLAD CABLE (MC CABLE)

When Installed in Thermal Insulation *N*

Where more than 2 Type MC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

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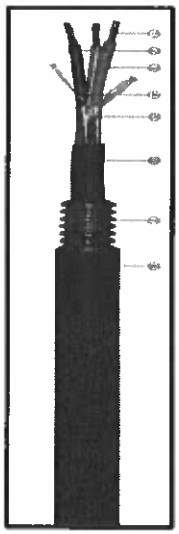
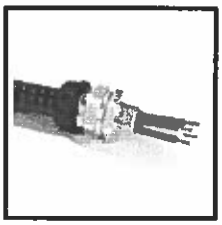
N 330.130 HAZARDOUS (CLASSIFIED) LOCATIONS



N ***Where required to be marked MC-HL, the cable shall be listed and shall have a gas / vapor tight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor.***



Not Current Code in Ohio

2020

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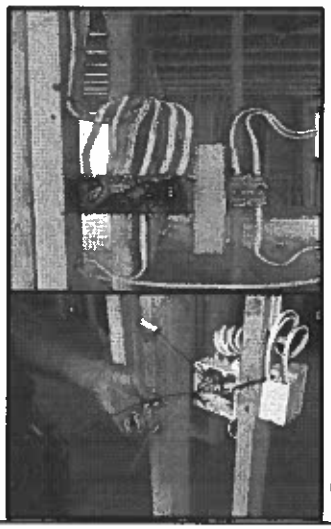
NON-METALLIC-SHEATHED CABLE (NM) 334.30 SECURING AND SUPPORTING

Revised / Relaxing the Rules

NM cable shall be supported and secured by staples, cable ties listed and identified for securement and support, or straps, hangers, or similar fittings every 4½' and within 12" of every enclosure. ***The cable length between the cable entry and the closest cable support shall not exceed 18".***



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ARTICLE 337 (NEW) CLASS P CABLE

Hazardous location cable up to 600-v, both armored and unarmored.

Typically, tinned copper conductor with a polyester tape separator. Insulation is chemically cross-linked polyolefin and the jacket is Arctic Neoprene.

Used for power, control, signaling and instrumentation for offshore drilling rigs. Severe cold durability, flame retardant and oil resistant

Cable tray installation and high strand count

Approved for Class I Div. 1 / Div. 2 locations

Class II Div. 1 / Div. 2 Locations

ANSI / UL 1309-2017 Marine Shipyard Cable

Not Current Code in Ohio

2020

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BOSTRIG™ 125 TYPE P POWER CABLE

five conductor / armored and sheathed

8 to 4/0 AWG / 600V/1000V

APPLICATIONS

FEATURES

CONSTRUCTION

RATINGS

APPROVALS

TYPE "P" CABLE DESIGNED FOR THE OIL AND GAS INDUSTRY

Numerous manufacturer's offer Type "P" cable.

Designed for harsh environments:

Oil and moisture resistant, severe temperature conditions, mechanical stress and drilling mud.

Uses include, drilling rigs, marine both onshore and offshore platform sites.

Available in both armored and sheathed

2020

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CHAPTER 4

Equipment for General Use

Article 404 – Switches

Article 406 – Receptacles, Cord Connectors, & Attachment Plugs

Article 408 – Switchboards, Switchgear & Panelboards

Article 410 – Luminaires, Lampholders, & Lamps

Article 422 – Appliances

Article 430 – Motors, Motor Circuits, & Controllers

Article 440 – A/C and Refrigeration Equipment

Article 445- Generators

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404.2(C) SWITCHES CONTROLLING LIGHTING LOADS

Further Clarification

The grounded circuit conductor for controlled lighting circuit shall be installed at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit serving bathrooms, hallway stairways, ***and habitable rooms or occupiable spaces*** as defined in the applicable building code.

2019 RCO – Habitable Space. **A space in a building for living, sleeping, eating or cooking.**

Not Current Code in Ohio

2020

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404.2(C) EXCEPTION

Exception: The connection requirement shall become effective on January 1, 2020. ***It shall not apply*** to replacement or retrofit switches installed in locations prior to local adoption of ***404.2(C) and where the grounded conductor cannot be extended without removing finish materials***. ***The number of electronic control switches on a branch circuit shall not exceed 5, and the number connected to any feeder on the load side of a system or main bonding jumper shall not exceed 25***. For the purpose of this exception, a neutral busbar, in compliance with **200.2(B)** and to which a main or system bonding jumper is connected shall not be limited as to the number of electronic lighting control switches connected.

2017 NEC Code Change Remains / when grounded conductor not able to be extended

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406.4 RECEPTACLE REPLACEMENTS. GROUNDING (D)(1); NON-GROUNDING (D)(2); GFCI (D)(3); AND AFCI (D)(4);

Reference to 210.12 (A), (B) & (C) Required "**AFCI**" Locations

2020 NEC 406.4(D) Arc-Fault Circuit-Interrupter (AFCI); Replacement Types

(1) Listed outlet branch-circuit AFCI type receptacle
(2) Receptacle protected by listed outlet branch-circuit type AFCI receptacle
(3) A receptacle protected by a listed combination type AFCI circuit breaker

210.12(D) Ex*: Branch Circuit Extensions or Modifications* – Dwelling Units, Dormitory Units, and Guest Rooms and Guest Suites locations only.

(1) 210.12 (A) Dwelling Units. (1-6)
(2) Listed outlet branch-circuit type AFCI at 1st outlet of existing circuit

Not Current Code in Ohio

2020

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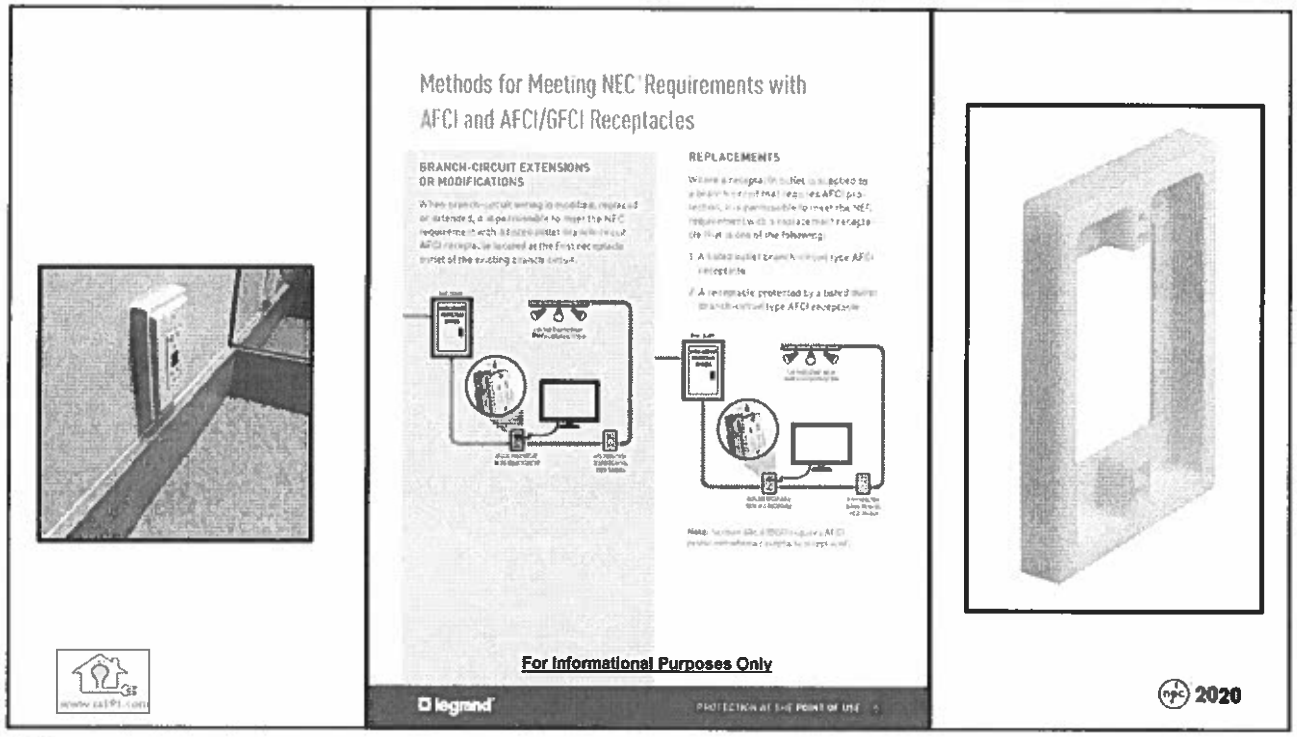
Methods for Meeting NEC® Requirements with
AFCI and AFCI/GFCI Receptacles
BRANCH-CIRCUIT EXTENSIONS OR MODIFICATIONS
REPLACEMENTS
For Informational Purposes Only
legrand
2020

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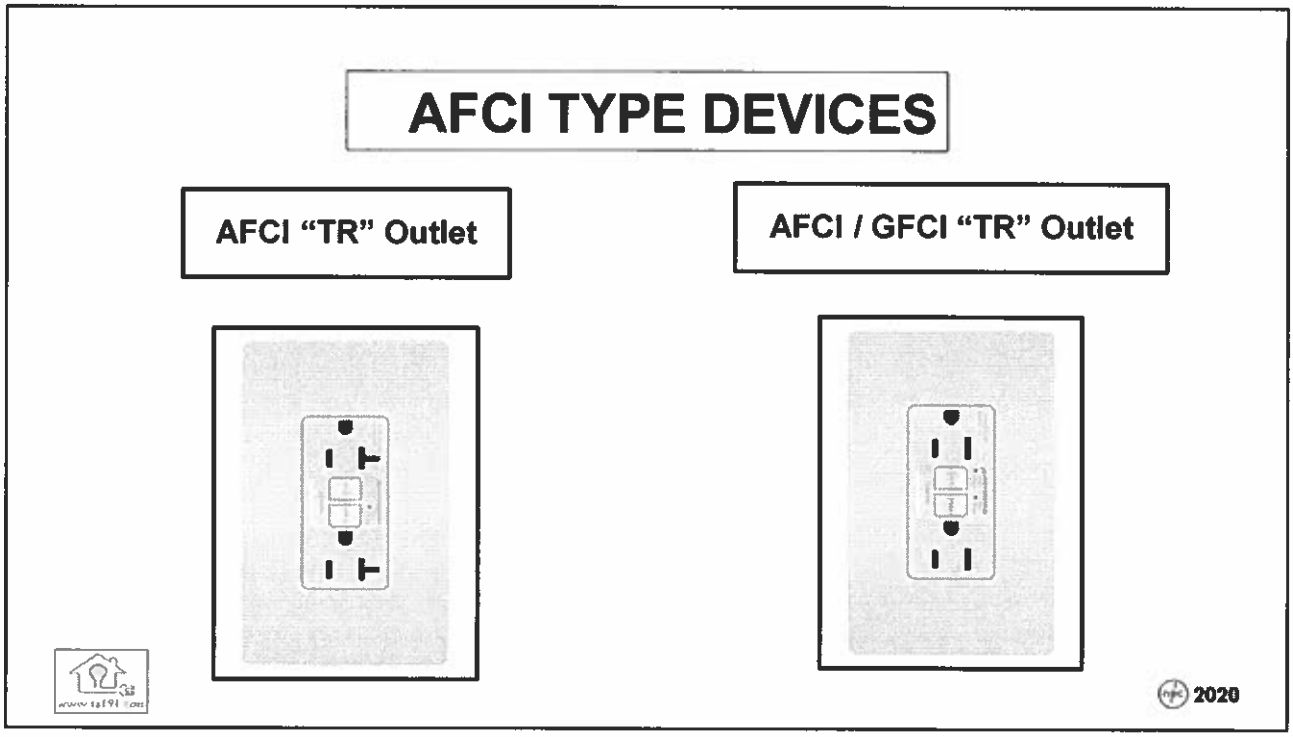
AFCI TYPE DEVICES
AFCI "TR" Outlet
AFCI / GFCI "TR" Outlet
2020

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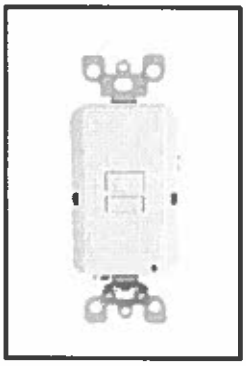
AFCI TYPE DEVICES

AFCI "Deadfront"



20a Hospital Grade AFCI / GFCI "TR" Outlet (Red)

2020

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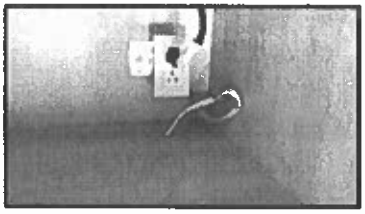
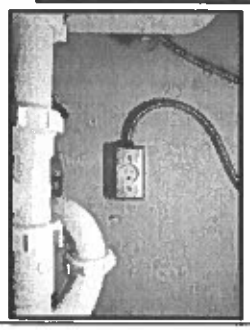
406.5(G)(2) NEW RECEPTACLE ORIENTATION UNDER SINKS

Receptacle outlets are prohibited from being installed face-up in or on countertop surfaces, unless they are listed for such installations.

The proposal will include prohibiting face-up installations in under sink locations as well.

Readily Accessible?





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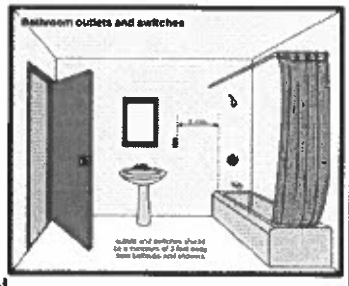
406.9(C) BATHTUB & SHOWER SPACE EXPANDED DETAILS

Receptacles shall ***not*** be installed ***within a zone measured 3' horizontally and 8' vertically from the top of the bathtub rim or shower stall threshold.*** The identified zone is all-encompassing and ***shall include*** the space directly over the tub or shower stall.



Exception: In bathrooms with less than the required zone, the receptacle(s) shall be permitted to be installed opposite the bathtub rim or shower stall threshold on the farthest wall within the room.

Same as light fixtures 410.10(D)

Not Current Code in Ohio

2020

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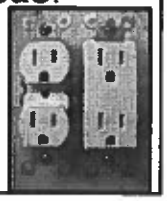
406.12 TAMPER RESISTANT RECEPTACLES

Additional Location Requirements

All 15- and 20-ampere, 125-v and 250-v nonlocking type receptacles in the areas specified 406.12(1) through ***(8)*** shall be listed tamper-resistant receptacles.

(1) Dwelling units, ***including attached & detached garages accessory buildings to dwelling units, & common areas of multifamily dwellings specified in 210.52 & 550.13.***
(2) Guest rooms & guest suites of hotels, ***motels & common areas***.
(6) Assembly areas; including places ***awaiting*** *transportation…*
(7) Dormitory ***units***
(***8***) ***Assisted living facilities (NEW)***



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2020

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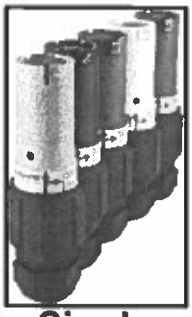
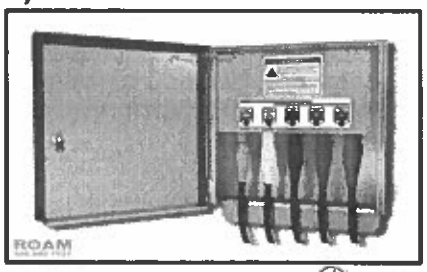


N 406.13 RECEPTACLES, CORD CONNECTORS, AND CAPS

Single-Pole Separable-Connector Type.

Single-pole separable connectors shall be listed and labeled and shall comply with 406.13(A) – (D).

- **(A) Locking or Latching Type**
- **(B) Identification**
- **(C) Interchangeability**
- **(D) Connecting and Disconnecting**



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2020

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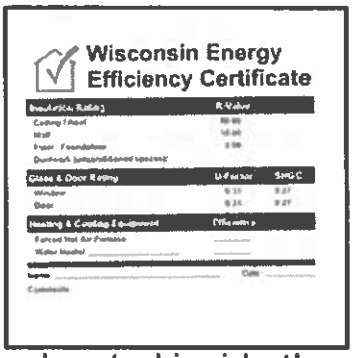
408.4 CIRCUIT DIRECTORY OR CIRCUIT IDENTIFICATION



Revision

Currently, the legible circuit directory is required to be located inside the panel door or face of the panelboard. **New revision text states "*inside of, or in an approved location adjacent to*"** the panel door.

Due to other information located on the panel, energy compliance certificate, AFC, inspection stickers, energy management info, etc..

2019 Residential Code of Ohio – 1101.14 Certificate

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2020

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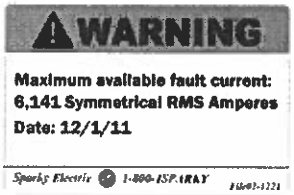
N 408.6 SWITCHBOARDS, SWITCHGEAR AND PANELBOARDS



Short-Circuit Current Rating

Switchboards, switchgear & panelboards *shall* have a SCCR not less than the available fault current in other than one- and two-family dwellings, the available fault current and the date the calculation was performed shall be field marked on the enclosure at the point of supply. The marking shall comply with 110.21(B)(3). **ANSI Z535.4 2011 (R2017)**

Not Current Code in Ohio

2020

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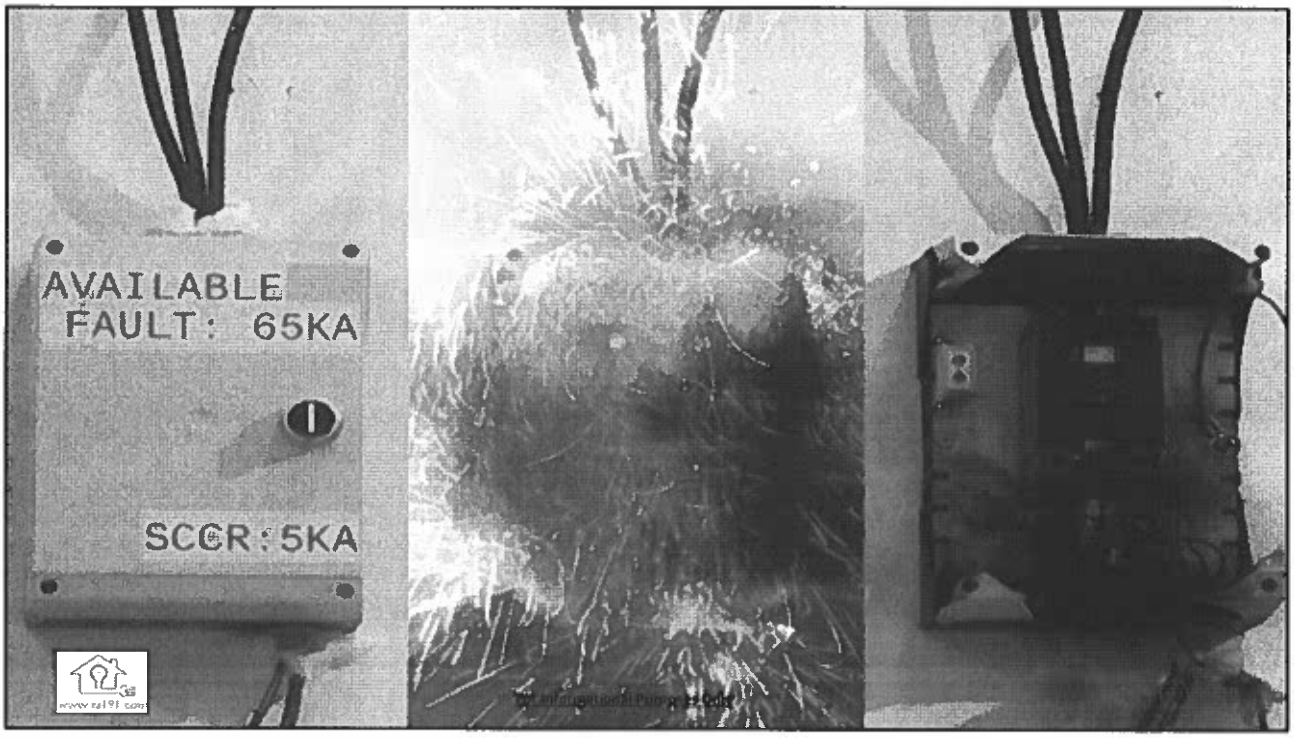

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ALL ABOUT SAFETY!

110.10 – Short Circuit Current Ratings. The equipment short-circuit current ratings and other characteristics of the circuit to be protected **shall be selected and coordinated** to permit the circuit protective devices used to clear a fault, to do so without extensive damage to the electrical equipment of the circuit. ***SCCR is Not overcurrent protection.***

Installing Properly Rated Overcurrent Protective Devices

Overcurrent protective devices (breakers or fuses) shall be rated greater than the maximum available fault current available at the line side terminals of the equipment ***(load)*** served.

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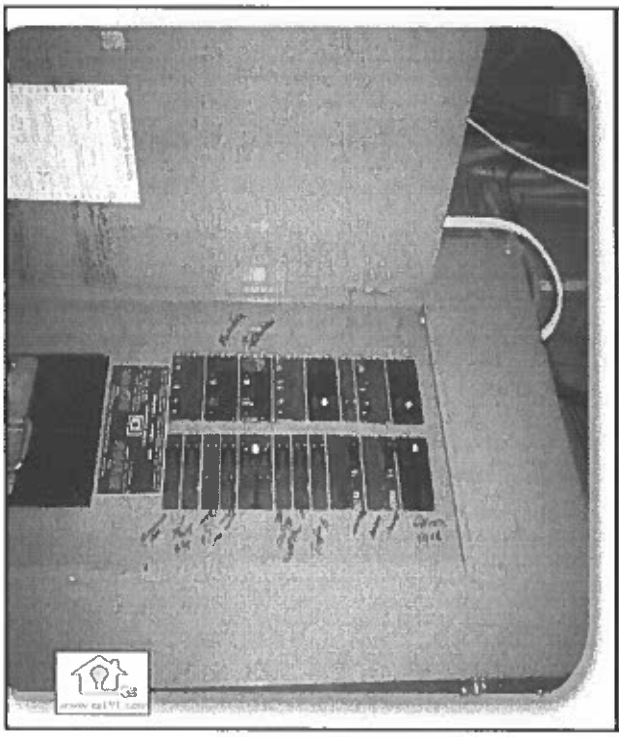

408.43 PANELBOARD ORIENTATION

The intent is to prohibit mounting panelboards from being installed in the face-up position.

Debris can accumulate and damage to the bus and OCD's can occur.

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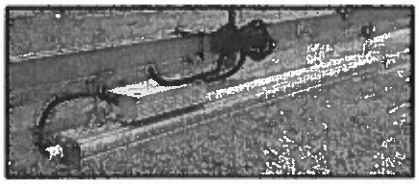
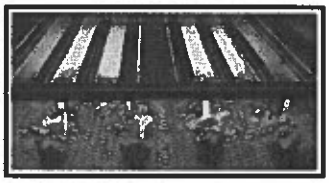
N PART XVI. SPECIAL PROVISIONS FOR HORTICULTURAL LIGHTING EQUIPMENT

410.172 Listing
410.174 Installation and Use
410.176 Locations Not Permitted
410.184 Ground-Fault Circuit-Interrupter Protection





Damp or Wet Location Listed / Labeled? / Light Spectrum
Fruits / Vegetables / Cannabis

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422.5(A) GFCI REQUIREMENTS FOR APPLIANCES

Revised

Removed the requirement "***provided for public use***" for both vacuum and tire inflation machines, GFCI protection is required.

Applies to all locations!

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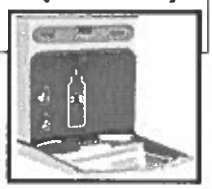
ARTICLE 422 APPLIANCES

GROUND-FAULT CIRCUIT-INTERRUPTER (GFCI) PROTECTION FOR PERSONNEL



422.5 General.

(1) Automotive Vacuum machines
(2) Drinking water coolers **and bottle fill stations**
(3) **Cord-and-plug connected high**-pressure spray washing machines
(4) Tire inflation machines
(5) Vending Machines
(6) **Sump pumps**
(7) **Dishwashers**

***N* Informational Note: Section 210.8 specifies requirements for GFCI protection for the branch-circuit outlet where the covered location warrants such protection.**

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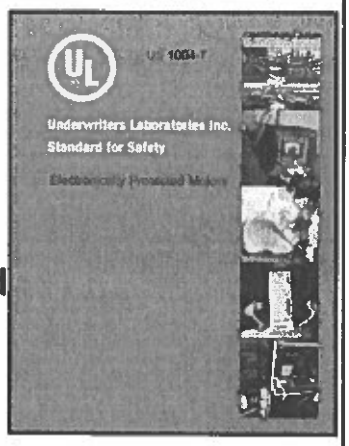
ARTICLE 430 – MOTORS, MOTOR CIRCUITS & CONTROLLERS

New Terminology – Electronically Protected



430.32 (A) Thermal Protector or "*Electronically Protected*" (designed for fractional motors).

An electronically protected motor shall be approved for use on the basis that it will prevent dangerous overheating due to the failure of the *electronic control*, overload, or failure to start the motor.

Terminology throughout Article 430

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430.122
CONDUCTORS – MINIMUM SIZE & AMPACITY

New Informational Note No. 2

Relates to adjustable-speed drive systems

Circuit conductors on the output of an adjustable-speed drive system are susceptible to breakdown under certain conditions due to the characteristics of the output waveform of the drive. Factors affecting the conductors include but not limited to the output voltage, frequency, & current, the length of the conductors, the spacing between the conductors, and *the dielectric strength of the conductor insulation*. Methods to mitigate breakdown include consideration of one or more of these factors.

ie: XHHW / XHHN Type Conductors

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440.9 A/C & REFRIGERATION EQUIPMENT

Clarification

All A/C & Refrigeration equipment installed outdoors on a roof, in a metallic raceway that utilizes ***compression-type*** fittings/connectors require a wire type equipment grounding conductor.

Was non-threaded fittings

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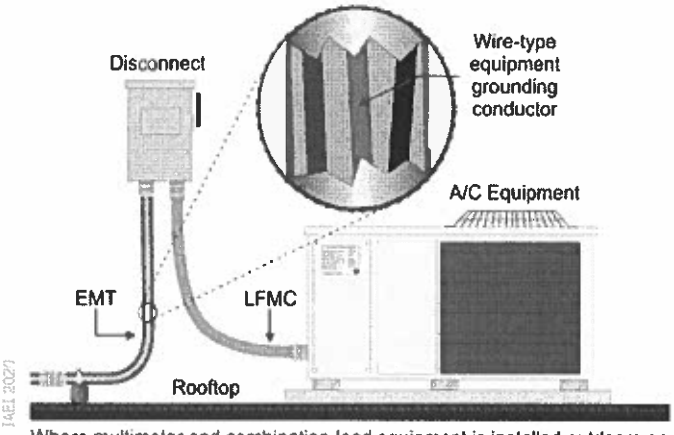
440.9 Grounding and Bonding-Rooftop Equipment



Where ~~multimotor and combination-load~~ equipment is installed outdoors on a roof, an equipment grounding conductor of the wire type shall be installed in outdoor portions of metallic raceway systems that use ~~non-threaded~~ compression-type fittings

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445.18(D) NEW EMERGENCY SHUTDOWN IN 1- & 2-FAMILY DWELLING UNITS

Generators

Generators other than cord-and-plug connected portable type, ***shall be provided*** with an emergency shutdown device, located on the ***outside*** of 1- and 2-family dwelling units.

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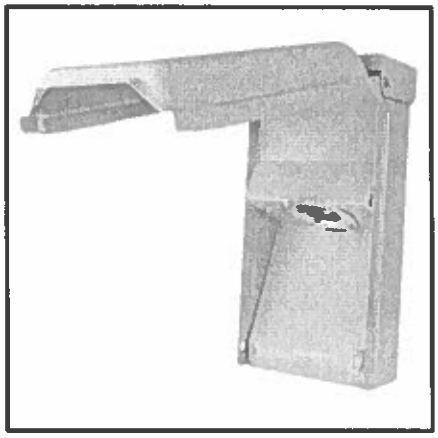
PORTABLE GENERATOR SET-UP

GE 50a Twist Lock Power Inlet



50a Twist Lock Power Cord

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2020

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CHAPTER 5

Special Occupancies

Article 500 – Hazardous (Classified) Locations, Classes I, II, III, Divisions 1 & 2

Article 511 – Commercial Garages, Repair and Storage

Article 517 – Healthcare Facilities

Article 545 – Manufactured Buildings & Relocatable Structures

Article 555 – Marinas, Boatyards / Commercial and Noncommercial Docking Facilities

Article 590 – Temporary Installations

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ARTICLE 500.4 DOCUMENTATION

Updated Current NFPA / API Standard References

All areas designated as hazardous (classified) locations shall be properly documented. This documentation shall be available to those authorized to design, install, inspect, maintain, or operate electrical equipment at the location.

NFPA 30-2018	NFPA 32-2016	NFPA 33-2018	NFPA 34-2018
NFPA 35-2016	NFPA 36-2017	NFPA 45-2019	NFPA 55-2016
NFPA 497-2017	NFPA 499-2017	NFPA 820-2016	API 500-2012

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NFPA CODES AND STANDARDS

NFPA 30- Flammable & Combustible Liquids
NFPA 32- Standard for Drycleaning Plants
NFPA 33- Standard for Spray Application Using Flammable or Combustible Materials
NFPA 34- Standard for Dipping, Coating, & Printing Processes Using Flammable or Combustible Liquids
NFPA 35- Standard for Manufacture of Organic Coatings
NFPA 36- Standard for Solvent Extraction Plants
NFPA 45- Standard on Fire Protection for Laboratories Using Chemicals
NFPA 55- Compressed Gases & Cyrogenic Fluids Code
NFPA 497- Classification of Combustible Liquids, Gases, & Vapors in Chemical Process Areas
NFPA 499- Classification of Combustible Dusts & Hazardous (Classified) Locations in Chemical Process Areas
NFPA 820- Fire Protection in Wastewater Treatment & Collection Facilities
API 500- Classifications of Locations of Electrical Installations at Petroleum Facilities

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501.10 CLASS I & CLASS II LOCATIONS

Listed MC-HL / TC-ER-HL

Metal Clad / Tray Cable

MC-HL; Flame resistant cable

TC-ER-HL; Flame resistant tray cable

Gas & vapor-tight provided with metal sheath & polymeric material with separate egc, and proper fittings.

For use in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installations.

Listed Type "P" Cable

Marine Shipyard Cable

Type "P" – Metal braid armor, with an overall jacket, and terminated with proper fittings.

For use in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installations.

Not Current Code in Ohio

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511.2 (REMOVED / RELOCATED) COMMERCIAL GARAGE REPAIR & STORAGE

Revision (Relocated to 210.8(B)(8)

GFCI Protection for Personnel

Removed reference to areas "***where diagnostic equipment, electrical hand tools, or portable lighting equipment***" are to be used (2017 NEC; was limited to 125-v 15- & 20-a receptacles).

Now Reads as indicated in 210.8(B)(1-12)

1ø 50amp and 3ø 100amp 150-v to ground or less receptacles

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513.12 (REMOVED / RELOCATED) AIRCRAFT HANGARS

Revision (Relocated to 210.8(B)

GFCI Protection for Personnel

Now Reads as indicated in 210.8(B)(1-12)

1ø 50amp and 3ø 100amp 150-v to ground or less receptacles

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514.11 MOTOR FUEL DISPENSING FACILITIES

514.11 Circuit Disconnects

(A) Emergency Electrical Disconnects

The emergency shutoff device shall disconnect simultaneously from the source of supply, all conductors of the circuits, including the grounded conductor, if any. *Equipment grounding conductors shall remain connected*.

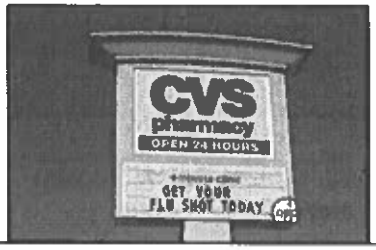
Switch neutral breaker required including data circuits!

517.10(B) HEALTH CARE FACILITIES – NOT COVERED

Not Covered

Proposed changes are intended to clarify that portions of health care facilities used for ***intermuscular injections*** (drug store flu shots), ***psychiatry and psychotherapy***, ***alternative medicine and optometry*** are ***not*** required to comply with Part II of 517.

Redundant Ground wiring!



517.17 GROUND-FAULT PROTECTION *OF EQUIPMENT*

(D) Testing. Expanded Intent

When ground-fault protection ***of equipment*** is first installed, each level shall be performance tested to ensure compliance with 517.17(C). ***The testing shall be conducted by a qualified person(s) using a test process in accordance with the instruction provided with the equipment. A written record of this testing shall be made and shall be available to the authority having jurisdiction.***

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517.21 HEALTHCARE FACILITIES- GFCI PROTECTION FOR PERSONNEL

Revision

Category 2 (General Care) & Category 1 (Critical Care) spaces

Receptacles shall *not* be required in bathrooms or toilet rooms. {99:6.3.2.2.2(D)}. Receptacles located in patient bathrooms and toilet rooms in Category 2 (general care) spaces shall have ground-fault circuit-interrupter protection in accordance with 210.8(B)(1).

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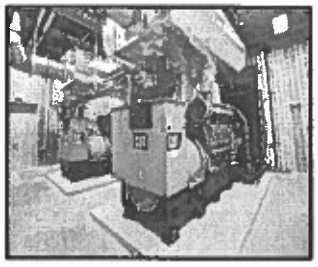
517.30 ESSENTIAL ELECTRICAL SYSTEMS



517.30 Sources of Power

(A) Two Independent Power Sources

(B) Types of Power Sources

(1) Generating Units

(2) Fuel Cell Systems – **NEW in 2017 NEC**

N **(3) Battery Systems shall be permitted to serve as the alternate source for all or part of an essential electrical system**

Lead Acid Batteries in Series

Not Current Code in Ohio

2020

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517.31 REQUIREMENTS FOR THE ESSENTIAL ELECTRICAL SYSTEM

517.31(A) Separate Branches

517.31(B) Transfer Switches

517.31(C) Separation from Other Circuits

517.31(D) Capacity of Systems

517.31(E) Receptacle Identification

517.31(F) Feeders from Alternate Power Source

517.31(G) Coordination

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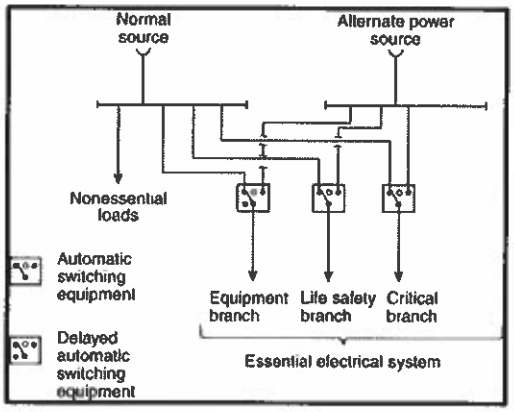
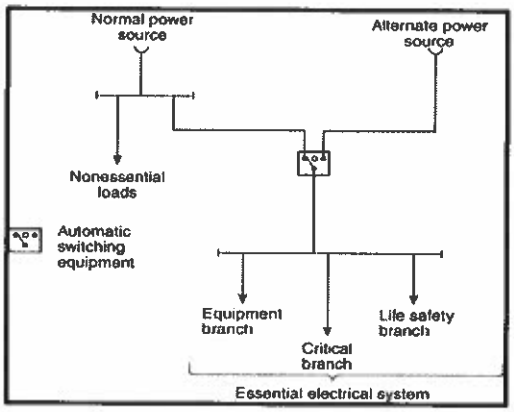
517.31(B) TRANSFER SWITCHES

Greater than 150 kVA



150 kVA or less



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517.31(C)(1) SEPARATION FROM OTHER CIRCUITS

Δ Revision D & E Are NEW

(d) Where category 2 (general care) locations are served from *two* separate transfer switches on the essential electrical system in accordance with 517.18(A), Exception No. 3, the category 2 (general care) circuits from the two separate systems *shall* be kept independent of each other.

(e) Where Category 1 (critical care) locations are served from *two* separate transfer switches on the essential electrical system in accordance with 517.19(A), Exception No.2, the critical care circuits from the two separate systems *shall* be kept independent of each other.

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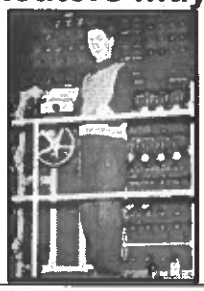
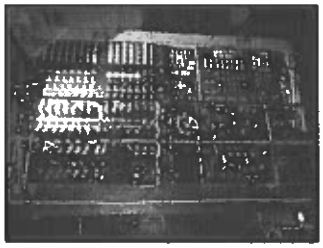
ARTICLE 520
THEATERS & SIMILAR LOCATIONS

520.25 Resistance- or Reactor-Type Dimmers

Deleted these types of dimmers, as they are outdated and potential fire hazards.

Historical Theaters may have some of these antiquated systems.





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ARTICLE 520
THEATERS & SIMILAR LOCATIONS

520.68 Conductors for Portable Stage Equipment

Previous editions of the NEC only permitted extra hard usage cords or cables

N **(2) Protected Applications. Listed, hard usage (junior hard service) cord or cable shall be permitted where all of the following conditions are met:**

(1) Protected from physical damage
(2) Not over 20a overcurrent protective device
(3) Cord or cable is 100' or less in length

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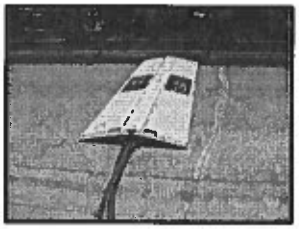
ARTICLE 525
CARNIVALS, CIRCUSES, FAIRS & SIMILAR EVENTS

When open to the Public

Δ 525.20(G) Protection. Shall be arranged to minimize tripping hazards. ***Secured to walkway surface or protected in another cable protection method.***

Reduce the Hazard!



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525.23 WHERE GFCI PROTECTION IS REQUIRED

(A) Where GFCI Protection is Required. ***In addition to the requirements of 210.8(B)***, GFCI protection for personnel shall be provided for the following:

(1) All 125-v, 1ø, 15- & 20-a non-locking receptacles readily accessible to the public.

(2) Equipment that is readily accessible to the general public and supplied from a 125-v, 1ø, 15- & 20-ampere branch circuit.

GFCI is permitted to be an integral part of the attachment plug or located in the power-supply cord within 12" of the plug.

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ARTICLE 545 MANUFACTURED BUILDINGS AND RELOCATABLE STRUCTURES

Part II - NEW

Relocatable Structures

Mobile offices, classrooms, training areas and similar structures are now part of Article 545, rather than Article 550 (dwelling units).

Not Current Code in Ohio

2020

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ARTICLE 547 – AGRICULTURAL BUILDINGS

547.5 Wiring Methods.

Δ (G) **Receptacles.** ***Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B). GFCI protection shall not be required*** for other than the 125-v, 15- and 20-ampere receptacles installed ***within*** the following areas:

1. Areas having an equipotential plane
2. Outdoors
3. Damp or wet locations
4. Dirt confinement areas for livestock

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ARTICLE 550 – MOBILE HOMES, MANUFACTURED HOMES & M/H PARKS

Δ **550.12(B) Ground-Fault Circuit Interrupters (GFCI).**

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(A). GFCI protection shall not be required for other than the 125-v, 15- and 20-ampere receptacles installed ***within a mobile or manufactured home*** in the following areas:

1. Compartments accessible from outside the unit
2. Bathrooms, including receptacles in luminaires
3. Kitchens, where receptacle are installed to serve countertop surfaces
4. Sinks, where receptacles are installed within 6' ***from the top inside*** edge of the sink
5. Dishwashers

Δ **550.32(D) Additional Receptacles**. – Receptacles located outside a mobile or manufactured home, shall be provided with GFCI protection as specified by 210.8(A).

Receptacles that provide unit power shall not require GFCI protection

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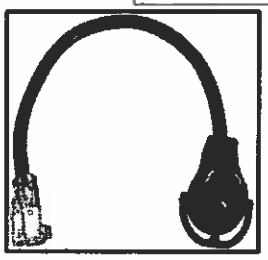
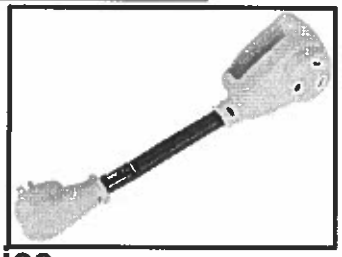
ARTICLE 551 – RV'S & RV PARKS





N **551.40(D) Reverse Polarity Device.**

A reverse polarity indicating device that provides a continuous visible or audible signal shall be installed in the RV in accordance with the installation instructions and shall respond to the reversal of the ungrounded and the grounded conductors in the 120-v ac system.

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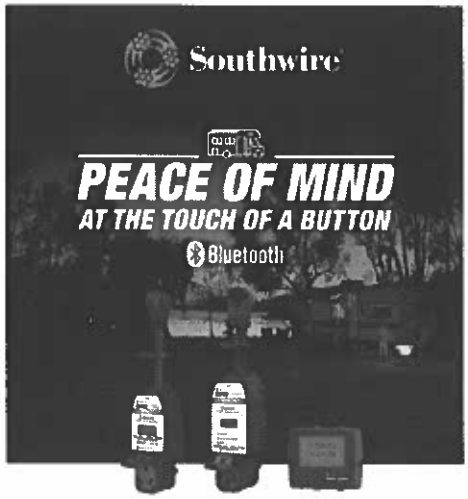
"NEW" SOUTHWIRE RV SPD PRODUCTS



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RV SURGE PROTECTIVE DEVICES

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MARINAS, BOATYARDS, & COMMERCIAL & NON-COMMERCIAL DOCKING FACILITIES

N 555.13 Bonding of Non-Current Carrying Metal Parts

All metal parts in contact with the water, all metal piping, and all non-current carrying metal parts that are likely to become energized shall be connected to the grounding bus in the panelboard using solid copper conductors, insulated, covered, or bare, not smaller than #8 AWG. Connections to bonded parts shall be made in accordance with 250.8.

Sounds Like 680.26 Equipotential Bonding Grid

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2020

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ARTICLE 555

Device	mA trip setting	Common Use	Code Section
GFCI - Class A	4 - 6	Branch circuits	210 8
ECFPD	6 - 50	Snow melting equip	426 28
GFPE	adjustable	Main OCPD	230 95

MARINAS, BOATYARDS AND COMMERCIAL AND NON-COMMERCIAL DOCKING FACILITIES

Ground-Fault Protection - 555.35 (NEW)

(A)(1)- GFPE shore power receptacles- ***30mA (Type "B")***

(A)(2)- GFCI 15a & 20a other than shore power receptacles ***(Type "A")***

(A)(3)- GFPE Protection of feeders and branch circuits installed on docking facilities - ***100mA (Type "C+"?)***

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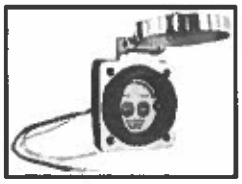
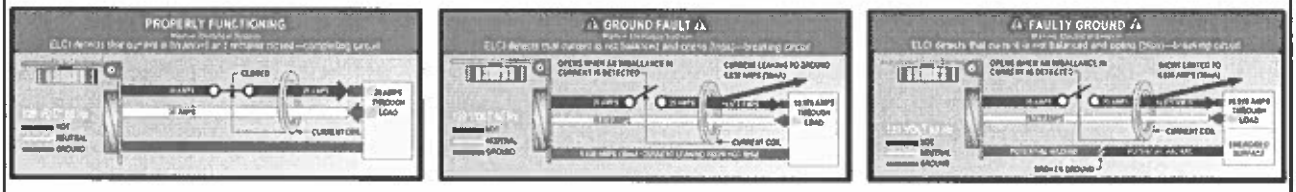
N 555.35(B) BOAT SHORE POWER

Leakage Current Measurement Device



Where more than 3 receptacles supply shore power to boats, a leakage current measurement device shall be available and be used to determine leakage current from each boat that will utilize shore power.



Equipment Leakage Circuit Interrupter **(ELCI)**

Marine Safety to Prevent ESD; (Electric shock drowning)

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2020

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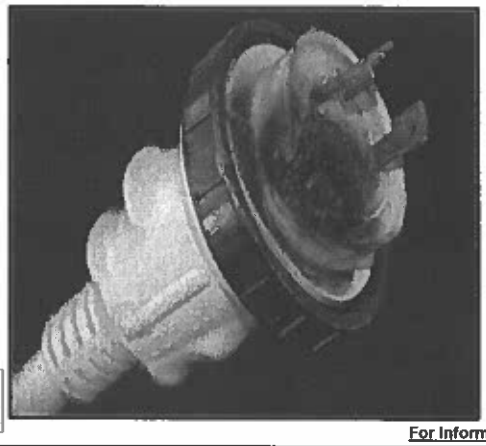
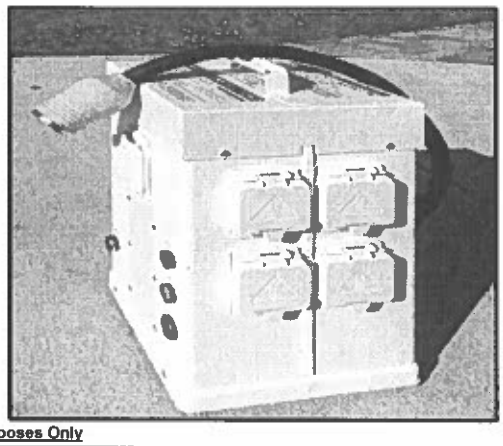
DAMAGED BOAT WIRING CAN CAUSE CURRENT FLOW INTO THE BOAT'S BONDING SYSTEM

Damaged power cord can expose users to hazards



Limits potential of energizing water around the boat's frame



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590.8 (NEW) TEMPORARY INSTALLATIONS OVERCURRENT PROTECTIVE DEVICES

(A) **Where Reused**. Where overcurrent protective devices that have been previously used are installed in a temporary installation, these overcurrent protective devices ***shall be examined*** to ensure these devices have been properly installed, maintained and there is ***no evidence*** of impending failure.

(B) **Service Overcurrent Protective Devices**. Overcurrent protective devices for solidly grounded wye electrical services of more than 150-v to ground but not exceeding 1000-v phase-to-phase shall be current limiting ***(fuses)***.

Not Current Code in Ohio

2020

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CHAPTER 6

Special Equipment

Article 620 – Elevators, Dumbwaiters, Escalators....

Article 625 – Electric Vehicle Power Transfer System

Article 645 – Information Technology Equipment

Article 680 – Swimming Pools, Fountains, & Similar Installations

Article 690 – Solar Photovoltaic (PV) Systems

Article 695 – Fire Pumps

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N 620.6 GFCI PROTECTION FOR PERSONNEL

New Section

Ground- Fault Circuit- Interrupter Protection for Personnel

Each 125-v, 1ø, 15 and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters, ... shall be of the GFCI type.
Re: 620.85 2017 NEC

Added ***machinery spaces*** / to have GFCI protection of 125-v receptacles

A permanently installed sump pump ***shall*** be permanently wired or **shall be supplied by a single receptacle that is GFCI protected.**

Hardwired sump pumps; GFCI protection not required!

Not Current Code in Ohio

2020

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N 620.65 SELECTIVE COORDINATION "SIGNAGE"

Equipment enclosures containing selectively coordinated overcurrent devices shall be legibly marked in the field to indicate that the overcurrent devices are selectively coordinated. The marking shall meet the requirements of 110.21(B), shall be readily visible, and shall state the following:

"CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED"

Applies to where more than one driving machine disconnect is supplied by the same source!

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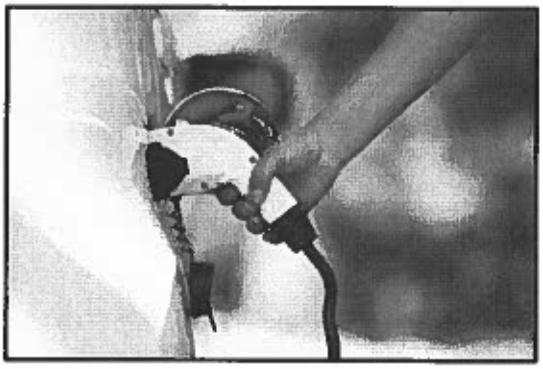
08.05.2021 PRESIDENT JOE BIDEN SIGNS EXECUTIVE ORDER



President Biden signs executive order (goal), that 50% of vehicles sold in the US to be EV's by 2030. Intended to cut carbon emissions.

Currently 2%

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NEW - EV CHARGING STATIONS

Federal Government Initiative – Infrastructure Plan

Construct 500,000 new charging stations throughout the USA

DOE Goal: 40 Level 2 charging ports / 1000 EVs

3.4 DC fast charging ports / 1000 EVs

5 Billion Dollars / 10,000 For each State

5,000,000,000 / 500,000 = 10,000 each

By the year 2030 number of EVs expected to be 35 million

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ARTICLE 625 – ELECTRIC VEHICLE POWER TRANSFER EQUIPMENT

N 625.2 Definitions

Electric Vehicle Connector. – A device that, when electrically coupled (conductive or inductive) to an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of power transfer and informational exchange.

Electric Vehicle Power Export Equipment (EVPE). – The equipment, including the outlet on the vehicle, that is used to provide electrical power at voltages greater than or equal to 30Vac or 60Vdc to loads external to the vehicle, using the vehicle as the source of supply.

Not Current Code in Ohio

2020

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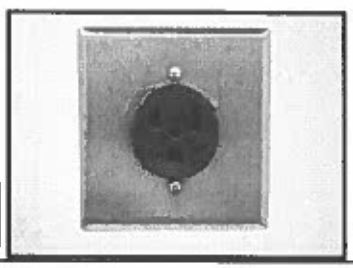
Δ 625.54 GFCI PROTECTION FOR PERSONNEL

***In addition to the requirements in 210.8, all* receptacles installed for the connection of electric vehicle charging shall have ground-fault circuit-interrupter protection for personnel. (Type A)**



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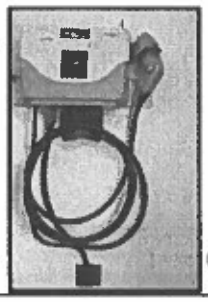

2020

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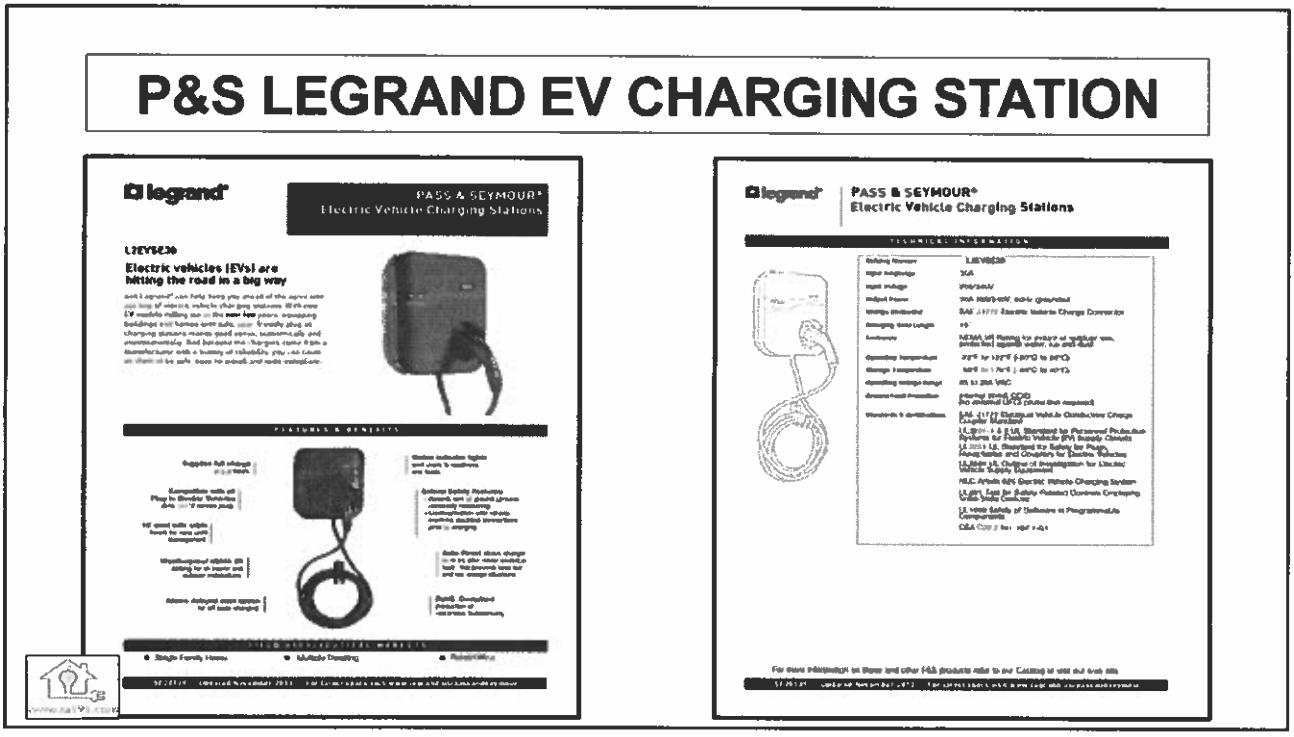
P&S LEGRAND EV CHARGING STATION



legrand®

PASS & SEYMOUR®
Electric Vehicle Charging Stations

Electric vehicles (EVs) are hitting the road in a big way

legrand®

PASS & SEYMOUR®
Electric Vehicle Charging Stations

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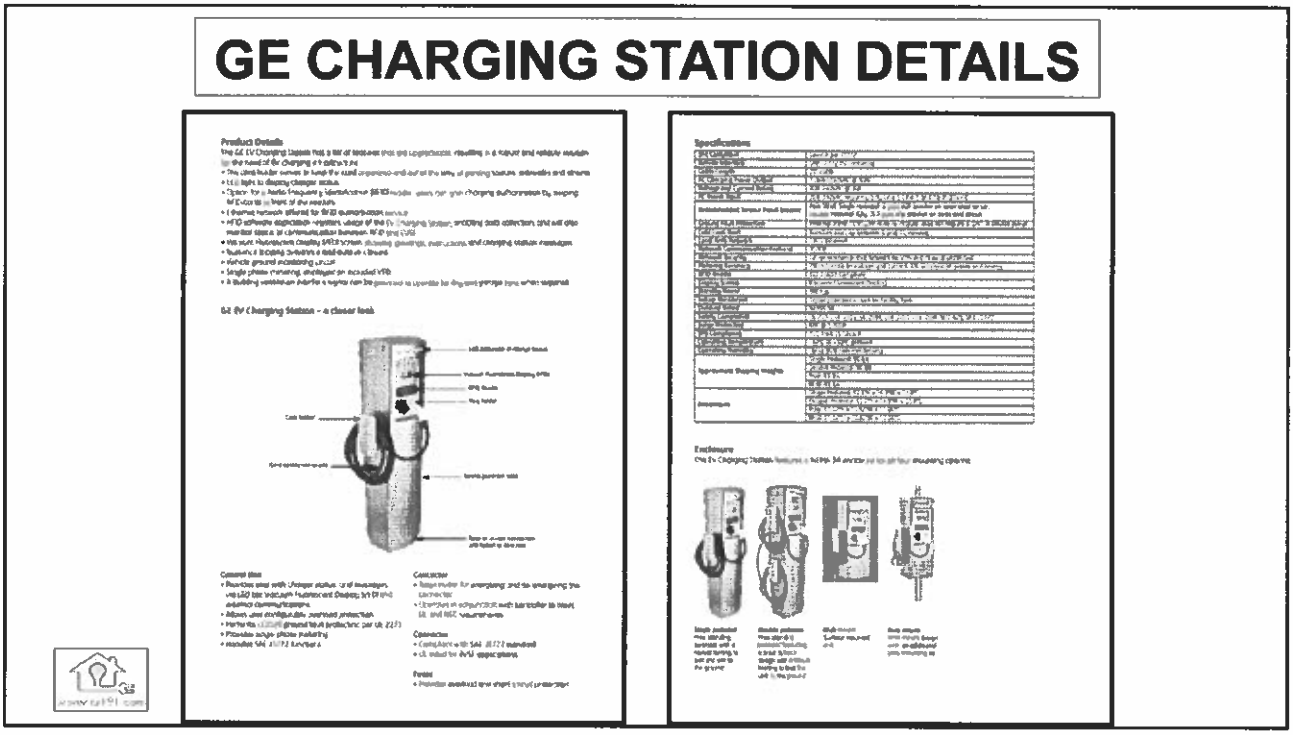
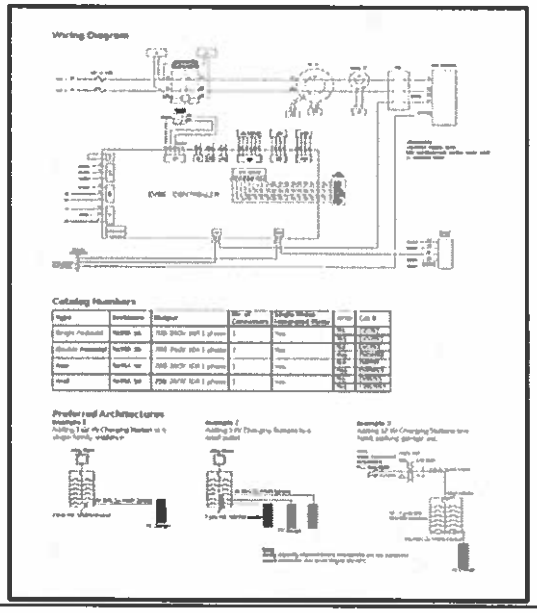
GE CHARGING STATION DETAILS



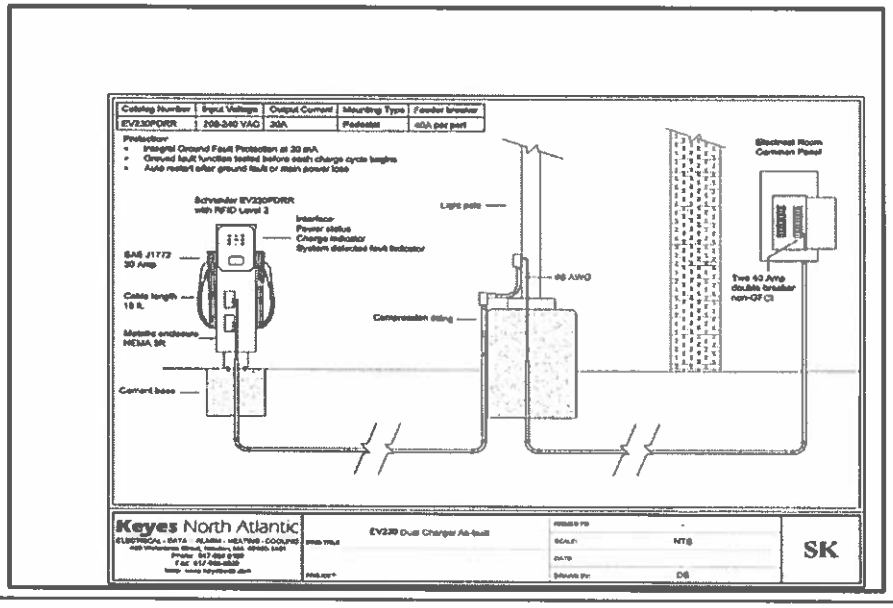
188

GE EV WIRING DIAGRAM



189

CHARGING STATION 1-LINE DRAWING



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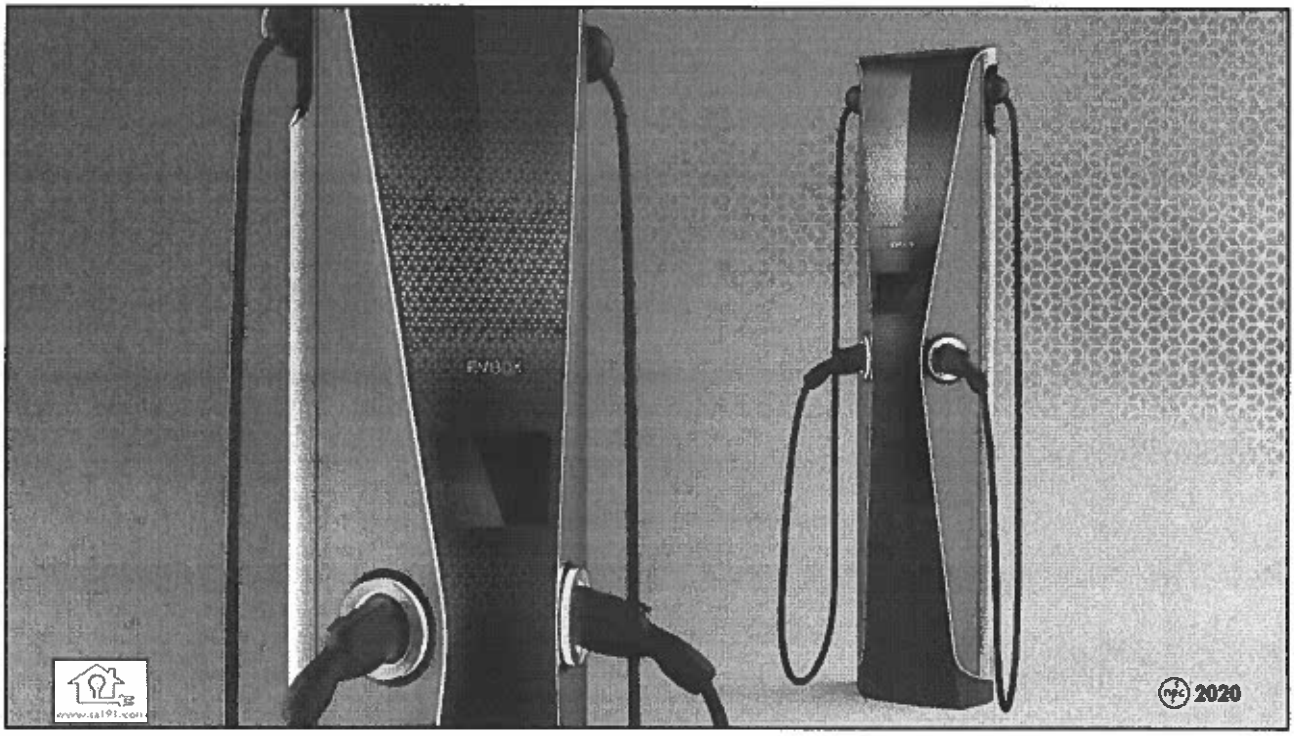

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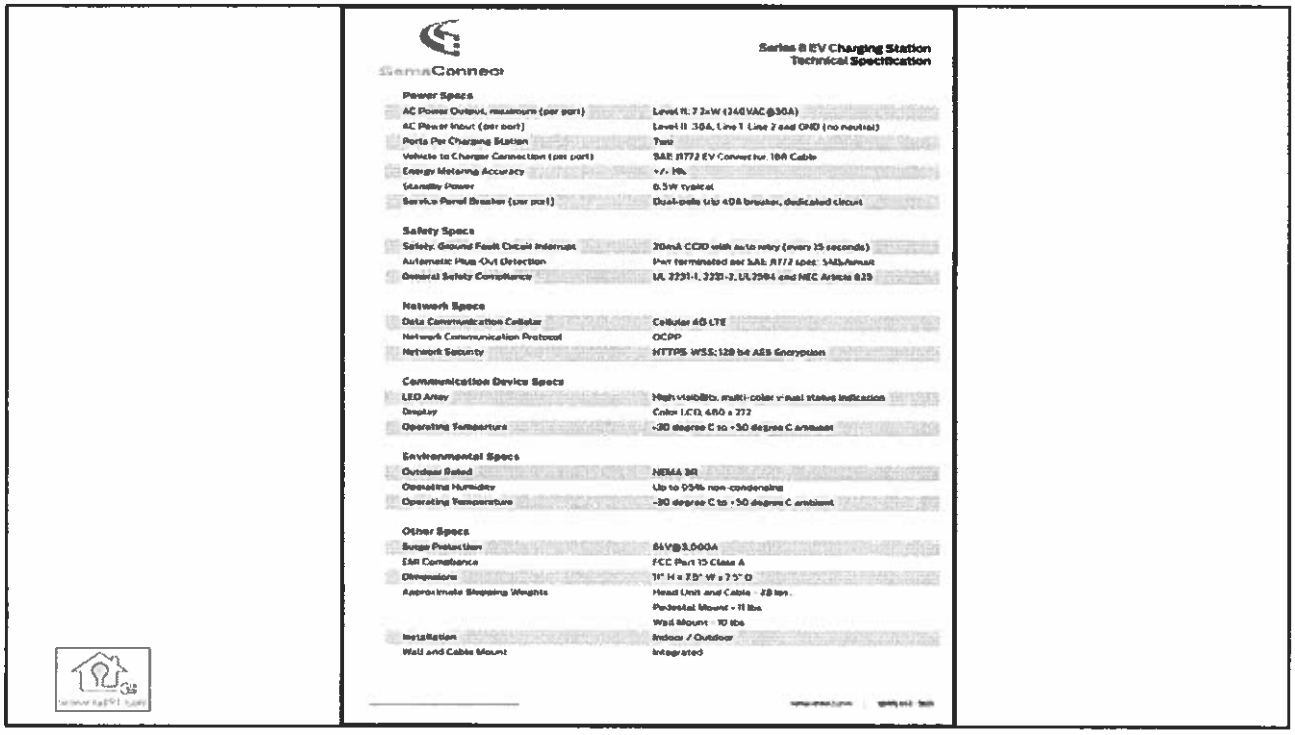

SemaConnect

Series 8 EV Charging Station
Technical Specification

Power Specs	
AC Power Output, maximum (per port)	Level II: 7.2kW (240VAC@30A)
AC Power Input (per port)	Level II: 208, Line 1, Line 2 and GND (no neutral)
Ports Per Charging Station	Two
Vehicle to Charger Connection (per port)	SAE J1772 EV Connector, 18ft Cable
Energy Metering Accuracy	+/- 1%
Standby Power	0.5W typical
Service Panel Breaker (per port)	Dual-pole 40A breaker, dedicated circuit
Safety Specs	
Safety: Ground Fault Circuit Interrupt	20mA CCID with auto retry (every 15 seconds)
Automatic Plug-Out Detection	Port terminated per SAE J1772 spec: SAE/Annex
General Safety Compliance	UL 2231-1, 2231-2, UL2594 and NEC Article 625
Network Specs	
Data Communication Cellular	Cellular 4G LTE
Network Communication Protocol	OCPP
Network Security	HTTPS: WSS: 128 bit AES Encryption
Communication Device Specs	
LED Array	High visibility, multi-color visual status indication
Display	Color LCD, 480 x 272
Operating Temperature	-30 degree C to +50 degree C ambient
Environmental Specs	
Outdoor Rated	NEMA 3R
Operating Humidity	Up to 95% non-condensing
Operating Temperature	-30 degree C to +50 degree C ambient
Other Specs	
Surge Protection	6kV@3,000A
EMI Compliance	FCC Part 15 Class A
Dimensions	11" H x 23" W x 7.5" D
Approximate Shipping Weights	Head Unit and Cable - 28 lbs. Pedestal Mount - 11 lbs. Wall Mount - 10 lbs.
Installation	Indoor / Outdoor
Wall and Cable Mount	Integrated

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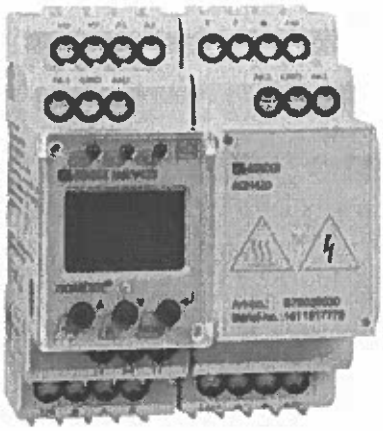
EV CHARGING STATIONS



Manufactured Charging Stations

Inherent (Built-In) GFCI protection

20mA CCID "Type C" Protection

CCID = Charge Current Interrupting Device

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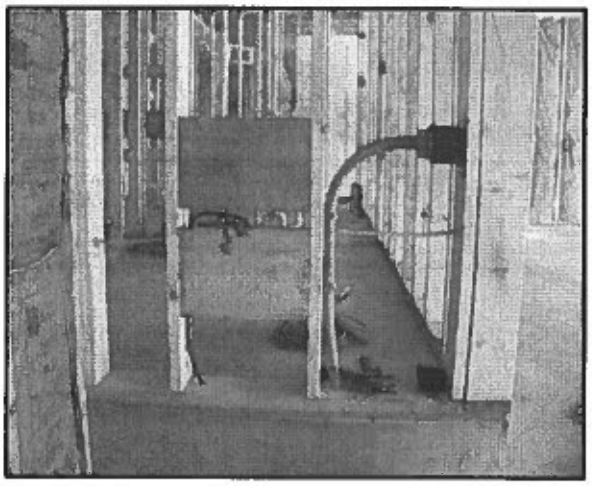
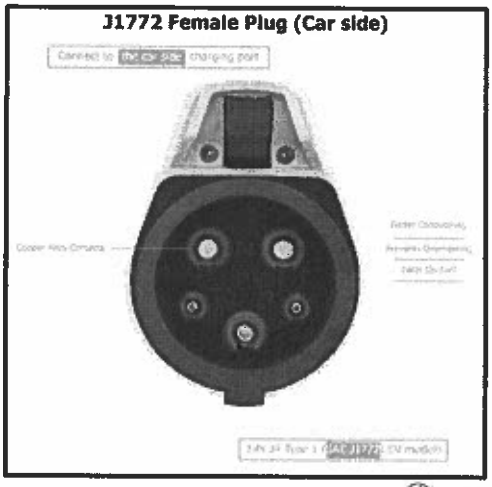
ELECTRIC VEHICLE RECEPTACLE ROUGH-IN





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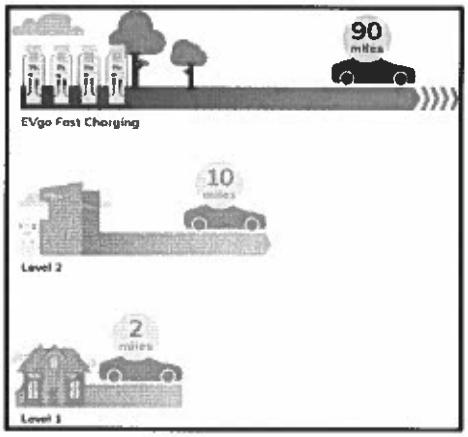
ARTICLE 625 ELECTRIC VEHICLE POWER TRANSFER SYSTEM

30 Minute Charge



Estimated Charging Cost:

Charging Station Fees

- **Fast Charge $1.50 minute**
- **Approximately .30 minute for Level 1 or Level 2**
- **Typically, a Tesla vehicle will require a separate adapter or specific Tesla charging station**

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PUBLIC EVSE STATIONS / PORTS BY STATE (DOE)
US / LEVEL 1 – 1,331 / LEVEL 2 – 86,095 / DC FAST 18,895

- Ohio – 770 / 1,680
- West Virginia – 88 / 254
- Virginia – 898 / 2,471
- Pennsylvania – 1,008 / 2,377
- Kentucky – 163 / 388
- Indiana – 294 /810
- Illinois – 875 / 2,192
- North Carolina – 918 / 2,158
- Tennessee – 584 / 1,334

- California – 13,088 / 33,461
- New York – 2,563 / 6,235
- Florida – 2,256 / 5,529
- Texas – 2,077 / 4,849
- Massachusetts – 1,771 / 3,916
- Washington – 1,518 / 3,716
- Georgia – 1,483 / 3,669
- Colorado – 1,363 / 3,208
- Entire US – 43,413 / 106,321

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TOTAL STATION LOCATIONS COUNTS IN US

Alternative Fuel Types:

- Biodiesel – 313
- CNG – 851
- E85 – 3,905
- Electric – 43,413 / 106,321
- Hydrogen – 49
- LNG – 55
- Propane – 1,233 Primary / 1,243 Secondary / Total 2,576

Total 114,070

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N 625.60 AC RECEPTACLE OUTLETS USED FOR EVPE

EVPE = Electric Vehicle Power Export Equipment

AC receptacles installed in electric vehicles and intended to allow for connection of off-board utilization equipment shall comply with 625.60 (A) – (D).

- **(A) Type. The receptacle shall be listed**
- **(B) Rating. Outlet shall be rated 250-v max, 1ø, 50a max**
- **(C) Overcurrent Protection. Integral to power export system**
- **(D) GFCI Protection for Personnel. All receptacles shall be GFCI protected, indication and reset shall be accessible**

Not Current Code in Ohio

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2022 FORD F-150 LIGHTNING PICK-UP

All-Electric. All F-150

Available features include Backup Power that can provide full-home power for up to 3 days, on a fully charge battery and 80-amp Ford Charge station Pro. *When home is properly equipped & home transfer switch disconnects home from the grid*. Based on 30 kWh used per day. Turn your truck into a generator. Pro Power Onboard offers an available 9.6kw max power provided through 11 outlets. (4) 120v outlets in front trunk, (2) in the cab (4) in the bed, and (1) 240-v outlet for tougher tasks.

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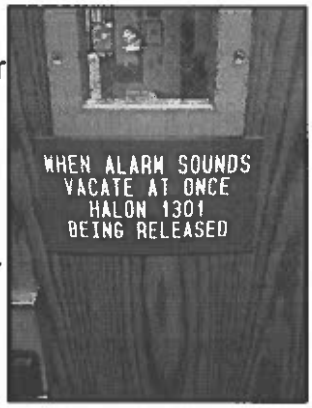
ARTICLE 645
INFORMATION TECHNOLOGY EQUIPMENT

645.5 Supply Circuits and Interconnecting Cables

Δ **645.5 (E) Under Raised Floors.** Where the area under the floor is accessible and openings minimize the entrance of debris beneath the floor, power cables, ***communications cables,*** connection cables, interconnecting cables, cord-and-plug connections and receptacles with the IT equipment. ***Typically protected with a Halon (clean agent) fire suppression system or Fm200 system.***



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THERE ARE "8" PARTS TO ARTICLE 680

Part 1 **General** (Page 564)

Part 2 **Permanently Installed Pools** (Page 567)

Part 3 **Storable Pools, Spas, Hot Tubs** (Page 573)

Part 4 **Spas, Hot Tubs & Immersion Pools** (Page 574)

Part 5 **Fountains** (Page 576)

Part 6 **Pools and Tubs for Therapeutic Use** (Page 578)

Part 7 **Hydromassage Bathtubs** (Page 578)

Part 8 **Electrically Powered Pool Lifts** (Page 579)

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2020

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680.2 NEW DEFINITIONS

N Corrosive Environment. ***Areas where pool sanitation chemicals are stored, handled, or dispensed, and confined areas under decks adjacent to such areas, as well as areas with circulation pumps, automatic chlorinators, filters, open areas under decks adjacent to or abutting the pool structure, and similar locations. (Refer to 680.14)***

N Immersion Pool. **A pool for ceremonial or ritual immersion of users, which is designed and intended to have its contents drained or discharged.**

N Splash Pad. ***A fountain with a pool depth of 1" or less, intended for recreational use by pedestrians. This definition does not include showers intended for hygienic rinsing prior to use of a pool, spa, or other water feature.***

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680.2 / 680.50 SPLASH PAD

NEW Definition / Requirements

Definition: A fountain with a pool depth of 1" or less, intended for recreational use by pedestrians.

Requirements of splash pads will need to comply with Parts I (***general***), II (***permanently installed pools***), and V (***fountains***) of Article 680

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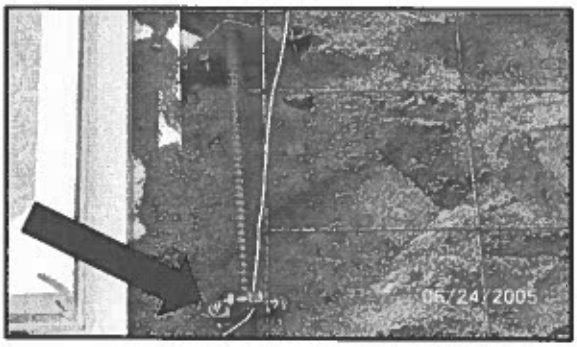
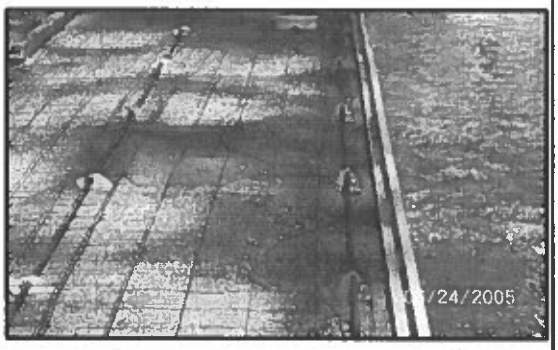
N 680.4 INSPECTION AFTER INSTALLATION

N Section

The authority having jurisdiction shall be permitted to require periodic inspection and testing.





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680.21 MOTORS

Δ **680.21 Wiring Methods.** The wiring to a pool motor shall comply with 680.21(A)(1) unless modified for specific circumstances to (A)(2) or (A)(3).

Δ **680.21 (A)(1) General.**
Wiring methods installed in a corrosive environment shall comply with **(680.14)** or shall be Type MC cable listed for the location, wiring methods in these locations shall include an insulated equipment grounding conductor, sized per Table (250.122), but not smaller than 12 AWG.

Where installed in noncorrosive environments, the wiring methods of branch circuits shall comply with the general requirements of Chapter 3.

2017 NEC Removed Interior of 1-Family

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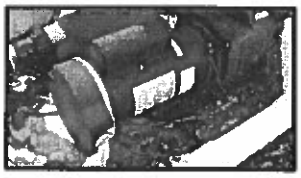
ARTICLE 680.21(C) – PART II.

PERMANENTLY INSTALLED POOLS

Expanded GFCI Protection of Pool Motors



Outlets supplying ***all*** pool ***motors on branch circuits rated 150-v or less to ground and 60 amperes or less, single or 3-phase shall be provided with Class "A"*** ground-fault circuit-interrupter protection.

Was 120-v through 240-v motors / + added 3-phase Motors

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ARTICLE 680.22
RECEPTACLE OUTLET LOCATIONS

2020 NEC; 15 and 20- ampere 125-v Outlets

680.22 (A)(1) – Required Outlet; (1) <6' – >20'

680.22 (A)(2) – Circulation pump; <6'

680.22 (A)(3) – Other Receptacles; – <6'

680.22 (A)(4) – GFCI Protection; – All 15 & 20a; within 20'

N **680.22(A)(5) – Pool Equipment Room; (1) GFCI outlet**

680.34 – Storable pool, Spa, & Hot Tub outlets; – 6 '

680.43 (A) – Indoor Spa & Hot Tub outlets; <6' – >10'

680.62 (E) – Therapeutic Tubs and pools – 6'

680.71 – Hydromassage Bathtubs – 30a or less; 6'

Type "A" GFCI Protection Required

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680.23(F) UNDERWATER LUMINAIRES

Branch Circuit Wiring for Underwater Luminaires

Branch circuits supplying underwater luminaires (Refer to 680.2) ***shall*** *include an insulated equipment grounding conductor, minimum size #12 CU. (Only permitted wiring methods are RMC, IMC, PVC and RTRC. (Refer to 680.14)*

Relaxing the requirements; Only the portion of the branch circuit in the "corrosive environment" requires an insulated equipment grounding conductor.

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680.26 EQUIPOTENTIAL BONDING (B)(2) PERIMETER SURFACES.

Copper Ring. Was alternative means.

(1) Minimum #8 bare solid CU conductor.
(2) Follow contour of pool perimeter surface
(3) Listed ***splicing devices or exothermic welding***
(4) 18" – 24" from the inside wall of the pool
(5) Secured under 4" – 6" below the subgrade

(C) Copper Grid.

(1) #8 bare solid CU conductor
(2) Follow contour of pool; 3' horizontally beyond pool
(3) Only listed splicing devices or exothermic welding
(4) Secured under 4" to 6" below the subgrade

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"VOLTAGE GRADIENTS"

- Corrected the wording regarding the performance and design of the Equipotential Bonding Grid.
- Replaced the word ***eliminate*** (which may be impossible to achieve) to the realistic term of ***"reduce"*** voltage gradients.
- ***The goal would be to keep the pool and all surrounding areas at or near the same potential.***

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680.31 / 32 STORABLE POOLS

Manufacturer Requirement

*Cord-connected pool filter pumps **"shall"** be provided with a ground-fault circuit interrupter that is an integral part of the attachment plug or located in the power supply cord within 12" of the attachment plug.*

Contractors Note: You are responsible to provide GFCI protection for the filter pump as well, if you add a new circuit, or replace a device on an existing circuit! Homeowners can and will plug the filter pump into a non-GFCI protected outlet.

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2020

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680.35 STORABLE & PORTABLE IMMERSION POOLS

N **New Section / Requirements**

(A) Cord Connection
(B) Pumps
(C) Heaters
(D) Audio Equipment
(E) Luminaires, Lighting Outlets & Fans
(F) Switches
(G) Receptacles

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680.45 IMMERSION POOLS

N **New Section / Requirements**

(A) Cord and Plug Connections
(B) Pumps
(C) Heaters
(D) Audio Equipment

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2020

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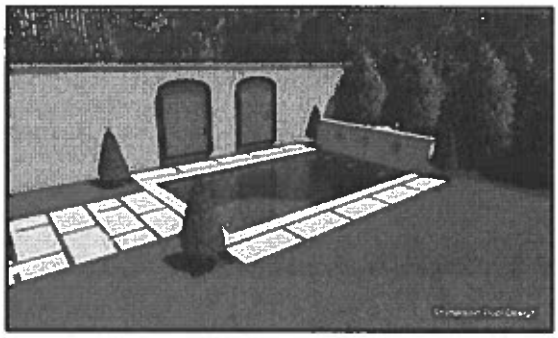
680.35 / 680.45 IMMERSION POOLS

NEW / & Clarification Info

680.35 Storable / portable immersion pools.

680.45 Permanently installed immersion pools

Addressing both custom built (on-site) and pre-packaged units.



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680.59 GFCI PROTECTION FOR PERMANENTLY INSTALLED NON-SUBMERSIBLE PUMPS

Re: Fountains / New Section

Outlets supplying all permanently installed non-submersible pump motors rated 250-v or less and 60a or less, 1ø or 3ø, shall be provided with ground-fault circuit interrupter protection.

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680.74(A) BONDING

Re: Hydromassage Bathtubs

(3) Added metal raceways within 5'

(5) Non-current-carrying metal parts of electrical devices and controls that are not associated with the hydromassage tubs within 5'.

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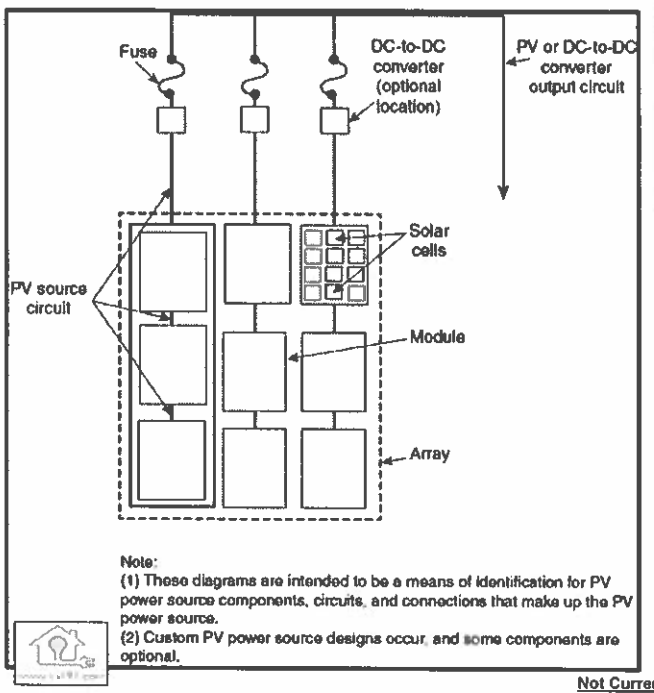

SOLAR PHOTOVOLTAIC (PV) SYSTEMS

690.1 Scope

This article applies to solar PV systems, other than those covered by Article 691, including the array circuit(s), inverter(s), & controller(s) for such systems. The systems covered by this article ***include those*** interactive with ***electric*** power production sources or stand-alone, ***or both.*** These PV systems may have ac or dc output for utilization.

2020

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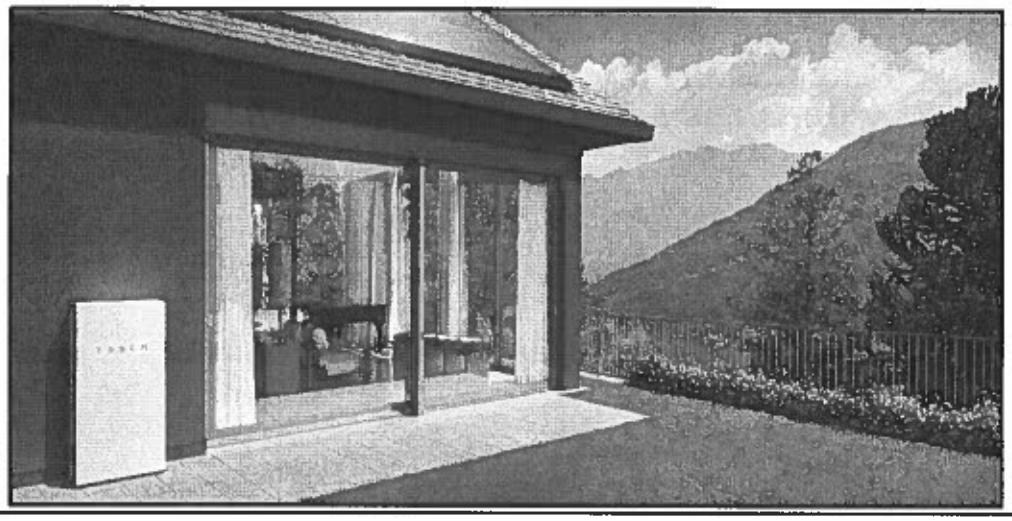
TESLA POWERWALL HOME BATTERY SYSTEM



2020

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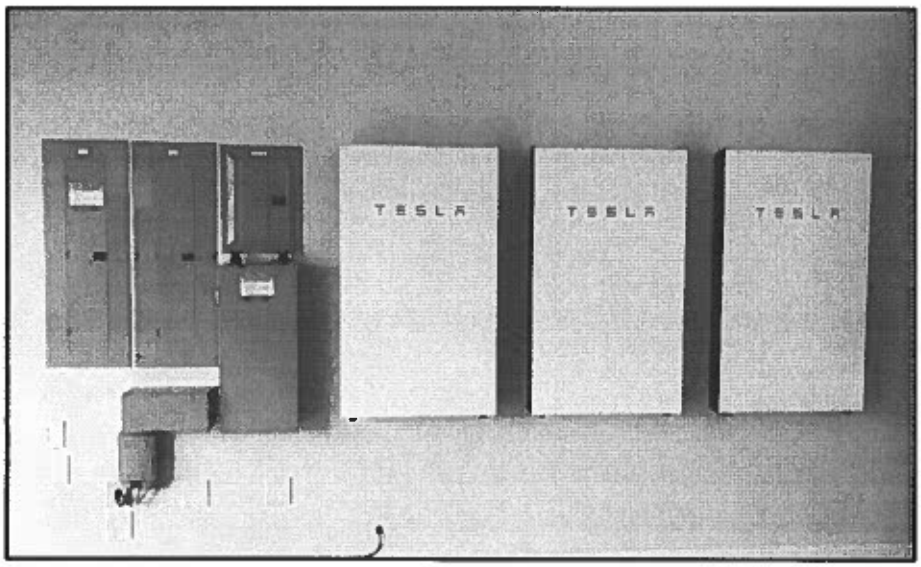
TESLA POWER WALL



2020

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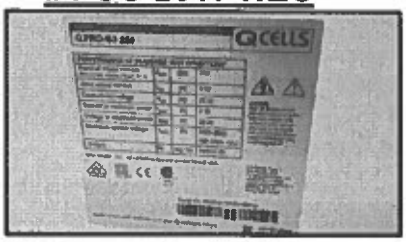
690.8 CIRCUIT SIZING AND CURRENT

N 690.8(A)(2)
Circuits Connected to the Input of Electronic Power Converters

Where a circuit is protected with an overcurrent device not exceeding the conductor ampacity, the maximum current shall be permitted to be the rated input current of the electronic power converter input to which it is connected. ***(Significant change for commercial installations)***

8.62 x 125% = 10.775a x (6) = 64.65a
****#4 CU 2017 NEC****

(6) 250-watt modules = (the string)



Input 33a x 125% = 41.25a

24 kW Inverter
75°C terminals
***#8 CU* / 50a ocd**
41.25amps =
Continuous duty

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ARTICLE 690
SOLAR PHOTOVOLTAIC (PV) SYSTEMS

This Article has been extensively revised and updated

690.13(A) – The PV system disconnecting means shall be located in a readily accessible location. ***Where disconnecting means of systems above 30-v are readily accessible to "unqualified" persons, any enclosure door or hinged cover that exposes live parts when open shall be "locked" or require a tool to open.***

Limit unintentional contact

690.15(A) Reads the same for Isolating PV Equipment

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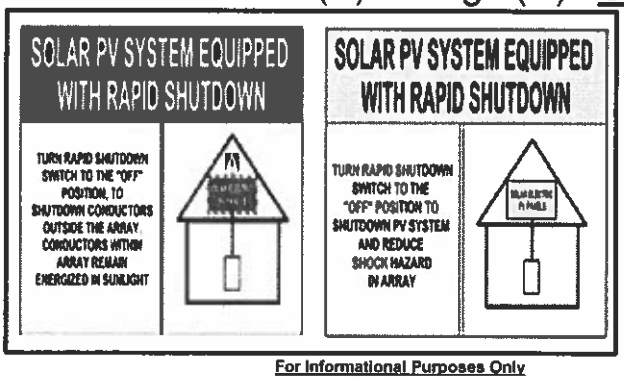
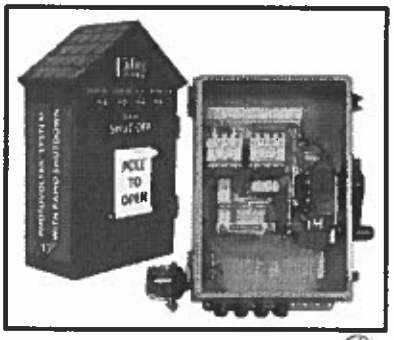
690.12 RAPID SHUTDOWN OF PV SYSTEMS ON BUILDINGS

PV system circuits ***installed <u>on</u> or <u>in</u> buildings*** shall include a rapid shutdown ***function to reduce shock hazard for firefighters*** in accordance with 690.12(A) through (D). **<u>UL3741</u>**





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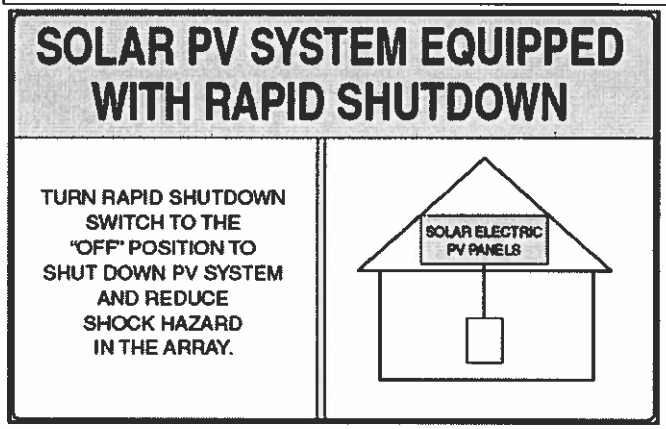
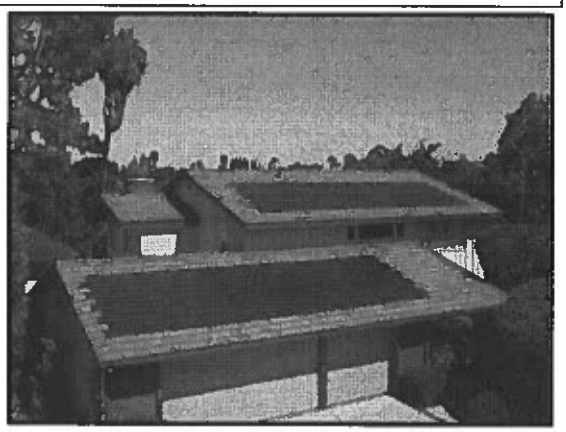
690.12(B)(1)(2) RAPID SHUTDOWN FOR PV SYSTEMS *<u>ON OR IN</u>* BUILDINGS FOR FIREFIGHTERS





Outside the boundary = >3' from the array, from point of entry, requires rapid shutdown.
Inside the boundary = <1 from array, requires rapid shutdown.
<u>PV Hazard Control System / <80v in 30seconds / or integrated roof shingles / UL 3741 Standard</u>

<u>Not Current Code in Ohio</u>

2020

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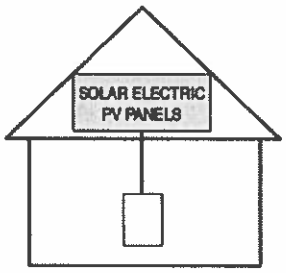
LABEL FOR ROOF MOUNTED PV SYSTEMS WITH RAPID SHUTDOWN

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY.



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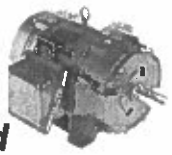
FIRE PUMPS
695.3(C)(2) SELECTIVE COORDINATION

Expanded Requirement (Revised)

Overcurrent protective device(s) shall be selectively coordinated with ***all*** supply-side overcurrent protective devices(s).



Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, maintain, and operate the system.

Similar to 700.32 Emergency Systems

Not Current Code in Ohio

2020

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CHAPTER 7

Special Conditions

Article 700 – Emergency Systems

Article 725 – Class 1, 2, & 3 Power Limiting Cables

Article – 760 Fire Alarm Systems

For Informational Purposes Only

2020

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700.2 EMERGENCY SYSTEMS

N **Emergency Systems.** ***This definition shall apply within this article and throughout the Code.***

Informational Note: Emergency systems are generally installed in places of assembly where artificial illumination is required for safe exiting and for panic control in buildings subject to occupancy by large numbers of persons, such as hotels theaters, sports arenas, healthcare facilities, and similar installations. Emergency systems may also provide power for such functions as ventilation where essential to maintain life, fire detection and ***alarm systems***, elevators, fire pumps, public safety communications systems, industrial processes where current interruption would produce serious life-safety or health hazards, and similar functions.

Definition Modified / Clarified!

Not Current Code in Ohio

2020

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ARTICLE 700 – PART 4 EMERGENCY SYSTEM CIRCUITS FOR LIGHTING AND POWER

700.16 Emergency Illumination – Rewritten (Clarification)

N **(B)** ***System Reliability*****. Emergency lighting systems shall be designed and installed *so that the failure of any illumination source* cannot leave in total darkness any space that requires emergency illumination. Control devices in the emergency lighting system shall be listed for use in emergency system. Listed unit equipment in accordance with 700.12(F) shall be considered as meeting the provisions of this section.**

Removed reference to burning out of a lamp
(due to the use of LED's luminaires)

For Informational Purposes Only

2020

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N 700.32 SELECTIVE COORDINATION *INFORMATIONAL NOTE*

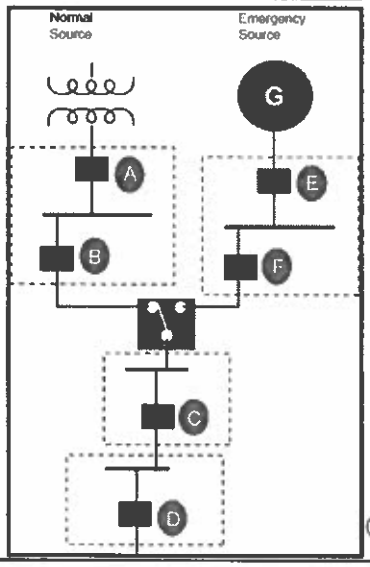
Informational Note: See Informational Note Figure Note 701.32 for an example of how legally required standby system overcurrent protective devices (OCPDs) selectively coordinate with all supply-side OCPDs.

OCPD "D" selectively coordinates with **OCPD's C, F, E, B, and A**.

OCPD "C" selectively coordinates with **OCPD's F, E, B, and A**.

OCPD "F" selectively coordinates with **OCPD E**.

OCPD "B" is not required to selectively coordinate with OCPD A because OCPD B is not a legally required standby system OCPD.



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2020

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ARTICLE 720 – CIRCUITS & EQUIPMENT OPERATING AT LESS THAN 50 VOLTS

720.1 Scope. This article covers installations operating at less than 50 volts, direct current or alternating current.

720.2 Other Articles. Direct current or alternating-current installations operating at less than 50 volts, as covered in Articles 411, 517, 551, 552, 650, 669, 690 and 760.... "Parts I, ***II***, and III of Article 725, ***shall not be required to comply with this article***".

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2020

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ARTICLE 725 CLASS 1, 2, & 3 REMOTE CONTROL, SIGNALING & POWER LIMITED CIRCUITS

There are two types of Class 1 circuits:

1. **Power-limited**; supplied by a transformer, limited to 30v and 1000VA, have a current limiter (OCPD) that limits the amount of supply current on the circuit, due to an overload, short-circuit or ground-fault.
2. **Remote-control & signaling;** maximum voltage is 600 and limited on the power output of the source.

Note: Class 1 circuits are permitted to occupy the same cable, raceway or enclosure of power and lighting circuits (whether A/C or D/C), when installed in associated equipment, and conductors are properly insulated. (watch de-rating).

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CLASS 2 & 3 CIRCUITS

Both Class 2 & 3 circuits have power limitations as identified in Chapter 9 of the 2020 National Electrical Code;

Table 11(a) Alternating Current Limitations

Table 11(b) Direct Current Limitations

Class 2 Note: Typical operating voltage is 48v, not exceeding 100VA, with a listed power supply. (limited in length due to voltage drop)

Class 3 Note: Have higher current thresholds than Class 2 circuits, therefore have additional requirements. (can run longer lengths than Class 2 circuits)

2020

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725.144 TRANSMISSION OF POWER & DATA

New in 2017 NEC

Typically, referred as Power over Ethernet **(PoE)**. A common use is for video cameras, that have a class 2 power supply, that will also utilize conductors within the same cable for video transmission (network cable).

Ampacity ratings of these cables are based on 86°F. As current flow in these bundled or bunched cables can increase the temperature and therefore can degrade the insulation of the cables (overheating).

Generally operating @ 48v / connectors rated @ 1.3 amperes maximum

2020

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POE TERMINOLOGY

- **IEEE 802.3 PoE Standard; *(48v and up to 15.4W)***

Typically, Cat 5 Cable contains 8 wires; as 4 twisted pairs of conductors 2 pairs are used for data (data pairs), 1 pair can be used for power 48v DC

PSE = Power Sourcing Equipment; Equipment that provides power to the cable. (WAP); Wired Access Points (IP); Security Cameras

PD = Powered Device; Device that receives power from the cable

PSE = Power Sourcing Equipment; Devices that send power and data over ethernet cable to a connected PD. (midpoint, endpoint or span); no additional power source required.

VOIP = Voice over internet phone; PoE is needed to power the phone, via the network.

2020

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POWER OVER ETHERNET (POE) NEW IN THE 2017 NEC

Applies to both Class 2 & Class 3 Circuits

IN #1 – Applies to *CCTV cameras*

IN #2 – Used in Powered *Communication systems*

IN #3 – 4 Pair copper balanced twisted conductors

IN #4 – Guidelines for supporting power delivery over balanced twisted conductors

IN #5 – Minimum Requirements for *PoE lighting systems*

IN #6 – Rated current for power sources; designed to deliver

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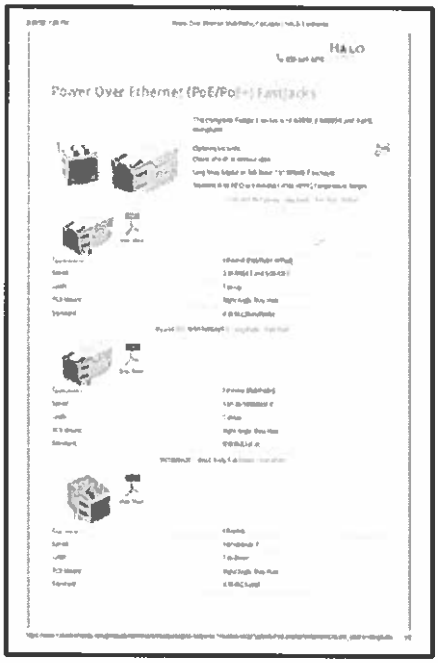

725.144 TRANSMISSION OF POWER & DATA

Power over Ethernet (PoE)

Section 725.144(A) & (B) shall apply to Class 2 & Class 3 circuits that transmit power and data to a powered device. Section 300.11 and Parts I and III of Article 725 shall apply to Class 2 & Class 3 circuits that transmit power and data. Conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

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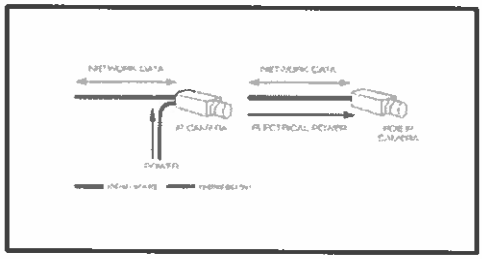
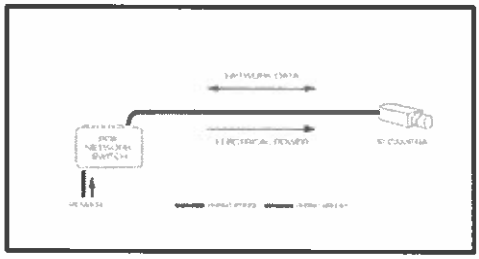
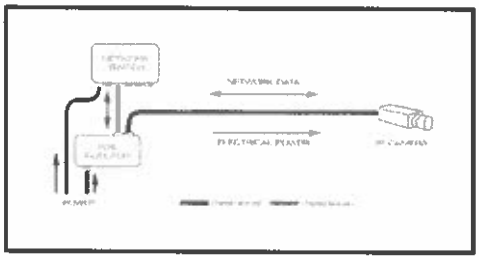
NETWORK CABLES THAT CARRY ELECTRIC POWER







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PoE [power over ethernet] USE CASES

PoE Deployment Locations

- Campus Building
- Campus
- Office
- Home

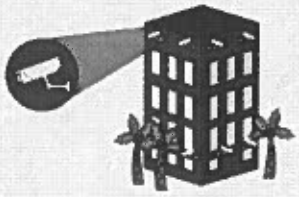
PoE facilitates the deployment of powered devices in several scenarios. The following are just a few sample use-cases for PoE.

VoIP in an Office Environment

Businesses seeking to save on wired telephone services switch to VoIP private systems

IP Surveillance in an Enterprise Building

Outdoor IP cameras give system integrators the ability to deploy cameras around a multi-story enterprise building where electrical circuitry may be absent



Access Points in a Campus

PoE-capable wireless access points make it simple to designate the placement of electrical circuitry, and place wireless access points anywhere on a campus.

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Figure 1 illustrates a typical PoE application. The PoE subsystem resides in a communication room and connects to the Ethernet infrastructure via standard category 5 cabling.

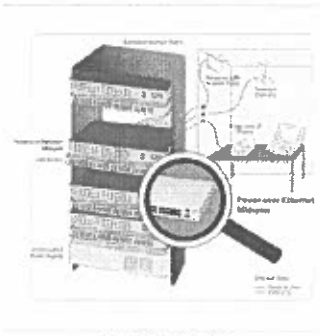

Figure 1 - Typical PoE installation

Paper Goals

This white paper describes PoE concepts, processes, considerations and changes from both the Sourcing side (Power Sourcing Equipment or PSE) and the Terminal side (Powered Device or PD) perspectives and details the current highlights of the IEEE 802.3af standard for provision of PoE

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ADDITIONAL USES

Integrating Building Systems

Heating, Ventilation & A/C Systems (VAV Boxes)

Lighting System Sensors

Security Camera Systems

Automation, Control Systems & Energy Savings

Refer to Chapter 9 Tables 11(a) & (b)

2020

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CLASS 2 & CLASS 3 NETWORK CABLING

Data and Power Circuits

1. Cable Listing & Compliance
2. Structured Cabling
3. Data Centers
4. Power over Ethernet (PoE)
5. Uses Cat 5 or Cat 6 Cable

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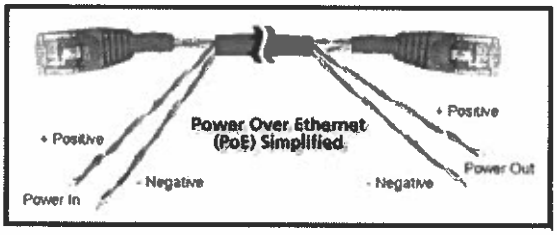
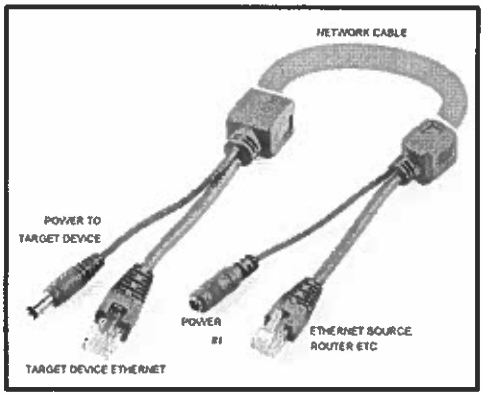
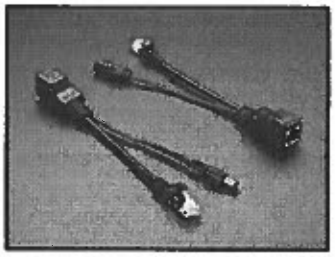
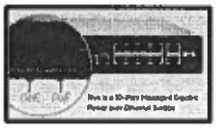
EXAMPLES OF CAT 5 / 6 CABLES / USES









2020

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CHAPTER 8

Communications Systems

N Article 805 – Communication Circuits

2020

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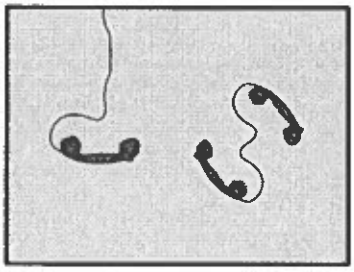
ARTICLE 805 (NEW) GENERAL REQUIREMENTS FOR COMMUNICATION SYSTEMS

General info for Articles;

800, 820, 830 and 840 combined in one location.



800 – Communication Circuits
820 – CATV & Radio Dist. Systems
830 – Network Powered Broadband Comm. Systems
840 – Premises-Powered Broadband Comm. Systems

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CHAPTER 9

Tables

Table 1 – Conduit Fill

Informative Annex I – Recommended Tightening Torque Tables from UL Standard 486A – 486B

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CHAPTER 9 – TABLES

Table 1

Conduit Fill / Cross Sectional Area (%)

1 Conductor = 53% Cross Sectional Fill
2 Conductors = 31% Cross Sectional Fill
Over 2 Conductors = 40% Cross Sectional Fill

Notes to Tables:

(3) EGC's / bonding conductors ***to be included*** in calculating conduit fill

(4) Where conduit or tubing nipples having a maximum length not to exceed ***24"*** are installed between boxes, cabinets, and similar enclosures, the nipples shall be permitted to be filled to ***60%*** of their cross-sectional area, and 310.15(C)(1) adjustment factors need not apply to this condition. ***(no de-rating required)***

2020

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2020 NEC COMMERCIAL OVERVIEW

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

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2020 NEC RESIDENTIAL OVERVIEW

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

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2020

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2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Labriola Training Agency #191
www.ta191.com

John M. Labriola
Principal

150 Maplecrest Street SW
North Canton, Ohio 44720

330.497.6309 Phone
330.606.8098 Cell
john@ta191.com

www.ta191.com

Thank You!

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File Attachments for Item:

EC-5 2020 NEC Changes and Updates Articles 210.8(B) - 220 (Labriola)

All certifications except plumbing (4 hours)

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: John M. Labriola (Contact Name)
Organization: Training Agency #191 (Organization/Company)
Address: 150 Maplecrest St. SW (Include Room Number, Suite, etc.)
City: North Canton State: Ohio Zip: 44720
E-Mail: john@ta191.com
Telephone: 330.497.6309 Fax:
Course Sponsor: None

COURSE INFORMATION:

Course Title: 2020 National Electrical Code Changes & Updates - Articles 210.8(B) - 220

New Course Submittal: ☒ Update Course: ☐ Prior Approval Number:

Purpose and Objective:
To provide BBS certified personnel a better understanding of the changes & Updates to the 2020 National electrical Code,
by utilizing a power-point presentation and real-life examples, for no charge to attendees.

Number of Instructional Contact Hours that can be obtained upon completion: 4 Hours

If Multi-Session, Number of Instructional Contact Hours Per Session:

Program Applicable for the Following Participants:

Building Official ☒	Master Plans Examiner ☒	Building Inspector ☒	Fire Protection Inspector ☒	Mechanical Inspector ☒
	Plumbing Plans Exam. ☐			Plumbing Inspector ☐
	Electrical Plans Exam. ☒			Non-Res IU Inspector ☒
	Mechanical Plans Exam. ☒			

Res Building Official ☒ Res Plans Examiner ☒ Res Building Inspector ☒ Res Mechanical Inspector ☒ Res IU Inspector ☒

Electrical Safety Inspectors ☒
Location of ESI Course: Various locations Date(s) of ESI Course(s): TBD

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

RECEIVED
MAY 04 2022
BOARD OF BUILDING STANDARDS

Form 1526 BBS 5102320

October 16, 2020

John M. Labriola
150 Maplecrest St. SW
North Canton, Ohio 44720

330.497.6309 Home 330.606.8098 Cell

Professional Bio'

Education

2012- 1984	Akron University, Stark State College: Continuing Education
1975	St. Thomas Aquinas High School; Louisville, Ohio
1971	Fairmount Elementary; Canton, Ohio

Building Department Experience

2017 – 2009	Summit County, Ohio; Chief Building Official (retired)
2009 – 2006	City of Canton, Ohio; Chief Building Official
2008 – 1997	City of Alliance, Ohio; Back-up Building and Electrical Inspector
2006 – 1997	City of North Canton, Ohio; Building and Electrical Inspector
1997 – 1986	Stark County, Ohio; Chief Electrical Inspector
1988 – 1984	City of Louisville, Ohio; Part-time Electrical Inspector

Current Certifications Held

International Code Council (ICC)

Accessibility Inspector/ Plans Examiner, Building Inspector, Building Plans Examiner, Certified Building Code Official, Certified Building Official, Certified Electrical Code Official, Certified Mechanical Code Official, Commercial Electrical Inspector, Commercial Mechanical Inspector, Commercial Plumbing Inspector, Electrical Inspector, Electrical Plans Examiner, Fire Plans Examiner, Master Code Professional, Mechanical Inspector, Mechanical Plans Examiner, Property Maintenance and Housing Inspector, Residential Electrical Inspector, Residential Energy Inspector / Plans Examiner, Residential Mechanical Inspector and Residential Plumbing Inspector.

State of Ohio:

Building Inspector, Building Official, Building Plans Examiner, Electrical Plans Examiner, Electrical Safety Inspector, Fire Protection Plans Examiner, Mechanical Plans Examiner and Residential Building Official.

Construction Experience

2007 – 1986	President; Electrical Design and Construction Co.
2004 – Present	State of South Carolina; Licensed Commercial Contractor
1992 – Present	State of Ohio; Licensed Electrical Contractor
1986 – 1981	Owner; Labriola Electric
1981 – 1975	Pedersen Electric; Helper / Apprentice / Journeyman Electrician
1980 – Present	Journeyman Electrician; City of Canton, Ohio

Professional Organization Memberships

2010 – 2017	American Institute of Architects - Akron Chapter (AIA-Akron)
2009 – 2017	Building Officials Code Officials of Northeast Ohio (BOCONEO)
2009 – 2017	National Fire Protection Association (NFPA)
1997 – 2017	Five County Building Officials Association (FBOA)
1997 – 2017	Ohio Building Officials Association (OBOA)
1986 – Present	International Association of Electrical Inspectors (IAEI)

Appointments (Director Positions)

2011 – 2017	Air-Conditioning Contractors Association of Akron / Canton
2011 – 2017	Home Builders Association of Summit and Portage Counties

Teaching Experience

2012 – 2017	Instructor; Home Builders Association of Greater Cleveland
2012 – 2017	Instructor; Home Builders Association of Summit and Portage Counties
2012 – Present	Instructor; National Electrical Contractors Association (NECA); Greater Cleveland, Ohio Division
2011 – Present	Instructor; Northeast Ohio Electrical Contractors Association (NOECA)
2005	Instructor; Clemson University; Clemson, South Carolina
2004 – Present	Instructor; Electrical League of Ohio; Cleveland, Ohio
2000 – 2016	Instructor; Stark State College of Technology: North Canton, Ohio
1999 – Present	Instructor; National Electrical Contractors Association (NECA); Akron, Ohio Division
1991 – 2009	OCILB Approved Contractor Training Agency
1990 – Present	State of Ohio; Approved Electrical Safety Inspector, Instructor

Respectfully,
John M. Labriola
John M. Labriola
OBBS ID #815
john@ta191.com

www.ta191.com

May 02, 2022

Labriola Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720

Ohio Board of Building Standards
6606 Tussing Road – PO Box 4009
Reynoldsburg, Ohio 43068 – 9009

Course Submittal #2 – 4 Hours

Code Sections to be discussed in detail Articles 210.8(B) – 220

Discussion on GFCI protection for personnel requirements

Discussion on AFCI protection for personnel requirements

Branch Circuit requirements

Article 220 – Load Calculations for all circuits

2 ☐ **CURRENT ADOPTED CODES**

3 ☐ **2019 RESIDENTIAL CODE OF OHIO**

4 ☐

5 ☐

THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

6 ☐ **"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)**

Subject to the local or State adoption authority

38 ☐ **210.8(B) GFCI PROTECTION FOR**

PERSONNEL- OTHER THAN DWELLING UNITS

Expanded Requirements:

The change will require that *all* 125-v through 250-v "*receptacles*" supplied by 1ø branch circuits rated 150-v to ground or less, 50a or less and "*all receptacles*" supplied by 3ø branch circuits rated 150-v to ground, 100a or less, installed in the locations in areas specified in 210.8(B)(1) through 210.8(B)(12) will now require GFCI protection for personnel.

Bathrooms, kitchens, rooftops, outdoors, sinks, indoor *damp and* wet locations, locker rooms with associated showering facilities, garages, *accessory buildings*, service bays, crawl spaces, unfinished *areas of basements*, *laundry areas*, and *bathtubs and shower stalls*.

12 Locations / Type "A" GFCI Protection 4 – 6 mA

39 ☐

210.8(B)(2)
GFCI PROTECTION

OTHER THAN DWELLING UNITS

KITCHENS / *FOOD PREP*

Expanded Requirement

Kitchens *or areas with a sink "and" permanent provisions for either food preparation* or cooking.
For Informational Purposes Only

40 ☐ **210.8(B)(5)**
OTHER THAN DWELLING UNITS - SINKS
Ex. #2 – Health Care Facility locations – Clarification

Receptacles located in patient bed locations of Category 2 (*general care*) or Category 1 (*critical care*) spaces of health care facilities *shall be permitted to comply with 517.21*

517.21: Ground-fault circuit-interrupter protection for personnel *shall not* be required for receptacles installed in those critical care (*Category 1*) spaces where the toilet and basin are installed within the patient room.

Prevent patient from being exposed to additional hazards!

41 ☐ **210.8(B) OTHER THAN DWELLING UNITS – GFCI PROTECTION**
NEW – Exception

Exception to #1-5, 8 and 10: Listed locking support & mounting receptacles utilized in combinations with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not require GFCI protection. (Safety Quick Ltg. & Fans Corp)

If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

Applies to: Bathrooms, Kitchens, Rooftops, Outdoors, Sinks, Garages and unfinished portions of Basements

42 ☐ **210.8(C) CRAWL SPACE LIGHTING OUTLETS**
210.8(D) SPECIFIC APPLIANCES
210.8(E) EQUIPMENT REQUIRING SERVICING
210.8(F) OUTDOOR OUTLETS

(C) Crawl Space Lighting Outlets- 120-v or less

N (D) Specific Appliances- 422.5 all dishwasher *outlets*

N (E) Equipment Requiring Servicing- 210.63

N (F) Outdoor Outlets- all outdoor *outlets* for dwellings, 1ø branch circuits, 150-v or to ground or less, 50a or less

43 ☐

210.8(C) BOAT HOISTS

Removed / Re-directed

2017 NEC – GFCI protection is required per 555.3

2020 NEC – GFCI Protection will be 555.9

Type "A" Protection 4-6mA

44 ☐ **210.8(D) SPECIFIC APPLIANCES; WAS KITCHEN D/W BRANCH CIRCUIT - DWELLING UNIT**

Expanded Requirement

2020 NEC - *Specific Appliances* (now will apply to all dishwasher locations, both *residential /commercial*). GFCI protection for personnel:

Refer to 422.5(A) & (B)

Type "A" Protection 4 – 6mA

Crawl Space Lighting – GFCI Requirements 2017 NEC 210.8(E) / 2020 NEC 210.8(C)

45 ☐ ***N*** **210.8(F) OUTDOOR OUTLETS**

NEW Requirement – Dwelling Units

All outdoor *outlets* for dwellings, other than those covered in 210.8(A)(3), exception to (3), that are applied to single-phase branch circuits rated 150-v to ground or less, *50* amps or less, shall have ground-fault circuit-interrupter protection for personnel. (*Exception; Lighting Outlets*)

46 ☐ **PROPOSED 08.20.2021 OBBS UPDATE RE: OUTDOOR OUTLETS**

Posted 09.02.2021 OBBS Proposed Amendment

Amendment 20-01 to NFPA 70 210.8(F) to exempt certain HVAC equipment from the GFCI requirement.

- (VSD's) Variable speed drive motors (peak load conditions)
- ECM motors are energy efficient; (electronically commutated motor) (variable / multi-speed, auto reversing motors); typically provided with 20 - 30 SEER equipment (split systems).

Note: These devices are not compatible with GFCI devices

-

47 ☐ **OBBS *DRAFT* 4101:1-35-01**
CHAPTER 35
REFERENCED STANDARDS

Proposed Amendment to 2020 NFPA 70

National Electrical Code (except that section 210.8(F) does not apply to HVAC units employing power conversion equipment (variable speed drive) as a means to control compressor speed).

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49 ☐ **210.12 ARC-FAULT CIRCUIT PROTECTION**

(A) Dwelling Units – Clarified Wiring Method / Revision

(5) Metal raceway, *metal wireways, metal auxiliary gutters, or* Type MC or Type AC *cable* meeting the *applicable* requirements of 250.118, *with* metal *boxes*, metal *conduit bodies*, and metal *enclosures* are installed for the portion of the branch-circuit between the OCD and the 1st outlet, it shall be permitted to install a listed outlet branch-circuit type AFCI at the 1st outlet to provide protection for the remaining portion of the branch-circuit.

Clarified AFCI receptacle wiring method / use

(A)

50 ☐ **210.12(C) & (D) ARC-FAULT CIRCUIT-INTERRUPTER PROTECTION (AFCI)**

Additional Required Locations

(C) Guest Rooms, Guest Suites (added to 2017 NEC), *and Patient Sleeping Rooms in Nursing Homes and Limited-Care Facilities.* All 120-v 15- and 20-ampere branch circuits supplying outlets *and devices* installed in guest rooms 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).

(D) Branch circuit Extensions or Modifications. – Dwelling Units, Dormitory units, *and Guest Rooms and Suites.*

51 ☐

52 ☐ **210.15 RECONDITIONED EQUIPMENT (NEW)**

The following shall not be reconditioned:

(1) Equipment that provides GFCI protection for personnel

(2)

(2) Equipment that provides AFCI protection

(3)

(3) Equipment that provides GFPE

53 ☐ **210.25(B) COMMON AREA BRANCH CIRCUITS**

Branch circuits installed for lighting, central alarm, signal, communications, or other purposes for public or common areas of two-family dwellings, a multifamily dwelling, or multi-occupancy building shall not be supplied from equipment that supplies an individual dwelling unit or tenant space.

N New Informational Note

Informational Note: Examples of public or common areas include, but are not limited to, lobbies, corridors, stairways, laundry rooms, roofs, elevators, washrooms, store rooms, driveways (parking), and mechanical rooms.

54 ☐

210.52(C)(2) REVISION TO
ISLAND & PENINSULAR COUNTERTOPS

2017 NEC required (1) receptacle outlet, no matter the size of peninsular *(wall outlet)*.

2020 NEC will require (1) receptacle outlet for the 1st
9 ft² of countertop space. A receptacle outlet is required for every additional 18 ft² or fraction thereof, of countertop space (+ within 2' of outer end for peninsular locations).

55 ☐ **210.52(E)(3) BALCONIES, DECKS, & PORCHES**

Balconies, decks, and porches that are *within 4" horizontally of the dwelling unit* shall have at least *one* receptacle outlet accessible from the balcony, deck or porch.

Clarification / Self-supporting deck

56 ☐ **210.63 EQUIPMENT REQUIRING SERVICING**

A 125-v single-phase, 15- or 20-a rated receptacle outlet shall be installed at an accessible location *within 25' of the equipment* as specified in 210.63(A) and (B). (*in same room, area and level)*

N 210.63(A) Heating, A/C, and refrigeration equipment

210.63(B) Other Electrical Equipment (other than 1- and 2-family)

N 210.63(B)(1) Indoor Service Equipment (located in same room)

N 210.63(B)(2) Indoor Equip. Requiring Dedicated Equip. Spaces

Not connected on load side of disconnecting means!

57 ☐ **210.65 MEETING ROOMS**

Rooms 1000 ft² or less – Easier to Understand

210.65(A) – General

210.65(B) – Receptacle Outlets Required; 2' / 6' / 12' (per 210.52)

1. Receptacle outlets; in fixed walls.
2. Floor outlets; applies to rooms greater than 12' in any direction and floor area of 215 ft² shall have at least *one floor receptacle outlet, or at least one floor outlet to serve receptacle(s). Located at a distance of not less than 6' from any fixed wall for each 215 ft² or major portion of floor space.*

N 2017 NEC / 210.71

58 ☐ **210.70 LIGHTING OUTLETS REQUIRED**

Revised

210.70(A)(1) Habitable Rooms. 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.*

210.70(A)(2) *Additional Locations. – Remains Same*
210.70(B) *Guest Rooms or Guest Suites. – Remains same*
210.70(C) *All Occupancies. – Remains Same*

Control device = switch / occ. sensor / other device

59 ☐ **215.9**
GROUND FAULT CIRCUIT INTERRUPTER PROTECTION FOR PERSONNEL (FEEDERS)

Proposed revisions to *update* this section to allow GFCI protection of feeders to correlate with both 210.8 GFCI protection for personnel and 590.6 Temporary Installations.

Was limited to 15- and 20a branch circuits.
(i.e.: electric dryers and ranges)

60 ☐ **215.10 GROUND-FAULT PROTECTION OF EQUIPMENT**

New Exception

N 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.

AT+T Switching Facility

61 ☐ **TABLE 220.12 GENERAL LIGHTING LOADS BY OCCUPANCY**

Due to lighting system technology (LED) specifically and energy code compliance requirements, *ASHRAE 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings,* designers around the Country utilize these requirements and the NEC is updating their requirements.

Reducing lighting minimums

62 ☐ ***N* 220.12**
LIGHTING LOADS FOR NON-DWELLING OCCUPANCIES

Added (B) Energy Code / Revised / #4 is new

(A) General. Lighting loads shall be not less than specified in Table 220.12. Motors less than 1/8 HP and connected to a lighting circuit are considered general lighting load.

(B) Energy Code. 2017 NEC, was exception, now revised to positive code language.

1. Power monitoring system installed for general lighting system.
2. Provided with alarm values.
3. Demand factors are not applicable
4. *Continuous load of 125% shall be applied.*

63 ☐ **TABLE 220.12**
GENERAL LTG. LOADS

Revised / Enlarged Table

[a]Armories & Auditoriums = *gyms*
[b]Lodge rooms = *hotels / motels*
[c]Industrial Comm. = *manufacturing / factory*
[d]Banks = *offices*
[e]Storage garages = *parking garages*
[f]Clubs = *restaurants*
[g]/[H] Barber / Beauty shops / Stores = *retail*

Not Current Code in Ohio

248 ☐ **2020 NEC COMMERCIAL OVERVIEW**

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

249 **2020 NEC RESIDENTIAL OVERVIEW**

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

250 **2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES**

Thank You!

CURRENT ADOPTED CODES

July 01, 2019

Current Adopted Codes in Ohio – (2017)

Non-Residential Construction (4- Family and Above)

2017 Ohio Building Code (Based on the 2016 International Building Code)
2017 Ohio Mechanical Code (Based on the 2015 International Mechanical Code)
2017 Ohio Plumbing Code (Based on the 2015 International Plumbing Code)
2017 Ohio Fire Code (Based on the 2015 International Fire Code)
2017 NFPA 70 – National Electrical Code (Effective 11 01 2017)
2016 NFPA 13 – Standard for Installation of Sprinkler Systems
2016 NFPA 72 – National Fire Alarm and Signaling Code
2015 International Fuel Gas Code
2012 International Energy Conservation Code / ASHRAE 90.1 2010
ICC / ANSI A117.1 2009 Accessible & Usable Buildings and Facilities

Residential Construction (1, 2 and 3- Family Dwellings)

2019 Residential Code of Ohio (Based on the 2018 International Residential Code)
2017 Ohio Plumbing Code
2017 NFPA 70 – National Electrical Code w/ amendments (07.01.2017)
2018 International Energy Conservation Code

March 24 2020

Current Adopted Building Codes in West Virginia

The State of West Virginia Fire Commission has adopted statewide the 2015 ICC (International Code Council), family of Codes for any jurisdiction that chooses to enforce building codes. Check locally for enforcement information / details.

2015 International Building Code (IBC)
2009 International Energy Conservation Code (IECC)
2015 International Existing Building Code (IEBC)
2015 International Fuel Gas Code (IFGC)
2015 International Mechanical Code (IMC)
2015 International Plumbing Code (IPC)
2012 International Property Maintenance Code (IPMC)
2015 International Residential Code (1- & 2- Family) (IRC)
2015 International Swimming Pool & Spa Code (ISPSC)

2015 NFPA 1 – Fire Code (Effective 07.01.2016)
2015 NFPA 101 – Life Safety Code (Effective 07.01.2016)
2017 NFPA 70 – National Electrical Code (Effective 03.04.2020)

2

2019 RESIDENTIAL CODE OF OHIO

Part VIII—Electrical

CHAPTER 50

ELECTRICAL

3

www.ta191.com

2020 "Proposed" National Electrical Code (NEC) Changes & Updates

Training Agency #191

150 Maplecrest Street SW
North Canton, Ohio 44720
330.497.6309 Phone

John M. Labriola

www.ta191.com

2020

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THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

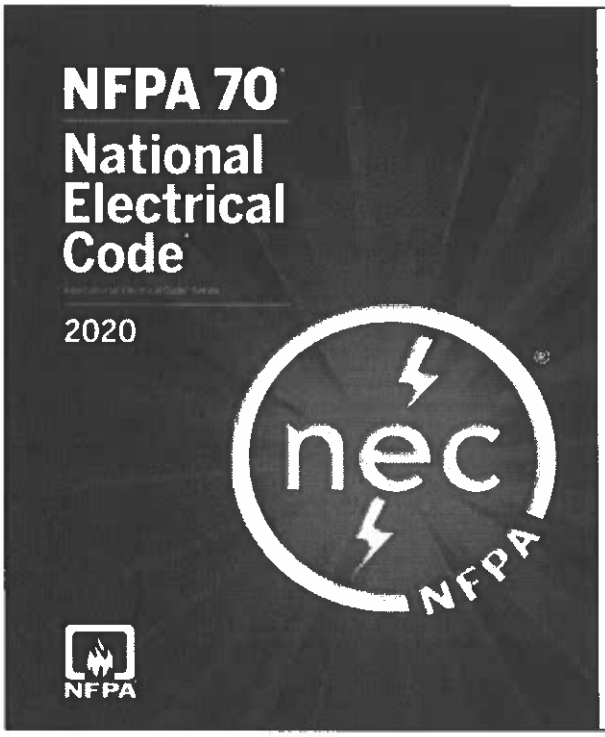
THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

2020

5



"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)

Subject to the local or State adoption authority

2020

6

210.8(B) GFCI PROTECTION FOR PERSONNEL- OTHER THAN DWELLING UNITS

Expanded Requirements:

The change will require that *all* 125-v through 250-v "*receptacles*" supplied by 1ø branch circuits rated 150-v to ground or less, 50a or less and "*all receptacles*" supplied by 3ø branch circuits rated 150-v to ground, 100a or less, installed in the locations in areas specified in 210.8(B)(1) through 210.8(B)(12) will now require GFCI protection for personnel.

Bathrooms, kitchens, rooftops, outdoors, sinks, indoor *damp and* wet locations, locker rooms with associated showering facilities, garages, *accessory buildings*, service bays, crawl spaces, unfinished *areas of basements*, *laundry areas*, and *bathtubs and shower stalls*.

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12 Locations / Type "A" GFCI Protection 4 – 6 mA

Not Current Code in Ohio

2020

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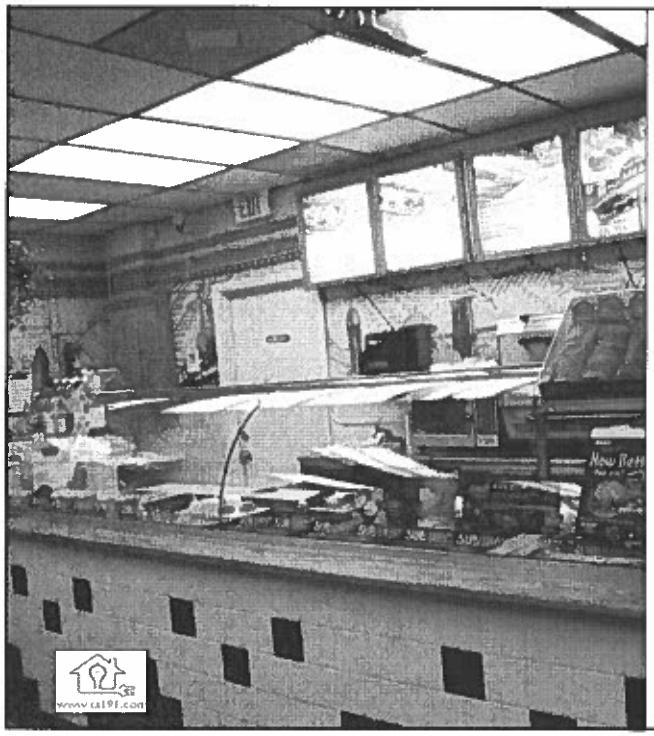

210.8(B)(2)
GFCI PROTECTION

OTHER THAN DWELLING UNITS

KITCHENS / *FOOD PREP*

Expanded Requirement

Kitchens ***or areas with a sink "and" permanent provisions for either food preparation*** or cooking.

For Informational Purposes Only

2020

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210.8(B)(5)
OTHER THAN DWELLING UNITS - SINKS

Ex. #2 – Health Care Facility locations – Clarification

Receptacles located in patient bed locations of Category 2 (*general care*) or Category 1 (*critical care*) spaces of health care facilities ***shall be permitted to comply with 517.21***

517.21: Ground-fault circuit-interrupter protection for personnel ***shall not*** be required for receptacles installed in those critical care (*Category 1*) spaces where the toilet and basin are installed within the patient room.

Prevent patient from being exposed to additional hazards!

Not Current Code in Ohio

2020

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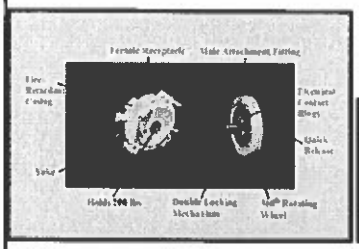
210.8(B) OTHER THAN DWELLING UNITS – GFCI PROTECTION

NEW – Exception



***Exception** to #1-5, 8 and 10: **Listed locking** support & mounting receptacles utilized in combinations with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not require GFCI protection.* (Safety Quick Ltg. & Fans Corp)

If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

***Applies to**: Bathrooms, Kitchens, Rooftops, Outdoors, Sinks, Garages and unfinished portions of Basements*

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2020

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210.8(C) CRAWL SPACE LIGHTING OUTLETS
210.8(D) SPECIFIC APPLIANCES
210.8(E) EQUIPMENT REQUIRING SERVICING
210.8(F) OUTDOOR OUTLETS

(C) Crawl Space Lighting Outlets- 120-v or less

N (D) Specific Appliances- 422.5 all dishwasher *outlets*

N (E) Equipment Requiring Servicing- 210.63

N (F) Outdoor Outlets- all outdoor *outlets* for dwellings, 1ø branch circuits, 150-v or to ground or less, 50a or less

Not Current Code in Ohio

2020

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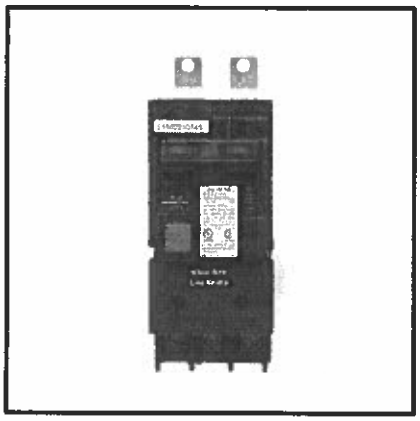
210.8(C) BOAT HOISTS

Removed / Re-directed

2017 NEC – GFCI protection is required per 555.3

2020 NEC – GFCI Protection will be 555.9

Type "A" Protection 4-6mA



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2020

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210.8(D) SPECIFIC APPLIANCES; WAS KITCHEN D/W BRANCH CIRCUIT - DWELLING UNIT

Expanded Requirement

2020 NEC - *Specific Appliances* (now will apply to all dishwasher locations, both ***residential /commercial***). GFCI protection for personnel:

Refer to 422.5(A) & (B)

Type "A" Protection 4 – 6mA

Crawl Space Lighting – GFCI Requirements 2017 NEC 210.8(E) / 2020 NEC 210.8(C)

Not Current Code in Ohio

2020

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N 210.8(F) OUTDOOR OUTLETS

NEW Requirement – Dwelling Units

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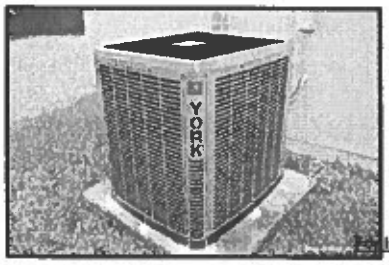

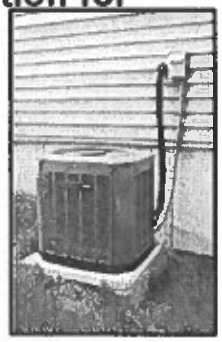

2020

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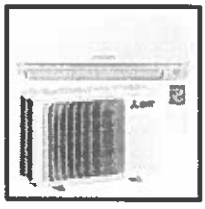

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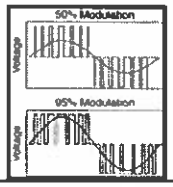

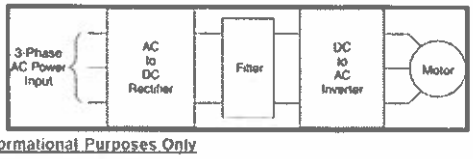

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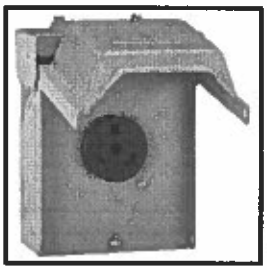

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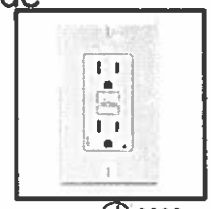

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2020

49

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Not Current Code in Ohio

2020

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Fire Estimate Summary

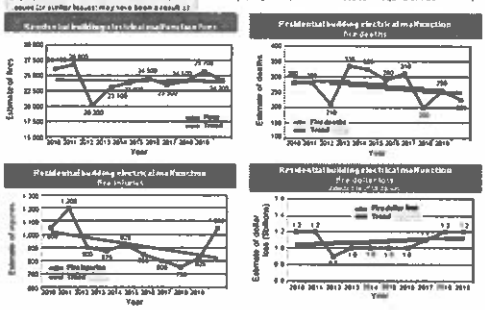
Residential Building Electrical Malfunction Fire Trends (2010-2019)

The 2019 national estimates for residential building electrical malfunction fires and losses show that there were

- 24,200 fires
- 225 deaths
- 1,050 injuries
- $1,208,300,000 in dollar loss

Overall trends for residential building electrical malfunction fires and losses for the 10-year period of 2010 to 2019 show the following

- A 9.6% decrease in fires
- A 15% decrease in deaths
- A 20% decrease in injuries
- A 9% increase in dollar loss. In 2018 and 2019, there were 32 and 14 incidents, respectively, with a reported dollar loss of $1,000,000 or more, which may have contributed to the continued increase in fire dollar loss. The 2019 high dollar loss fires included a $26,400,000 hotel fire in New Orleans, Louisiana. (Note: The overall constant dollar loss trend takes inflation into account by adjusting each year's dollar loss to its equivalent 2019 value.)



FEMA

National Fire Data Center
16825 S Seton Ave
Emmitsburg, MD 21727
usfa.fema.gov

2020

51

210.15 RECONDITIONED EQUIPMENT (NEW)

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(1) Equipment that provides GFCI protection for personnel

(2) Equipment that provides AFCI protection

(3) Equipment that provides GFPE

Not Current Code in Ohio

2020

52

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N **New Informational Note**

Informational Note: Examples of public or common areas include, but are not limited to, lobbies, corridors, stairways, laundry rooms, roofs, elevators, washrooms, store rooms, driveways (parking), and mechanical rooms.

For Informational Purposes Only

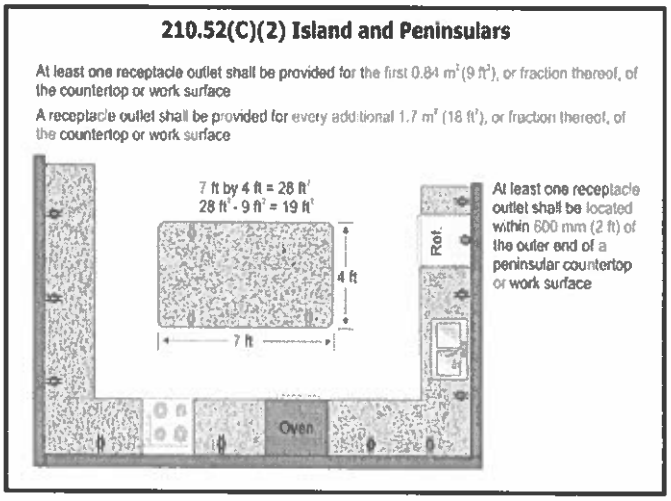
2020

53

210.52(C)(2) REVISION TO ISLAND & PENINSULAR COUNTERTOPS

2017 NEC required (1) receptacle outlet, no matter the size of peninsular ***(wall outlet)***.

2020 NEC **will require (1) receptacle outlet for the 1st 9 ft² of countertop space. A receptacle outlet is required for every additional 18 ft² or fraction thereof, of countertop space (+ within 2' of outer end for peninsular locations).**



Not Current Code in Ohio

2020

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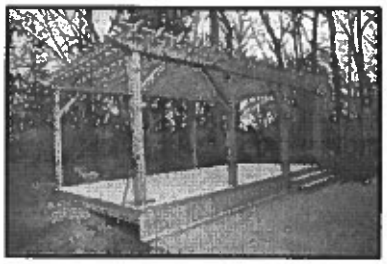
210.52(E)(3) BALCONIES, DECKS, & PORCHES



Balconies, decks, and porches that are ***within 4" horizontally of the dwelling unit*** shall have at least ***one*** receptacle outlet accessible from the balcony, deck or porch.

Clarification / Self-supporting deck

For Informational Purposes Only

2020

55

210.63 EQUIPMENT REQUIRING SERVICING

A 125-v single-phase, 15- or 20-a rated receptacle outlet shall be installed at an accessible location ***within 25' of the equipment*** as specified in 210.63(A) and (B). ***(in same room, area and level)***

N 210.63(A) **Heating, A/C, and refrigeration equipment**

210.63(B) Other Electrical Equipment **(other than 1- and 2-family)**

N 210.63(B)(1) Indoor Service Equipment (located in same room)

N 210.63(B)(2) Indoor Equip. Requiring Dedicated Equip. Spaces

Not connected on load side of disconnecting means!

Not Current Code in Ohio

2020

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210.65 MEETING ROOMS

Rooms 1000 ft² or less – Easier to Understand

210.65(A) – General

210.65(B) – Receptacle Outlets Required; 2' / 6' / 12' (per 210.52)

1. Receptacle outlets; in fixed walls.
2. Floor outlets; applies to rooms greater than 12'

in any direction and floor area of 215 ft² shall have at least ***one floor receptacle outlet, or at least one floor outlet to serve receptacle(s). Located at a distance of not less than 6' from any fixed wall for each 215 ft² or major portion of floor space.***

***N* 2017 NEC / 210.71**

For Informational Purposes Only

2020

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210.70 LIGHTING OUTLETS REQUIRED

Revised

210.70(A)(1) Habitable Rooms. 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.***

210.70(A)(2) ***Additional Locations. – Remains Same***
210.70(B) ***Guest Rooms or Guest Suites. – Remains same***
210.70(C) ***All Occupancies. – Remains Same***

Control device = switch / occ. sensor / other device

Not Current Code in Ohio

2020

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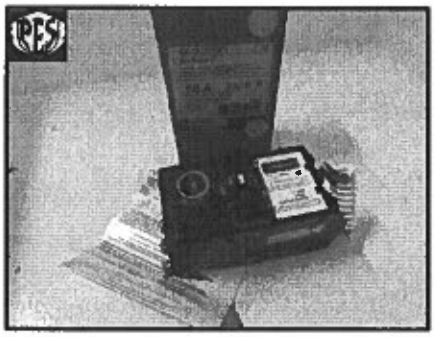
215.9 GROUND FAULT CIRCUIT INTERRUPTER PROTECTION FOR PERSONNEL (FEEDERS)

Proposed revisions to ***update*** this section to allow GFCI protection of feeders to correlate with both 210.8 GFCI protection for personnel and 590.6 Temporary Installations.

Was limited to 15- and 20a branch circuits. (i.e.: electric dryers and ranges)



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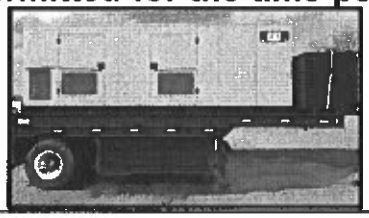
215.10 GROUND-FAULT PROTECTION OF EQUIPMENT

New Exception

N **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.**



AT+T Switching Facility

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2020

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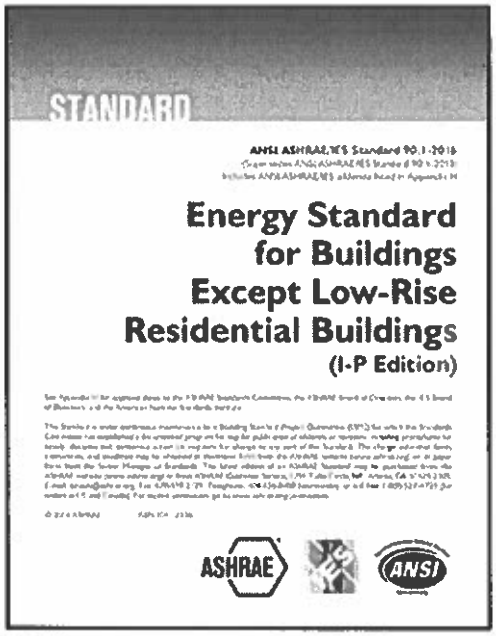
TABLE 220.12 GENERAL LIGHTING LOADS BY OCCUPANCY

Due to lighting system technology (LED) specifically and energy code compliance requirements, ***ASHRAE 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings,*** designers around the Country utilize these requirements and the NEC is updating their requirements.

Reducing lighting minimums



2020

Not Current Code in Ohio

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N 220.12 LIGHTING LOADS FOR NON-DWELLING OCCUPANCIES

Added (B) Energy Code / Revised / #4 is new

(A) General. Lighting loads shall be not less than specified in Table 220.12. Motors less than 1/8 HP and connected to a lighting circuit are considered general lighting load.

(B) Energy Code. 2017 NEC, was exception, now revised to positive code language.

1. **Power monitoring system installed for general lighting system.**
2. **Provided with alarm values.**
3. **Demand factors are not applicable**
4. ***Continuous load of 125% shall be applied.***

2020

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Table 220.12 General Lighting Loads by Non-Dwelling Occupancy

Type of Occupancy	Unit Load Volt-amperes/ m^2	Unit Load Volt-amperes/ ft^2
Automotive facility	16	1.5
Convention center	15	1.4
Courthouse	15	1.4
Dormitory	16	1.5
Exercise center	15	1.4
Fire station	14	1.3
Gymnasium[a]	18	1.7
Health care clinic	17	1.6
Hospital	17	1.8
Hotels and motels, including apartment houses without provisions for cooking by tenants[b]	18	1.7
Library	16	1.5
Manufacturing facility[c]	24	2.2
Motion picture theater	17	1.6
Museum	17	1.6
Office[d]	14	1.3
Parking garage[e]	3	0.3
Penitentiary	13	1.2
Performing arts theater	16	1.5
Police station	14	1.3
Post office	17	1.6
Religious facility	24	2.2
Restaurant[f]	16	1.5
Retail[g,h]	20	1.9
School/university	33	3
Sports arena	33	3
Town hall	15	1.4
Transportation	13	1.2
Warehouse	13	1.2
Workshop	18	1.7

TABLE 220.12 GENERAL LTG. LOADS

Revised / Enlarged Table

[a]Armories & Auditoriums = ***gyms***

[b]Lodge rooms = ***hotels / motels***

[c]Industrial Comm. = ***manufacturing / factory***

[d]Banks = ***offices***

[e]Storage garages = ***parking garages***

[f]Clubs = ***restaurants***

[g/H] Barber / Beauty shops / Stores = ***retail***

Not Current Code in Ohio

2020

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2020 NEC COMMERCIAL OVERVIEW

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

Not Current Code in Ohio

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2020 NEC RESIDENTIAL OVERVIEW

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

For Informational Purposes Only

2020

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2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Labriola Training Agency #191
www.ta191.com

John M. Labriola
Principal

150 Maplecrest Street SW
North Canton, Ohio 44720

330.497.6309 Phone
330.606.8098 Cell
john@ta191.com

www.ta191.com

Thank You!

250

File Attachments for Item:

EC-6 2020 NEC Changes and Updates Articles 230-250 (Labriola)

All certifications except plumbing (4 hours)

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: John M. Labriola (Contact Name)
Organization: Training Agency #191 (Organization/Company)
Address: 150 Maplecrest St. SW (Include Room Number, Suite, etc.)
City: North Canton State: Ohio Zip: 44720
E-Mail: john@ta191.com
Telephone: 330.497.6309 Fax:
Course Sponsor: None

COURSE INFORMATION:

Course Title: 2020 National Electrical Code Changes & Updates - Articles 230 - 250

New Course Submittal: ■ Update Course: ☐ Prior Approval Number:

Purpose and Objective:
To provide BBS certified personnel a better understanding of the changes & Updates to the 2020 National electrical Code.
by utilizing a power-point presentation and real-life examples, for no charge to attendees.

Number of Instructional Contact Hours that can be obtained upon completion: 4 Hours

If Multi-Session, Number of Instructional Contact Hours Per Session:

Program Applicable for the Following Participants:

Building Official ■	Master Plans Examiner ■	Building Inspector ■	Fire Protection Inspector ■	Mechanical Inspector ■
	Plumbing Plans Exam. ☐			Plumbing Inspector ☐
	Electrical Plans Exam. ■			Non-Res IU Inspector ■
	Mechanical Plans Exam. ■			

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ■ Res IU Inspector ■

Electrical Safety Inspectors [X]
Location of ESI Course: Various locations Date(s) of ESI Course(s): TBD

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:	RECEIVED	

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

MAY 04 2022

BOARD OF BUILDING STANDARDS

Form 1526 BBS 5/03/2010

October 16, 2020

John M. Labriola
150 Maplecrest St. SW
North Canton, Ohio 44720

330.497.6309 Home 330.606.8098 Cell

Professional Bio'

Education

2012- 1984	Akron University, Stark State College: Continuing Education
1975	St. Thomas Aquinas High School; Louisville, Ohio
1971	Fairmount Elementary; Canton, Ohio

Building Department Experience

2017 – 2009	Summit County, Ohio; Chief Building Official (retired)
2009 – 2006	City of Canton, Ohio; Chief Building Official
2008 – 1997	City of Alliance, Ohio; Back-up Building and Electrical Inspector
2006 – 1997	City of North Canton, Ohio; Building and Electrical Inspector
1997 – 1986	Stark County, Ohio; Chief Electrical Inspector
1988 – 1984	City of Louisville, Ohio; Part-time Electrical Inspector

Current Certifications Held

International Code Council (ICC)

Accessibility Inspector/ Plans Examiner, Building Inspector, Building Plans Examiner, Certified Building Code Official, Certified Building Official, Certified Electrical Code Official, Certified Mechanical Code Official, Commercial Electrical Inspector, Commercial Mechanical Inspector, Commercial Plumbing Inspector, Electrical Inspector, Electrical Plans Examiner, Fire Plans Examiner, Master Code Professional, Mechanical Inspector, Mechanical Plans Examiner, Property Maintenance and Housing Inspector, Residential Electrical Inspector, Residential Energy Inspector / Plans Examiner, Residential Mechanical Inspector and Residential Plumbing Inspector.

State of Ohio:

Building Inspector, Building Official, Building Plans Examiner, Electrical Plans Examiner, Electrical Safety Inspector, Fire Protection Plans Examiner, Mechanical Plans Examiner and Residential Building Official.

Construction Experience

2007 – 1986	President; Electrical Design and Construction Co.
2004 – Present	State of South Carolina; Licensed Commercial Contractor
1992 – Present	State of Ohio; Licensed Electrical Contractor
1986 – 1981	Owner; Labriola Electric
1981 – 1975	Pedersen Electric; Helper / Apprentice / Journeyman Electrician
1980 – Present	Journeyman Electrician; City of Canton, Ohio

Professional Organization Memberships

2010 – 2017	American Institute of Architects - Akron Chapter (AIA-Akron)
2009 – 2017	Building Officials Code Officials of Northeast Ohio (BOCONEO)
2009 – 2017	National Fire Protection Association (NFPA)
1997 – 2017	Five County Building Officials Association (FBOA)
1997 – 2017	Ohio Building Officials Association (OBOA)
1986 – Present	International Association of Electrical Inspectors (IAEI)

Appointments (Director Positions)

2011 – 2017	Air-Conditioning Contractors Association of Akron / Canton
2011 – 2017	Home Builders Association of Summit and Portage Counties

Teaching Experience

2012 – 2017	Instructor; Home Builders Association of Greater Cleveland
2012 – 2017	Instructor; Home Builders Association of Summit and Portage Counties
2012 – Present	Instructor; National Electrical Contractors Association (NECA); Greater Cleveland, Ohio Division
2011 – Present	Instructor; Northeast Ohio Electrical Contractors Association (NOECA)
2005	Instructor; Clemson University; Clemson, South Carolina
2004 – Present	Instructor; Electrical League of Ohio; Cleveland, Ohio
2000 – 2016	Instructor; Stark State College of Technology: North Canton, Ohio
1999 – Present	Instructor; National Electrical Contractors Association (NECA); Akron, Ohio Division
1991 – 2009	OCILB Approved Contractor Training Agency
1990 – Present	State of Ohio; Approved Electrical Safety Inspector, Instructor

Respectfully,
John M. Labriola
John M. Labriola
OBBS ID #815
john@ta191.com

www.ta191.com

May 02, 2022

Labriola Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720

Ohio Board of Building Standards
6606 Tussing Road – PO Box 4009
Reynoldsburg, Ohio 43068 – 9009

Course Submittal #3 – 4 Hours

Code Sections to be discussed in detail Articles 230 – 250

Split-bus type panels no longer permitted

Dwelling Unit- Surge Protective Device (SPD) requirements

Meter mounted transfer switches

Exterior Emergency SE Disconnects (1- 2 Family Dwellings)

Smart Meters (Power Co's)

Paralleling Transformers

Steel Structures

GEC Protection (Schedule 80 PVC)

Sizing EGC's

2 ☐ **CURRENT ADOPTED CODES**

3 ☐ **2019 RESIDENTIAL CODE OF OHIO**

4 ☐

5 ☐

THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

6 ☐ **"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)**

Subject to the local or State adoption authority

64 ☐ **ARTICLE 230**
SERVICES

230.1 Scope

This article covers service conductors and equipment for control and protection of services and their installation requirements.

For Informational Purposes Only

65 ☐ **ARTICLE 230 - SERVICES**

General Safety Issues Addressed

Panelboards with 6 SE disconnects *no longer permitted*. (MLO & split-bus panels)

Firefighter exterior SE disconnects for one- and two- family dwellings.

Line-side barriers to SE equipment to extend beyond panelboards only.

Arc-reduction for 1200 amps and greater to incorporate this technology (1/1/2020).

SCCR identification for pressure connectors and devices as *"suitable for use on the line side of*

SE equipment" (2017 NEC "PDB's).

Surge protective devices *(SPD's)* now required for *all* dwelling units.

66 ☐ **230.46 SPLICED AND *TAPPED* CONDUCTORS**

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 (PDB's), pressure connectors, and devices for splices and taps shall be listed. PDB's installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.*

Effective 01.01.2023; pressure connectors and devices for splices and taps installed on service conductors shall be marked "suitable for use on the line side of service equipment" or equivalent.

IE: Protective covers

67 ☐ ***N* 230.62 (C) BARRIERS**

Relocated from 408.3(A)

Barriers shall be placed in *SE* 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.

Now applies to all SE Equipment

Exception Removed:

68 ☐ ***N* 230.67 SURGE PROTECTION**

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

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

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

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

(D) N Replacement. Where SE equipment is replaced, all of the requirements of this section

shall apply.

69 ☐ ***N* 230.67**

SURGE PROTECTION FOR DWELLING UNITS

All services supplying dwelling units shall be provided with a surge protection device (SPD). Designed to protect against surges to electrical systems.

New Construction and Upgrades

Type 1 or Type 2 SPD

Not Current Code in Ohio

70 ☐ **230.71 MAXIMUM NUMBER OF DISCONNECTS**

Each service shall have only one disconnecting means unless the requirements of 230.71(B) are met.

230.71(B) Two to six service disconnects shall be permitted *for each service permitted by 230.2 or for each set of SE conductors permitted by 230.40, Ex. 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, each with a main SE disconnect.*
2. *Panelboards with a main SE disconnect.*
3. *Vertical switchboard sections that have separate SE disc.*
4. *SE disconnect in meter mods where each disconnect is located in a separate compartment.*

Refer to Informational Notes 1 & 2

71 ☐

72 ☐ **Δ 230.82 EQUIPMENT CONNECTED TO THE SUPPLY-SIDE OF SERVICE DISCONNECT**

Revision

(6) Solar PV, fuel cells, wind electric, energy storage, or interconnected electric power production systems, *if provided with a disconnecting means listed as SUSE rated and overcurrent protection as specified in Part VII of Article 230.*

(10) Emergency disconnects in accordance to 230.85, if all metal housings and SE enclosures are grounded (Part VII) and bonded in accordance with Article 250 (Part V).

(11) Meter mounted transfer switches, rated < 1000-v, have appropriate SCCR equal to or greater than the AFC. The transfer switch shall be listed and be capable of transferring the load served.

Identified on its exterior with both:

(a) Meter-mounted transfer switch
(b) Not service equipment.

73 ☐ **METER MOUNTED TRANSFER SWITCHES**
[1] Gener Link w/ 75kA
Surge Protection per phase
[2] For Portable Generators

74 ☐

75 ☐

230.85 "NEW" EXTERIOR EMERGENCY "SE" DISCONNECT
Applies to 1- and 2-Family Dwelling Units

All service conductors to terminate in a SUSE rated disconnecting means, with adequate SCCR, in a readily accessible *outdoor* location. Grouping is required.

Intent to protect firefighters / other emergency personnel.
For Informational Purposes Only

76 ☐ **230.85 EMERGENCY DISCONNECTS**
Each emergency disconnect shall be one of the following:

(1) Service disconnects marked:

"EMERGENCY DISCONNECT,
SERVICE DISCONNECT"

(2) Meter disconnects installed per 230.82(3) & marked:

"EMERGENCY DISCONNECT,
METER DISCONNECT,
NOT SERVICE DISCONNECT"

(3) Other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are suitable for use as service equipment & marked:

"EMERGENCY DISCONNECT,
NOT SERVICE EQUIPMENT"

77 ☐ ***<u>NEWS</u>***

09.20.2020
FIRST ENERGY ANNOUNCES
SMART METER CONVERSION; INDICATES 700K TO BE INSTALLED IN OHIO

78 ☐ **AEP SMART METER FLYER 01.18.2020**

79 ☐ **SMART METER**
RESIDENTIAL APPLICATION

80 ☐ **SMART METER UTILIZED FOR MULTIPLE VOLTAGES / PHASES**

81 ☐ **240.67(C) & 240.87(C) PERFORMANCE TESTING (NEW)**
ARC-ENERGY REDUCTION (FUSES / CKT. BRKRS)
<u>2017 NEC</u> Effective Date: 01.01.2020 (Fuses)

(A) Documentation
(B) Method to Reduce clearing Time
(C) *<u>Performance Testing (NEW)</u>*

AER Protection System – Tested when 1st installed
Qualified person, primary current injection & manufacturer test
Written record made available to AHJ

82 ☐ **240.88 RECONDITIONED EQUIPMENT (NEW)**
(A) <u>Circuit Breakers</u>

(1) Molded-case circuit breakers *<u>shall not</u>* be reconditioned
(2) Low-and medium-voltage circuit breakers *<u>shall be permitted</u>* to be reconditioned.
(3) High-voltage circuit breakers *<u>shall be permitted</u>* to be reconditioned.

(B) <u>Components</u>

(1) Low-voltage power circuit breaker electronic trip units *<u>shall not</u>* be reconditioned.
(2) Electromechanical protective relays and c/t's *<u>shall be permitted</u>* to be reconditioned.

83 ☐ **ARTICLE 242 (NEW) OVERVOLTAGE PROTECTION**
Discusses overvoltage connection requirements. Permanently installed surge-protective devices (SPD's) not more than 1000-v and permanently installed surge arresters over 1000-v.

(Relocated information from Articles 280 & 285)

Type 1 SPD- Connected at the Service- line or load

Type 2 SPD- Connected on load Side of Service Disc.
Type 3 SPD- Connected to load side of Branch OCD

Each SE Disc. Should be Protected!

84 ☐ **ARTICLE 250 GROUNDING & BONDING**

250.4(A)(1) Electrical System Grounding
Electrical systems that are grounded shall be connected to earth in a manner that will limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operation.

250.4(A)(5) Effective Ground-Fault Path.
Installed in a manner that creates a low-impedance path that facilitates the operation of the OCD in a safe manner.

85 ☐ ***N*** **250.25**

(NEW GROUNDING SYSTEMS PERMITTED TO BE CONNECTED ON THE SUPPLY-SIDE OF THE SE DISCONNECT)

The intent is that supply-side equipment [*whether considered a service or not*] needs to be properly grounded to a grounding electrode system. In order to create an effective fault current path. [Refer to 250.92 250.102(C)].
Systems such as wind, solar, fuel cells, and interconnected power production.

Note: 250.24(D) GEC Sized per Table 250.66

86 ☐ ***N*** **250.25(A) SUPPLY-SIDE SE GROUNDING INSTALLED IN SEPARATE ENCLOSURES FROM SE EQUIPMENT**

87 ☐ **MANUAL TRANSFER SWITCHES**

1 •
200a 2-pole 240-v 1ø

2
200a 3-pole 480-v 3ø

88 ☐ ***N*** **250.30(A)(1) EX. (3)(B)EXCEPTION**

GROUNDING SEPARATELY DERIVED SYSTEMS
System Bonding Jumper

N Ex. Separately derived systems consisting of multiple sources of the same type that are connected in parallel shall be permitted to have the system bonding jumper installed at the paralleling switchgear, switchboard, or other paralleling connection point instead of at the disconnecting means located at each separate source.

89 ☐ **PARALLELING OF TRANSFORMERS**

Transformers operating in parallel

Occurs in installations that have their primary windings of the *paralleled* transformers connected to the same voltage supply and the secondary windings are connected to a common load.

Note: Transformers need to have the same Kva rating, turn ratios, and impedance characteristics. This would create equal load sharing between the source transformers, without creating circulating currents in the windings (heat loss).

90 ☐ ***N*** **250.30(A)(6) EX. #3 GEC MULTIPLE SEPARATELY DERIVED SYSTEMS**

Relocated from 250.30(A)(6) Ex. 2(B) Ex. Tap Conductor Size

Now Expanded for all GEC, Multiple Separately Derived Systems

If the source of a separately derived system is located within equipment listed and identified as suitable for use as service equipment (SUSE), the grounding electrode conductor from the service or feeder equipment to the grounding electrode shall be permitted as the grounding electrode conductor for the separately derived system, if the grounding electrode conductor is of sufficient size for the separately derived system. If the equipment grounding bus internal to the equipment is not smaller than the required grounding electrode conductor for the separately derived system, the grounding electrode connection for the separately derived system shall be permitted to be made to the bus

Not Current Code in Ohio

91 ☐ **GROUNDING TRIANGLE / FOUNDATION**

250.50 All Electrodes present shall be bonded together (1-7)

250.52 Permitted Electrodes (1-8)

Focus:

1. Metal UG Water Pipe
2. Building Steel
3. Concrete-Encased
4. Rod / Pipe

92 ☐ ***N 2017*** **NEC 250.52(A)(2)**
METAL IN-GROUND SUPPORT STRUCTURES

93 ☐ **EFFECTIVELY GROUNDED STEEL STRUCTURE**

94 ☐ **250.64(A) GEC INSTALLATION**
AL OR COPPER-CLAD AL CONDUCTORS

[1] 2020 NEC

[2]

Revised / Expanded Details

(1)Conductors w/o an extruded polymeric covering shall not be installed in corrosive conditions or in direct contact with *concrete*

(2)Outdoor locations in listed & identified enclosures, OK! Within 18" of bottom of enclosure.

(3)AL / CU-AL external to buildings shall not terminate within 18" of the earth.

3 2017 NEC

4

(A)Bare aluminum or copper-clad aluminum grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum grounding electrode conductors shall not be permitted within 18" of the earth.

95 ☐ **250.64(B)(2) EXPOSED TO PHYSICAL DAMAGE**

Intent / Clarification

Any / all references for physical protection of grounding electrode conductors enclosed in PVC conduit will now require the use of Schedule 80 rigid polyvinyl chloride conduit.

Whether smaller than #6 AWG or larger

96 ☐

97 ☐ **GROUNDING / BONDING FITTINGS**

1

Servit Fitting

2 Parallel Body Connector aka: Split Bolt

98 ☐

99 ☐ **250.68(C)(3)**
GROUNDING ELECTRODE CONDUCTOR CONNECTIONS

Clarification of Intent

The intent is that the steel rebar system installed within the footing or foundation is *not* suitable as a conductor to interconnect other grounding electrodes of the system.

Rebar has not been tested to be a conductor.

Also corrosion protection

100 ☐ **250.98 BONDING LOOSELY JOINTED METAL RACEWAYS**

Added: Expansion-deflection and Deflection Fittings

Expansion, *expansion-deflection, or deflection* fittings and telescoping sections of metal raceway shall be made electrically continuous by equipment bonding jumpers or other means.

Not Current Code in Ohio

101 ☐ **250.120(B) EQUIPMENT GROUNDING CONDUCTOR INSTALLATION**

Expanded Revisions

Aluminum and Copper-Clad Aluminum Conductors. EGC's of bare, covered, or insulated aluminum or copper-clad aluminum shall comply with the following:

1. Unless *part of a suitable Chapter 3 cable wiring method*, bare or covered conductors shall not be installed in corrosive conditions or be installed in direct contact with *concrete*, masonry, or the earth.
2. Terminations are permitted in *outdoor listed and identified* for the environment enclosures within 18" of the bottom of the enclosure.
3. External to buildings shall not be terminated within 18" of the earth, *unless terminated within a listed wire connector system.*

102 ☐ **250.121(B)**
RESTRICTED USE OF EGC'S

Metal frame of a building or structure

Proposal would *prohibit* the structural metal frame of a building or structure from being used as an equipment grounding conductor (egc).

Clarification of 250.136(A), equipment secured to grounded metal structure. Acceptable to be used as a GEC, but not egc.

Relocated from 250.136(A)

103 ☐

104 ☐ **250.122**
SIZING EQUIPMENT GROUNDING CONDUCTORS

(C) Multiple Circuits – Revision

A single equipment grounding conductor *shall be permitted to be installed for multiple circuits that are installed* in the same raceway, cable, *trench,* or cable tray.

Separate raceways = separate EGC's

EGC Size based on Table 250.122

105 **250.122(B) SIZING EQUIPMENT GROUNDING CONDUCTORS**

N Increased in Size

If ungrounded conductors are increased in size for any reason other than as required in 310.15(B) or 310.15(C), wire-type equipment grounding conductors, if installed, shall be increased in size proportionately to the increase in circular mil area of the ungrounded conductors.

310.15(B) – Ambient Temperature Correction Factors.

310.15(C) – Adjustment Factors

All conductors shall be increased in order to lower the overall voltage drop & impedance (of the GF current path) in order to open the OCD during a phase to ground fault.

106

107 **250.136 EQUIPMENT SECURED TO GROUNDED METAL SUPPORTS**

Clarification

Electrical equipment secured to and *in* electrical contact with a metal rack or structure provided for its support *shall* be permitted to be considered as being connected to an equipment grounding conductor *if the metal rack or structure is connected to an equipment grounding conductor by one of the means indicated in 250.134.*

248 **2020 NEC COMMERCIAL OVERVIEW**

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)

- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

249 ☐ **2020 NEC RESIDENTIAL OVERVIEW**

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

250 ☐

2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Thank You!

CURRENT ADOPTED CODES

July 01, 2019

Current Adopted Codes in Ohio – (2017)

Non-Residential Construction (4- Family and Above)

2017 Ohio Building Code (Based on the 2015 International Building Code)
2017 Ohio Mechanical Code (Based on the 2015 International Mechanical Code)
2017 Ohio Plumbing Code (Based on the 2015 International Plumbing Code)
2017 Ohio Fire Code (Based on the 2015 International Fire Code)
2017 NFPA 70 – National Electrical Code (Effective 11.01.2017)
2016 NFPA 13 – Standard for Installation of Sprinkler Systems
2016 NFPA 72 – National Fire Alarm and Signaling Code
2015 International Fuel Gas Code
2012 International Energy Conservation Code / ASHRAE 90.1 2010
ICC / ANSI A117.1 2009 Accessible & Usable Buildings and Facilities

Residential Construction (1, 2 and 3- Family Dwellings)

2019 Residential Code of Ohio (Based on the 2015 International Residential Code)
2017 Ohio Plumbing Code
2017 NFPA 70 – National Electrical Code w/ amendments (07.01.2019)
2018 International Energy Conservation Code

March 24, 2020

Current Adopted Building Codes in West Virginia

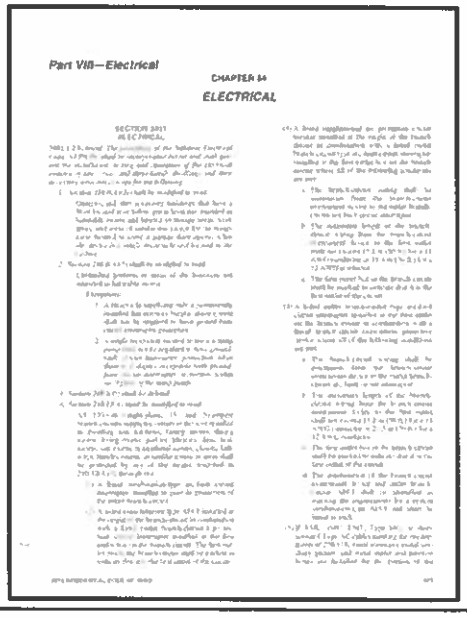
The State of West Virginia Fire Commission has adopted statewide the 2015 ICC (International Code Council), family of Codes for any jurisdiction that chooses to enforce building codes. Check locally for enforcement information / details.

2015 International Building Code (IBC)
2009 International Energy Conservation Code (IECC)
2015 International Existing Building Code (IEBC)
2015 International Fuel Gas Code (IFGC)
2015 International Mechanical Code (IMC)
2015 International Plumbing Code (IPC)
2012 International Property Maintenance Code (IPMC)
2015 International Residential Code (1- & 2- Family) (IRC)
2015 International Swimming Pool & Spa Code (ISPSC)

2015 NFPA 1 – Fire Code (Effective 07.01.2018)
2015 NFPA 101 – Life Safety Code (Effective 07.01.2016)
2017 NFPA 70 – National Electrical Code (Effective 03.24.2020)

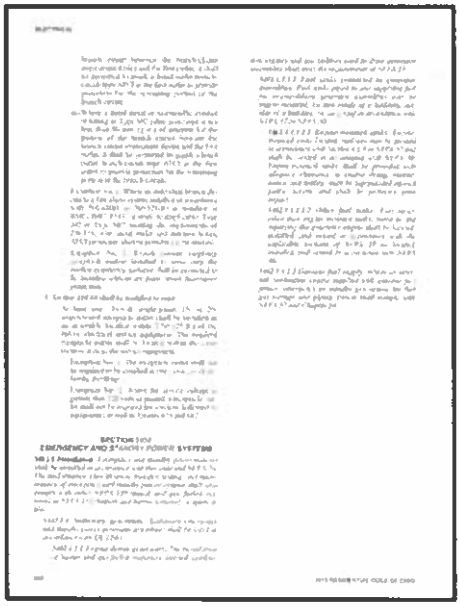
2

2019 RESIDENTIAL CODE OF OHIO


Part VIII—Electrical

CHAPTER 34

ELECTRICAL



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www.ta191.com

2020 "Proposed" National Electrical Code (NEC) Changes & Updates

Training Agency #191

150 Maplecrest Street SW
North Canton, Ohio 44720
330.497.6309 Phone

John M. Labriola

www.ta191.com

2020

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THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

2020

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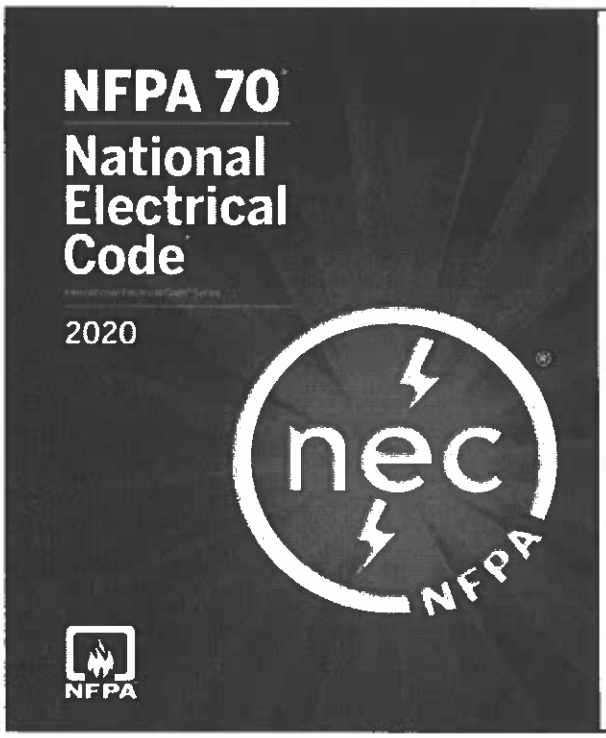

"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)

Subject to the local or State adoption authority

2020

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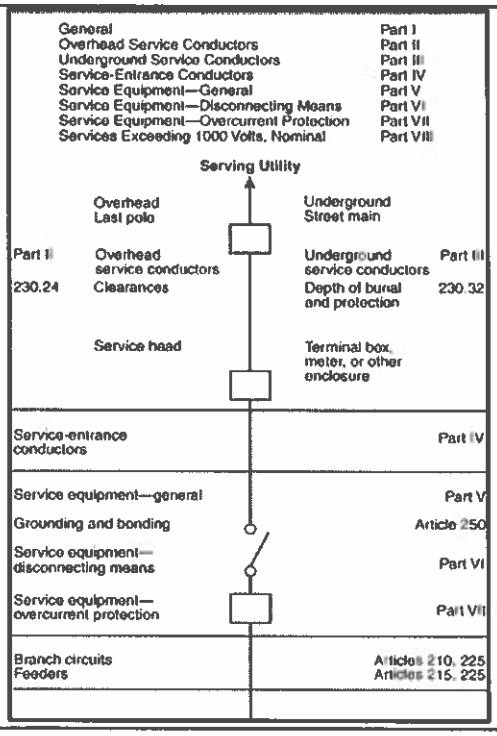

ARTICLE 230 SERVICES

230.1 Scope

This article covers service conductors and equipment for control and protection of services and their installation requirements.

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2020

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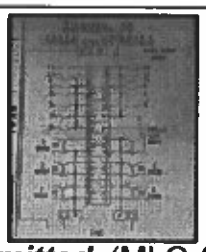
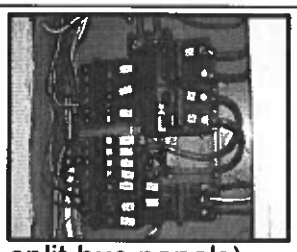
ARTICLE 230 - SERVICES

General Safety Issues Addressed





Panelboards with 6 SE disconnects ***no longer permitted***. (MLO & split-bus panels)

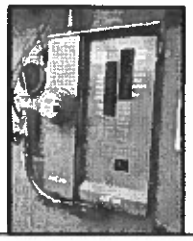
Firefighter exterior SE disconnects for one- and two- family dwellings.

Line-side barriers to SE equipment to extend beyond panelboards only.

Arc-reduction for 1200 amps and greater to incorporate this technology (1/1/2020).

SCCR identification for pressure connectors and devices as ***"suitable for use on the line side of SE equipment"*** *(2017 NEC "PDB's).*

Surge protective devices ***(SPD's)*** now required for ***all*** dwelling units.



Not Current Code in Ohio

2020

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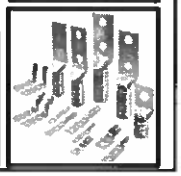
230.46 SPLICED AND *TAPPED* CONDUCTORS

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 (PDB's), pressure connectors, and devices for splices and taps shall be listed. PDB's installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.***

Effective 01.01.2023; pressure connectors and devices for splices and taps installed on service conductors shall be marked "suitable for use on the line side of service equipment" or equivalent.

IE: Protective covers



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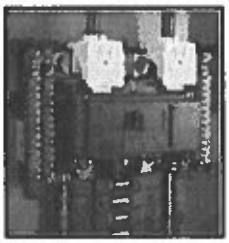
N 230.62 (C) BARRIERS

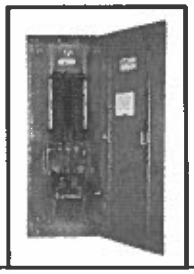


Relocated from 408.3(A)

Barriers shall be placed in *SE* 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.

Now applies to all SE Equipment

Exception Removed:



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N 230.67 SURGE PROTECTION

(A) *N* SPD Device. All services supplying dwelling units shall be provided with a surge-protective device (SPD).

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

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

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

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

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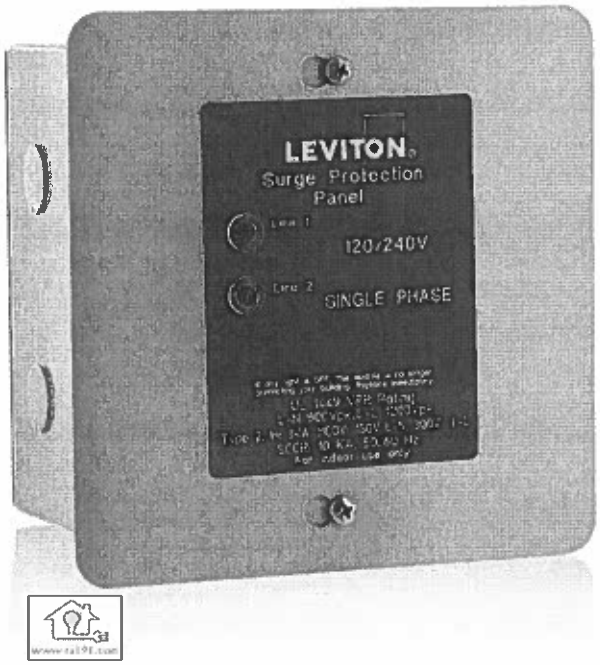

N 230.67 SURGE PROTECTION FOR DWELLING UNITS

All services supplying dwelling units shall be provided with a surge protection device (SPD). Designed to protect against surges to electrical systems.

New Construction and Upgrades

Type 1 or Type 2 SPD

Not Current Code in Ohio

2020

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230.71 MAXIMUM NUMBER OF DISCONNECTS

Each service shall have only one disconnecting means unless the requirements of 230.71(B) are met.

230.71(B) Two to six service disconnects shall be permitted ***for each service permitted by 230.2 or for each set of SE conductors permitted by 230.40, Ex. 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, each with a main SE disconnect.***
2. ***Panelboards with a main SE disconnect.***
3. ***Vertical switchboard sections that have separate SE disc.***
4. ***SE disconnect in meter mods where each disconnect is located in a separate compartment.***

Refer to Informational Notes 1 & 2

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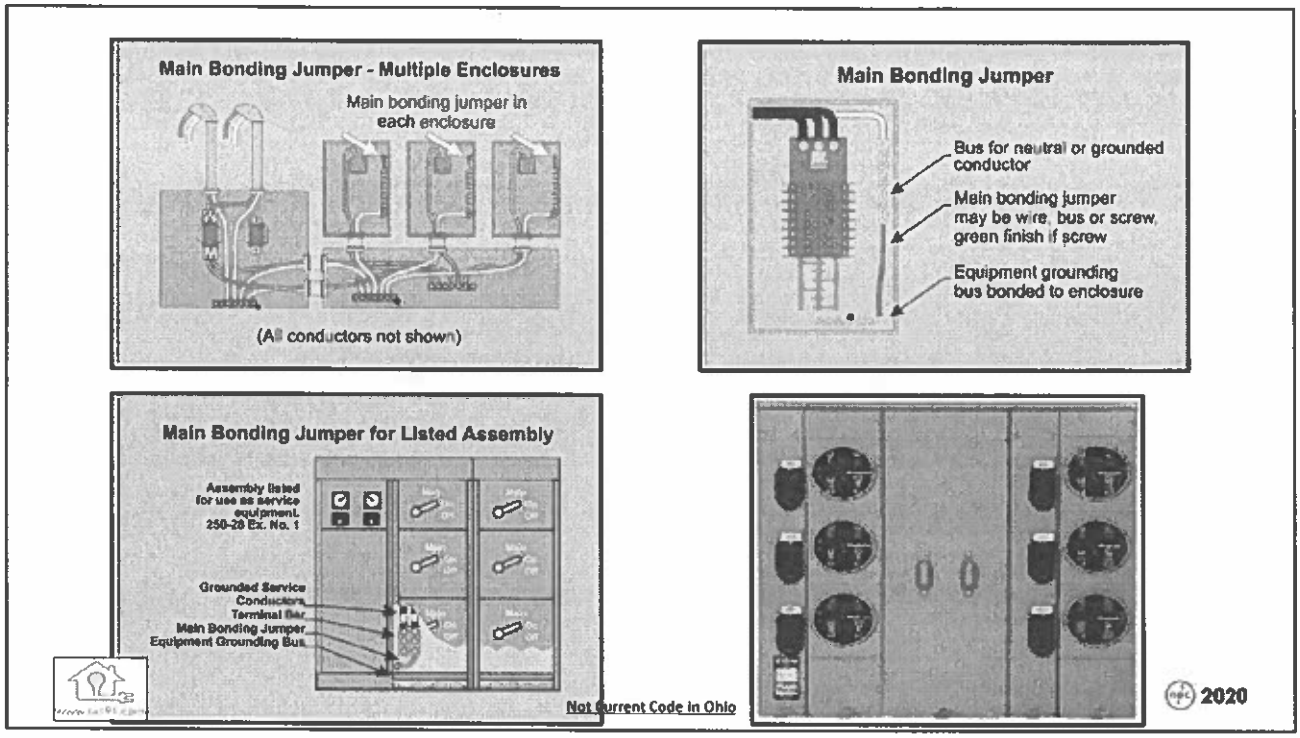

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Δ 230.82 EQUIPMENT CONNECTED TO THE SUPPLY-SIDE OF SERVICE DISCONNECT

Revision

(6) Solar PV, fuel cells, wind electric, energy storage, or interconnected electric power production systems, ***if provided with a disconnecting means listed as SUSE rated and overcurrent protection as specified in Part VII of Article 230.***

(10) Emergency disconnects in accordance to 230.85, if all metal housings and SE enclosures are grounded (Part VII) and bonded in accordance with Article 250 (Part V).

(11) Meter mounted transfer switches, rated <1000-v, have appropriate SCCR equal to or greater than the AFC. The transfer switch shall be listed and be capable of transferring the load served. Identified on its exterior with both:
(a) Meter-mounted transfer switch
(b) Not service equipment.

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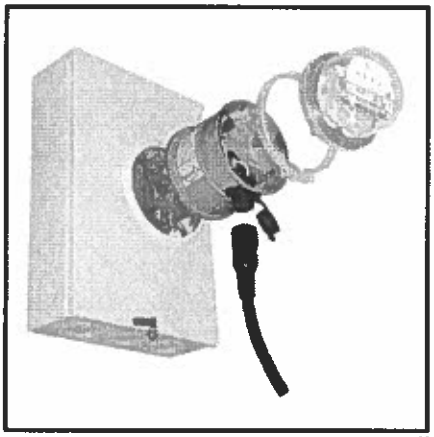
METER MOUNTED TRANSFER SWITCHES

Gener Link w/ 75kA Surge Protection per phase

For Portable Generators



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2020

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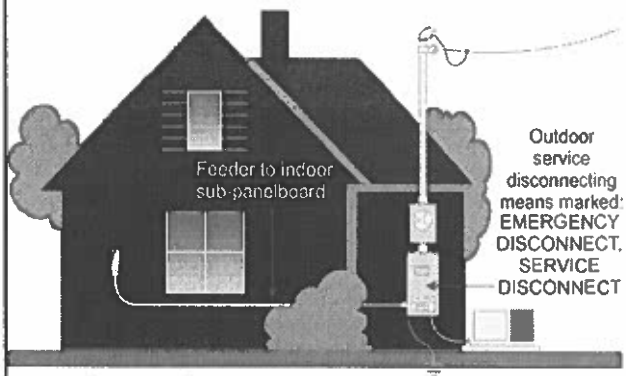
230.85 Exterior Emergency Disconnect(s)



For dwellings, all service conductors to 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

230.85 "NEW" EXTERIOR EMERGENCY "SE" DISCONNECT

Applies to 1- and 2-Family Dwelling Units

All **service conductors to terminate in a SUSE rated disconnecting means, with adequate SCCR, in a readily accessible *outdoor* location. Grouping is required.**

Intent to protect firefighters / other emergency personnel.

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230.85 EMERGENCY DISCONNECTS

Each emergency disconnect shall be one of the following:

(1) Service disconnects marked:

"EMERGENCY DISCONNECT, SERVICE DISCONNECT"

(2) Meter disconnects installed per 230.82(3) & marked:

"EMERGENCY DISCONNECT, METER DISCONNECT, NOT SERVICE DISCONNECT"

(3) Other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are suitable for use as service equipment & marked:

"EMERGENCY DISCONNECT, NOT SERVICE EQUIPMENT"

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2020

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NEWS

09.20.2020
FIRST ENERGY
ANNOUNCES
SMART METER
CONVERSION;
INDICATES 700K TO BE
INSTALLED IN OHIO

2020

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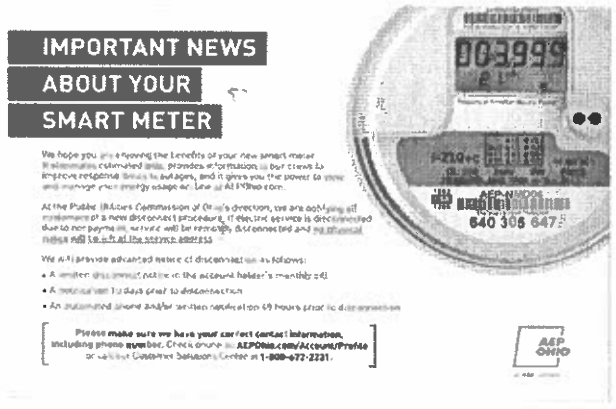
AEP SMART METER FLYER 01.18.2020

AEP AMERICAN ELECTRIC POWER



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SMART METER RESIDENTIAL APPLICATION

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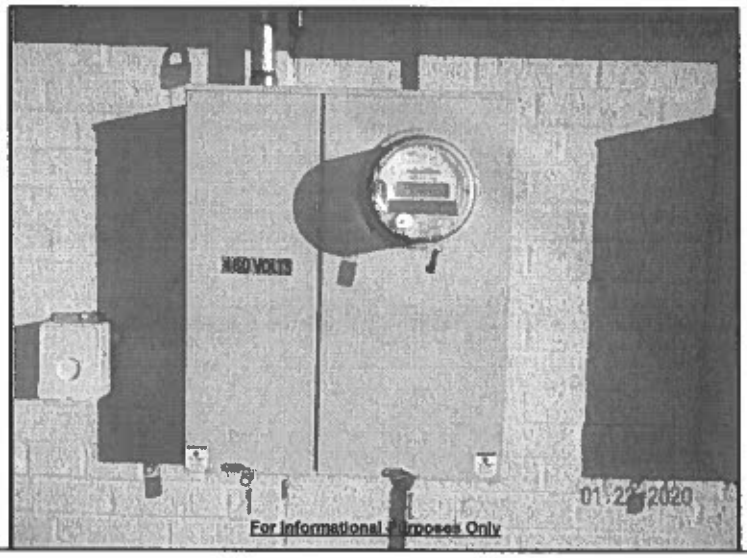
SMART METER UTILIZED FOR MULTIPLE VOLTAGES / PHASES



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240.67(C) & 240.87(C) PERFORMANCE TESTING (NEW) ARC-ENERGY REDUCTION (FUSES / CKT. BRKRS)

2017 NEC Effective Date: 01.01.2020 (Fuses)

(A) Documentation
(B) Method to Reduce clearing Time
(C) *Performance Testing (NEW)*

AER Protection System – Tested when 1st installed
Qualified person, primary current injection & manufacturer test
Written record made available to AHJ

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2020

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240.88 RECONDITIONED EQUIPMENT (NEW)

(A) Circuit Breakers

(1) Molded-case circuit breakers ***shall not*** be reconditioned
(2) Low-and medium-voltage circuit breakers ***shall be permitted*** to be reconditioned.
(3) High-voltage circuit breakers ***shall be permitted*** to be reconditioned.

(B) Components

(1) Low-voltage power circuit breaker electronic trip units ***shall not*** be reconditioned.
(2) Electromechanical protective relays and c/t's ***shall be permitted*** to be reconditioned.

Not Current Code in Ohio

2020

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ARTICLE 242 (NEW) OVERVOLTAGE PROTECTION

Discusses overvoltage connection requirements. Permanently installed surge-protective devices (SPD's) not more than 1000-v and permanently installed surge arresters over 1000-v.

(Relocated information from Articles 280 & 285)

Type 1 SPD- Connected at the Service- line or load
Type 2 SPD- Connected on load Side of Service Disc.
Type 3 SPD- Connected to load side of Branch OCD

Each SE Disc. Should be Protected!

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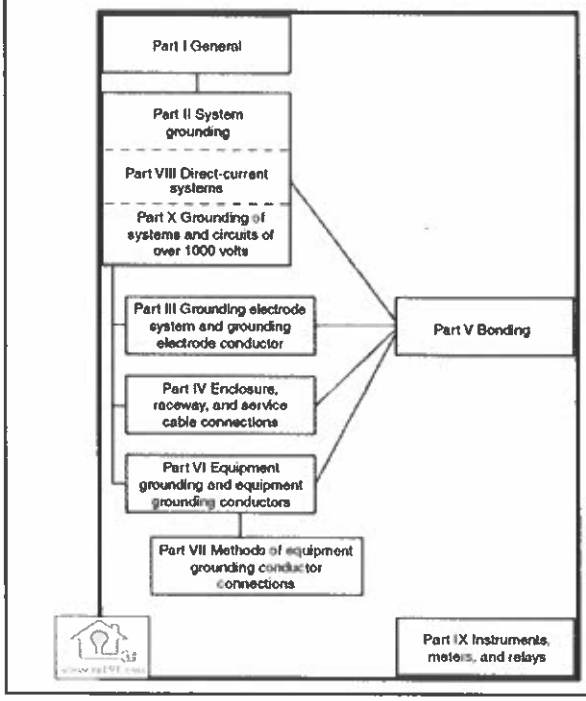

ARTICLE 250 GROUNDING & BONDING

250.4(A)(1) Electrical System Grounding

Electrical systems that are grounded shall be connected to earth in a manner that will limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operation.

250.4(A)(5) Effective Ground-Fault Path.

Installed in a manner that creates a low-impedance path that facilitates the operation of the OCD in a safe manner.

Not Current Code in Ohio

2020

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N 250.25

(NEW GROUNDING SYSTEMS PERMITTED TO BE CONNECTED ON THE SUPPLY-SIDE OF THE SE DISCONNECT)

The intent is that supply-side equipment [***whether considered a service or not***] needs to be properly grounded to a grounding electrode system. In order to create an effective fault current path. [Refer to 250.92 250.102(C)].
Systems such as wind, solar, fuel cells, and interconnected power production.

Note: 250.24(D) GEC Sized per Table 250.66

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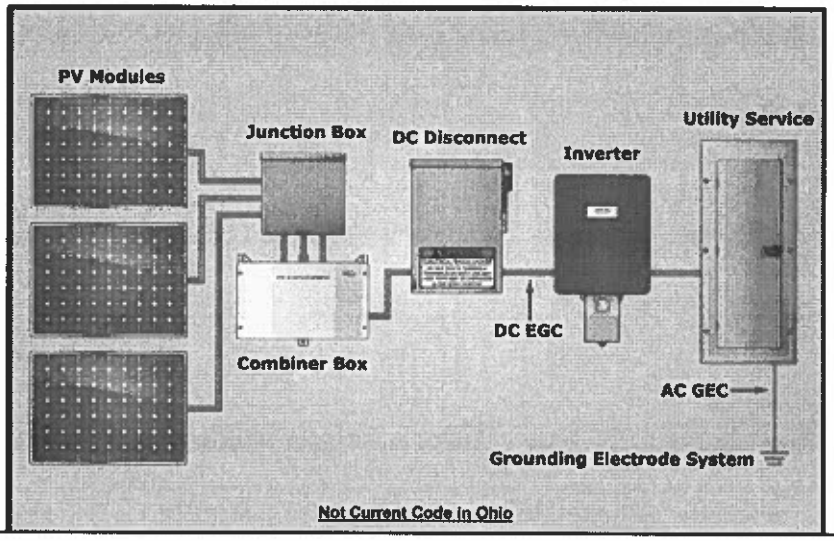
N 250.25(A) SUPPLY-SIDE SE GROUNDING INSTALLED IN SEPARATE ENCLOSURES FROM SE EQUIPMENT



2020

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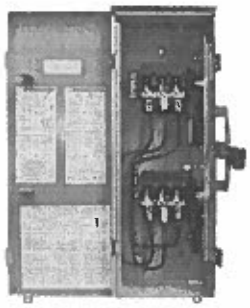
MANUAL TRANSFER SWITCHES

200a 2-pole 240-v 1ø

200a 3-pole 480-v 3ø



2020

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N 250.30(A)(1) EX. (3)(B)EXCEPTION GROUNDING SEPARATELY DERIVED SYSTEMS

System Bonding Jumper

N* Ex. *Separately derived systems consisting of multiple sources of the same type that are connected in parallel shall be permitted to have the system bonding jumper installed at the paralleling switchgear, switchboard, or other paralleling connection point instead of at the disconnecting means located at each separate source.

Not Current Code in Ohio

2020

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PARALLELING OF TRANSFORMERS

Transformers operating in parallel

Occurs in installations that have their primary windings of the ***paralleled*** transformers connected to the same voltage supply and the secondary windings are connected to a common load.

***Note*: Transformers need to have the same Kva rating, turn ratios, and impedance characteristics. This would create equal load sharing between the source transformers, without creating circulating currents in the windings (heat loss).**

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N 250.30(A)(6) EX. #3 GEC MULTIPLE SEPARATELY DERIVED SYSTEMS

Relocated from 250.30(A)(6) Ex. 2(B) Ex. Tap Conductor Size

Now Expanded for all GEC, Multiple Separately Derived Systems

If the source of a separately derived system is located within equipment listed and identified as suitable for use as service equipment (SUSE), the grounding electrode conductor from the service or feeder equipment to the grounding electrode shall be permitted as the grounding electrode conductor for the separately derived system, if the grounding electrode conductor is of sufficient size for the separately derived system. If the equipment grounding bus internal to the equipment is not smaller than the required grounding electrode conductor for the separately derived system, the grounding electrode connection for the separately derived system shall be permitted to be made to the bus

Not Current Code in Ohio

2020

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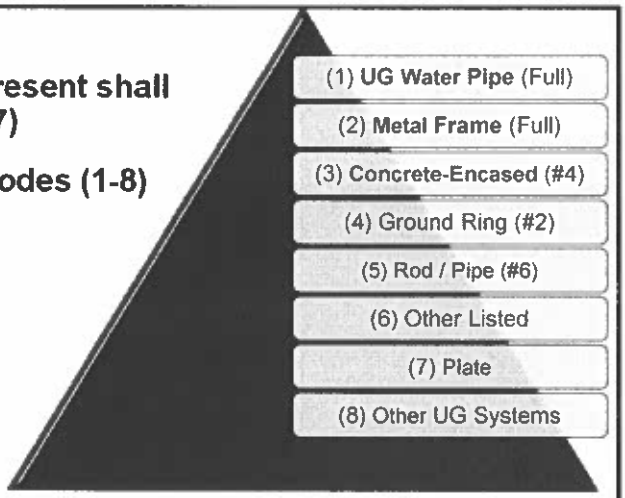
GROUNDING TRIANGLE / FOUNDATION

250.50 All Electrodes present shall be bonded together (1-7)

250.52 Permitted Electrodes (1-8)

Focus:

1. Metal UG Water Pipe
2. Building Steel
3. Concrete-Encased
4. Rod / Pipe



2020

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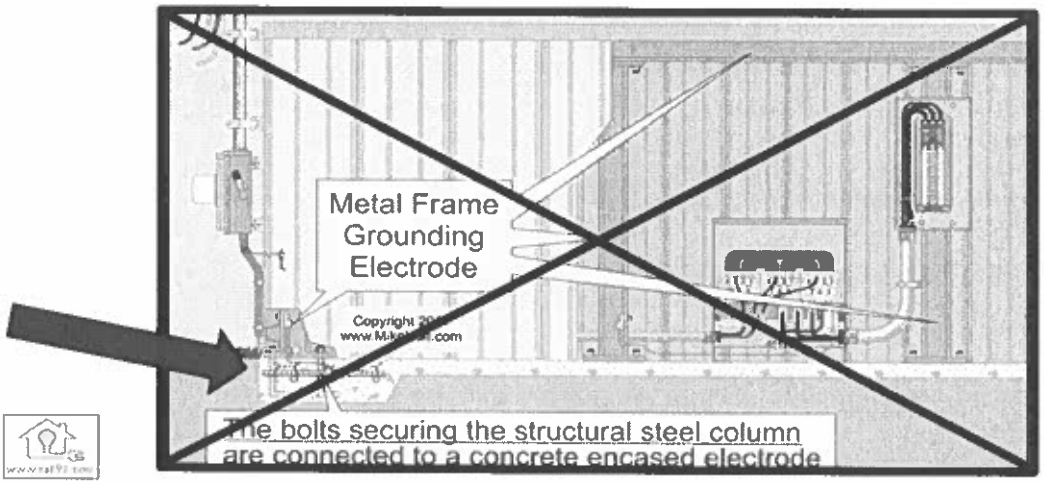
N 2017 NEC 250.52(A)(2) METAL IN-GROUND SUPPORT STRUCTURES



2020

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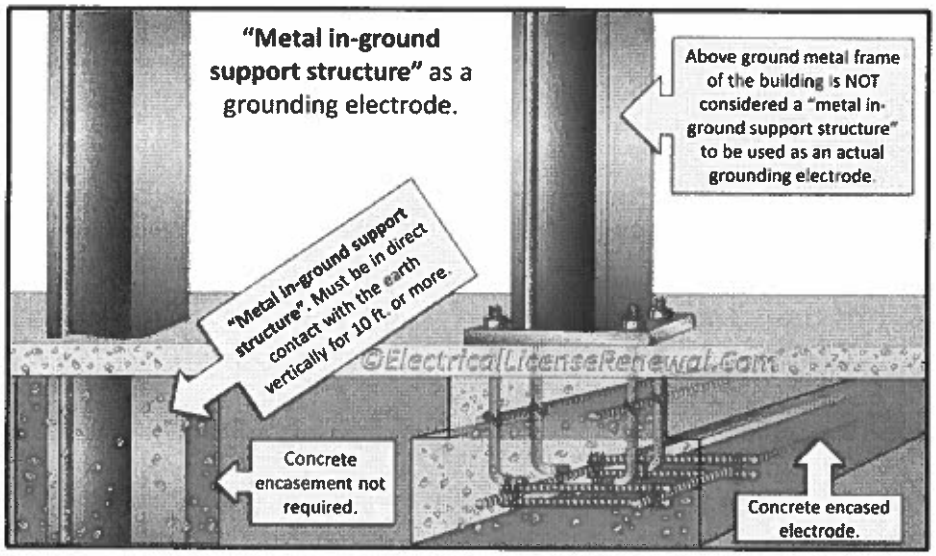
EFFECTIVELY GROUNDED STEEL STRUCTURE



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250.64(A) GEC INSTALLATION AL OR COPPER-CLAD AL CONDUCTORS

2020 NEC

Revised / Expanded Details

(1) Conductors w/o an extruded polymeric covering shall not be installed in corrosive conditions or in direct contact with ***concrete***

(2) Outdoor locations in listed & identified enclosures, OK! Within 18" of bottom of enclosure.

(3) AL / CU-AL external to buildings shall not terminate within 18" of the earth.

2017 NEC

(A) Bare aluminum or copper-clad aluminum grounding electrode conductors shall **not** be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum grounding electrode conductors shall not be permitted within 18" of the earth.

For Informational Purposes Only

2020

94

250.64(B)(2) EXPOSED TO PHYSICAL DAMAGE

Intent / Clarification

Any / all references for physical protection of grounding electrode conductors enclosed in PVC conduit will now require the use of Schedule 80 rigid polyvinyl chloride conduit.

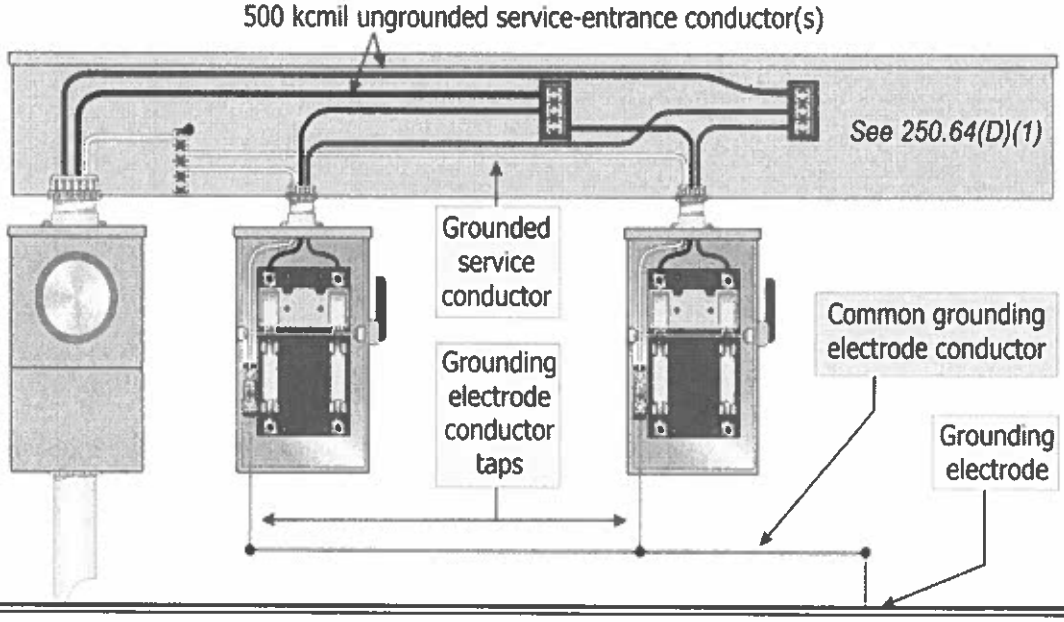
Whether smaller than #6 AWG or larger

Not Current Code in Ohio

2020

95

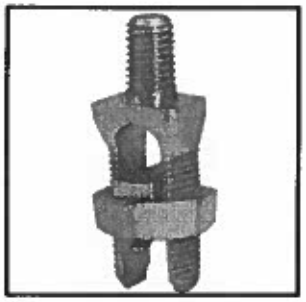
Taps to Common Grounding Electrode Conductor



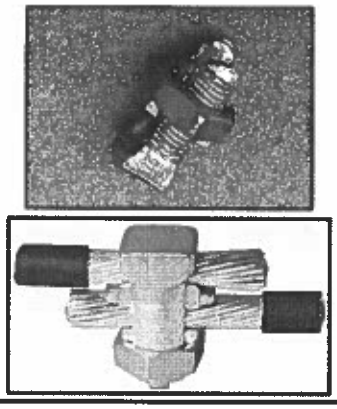
96

GROUNDING / BONDING FITTINGS

Servit Fitting



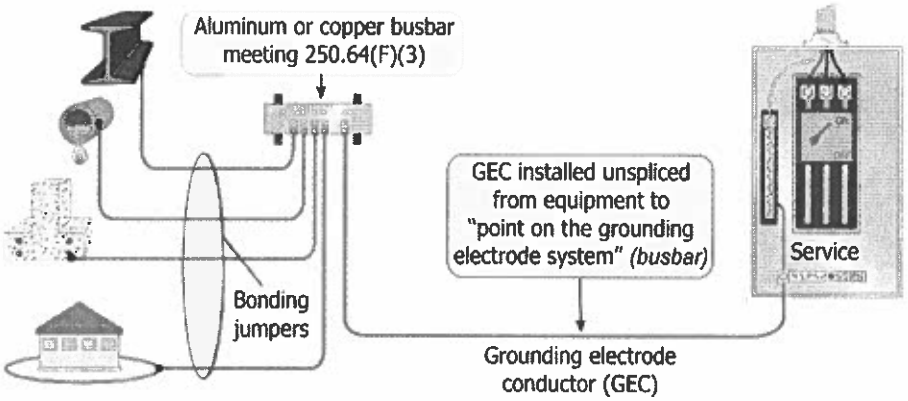
Parallel Body Connector aka: Split Bolt



2020

97

250.64(F) Installation to Electrode(s)



Bonding jumper(s) from grounding electrodes and grounding electrode conductors are permitted to be connected to copper or aluminum busbars to form the grounding electrode system

Connection to be made by a listed connector or by the exothermic welding process

98

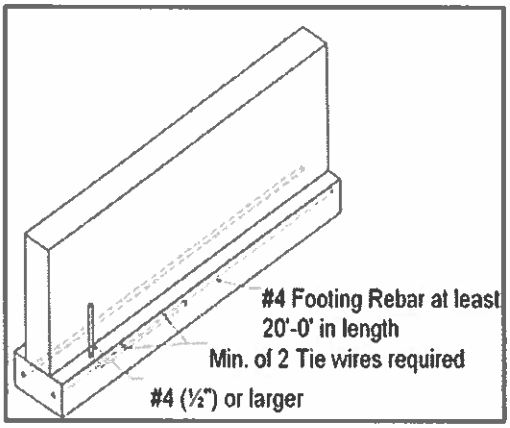
250.68(C)(3) GROUNDING ELECTRODE CONDUCTOR CONNECTIONS

Clarification of Intent

The intent is that the steel rebar system installed within the footing or foundation is *not* suitable as a conductor to interconnect other grounding electrodes of the system.

Rebar has not been tested to be a conductor.

****Also corrosion protection****



For Informational Purposes Only

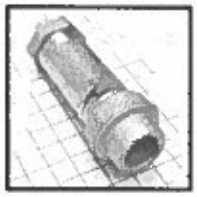
2020

99

250.98 BONDING LOOSELY JOINTED METAL RACEWAYS

Added: Expansion-deflection and Deflection Fittings

Expansion, ***expansion-deflection, or deflection*** fittings and telescoping sections of metal raceway shall be made electrically continuous by equipment bonding jumpers or other means.



Not Current Code in Ohio

2020

100

250.120(B) EQUIPMENT GROUNDING CONDUCTOR INSTALLATION

Expanded Revisions

Aluminum and Copper-Clad Aluminum Conductors. EGC's of bare, covered, or insulated aluminum or copper-clad aluminum shall comply with the following:

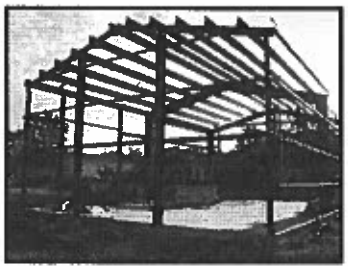
1. Unless ***part of a suitable Chapter 3 cable wiring method***, bare or covered conductors shall not be installed in corrosive conditions or be installed in direct contact with ***concrete***, masonry, or the earth.
2. Terminations are permitted in ***outdoor listed and identified*** for the environment enclosures within 18" of the bottom of the enclosure.
3. External to buildings shall not be terminated within 18" of the earth, ***unless terminated within a listed wire connector system***.

For Informational Purposes Only

2020

101

250.121(B) RESTRICTED USE OF EGC'S



Metal frame of a building or structure

Proposal would *prohibit* the structural metal frame of a building or structure from being used as an equipment grounding conductor (egc).

Clarification of 250.136(A), equipment secured to grounded metal structure. Acceptable to be used as a GEC, but not egc.

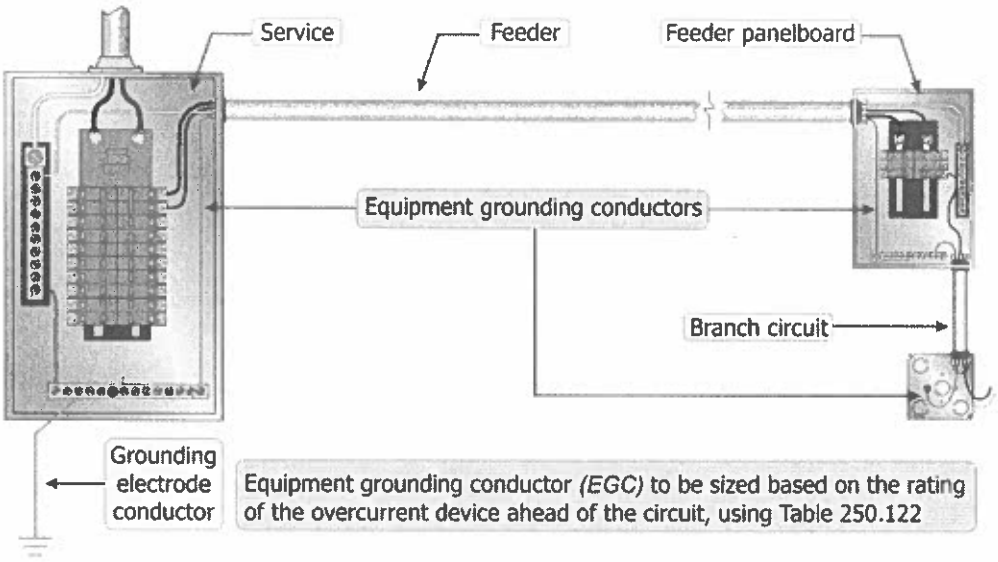
Relocated from 250.136(A)

Not Current Code in Ohio

2020

102

250.122(A) Sizing Equipment Grounding Conductors *(EGC)*



103

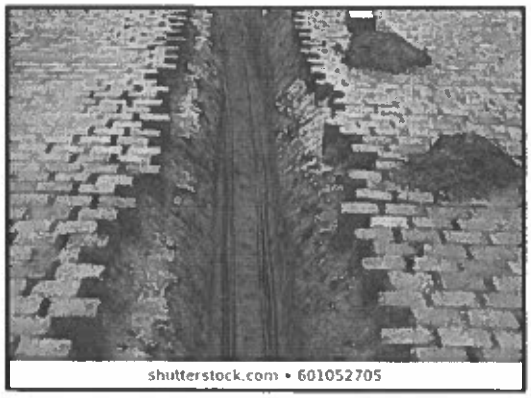
250.122
SIZING EQUIPMENT GROUNDING CONDUCTORS

(C) Multiple Circuits – Revision

A single equipment grounding conductor ***shall be permitted to be installed for multiple circuits that are installed*** in the same raceway, cable, ***trench,*** or cable tray.

Separate raceways = separate EGC's

EGC Size based on Table 250.122



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2020

104

250.122(B) SIZING EQUIPMENT GROUNDING CONDUCTORS

N Increased in Size

If ungrounded conductors are increased in size for any reason other than as required in 310.15(B) or 310.15(C), wire-type equipment grounding conductors, if installed, shall be increased in size proportionately to the increase in circular mil area of the ungrounded conductors.

310.15(B) – Ambient Temperature Correction Factors.

310.15(C) – Adjustment Factors

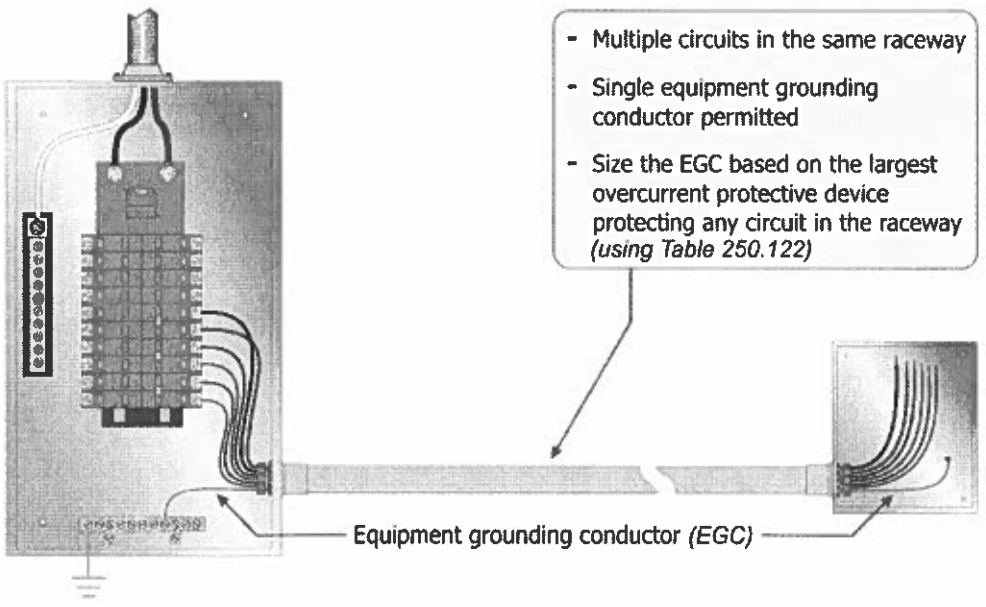
All conductors shall be increased in order to lower the overall voltage drop & impedance (of the GF current path) in order to open the OCD during a phase to ground fault.

Not Current Code in Ohio

2020

105

250.122(C) Multiple Circuits in the Same Raceway

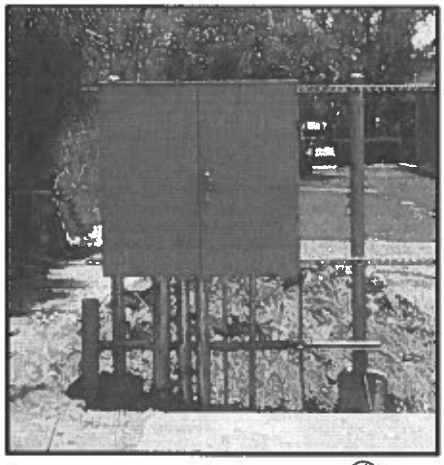


106

250.136 EQUIPMENT SECURED TO GROUNDED METAL SUPPORTS

Clarification

Electrical equipment secured to and ***in*** electrical contact with a metal rack or structure provided for its support ***shall*** be permitted to be considered as being connected to an equipment grounding conductor ***if the metal rack or structure is connected to an equipment grounding conductor by one of the means indicated in 250.134.***



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2020

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2020 NEC COMMERCIAL OVERVIEW

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

Not Current Code in Ohio

2020

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2020 NEC RESIDENTIAL OVERVIEW

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

For Informational Purposes Only

2020

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2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Labriola Training Agency #191
www.ta191.com

John M. Labriola
Principal

150 Maplecrest Street SW
North Canton, Ohio 44720

330.497.6309 Phone
330.606.8098 Cell
john@ta191.com

www.ta191.com

Thank You!

250

File Attachments for Item:

EC-7 2020 NEC Changes and Updates Articles 90 through 210.8(a) (Labriola)

All certifications except plumbing (4 hours)

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: John M. Labriola (Contact Name)
Organization: Training Agency #191 (Organization/Company)
Address: 150 Maplecrest St. SW (Include Room Number, Suite, etc.)
City: North Canton State: Ohio Zip: 44720
E-Mail: john@ta191.com
Telephone: 330.497.6309 Fax:
Course Sponsor: None

COURSE INFORMATION:

Course Title: 2020 National Electrical Code Changes & Updates - Articles 90 - 210.8(a)

New Course Submittal: ■ Update Course: ☐ Prior Approval Number:

Purpose and Objective:
To provide BBS certified personnel a better understanding of the changes & Updates to the 2020 National electrical Code.
by utilizing a power-point presentation and real-life examples, for no charge to attendees.

Number of Instructional Contact Hours that can be obtained upon completion: 4 Hours

If Multi-Session, Number of Instructional Contact Hours Per Session:

Program Applicable for the Following Participants:

Building Official ■	Master Plans Examiner ■	Building Inspector ■	Fire Protection Inspector ■	Mechanical Inspector ■
	Plumbing Plans Exam. ☐			Plumbing Inspector ☐
	Electrical Plans Exam. ■			Non-Res IU Inspector ■
	Mechanical Plans Exam. ■			

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ■ Res IU Inspector ■

Electrical Safety Inspectors [x]
Location of ESI Course: Various locations Date(s) of ESI Course(s): TBD

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

RECEIVED
MAY 04 2022
BOARD OF BUILDING STANDARDS

Form 1526 BBS 5102321

October 16, 2020

John M. Labriola
150 Maplecrest St. SW
North Canton, Ohio 44720

330.497.6309 Home 330.606.8098 Cell

Professional Bio'

Education

2012- 1984	Akron University, Stark State College: Continuing Education
1975	St. Thomas Aquinas High School; Louisville, Ohio
1971	Fairmount Elementary; Canton, Ohio

Building Department Experience

2017 – 2009	Summit County, Ohio; Chief Building Official (retired)
2009 – 2006	City of Canton, Ohio; Chief Building Official
2008 – 1997	City of Alliance, Ohio; Back-up Building and Electrical Inspector
2006 – 1997	City of North Canton, Ohio; Building and Electrical Inspector
1997 – 1986	Stark County, Ohio; Chief Electrical Inspector
1988 – 1984	City of Louisville, Ohio; Part-time Electrical Inspector

Current Certifications Held

International Code Council (ICC)

Accessibility Inspector/ Plans Examiner, Building Inspector, Building Plans Examiner, Certified Building Code Official, Certified Building Official, Certified Electrical Code Official, Certified Mechanical Code Official, Commercial Electrical Inspector, Commercial Mechanical Inspector, Commercial Plumbing Inspector, Electrical Inspector, Electrical Plans Examiner, Fire Plans Examiner, Master Code Professional, Mechanical Inspector, Mechanical Plans Examiner, Property Maintenance and Housing Inspector, Residential Electrical Inspector, Residential Energy Inspector / Plans Examiner, Residential Mechanical Inspector and Residential Plumbing Inspector.

State of Ohio:

Building Inspector, Building Official, Building Plans Examiner, Electrical Plans Examiner, Electrical Safety Inspector, Fire Protection Plans Examiner, Mechanical Plans Examiner and Residential Building Official.

Construction Experience

2007 – 1986	President; Electrical Design and Construction Co.
2004 – Present	State of South Carolina; Licensed Commercial Contractor
1992 – Present	State of Ohio; Licensed Electrical Contractor
1986 – 1981	Owner; Labriola Electric
1981 – 1975	Pedersen Electric; Helper / Apprentice / Journeyman Electrician
1980 – Present	Journeyman Electrician; City of Canton, Ohio

Professional Organization Memberships

2010 – 2017	American Institute of Architects - Akron Chapter (AIA-Akron)
2009 – 2017	Building Officials Code Officials of Northeast Ohio (BOCONEO)
2009 – 2017	National Fire Protection Association (NFPA)
1997 – 2017	Five County Building Officials Association (FBOA)
1997 – 2017	Ohio Building Officials Association (OBOA)
1986 – Present	International Association of Electrical Inspectors (IAEI)

Appointments (Director Positions)

2011 – 2017	Air-Conditioning Contractors Association of Akron / Canton
2011 – 2017	Home Builders Association of Summit and Portage Counties

Teaching Experience

2012 – 2017	Instructor; Home Builders Association of Greater Cleveland
2012 – 2017	Instructor; Home Builders Association of Summit and Portage Counties
2012 – Present	Instructor; National Electrical Contractors Association (NECA); Greater Cleveland, Ohio Division
2011 – Present	Instructor; Northeast Ohio Electrical Contractors Association (NOECA)
2005	Instructor; Clemson University; Clemson, South Carolina
2004 – Present	Instructor; Electrical League of Ohio; Cleveland, Ohio
2000 – 2016	Instructor; Stark State College of Technology: North Canton, Ohio
1999 – Present	Instructor; National Electrical Contractors Association (NECA); Akron, Ohio Division
1991 – 2009	OCILB Approved Contractor Training Agency
1990 – Present	State of Ohio; Approved Electrical Safety Inspector, Instructor

Respectfully,
John M. Labriola
John M. Labriola
OBBS ID #815
john@ta191.com

www.ta191.com

May 02, 2022

Labriola Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720

Ohio Board of Building Standards
6606 Tussing Road – PO Box 4009
Reynoldsburg, Ohio 43068 – 9009

Course Submittal #1 – 4 Hours

Code Sections to be discussed in detail Article 90 – 210.8(A)

2020 NEC Code Adoption Process in Ohio

Highlights of the class will include Article 100 (Definitions)

Article 210 – Branch Circuits (GFCI Protection)

1 ☐ **OCILB LICENSE INFORMATION**

2 ☐ **CURRENT ADOPTED CODES**

3 ☐ **2019 RESIDENTIAL CODE OF OHIO**

4 ☐

5 ☐

THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

6 ☐ **"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)**

Subject to the local or State adoption authority

7 ☐ **OHIO LEGISLATION 3783.02**

- Ohio Revised Code Section 3783.02 Exemptions. Effective: November 3, 1989 Legislation: House Bill 222 - 118th General Assembly Nothing in sections 3783.01 to 3783.08 of the Revised Code shall apply to inspection of the design, construction, maintenance, or replacement of any of the following: (A) Installations in ships, watercraft, railway rolling stock, aircraft, or automotive vehicles; (B) Installations underground in mines; (C) Installations of railways for the generation, transformation, transmission, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communication purposes; (D) Installations of communication equipment under control of communication utilities, located outdoors or in building spaces used for such installations; (E) Installations under the control of electric utilities for the purpose of communication, metering, or for the generation, control, transformation, transmission, and distribution of electric energy located in building spaces used by utilities for such purposes or located on property owned or leased by the utility or on public highways, streets, roads, etc., or by established rights on private property; (F) Installations of elevators, dumbwaiters, and escalators as regulated by the bureau of workers' compensation.

8 ☐ **2020 NATIONAL ELECTRICAL CODE (NEC) PROPOSED CHANGES AND UPDATE INFORMATION DETAILS**

Based on the 2020 National Electrical Code (NFPA 70) as published by the National Fire Protection Association (NFPA).

All information contained within this presentation is my personal and professional opinion, based upon over 43 years in the construction industry.

9 ☐ **2020 NATIONAL ELECTRICAL CODE**

Identifying Changes throughout the Code

Over 3,700 public inputs / 1,900 comments

New Revision Symbols

Δ before a section number = words in section deleted

Δ to left of table or figure = revision to table or figure

Δ throughout chapter = heavy revision to entire chapter

10 ☐

11 ☐

12 ☐ **NFPA STATE UPDATE MAP**

13 ☐ **NFPA STATE UPDATE MAP**

14 ☐ **2023 NEC WILL BE HERE SOON!!**

15 ☐ **ADDITIONAL USEFUL NFPA PUBLICATIONS**

16 ☐ **POWER CO. SERVICE GUIDES**

17 ☐ **(4) "*NEW*" ARTICLES**

Article 242 Overvoltage Protection

Article 311 Medium Voltage Conductors and Cable

Article 337 Type "P" Cable (Hazardous Locations)

Article 805 General Requirements for Communication Systems

18 ☐ **CHAPTER 1**

General

Article 100 – Definitions

Article 110 – Requirements for Electrical Installations

19 ☐

ARTICLE 100- DEFINITIONS

If a definition is utilized in two or more Articles
the definition will be in Article 100

Now Three Subparts

Part I. – General
Part II. – Over 1000 Volts. Nominal
Part III. – Hazardous Classified Locations. (CMP-14)

20 ☐ **ARTICLE 100**
DEFINITIONS

Available Fault Current

Fault Current:
The current delivered at a point on the system during a short-circuit condition. (CMP-10)

Available Fault Current:
The largest amount of current capable of being delivered at a point on the system during a short-circuit condition. (CMP-10)

Note: AFC is calculated at load-side terminals of the source and line-side terminals of OCPD and all other load locations.
Not Current Code in Ohio

21 ☐ **110.14(D) TERMINAL TIGHTENING 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 Notes: 1, 2 & 3
Shear bolts, breakaway-style devices with visual indicators
NFPA 70(B)-Electrical Equipment Maintenance

22 ☐ **110.22(A) IDENTIFICATION OF DISCONNECTING MEANS - GENERAL**

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. Re: ***ANSI Z535.4 2011 (R2017)***

23 ☐ **110.24(A) AVAILABLE FAULT CURRENT - FIELD MARKING**

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 of the calculation was performed and be of sufficient durability to withstand the environment involved.

Information Note 1 – Recognizes NFPA 70E- 2018

N Informational Note 2 – Values of AFC current for use in determining appropriate minimum SCCR of SE equipment is available from electric utilities in published or other forms.

Assistance from the local electrical utility

24 ☐ **110.26(A)(3) HEIGHT OF WORKING SPACE**

Revision

The work space shall be clear and extend from the grade, floor or platform to a height of 78" or the height of equipment, whichever is greater. Within the height requirements of this section, other equipment *or support structures, such as concrete pads shall not extend more than 6" beyond the front of the electrical equipment.*

25 ☐ **110.26(C)(2) LARGE EQUIPMENT –**
RATED 1200 AMPERES OR GREATER

Large Equipment is defined as follows:

(1) For equipment rated 1200 amperes or more and over 6' wide.

(2) For SE disconnecting means installed in accordance with 230.71 where the combined ampere rating is 1200 amperes or more and over 6' wide.

26 ☐ **ARTICLE 110.26(C)(2)**

The one entrance requirement has been 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 24" wide & 78" high at *each end of the working space*.

27 ☐ **CHAPTER 2**

Wiring and Protection

Article 210 – Branch Circuits

Article 220 – Branch-Circuit, Feeder, and Service Load Calculations

Article 230 – Services

Article 240 – Overcurrent Protection

N Article 242 – Overvoltage Protection

Article 250 – Grounding

28 ☐

210.8 GFCI PROTECTION FOR PERSONNEL

1 2017 NEC

(A) Dwelling Units
(B) Other Than Dwelling Units
(C) Boat Hoists
(D) Kitchen D/W Branch Ckt.
(E) Crawl Space Lighting Ckt.

2 2020 NEC

(A) Dwelling Units
(B) Other than Dwelling Units
(C) Crawl Space Ltg. Ckts.
(D) Specific Appliances
(E) Equip. Requiring Servicing
(F) Outdoor Outlets

29 ☐ **ARTICLE 100 - DEFINITIONS**

1 Receptacle
2 A contact device installed at the outlet for the connection of an attachment plug or for direct connection of electrical utilization equipment designed to mate with the corresponding contact device. A single receptacle is a single contact device with no other contact device on the same yoke *or strap*. A multiple receptacle is two or more contact devices on the same yoke *or strap*. (CMP-18)
210.8(A) & (B)
3 Outlet
4

A point on the wiring system at which current is taken to supply utilization equipment. (CMP-1)
210.8(C) – Crawl Space Ltg. Outlets
N 210.8(D) Specific Appliances *N* 210.8(E) Equip. Requiring Servicing *N* 210.8(F) Outdoor Outlets

30 ☐ **210.8(A) GFCI PROTECTION FOR PERSONNEL- DWELLING UNITS**
Significant Expanded Requirements:

This change will now require that *all* 125-v through 250-v "*receptacles*" installed in the locations specified in 210.8(A)(1) through 210.8(A)(11) and supplied by 1ø branch circuits rated 150-v or less to ground shall have GFCI protection for personnel (no maximum amperage noted)

Previous NEC editions were limited to 15- and 20-amp 125-v receptacles.

Bathrooms, *garages*, outdoors, crawl spaces, *basements*, *kitchens*, sinks, boathouses, bathtubs or shower stalls, *laundry areas* or indoor damp and wet locations.

11 Locations / Type "A" GFCI Protection 4 – 6 mA

31 ☐ **210.8(A)(5) DWELLING UNIT GFCI PROTECTION**
Basements – Changes the Intent

Removed: "unfinished portions or areas of the basement not intended as habitable rooms".

This change will now require *all* receptacles installed in basements will require GFCI protection.

Exception remains for fire alarm / burglar alarm systems.

All receptacles in dwelling unit basements are subject to dampness, moisture and conductive floors, whether finished or unfinished.

33 ☐ **210.8(A)(7) GROUND-FAULT CIRCUIT-INTERRUPTER PROTECTION FOR PERSONNEL**

Clarification of Intent

Re: Sinks where receptacles are installed within 6' from the top inside edge of the bowl of the sink.

This change *deletes referenced text* in the last paragraph to this section, which was new in the 2017 NEC. *"the shortest path the 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*".

2020 Removes the 6' cord without passing through a "door or doorway"!

ie: Garbage Disposal / Dishwasher / Instant Hot / Compactor receptacle

GFCI / AFCI protection required if within the 6' measurement

34 ☐ **210.8(A)(7)**

REVISION

Regarding all 125-v through 250-v 1ø, 150-v to ground or less, receptacles installed *within 6' from the top inside edge of a sink.*

Removed reference to all doors (cabinet, personnel or other) and doorway.

35 ☐ **210.8(A) GFCI PROTECTION (CONT'D)**

1 Bathroom Locations
2 Kitchen Locations

36 ☐ **210.8(A)(10) DWELLING UNIT**
LAUNDRY AREAS
(ROOMS)

Receptacles rated 125-v to 250-v (1ø 150-v to ground or less) located in laundry area(s) will now be required to be provided with GFCI protection.

No Max. Amperage Noted!
Not Current Code in Ohio

37 ☐ **210.8(A) DWELLING UNIT – GFCI PROTECTION**

NEW – Exception

Exception to #1-3, 5-8 and 10: Listed locking support & mounting receptacles utilized in combinations with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not require GFCI protection. (Safety Quick Ltg. & Fans Corp)

If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

Applies to: Bathrooms, Garages, Outdoors, Basements, Kitchens, Sinks, Boathouses and Laundry Areas

248 ☐ **2020 NEC COMMERCIAL OVERVIEW**

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

249 ☐ **2020 NEC RESIDENTIAL OVERVIEW**

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects

- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

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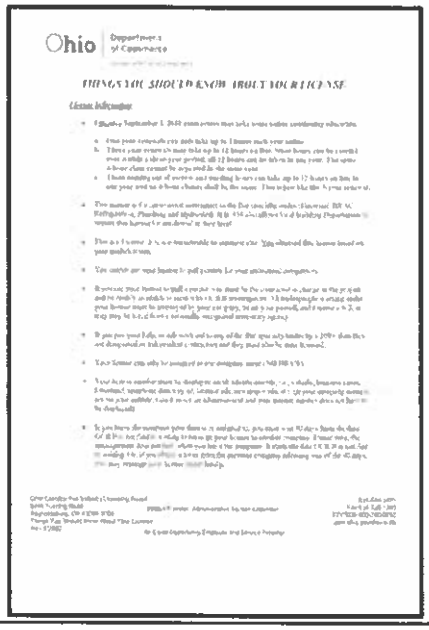
2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Thank You!

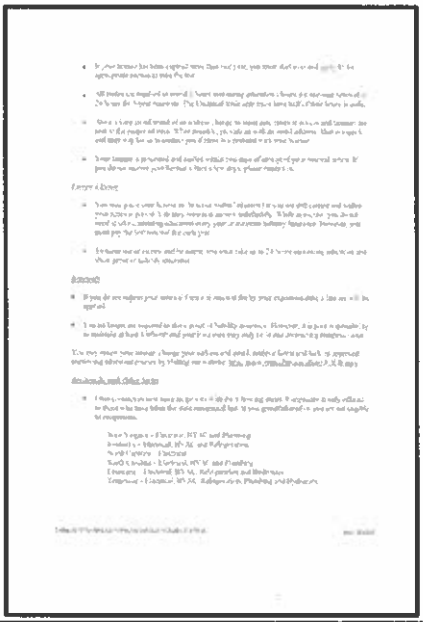
OCILB LICENSE INFORMATION



Ohio | Department of Commerce

THINGS YOU SHOULD KNOW ABOUT YOUR LICENSE

License Information



1

CURRENT ADOPTED CODES

July 01, 2019

Current Adopted Codes in Ohio – (2017)

Non-Residential Construction (4- Family and Above)

2017 Ohio Building Code (Based on the 2015 International Building Code)
2017 Ohio Mechanical Code (Based on the 2015 International Mechanical Code)
2017 Ohio Plumbing Code (Based on the 2015 International Plumbing Code)
2017 Ohio Fire Code (Based on the 2015 International Fire Code)
2017 NFPA 70 – National Electrical Code (Effective 11 01 2017)
2016 NFPA 13 – Standard for Installation of Sprinkler Systems
2016 NFPA 72 – National Fire Alarm and Signaling Code
2015 International Fuel Gas Code
2012 International Energy Conservation Code / ASHRAE 90.1 2010
ICC / ANSI A117.1 2009 Accessible & Usable Buildings and Facilities

Residential Construction (1, 2 and 3- Family Dwellings)

2019 Residential Code of Ohio (Based on the 2018 International Residential Code)
2017 Ohio Plumbing Code
2017 NFPA 70 – National Electrical Code w/ amendments (07 01 2019)
2018 International Energy Conservation Code

March 24, 2020

Current Adopted Building Codes in West Virginia

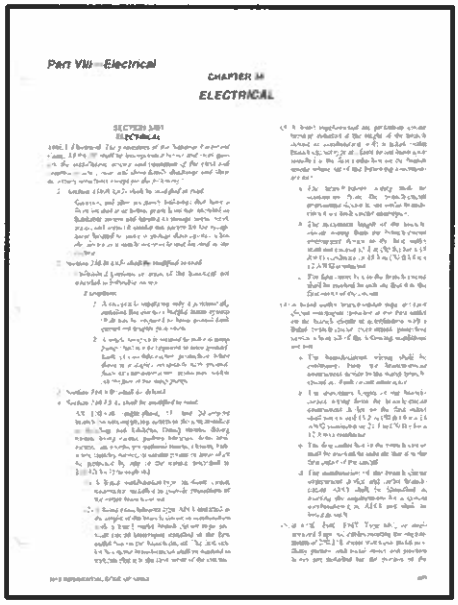
The State of West Virginia Fire Commission has adopted statewide the 2015 ICC (International Code Council), family of Codes for any jurisdiction that chooses to enforce building codes. Check locally for enforcement information / details.

2015 International Building Code (IBC)
2009 International Energy Conservation Code (IECC)
2015 International Existing Building Code (IEBC)
2015 International Fuel Gas Code (IFGC)
2015 International Mechanical Code (IMC)
2015 International Plumbing Code (IPC)
2012 International Property Maintenance Code (IPMC)
2015 International Residential Code (1- & 2- Family) (IRC)
2015 International Swimming Pool & Spa Code (ISPSC)

2015 NFPA 1 – Fire Code (Effective 07 01 2016)
2015 NFPA 101 – Life Safety Code (Effective 07 01 2016)
2017 NFPA 70 – National Electrical Code (Effective 03 24 2020)

2

2019 RESIDENTIAL CODE OF OHIO


Part VIII—Electrical

CHAPTER 34

ELECTRICAL

3

www.ta191.com

2020 "Proposed" National Electrical Code (NEC) Changes & Updates

Training Agency #191

150 Maplecrest Street SW
North Canton, Ohio 44720
330.497.6309 Phone

John M. Labriola

www.ta191.com

2020

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THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

2020

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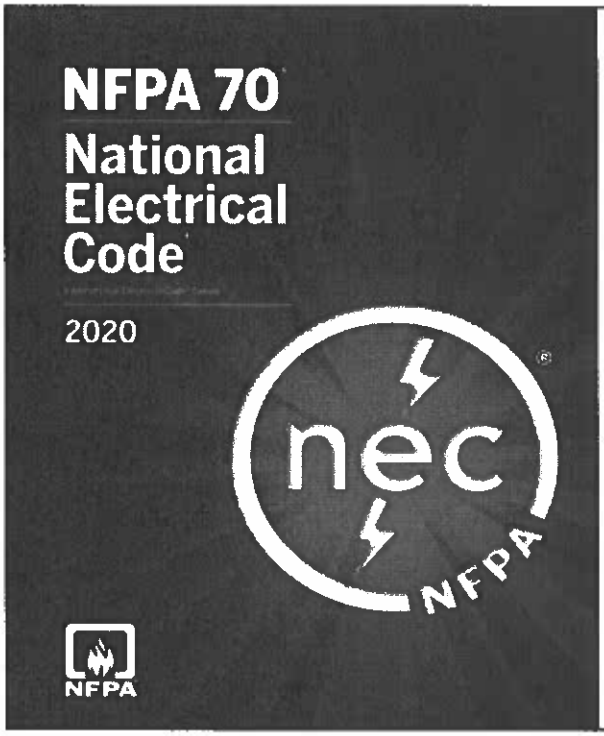

"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)

Subject to the local or State adoption authority

2020

6

OHIO LEGISLATION 3783.02

- Ohio Revised Code Section 3783.02 Exemptions. Effective: November 3, 1989 Legislation: House Bill 222 - 118th General Assembly Nothing in sections 3783.01 to 3783.08 of the Revised Code shall apply to inspection of the design, construction, maintenance, or replacement of any of the following: (A) Installations in ships, watercraft, railway rolling stock, aircraft, or automotive vehicles; (B) Installations underground in mines; (C) Installations of railways for the generation, transformation, transmission, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communication purposes; (D) Installations of communication equipment under control of communication utilities, located outdoors or in building spaces used for such installations; (E) Installations under the control of electric utilities for the purpose of communication, metering, or for the generation, control, transformation, transmission, and distribution of electric energy located in building spaces used by utilities for such purposes or located on property owned or leased by the utility or on public highways, streets, roads, etc., or by established rights on private property; (F) Installations of elevators, dumbwaiters, and escalators as regulated by the bureau of workers' compensation.

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2020 NATIONAL ELECTRICAL CODE (NEC) PROPOSED CHANGES AND UPDATE INFORMATION DETAILS

NFPA MEMBER

Based on the 2020 National Electrical Code (NFPA 70) as published by the National Fire Protection Association (NFPA).

All information contained within this presentation is my personal and professional opinion, based upon over 43 years in the construction industry.

Not Current Code in Ohio

2020

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2020 NATIONAL ELECTRICAL CODE

Identifying Changes throughout the Code

Over 3,700 public inputs / 1,900 comments

New Revision Symbols

Δ before a section number = words in section deleted

Δ to left of table or figure = revision to table or figure

Δ throughout chapter = heavy revision to entire chapter

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2020

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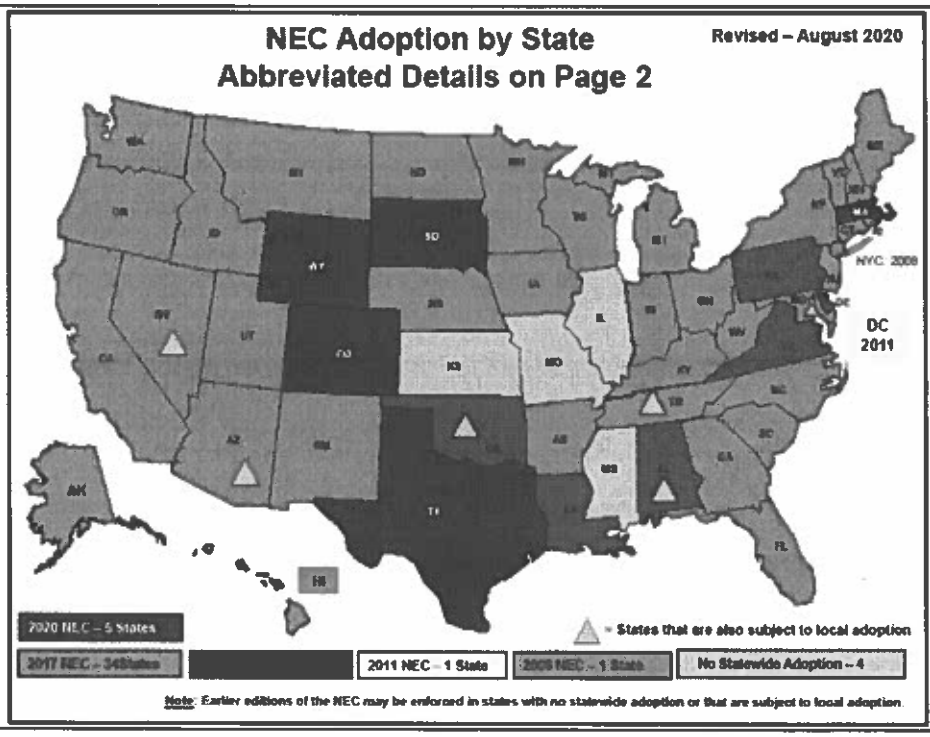

2020

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State	Adoption	Implementation	State	Adoption	Implementation
Alabama	7.1.16	See Adoption Report	Montana	12.7.19	12.7.19
Alaska	5.9.18	5.9.18	Nebraska	5.1.17	8.1.17
Arizona	Local Adoption	See Adoption Report	Nevada	2.5.19	Local Mayoral
Arkansas	9.19.17	1.1.18	New Hampshire	3.1.17	1.1.18
California	January 2019	1.1.20	New Jersey	9.3.19	9.3.19
Colorado	5.27.2020	8.1.20	New Mexico	11.15.17	2.1.18
Connecticut	7.25.18	10.1.18	New York	12.1.19	5.15.20 Ex. NYC
Delaware	3.11.16	3.11.16	North Carolina	12.12.17	6.12.18
Florida	6.2.20	12.31.20	North Dakota	3.14.17	7.1.17
Georgia	11.15.17	1.1.18	Ohio	5.26.17	11.1.17
Hawaii	7.26.18	1.1.19	Oklahoma	6.8.15	11.1.15
Idaho	7.1.17	7.1.17	Oregon	10.1.17	10.1.17
Illinois	Local Adoption	See Adoption Report	Pennsylvania	5.1.19	10.1.18
Indiana	August 2009	9.26.09	Rhode Island	8.1.19	8.1.19
Iowa	11.3.17	1.1.18	South Carolina	8.22.18	1.1.20
Kansas	Local Adoption	See Adoption Report	South Dakota	6.9.20	7.1.20
Kentucky	8.22.18	1.1.19	Tennessee	3.19.18	10.1.18
Louisiana	12.12.17	2.1.18	Texas	10.1.20	11.1.20
Maine	11.6.17	11.6.17	Utah	5.8.17	7.1.18
Maryland	See Adoption Report	Local State	Vermont	10.1.17	10.1.17
Massachusetts	12.6.19	1.1.20	Virginia	4.30.18	9.4.18
Michigan	1/4/19	1.4.19	Washington	7.1.17	7.1.17
Minnesota	8/1/17	7.1.17	West Virginia	3.24.20	3.24.20
Mississippi	Local Adoption	See Adoption Report	Wisconsin	4.1.18	8.1.18
Missouri	Local Adoption	See Adoption Report	Wyoming	2.1.20	7.1.20

2020

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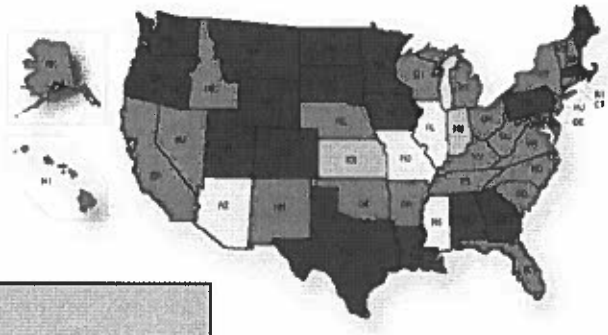
NFPA STATE UPDATE MAP

NEC® in Effect
1/1/2022



2020 NEC® - 14
2017 NEC® - 26
2014 NEC® - 4
2008 NEC® - 2
County/Municipality NEC® regulation only - 4

2020

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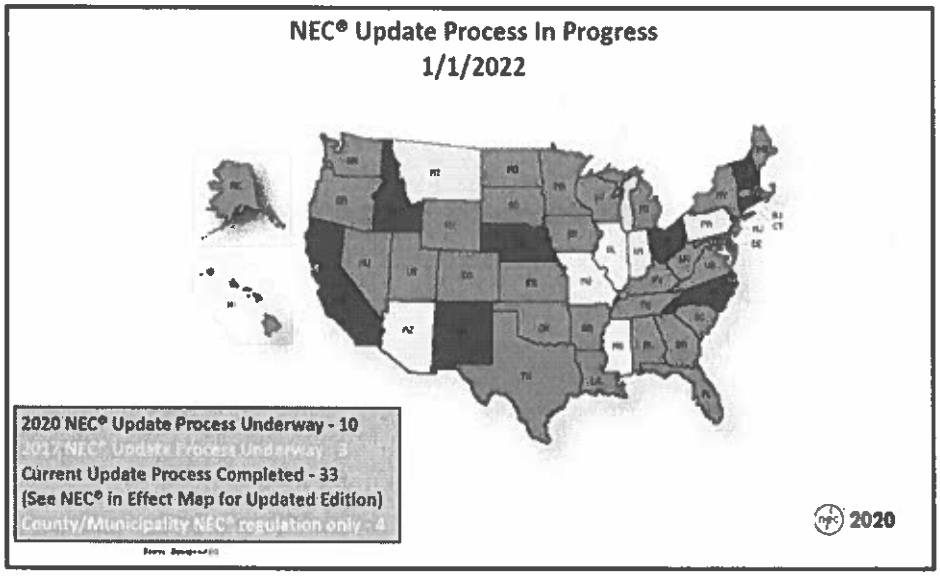
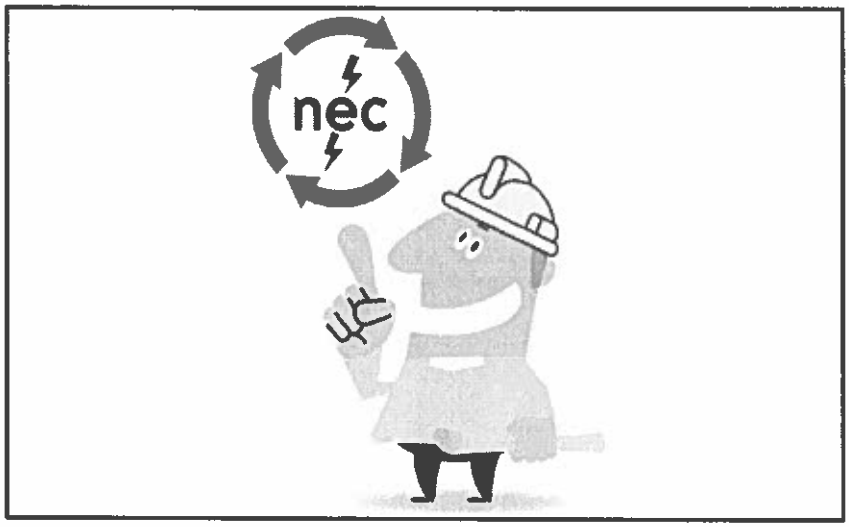
NFPA STATE UPDATE MAP



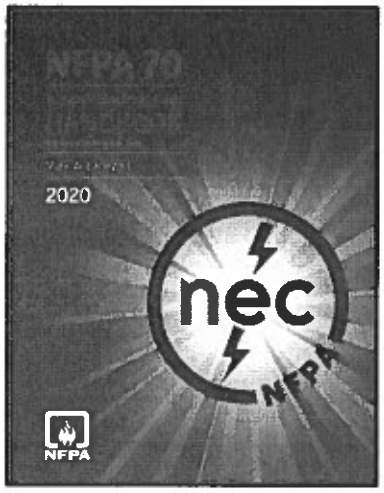
13

2023 NEC WILL BE HERE SOON!!



14

ADDITIONAL USEFUL NFPA PUBLICATIONS



2020

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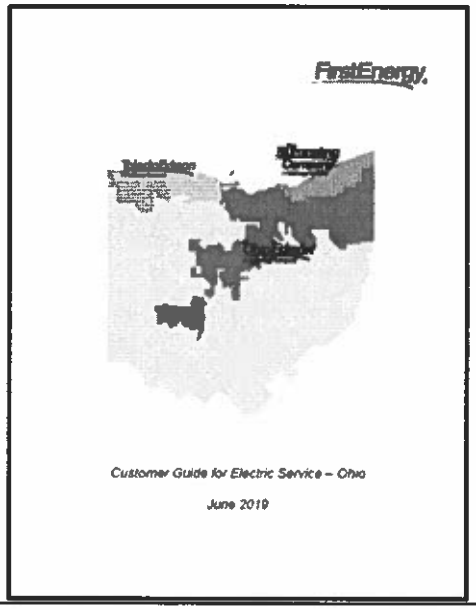
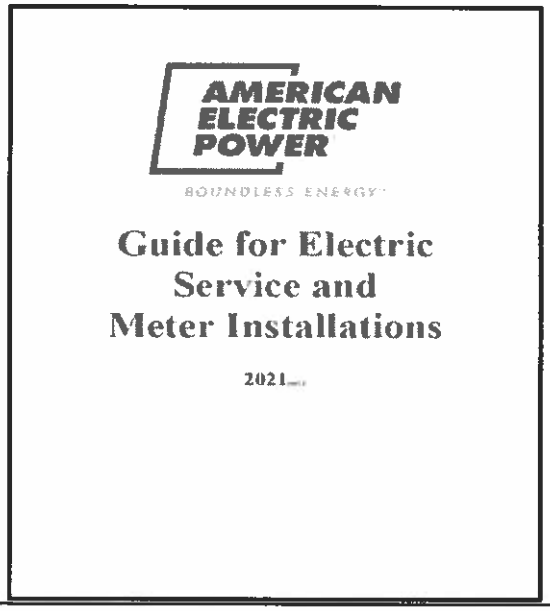
POWER CO. SERVICE GUIDES





2020

16

(4) "*NEW*" ARTICLES

Article 242 Overvoltage Protection

Article 311 Medium Voltage Conductors and Cable

Article 337 Type "P" Cable (Hazardous Locations)

Article 805 General Requirements for Communication Systems

For Informational Purposes Only

2020

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CHAPTER 1

General

Article 100 – Definitions

Article 110 – Requirements for Electrical Installations

Not Current Code in Ohio

2020

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ARTICLE 100- DEFINITIONS

If a definition is utilized in two or more Articles the definition will be in Article 100

Now Three Subparts

Part I. – General
Part II. – Over 1000 Volts. Nominal
Part III. – Hazardous Classified Locations. (CMP-14)

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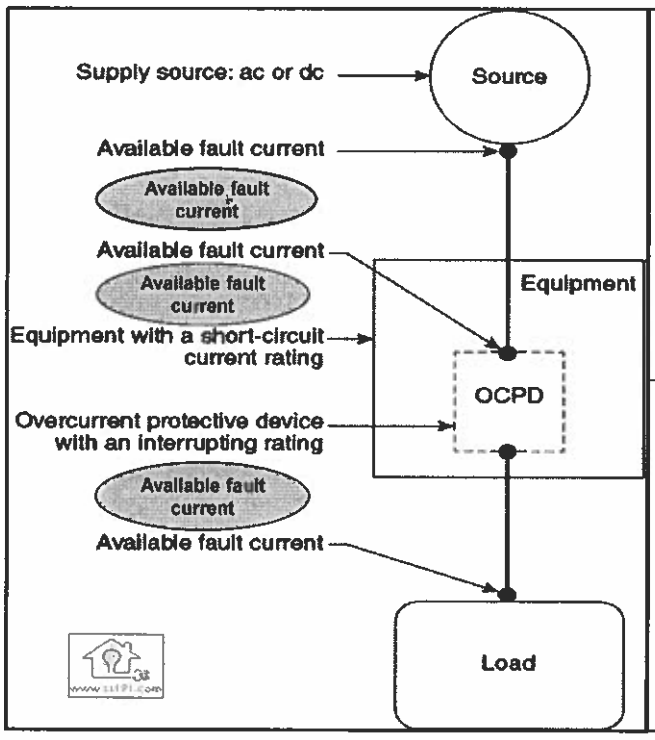

ARTICLE 100 DEFINITIONS

Available Fault Current

Fault Current:

The current delivered at a point on the system during a short-circuit condition. **(CMP-10)**

Available Fault Current:

The largest amount of current capable of being delivered at a point on the system during a short-circuit condition. **(CMP-10)**

Note: AFC is calculated at load-side terminals of the source and line-side terminals of OCPD and all other load locations.

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2020

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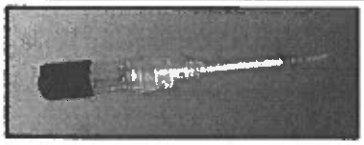
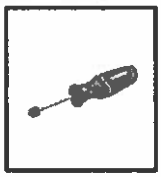
110.14(D) TERMINAL TIGHTENING TORQUE





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 Notes: 1, 2 & 3
Shear bolts, breakaway-style devices with visual indicators
NFPA 70(B)-Electrical Equipment Maintenance

For Informational Purposes Only

2020

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110.22(A) IDENTIFICATION OF DISCONNECTING MEANS - GENERAL

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. **Re: **ANSI Z535.4 2011 (R2017)****

Not Current Code in Ohio

2020

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110.24(A) AVAILABLE FAULT CURRENT - FIELD MARKING

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 of the calculation was performed and be of sufficient durability to withstand the environment involved.

Information Note 1 – **Recognizes NFPA 70E- 2018**

N Informational Note 2 – Values of AFC current for use in determining appropriate minimum SCCR of SE equipment is available from electric utilities in published or other forms.

Assistance from the local electrical utility

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2020

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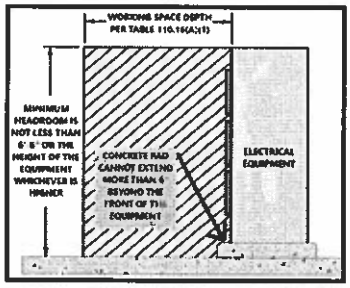
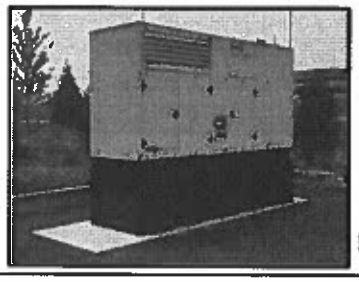
110.26(A)(3) HEIGHT OF WORKING SPACE

Revision

The work space shall be clear and extend from the grade, floor or platform to a height of 78" or the height of equipment, whichever is greater. Within the height requirements of this section, other equipment ***or support structures, such as concrete pads shall not extend more than 6" beyond the front of the electrical equipment.***





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2020

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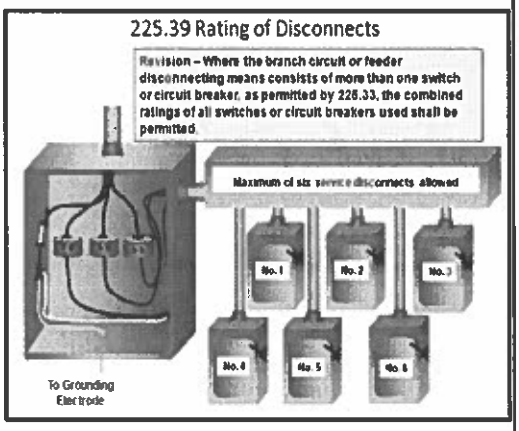
110.26(C)(2) LARGE EQUIPMENT – RATED 1200 AMPERES OR GREATER

Large Equipment is defined as follows:

(1) For equipment rated 1200 amperes or more and over 6' wide.

(2) For SE disconnecting means installed in accordance with 230.71 where the combined ampere rating is 1200 amperes or more and over 6' wide.



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2020

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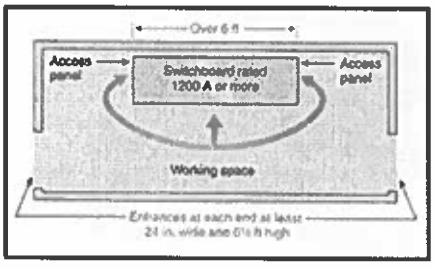
ARTICLE 110.26(C)(2)

The one entrance requirement has been 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 24" wide & 78" high at ***each end of the working space***.



Not Current Code in Ohio

2020

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CHAPTER 2

Wiring and Protection

Article 210 – Branch Circuits

Article 220 – Branch-Circuit, Feeder, and Service Load Calculations

Article 230 – Services

Article 240 – Overcurrent Protection

N **Article 242 – Overvoltage Protection**

Article 250 – Grounding

Not Current Code in Ohio

2020

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210.8 GFCI PROTECTION FOR PERSONNEL

2017 NEC	2020 NEC
(A) Dwelling Units	(A) Dwelling Units
(B) Other Than Dwelling Units	(B) Other than Dwelling Units
(C) Boat Hoists	(C) Crawl Space Ltg. Ckts.
(D) Kitchen D/W Branch Ckt.	(D) Specific Appliances
(E) Crawl Space Lighting Ckt.	(E) Equip. Requiring Servicing
	(F) Outdoor Outlets

Not Current Code in Ohio

2020

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ARTICLE 100 - DEFINITIONS

Receptacle

A contact device installed at the outlet for the connection of an attachment plug or for direct connection of electrical utilization equipment designed to mate with the corresponding contact device. A single receptacle is a single contact device with no other contact device on the same yoke ***or strap***. A multiple receptacle is two or more contact devices on the same yoke ***or strap.*** (CMP-18)

210.8(A) & (B)

Outlet

A point on the wiring system at which current is taken to supply utilization equipment. (CMP-1)

210.8(C) – Crawl Space Ltg. Outlets

N **210.8(D) Specific Appliances**
N **210.8(E) Equip. Requiring Servicing**
N **210.8(F) Outdoor Outlets**

For Informational Purposes Only

2020

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210.8(A) GFCI PROTECTION FOR PERSONNEL- DWELLING UNITS

Significant Expanded Requirements:

This change will now require that *all* 125-v through 250-v "*receptacles*" installed in the locations specified in 210.8(A)(1) through 210.8(A)(11) and supplied by 1ø branch circuits rated 150-v or less to ground shall have GFCI protection for personnel (no maximum amperage noted)

Previous NEC editions were limited to 15- and 20-amp 125-v receptacles.

Bathrooms, *garages*, outdoors, crawl spaces, *basements*, *kitchens*, sinks, boathouses, bathtubs or shower stalls, *laundry areas* or indoor damp and wet locations.

11 Locations / Type "A" GFCI Protection 4 – 6 mA

Not Current Code in Ohio

2020

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210.8(A)(5) DWELLING UNIT GFCI PROTECTION

Basements – Changes the Intent

Removed: "unfinished portions or areas of the basement not intended as habitable rooms".

This change will now require ***all*** receptacles installed in basements will require GFCI protection.

Exception remains for fire alarm / burglar alarm systems.

All **receptacles in dwelling unit basements are subject to dampness, moisture and conductive floors, whether finished or unfinished.**

For Informational Purposes Only

2020

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210.8(A)(7) GROUND-FAULT CIRCUIT-INTERRUPTER PROTECTION FOR PERSONNEL

Clarification of Intent

Re: Sinks where receptacles are installed within 6' from the top inside edge of the bowl of the sink.

This change ***deletes referenced text*** in the last paragraph to this section, which was new in the 2017 NEC. "***the shortest path the 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***".

2020 Removes the 6' cord without passing through a "door or doorway"!

ie: Garbage Disposal / Dishwasher / Instant Hot / Compactor receptacle

GFCI / AFCI protection required if within the 6' measurement

For informational Purposes Only

2020

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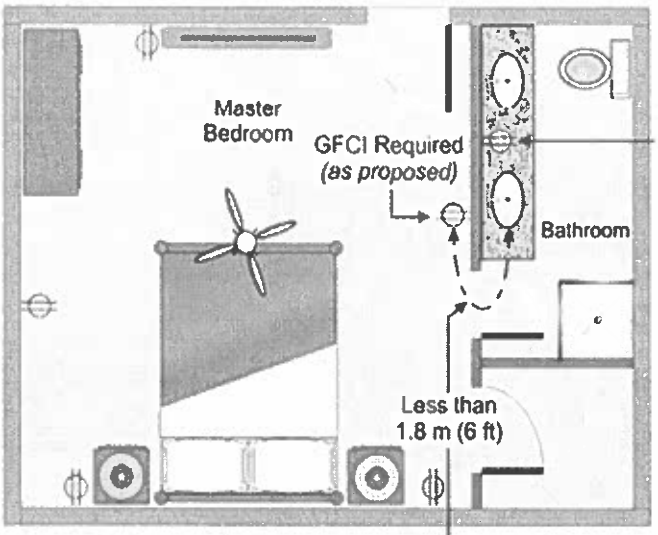
210.8(A)(7) REVISION

Regarding all 125-v through 250-v 1ø, 150-v to ground or less, receptacles installed *within 6' from the top inside edge of a sink.*

Removed reference to all doors (cabinet, personnel or other) and doorway.

210.8 Measurements for GFCI Protection



All 125-volt through 250-volt receptacles installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink requires GFCI protection. *[210.8(A)(7)]*

For the purposes of this section, when determining the distance from receptacles the distance shall be measured as the shortest path the cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or passing through a ~~door, doorway, or~~ window. *[210.8]*

Not Current Code in Ohio

2020

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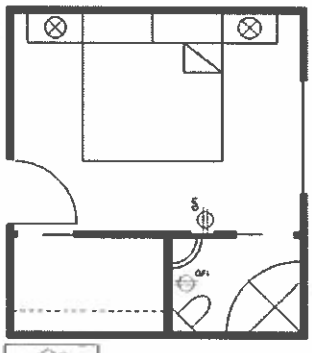
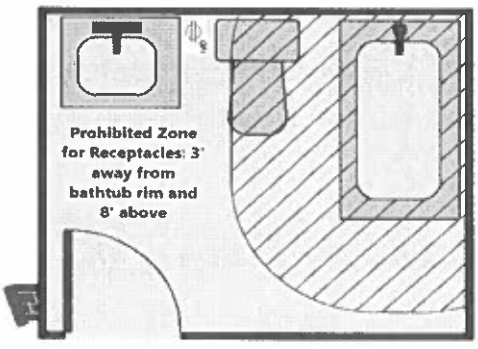
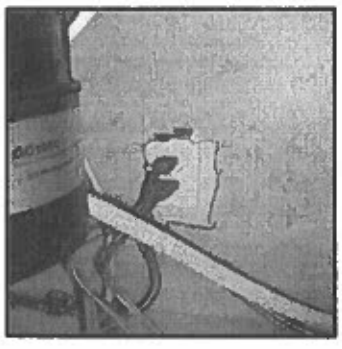
210.8(A) GFCI PROTECTION (CONT'D)

Bathroom Locations





Kitchen Locations



For Informational Purposes Only

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210.8(A)(10) DWELLING UNIT LAUNDRY AREAS (ROOMS)

Receptacles rated 125-v to 250-v (1ø 150-v to ground or less) located in laundry area(s) will now be required to be provided with GFCI protection.

No Max. Amperage Noted!

Not Current Code in Ohio

2020

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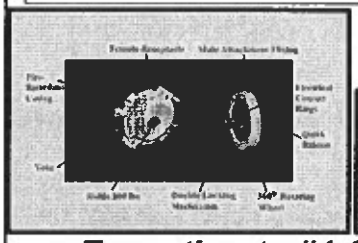
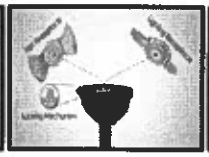
210.8(A) DWELLING UNIT – GFCI PROTECTION



NEW – Exception



***Exception** to #1-3, 5-8 and 10: **Listed locking** support & mounting receptacles utilized in combinations with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not require GFCI protection.* (Safety Quick Ltg. & Fans Corp)

If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

Applies to: Bathrooms, Garages, Outdoors, Basements, Kitchens, Sinks, Boathouses and Laundry Areas

For Informational Purposes Only

2020

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2020 NEC COMMERCIAL OVERVIEW

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

Not Current Code in Ohio

2020

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2020 NEC RESIDENTIAL OVERVIEW

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

For Informational Purposes Only

2020

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2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Labriola Training Agency #191
www.ta191.com

John M. Labriola
Principal

150 Maplecrest Street SW
North Canton, Ohio 44720

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330.606.8098 Cell
john@ta191.com

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Thank You!

250

File Attachments for Item:

EC-8 2020 NEC Changes and Updates Articles 90-220 (Labriola)

All certifications except NRIUI and plumbing (8 hours)

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: John M. Labriola (Contact Name)
Organization: Training Agency #191 (Organization/Company)
Address: 150 Maplecrest St. SW (Include Room Number, Suite, etc.)
City: North Canton State: Ohio Zip: 44720
E-Mail: john@ta191.com
Telephone: 330.497.6309 Fax:
Course Sponsor: None

COURSE INFORMATION:

Course Title: 2020 National Electrical Code Changes & Updates - Articles 90 - 220

New Course Submittal: ■ Update Course: ☐ Prior Approval Number:

Purpose and Objective:
To provide BBS certified personnel a better understanding of the changes & Updates to the 2020 National electrical Code.
by utilizing a power-point presentation and real-life examples, for no charge to attendees.

Number of Instructional Contact Hours that can be obtained upon completion: 8 Hours

If Multi-Session, Number of Instructional Contact Hours Per Session:

Program Applicable for the Following Participants:

Building Official ■ Master Plans Examiner ■ Plumbing Plans Exam. ☐ Electrical Plans Exam. ■ Mechanical Plans Exam. ■ Building Inspector ■ Fire Protection Inspector ■ Mechanical Inspector ■ Plumbing Inspector ☐ Non-Res IU Inspector ☐

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ■ Res IU Inspector ■

Electrical Safety Inspectors [X]
Location of ESI Course: Various locations Date(s) of ESI Course(s): TBD

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

Form 1526 BBS 54023210

RECEIVED
MAY 04 2022
BOARD OF BUILDING STANDARDS

October 16, 2020

John M. Labriola
150 Maplecrest St. SW
North Canton, Ohio 44720

330.497.6309 Home 330.606.8098 Cell

Professional Bio'

Education

2012- 1984	Akron University, Stark State College: Continuing Education
1975	St. Thomas Aquinas High School; Louisville, Ohio
1971	Fairmount Elementary; Canton, Ohio

Building Department Experience

2017 – 2009	Summit County, Ohio; Chief Building Official (retired)
2009 – 2006	City of Canton, Ohio; Chief Building Official
2008 – 1997	City of Alliance, Ohio; Back-up Building and Electrical Inspector
2006 – 1997	City of North Canton, Ohio; Building and Electrical Inspector
1997 – 1986	Stark County, Ohio; Chief Electrical Inspector
1988 – 1984	City of Louisville, Ohio; Part-time Electrical Inspector

Current Certifications Held

International Code Council (ICC)

Accessibility Inspector/ Plans Examiner, Building Inspector, Building Plans Examiner, Certified Building Code Official, Certified Building Official, Certified Electrical Code Official, Certified Mechanical Code Official, Commercial Electrical Inspector, Commercial Mechanical Inspector, Commercial Plumbing Inspector, Electrical Inspector, Electrical Plans Examiner, Fire Plans Examiner, Master Code Professional, Mechanical Inspector, Mechanical Plans Examiner, Property Maintenance and Housing Inspector, Residential Electrical Inspector, Residential Energy Inspector / Plans Examiner, Residential Mechanical Inspector and Residential Plumbing Inspector.

State of Ohio:

Building Inspector, Building Official, Building Plans Examiner, Electrical Plans Examiner, Electrical Safety Inspector, Fire Protection Plans Examiner, Mechanical Plans Examiner and Residential Building Official.

Construction Experience

2007 – 1986	President; Electrical Design and Construction Co.
2004 – Present	State of South Carolina; Licensed Commercial Contractor
1992 – Present	State of Ohio; Licensed Electrical Contractor
1986 – 1981	Owner; Labriola Electric
1981 – 1975	Pedersen Electric; Helper / Apprentice / Journeyman Electrician
1980 – Present	Journeyman Electrician; City of Canton, Ohio

Professional Organization Memberships

2010 – 2017	American Institute of Architects - Akron Chapter (AIA-Akron)
2009 – 2017	Building Officials Code Officials of Northeast Ohio (BOCONEO)
2009 – 2017	National Fire Protection Association (NFPA)
1997 – 2017	Five County Building Officials Association (FBOA)
1997 – 2017	Ohio Building Officials Association (OBOA)
1986 – Present	International Association of Electrical Inspectors (IAEI)

Appointments (Director Positions)

2011 – 2017	Air-Conditioning Contractors Association of Akron / Canton
2011 – 2017	Home Builders Association of Summit and Portage Counties

Teaching Experience

2012 – 2017	Instructor; Home Builders Association of Greater Cleveland
2012 – 2017	Instructor; Home Builders Association of Summit and Portage Counties
2012 – Present	Instructor; National Electrical Contractors Association (NECA); Greater Cleveland, Ohio Division
2011 – Present	Instructor; Northeast Ohio Electrical Contractors Association (NOECA)
2005	Instructor; Clemson University; Clemson, South Carolina
2004 – Present	Instructor; Electrical League of Ohio; Cleveland, Ohio
2000 – 2016	Instructor; Stark State College of Technology: North Canton, Ohio
1999 – Present	Instructor; National Electrical Contractors Association (NECA); Akron, Ohio Division
1991 – 2009	OCILB Approved Contractor Training Agency
1990 – Present	State of Ohio; Approved Electrical Safety Inspector, Instructor

Respectfully,
John M. Labriola
John M. Labriola
OBBS ID #815
john@ta191.com

www.ta191.com

May 02, 2022

Labriola Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720

Ohio Board of Building Standards
6606 Tussing Road – PO Box 4009
Reynoldsburg, Ohio 43068 – 9009

Course Submittal #7 – 8 Hours

Code Sections to be discussed in detail Articles 90 – 220

2020 NEC Code Adoption Process in Ohio

Highlights of the class will include Article 100 (Definitions)

Article 210 – Branch Circuits (GFCI & AFCI Protection) Requirements

Outdoor Outlets (Split systems)

Common Area Branch-Circuits

Island & Peninsular Outlets

Meeting Rooms

General Lighting Loads

Load Calculations

1 ☐ **OCILB LICENSE INFORMATION**

2 ☐ **CURRENT ADOPTED CODES**

3 ☐ **2019 RESIDENTIAL CODE OF OHIO**

4 ☐

5 ☐

THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

6 ☐ **"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)**

Subject to the local or State adoption authority

7 ☐ **OHIO LEGISLATION 3783.02**

- Ohio Revised Code Section 3783.02 Exemptions. Effective: November 3, 1989 Legislation: House Bill 222 - 118th General Assembly Nothing in sections 3783.01 to 3783.08 of the Revised Code shall apply to inspection of the design, construction, maintenance, or replacement of any of the following: (A) Installations in ships, watercraft, railway rolling stock, aircraft, or automotive vehicles; (B) Installations underground in mines; (C) Installations of railways for the generation, transformation, transmission, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communication purposes; (D) Installations of communication equipment under control of communication utilities, located outdoors or in building spaces used for such installations; (E) Installations under the control of electric utilities for the purpose of communication, metering, or for the generation, control, transformation, transmission, and distribution of electric energy located in building spaces used by utilities for such purposes or located on property owned or leased by the utility or on public highways, streets, roads, etc., or by established rights on private property; (F) Installations of elevators, dumbwaiters, and escalators as regulated by the bureau of workers' compensation.

8 ☐ **2020 NATIONAL ELECTRICAL CODE (NEC) PROPOSED CHANGES AND UPDATE INFORMATION DETAILS**

Based on the 2020 National Electrical Code (NFPA 70) as published by the National Fire Protection Association (NFPA).

All information contained within this presentation is my personal and professional opinion, based upon over 43 years in the construction industry.

9 ☐ **2020 NATIONAL ELECTRICAL CODE**

Identifying Changes throughout the Code

Over 3,700 public inputs / 1,900 comments

New Revision Symbols

Δ before a section number = words in section deleted

Δ to left of table or figure = revision to table or figure

Δ throughout chapter = heavy revision to entire chapter

10 ☐

11 ☐

12 ☐ **NFPA STATE UPDATE MAP**

13 ☐ **NFPA STATE UPDATE MAP**

14 ☐ **2023 NEC WILL BE HERE SOON!!**

15 ☐ **ADDITIONAL USEFUL NFPA PUBLICATIONS**

16 ☐ **POWER CO. SERVICE GUIDES**

17 ☐ **(4) "*NEW*" ARTICLES**

Article 242 Overvoltage Protection

Article 311 Medium Voltage Conductors and Cable

Article 337 Type "P" Cable (Hazardous Locations)

Article 805 General Requirements for Communication Systems

18 ☐ **CHAPTER 1**

General

Article 100 – Definitions

Article 110 – Requirements for Electrical Installations

19 ☐

ARTICLE 100- DEFINITIONS

If a definition is utilized in two or more Articles
the definition will be in Article 100

Now Three Subparts

Part I. – General
Part II. – Over 1000 Volts. Nominal
Part III. – Hazardous Classified Locations. (CMP-14)

20 ☐ **ARTICLE 100**
DEFINITIONS

Available Fault Current

Fault Current:
The current delivered at a point on the system during a short-circuit condition. (CMP-10)

Available Fault Current:
The largest amount of current capable of being delivered at a point on the system during a short-circuit condition. (CMP-10)

Note: AFC is calculated at load-side terminals of the source and line-side terminals of OCPD and all other load locations.

Not Current Code in Ohio

21 ☐ **110.14(D) TERMINAL TIGHTENING 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 Notes: 1, 2 & 3
Shear bolts, breakaway-style devices with visual indicators
NFPA 70(B)-Electrical Equipment Maintenance

22 ☐ **110.22(A) IDENTIFICATION OF DISCONNECTING MEANS - GENERAL**

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. Re: ***ANSI Z535.4 2011 (R2017)***

23 ☐ **110.24(A) AVAILABLE FAULT CURRENT - FIELD MARKING**

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 of the calculation was performed and be of sufficient durability to withstand the environment involved.

Information Note 1 – Recognizes NFPA 70E- 2018

N Informational Note 2 – Values of AFC current for use in determining appropriate minimum SCCR of SE equipment is available from electric utilities in published or other forms.

Assistance from the local electrical utility

24 ☐ **110.26(A)(3) HEIGHT OF WORKING SPACE**

Revision

The work space shall be clear and extend from the grade, floor or platform to a height of 78" or the height of equipment, whichever is greater. Within the height requirements of this section, other equipment *or support structures, such as concrete pads shall not extend more than 6" beyond the front of the electrical equipment.*

25 ☐ **110.26(C)(2) LARGE EQUIPMENT – RATED 1200 AMPERES OR GREATER**

Large Equipment is defined as follows:

(1) For equipment rated 1200 amperes or more and over 6' wide.

(2) For SE disconnecting means installed in accordance with 230.71 where the combined ampere rating is 1200 amperes or more and over 6' wide.

26 ☐ **ARTICLE 110.26(C)(2)**

The one entrance requirement has been 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 24" wide & 78" high at *each end of the working space*.

27 ☐ **CHAPTER 2**

Wiring and Protection

Article 210 – Branch Circuits

Article 220 – Branch-Circuit, Feeder, and Service Load Calculations

Article 230 – Services

Article 240 – Overcurrent Protection

N Article 242 – Overvoltage Protection

Article 250 – Grounding

28 ☐

210.8 GFCI PROTECTION FOR PERSONNEL

1 2017 NEC

(A) Dwelling Units
(B) Other Than Dwelling Units
(C) Boat Hoists
(D) Kitchen D/W Branch Ckt.
(E) Crawl Space Lighting Ckt.

2 2020 NEC

(A) Dwelling Units
(B) Other than Dwelling Units
(C) Crawl Space Ltg. Ckts.
(D) Specific Appliances
(E) Equip. Requiring Servicing
(F) Outdoor Outlets

29 ☐ **ARTICLE 100 - DEFINITIONS**

1 Receptacle
2 A contact device installed at the outlet for the connection of an attachment plug or for direct connection of electrical utilization equipment designed to mate with the corresponding contact device. A single receptacle is a single contact device with no other contact device on the same yoke *or strap*. A multiple receptacle is two or more contact devices on the same yoke *or strap*. (CMP-18)
210.8(A) & (B)
3 Outlet
4

A point on the wiring system at which current is taken to supply utilization equipment. (CMP-1)
210.8(C) – Crawl Space Ltg. Outlets
N 210.8(D) Specific Appliances *N* 210.8(E) Equip. Requiring Servicing *N* 210.8(F) Outdoor Outlets

30 ☐ **210.8(A) GFCI PROTECTION FOR PERSONNEL- DWELLING UNITS**

Significant Expanded Requirements:

This change will now require that *all* 125-v through 250-v "*receptacles*" installed in the locations specified in 210.8(A)(1) through 210.8(A)(11) and supplied by 1ø branch circuits rated 150-v or less to ground shall have GFCI protection for personnel (no maximum amperage noted)

Previous NEC editions were limited to 15- and 20-amp 125-v receptacles.

Bathrooms, *garages*, outdoors, crawl spaces, *basements*, *kitchens*, sinks, boathouses, bathtubs or shower stalls, *laundry areas* or indoor damp and wet locations.

11 Locations / Type "A" GFCI Protection 4 – 6 mA

31 ☐ **210.8(A)(5) DWELLING UNIT GFCI PROTECTION**

Basements – Changes the Intent

Removed: "unfinished portions or areas of the basement not intended as habitable rooms".

This change will now require *all* receptacles installed in basements will require GFCI protection.

Exception remains for fire alarm / burglar alarm systems.

All receptacles in dwelling unit basements are subject to dampness, moisture and conductive floors, whether finished or unfinished.

32 ☐ **210.8(A)(6) DWELLING UNIT**
KITCHENS

Receptacles rated 125-v to 250-v located to "*serve countertop surfaces*" in kitchens will now be required to be provided with GFCI protection.

No Max. Amperage noted!
Not Current Code in Ohio

33 ☐ **210.8(A)(7) GROUND-FAULT CIRCUIT-INTERRUPTER PROTECTION FOR PERSONNEL**
Clarification of Intent

Re: Sinks where receptacles are installed within 6' from the top inside edge of the bowl of the sink.

This change *deletes referenced text* in the last paragraph to this section, which was new in the 2017 NEC. "*the shortest path the 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*".

2020 Removes the 6' cord without passing through a "door or doorway"!

ie: Garbage Disposal / Dishwasher / Instant Hot / Compactor receptacle

GFCI / AFCI protection required if within the 6' measurement

34 ☐ **210.8(A)(7)**

REVISION

Regarding all 125-v through 250-v 1ø, 150-v to ground or less, receptacles installed *within 6' from the top inside edge of a sink.*

Removed reference to all doors (cabinet, personnel or other) and doorway.

35 ☐ **210.8(A) GFCI PROTECTION (CONT'D)**
1 Bathroom Locations
2 Kitchen Locations

36 ☐ **210.8(A)(10) DWELLING UNIT**

LAUNDRY AREAS
(ROOMS)

Receptacles rated 125-v to 250-v (1ø 150-v to ground or less) located in laundry area(s) will now be required to be provided with GFCI protection.

No Max. Amperage Noted!
Not Current Code in Ohio

37 ☐ **210.8(A) DWELLING UNIT – GFCI PROTECTION**

NEW – Exception

Exception to #1-3, 5-8 and 10: Listed locking support & mounting receptacles utilized in combinations with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not require GFCI protection. (Safety Quick Ltg. & Fans Corp)

If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

Applies to: Bathrooms, Garages, Outdoors, Basements,
Kitchens, Sinks, Boathouses and Laundry Areas

38 ☐ **210.8(B) GFCI PROTECTION FOR**

PERSONNEL- OTHER THAN DWELLING UNITS

Expanded Requirements:

The change will require that *all* 125-v through 250-v "*receptacles*" supplied by 1ø branch circuits rated 150-v to ground or less, 50a or less and "*all receptacles*" supplied by 3ø branch circuits rated 150-v to ground, 100a or less, installed in the locations in areas specified in 210.8(B)(1) through 210.8(B)(12) will now require GFCI protection for personnel.

Bathrooms, kitchens, rooftops, outdoors, sinks, indoor *damp and* wet locations, locker rooms with associated showering facilities, garages, *accessory buildings*, service bays, crawl spaces, unfinished *areas of basements*, *laundry areas*, and *bathtubs and shower stalls*.

12 Locations / Type "A" GFCI Protection 4 – 6 mA

39 ☐

210.8(B)(2)
GFCI PROTECTION

OTHER THAN DWELLING UNITS

KITCHENS / *FOOD PREP*

Expanded Requirement

Kitchens *or areas with a sink "and" permanent provisions for either food preparation* or cooking.
For Informational Purposes Only

41 ☐ **210.8(B) OTHER THAN DWELLING UNITS – GFCI PROTECTION**
NEW – Exception

Exception to #1-5, 8 and 10: Listed locking support & mounting receptacles utilized in combinations with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not require GFCI protection. (Safety Quick Ltg. & Fans Corp)

If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

Applies to: Bathrooms, Kitchens, Rooftops, Outdoors, Sinks, Garages and unfinished portions of Basements

42 ☐ **210.8(C) CRAWL SPACE LIGHTING OUTLETS**
210.8(D) SPECIFIC APPLIANCES
210.8(E) EQUIPMENT REQUIRING SERVICING
210.8(F) OUTDOOR OUTLETS

(C) Crawl Space Lighting Outlets- 120-v or less

N (D) Specific Appliances- 422.5 all dishwasher *outlets*

N (E) Equipment Requiring Servicing- 210.63

N (F) Outdoor Outlets- all outdoor *outlets* for dwellings, 1ø branch circuits, 150-v or to ground or less, 50a or less

43 ☐ **210.8(C) BOAT HOISTS**

Removed / Re-directed

2017 NEC – GFCI protection is required per 555.3

2020 NEC – GFCI Protection will be 555.9

Type "A" Protection 4-6mA

44 ☐ **210.8(D) SPECIFIC APPLIANCES; WAS KITCHEN D/W BRANCH CIRCUIT - DWELLING UNIT**

Expanded Requirement

2020 NEC - *Specific Appliances* (now will apply to all dishwasher locations, both *residential /commercial*). GFCI protection for personnel:

Refer to 422.5(A) & (B)

Type "A" Protection 4 – 6mA

Crawl Space Lighting – GFCI Requirements 2017 NEC 210.8(E) / 2020 NEC 210.8(C)

45 ☐ ***N*** **210.8(F) OUTDOOR OUTLETS**

NEW Requirement – Dwelling Units

All outdoor *outlets* for dwellings, other than those covered in 210.8(A)(3), exception to (3), that are applied to single-phase branch circuits rated 150-v to ground or less, *50* amps or less, shall have ground-fault circuit-interrupter protection for personnel. (*Exception; Lighting Outlets*)

46 ☐ **PROPOSED 08.20.2021 OBBS UPDATE RE: OUTDOOR OUTLETS**

Posted 09.02.2021 OBBS Proposed Amendment

Amendment 20-01 to NFPA 70 210.8(F) to exempt certain HVAC equipment from the GFCI requirement.

- (VSD's) Variable speed drive motors (peak load conditions)
- ECM motors are energy efficient; (electronically commutated motor) (variable / multi-speed, auto reversing motors); typically provided with 20 - 30 SEER equipment (split systems).

Note: These devices are not compatible with GFCI devices

-

47 ☐ **OBBS *DRAFT* 4101:1-35-01**
CHAPTER 35
REFERENCED STANDARDS

Proposed Amendment to 2020 NFPA 70

National Electrical Code (except that section 210.8(F) does not apply to HVAC units employing power conversion equipment (variable speed drive) as a means to control compressor speed).

48 ☐ ***N* 210.8(F) OUTDOOR OUTLETS**

NEW Requirement – Dwelling Units

All outdoor *outlets* for dwellings, other than those covered in 210.8(A)(3), exception to (3), that are applied to single-phase branch circuits rated 150-v to ground or less, 50 amps or less, shall have ground-fault circuit-interrupter protection for personnel. (*Exception; Lighting Outlets*)

49 ☐ **210.12 ARC-FAULT CIRCUIT PROTECTION**

(A) Dwelling Units – Clarified Wiring Method / Revision

(5) Metal raceway, *metal wireways, metal auxiliary gutters, or* Type MC or Type AC *cable* meeting the *applicable* requirements of 250.118, *with* metal *boxes*, metal *conduit bodies*, and metal *enclosures* are installed for the portion of the branch-circuit between the OCD and the 1st outlet, it shall be permitted to install a listed outlet branch-circuit type AFCI at the 1st outlet to provide protection for the remaining portion of the branch-circuit.

Clarified AFCI receptacle wiring method / use

(A)

50 ☐ **210.12(C) & (D) ARC-FAULT CIRCUIT-INTERRUPTER PROTECTION (AFCI)**

Additional Required Locations

(C) Guest Rooms, Guest Suites (added to 2017 NEC), *and Patient Sleeping Rooms in Nursing Homes and Limited-Care Facilities.* All 120-v 15- and 20-ampere branch circuits supplying outlets *and devices* installed in guest rooms 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).

(D) Branch circuit Extensions or Modifications. – Dwelling Units, Dormitory units, *and Guest Rooms and Suites.*

51 ☐

52 ☐ **210.15 RECONDITIONED EQUIPMENT (NEW)**

The following shall not be reconditioned:

(1) Equipment that provides GFCI protection for personnel
(2)
(2) Equipment that provides AFCI protection
(3)
(3) Equipment that provides GFPE

53 ☐ **210.25(B) COMMON AREA BRANCH CIRCUITS**

Branch circuits installed for lighting, central alarm, signal, communications, or other purposes for public or common areas of two-family dwellings, a multifamily dwelling, or multi-occupancy building shall not be supplied from equipment that supplies an individual dwelling unit or tenant space.

N New Informational Note

Informational Note: Examples of public or common areas include, but are not limited to, lobbies, corridors, stairways, laundry rooms, roofs, elevators, washrooms, store rooms, driveways (parking), and mechanical rooms.

54 ☐

210.52(C)(2) REVISION TO
ISLAND & PENINSULAR COUNTERTOPS

2017 NEC required (1) receptacle outlet, no matter the size of peninsular *(wall outlet)*.

2020 NEC will require (1) receptacle outlet for the 1st
9 ft² of countertop space. A receptacle outlet is required for every additional 18 ft² or fraction thereof, of countertop space (+ within 2' of outer end for peninsular locations).

55 ☐ **210.52(E)(3) BALCONIES, DECKS, & PORCHES**

Balconies, decks, and porches that are *within 4" horizontally of the dwelling unit* shall have at least *one* receptacle outlet accessible from the balcony, deck or porch.

Clarification / Self-supporting deck

56 ☐ **210.63 EQUIPMENT REQUIRING SERVICING**

A 125-v single-phase, 15- or 20-a rated receptacle outlet shall be installed at an accessible location *within 25' of the equipment* as specified in 210.63(A) and (B). (*in same room, area and level)*

N 210.63(A) Heating, A/C, and refrigeration equipment

210.63(B) Other Electrical Equipment (other than 1- and 2-family)

N 210.63(B)(1) Indoor Service Equipment (located in same room)

N 210.63(B)(2) Indoor Equip. Requiring Dedicated Equip. Spaces

Not connected on load side of disconnecting means!

57 ☐ **210.65 MEETING ROOMS**

Rooms 1000 ft² or less – Easier to Understand

210.65(A) – General

210.65(B) – Receptacle Outlets Required; 2' / 6' / 12' (per 210.52)

1. Receptacle outlets; in fixed walls.
2. Floor outlets; applies to rooms greater than 12' in any direction and floor area of 215 ft² shall have at least *one floor receptacle outlet, or at least one floor outlet to serve receptacle(s). Located at a distance of not less than 6' from any fixed wall for each 215 ft² or major portion of floor space.*

N 2017 NEC / 210.71

58 ☐ **210.70 LIGHTING OUTLETS REQUIRED**

Revised

210.70(A)(1) Habitable Rooms. 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.*

210.70(A)(2) *Additional Locations. – Remains Same*
210.70(B) *Guest Rooms or Guest Suites. – Remains same*
210.70(C) *All Occupancies. – Remains Same*

Control device = switch / occ. sensor / other device

59 ☐ **215.9**
GROUND FAULT CIRCUIT INTERRUPTER PROTECTION FOR PERSONNEL (FEEDERS)

Proposed revisions to *update* this section to allow GFCI protection of feeders to correlate with both 210.8 GFCI protection for personnel and 590.6 Temporary Installations.

Was limited to 15- and 20a branch circuits.
(i.e.: electric dryers and ranges)

60 ☐ **215.10 GROUND-FAULT**
PROTECTION OF EQUIPMENT

New Exception

N 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.

AT+T Switching Facility

61 ☐ **TABLE 220.12 GENERAL LIGHTING LOADS BY OCCUPANCY**

Due to lighting system technology (LED) specifically and energy code compliance requirements, *ASHRAE 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings,* designers around the Country utilize these requirements and the NEC is updating their requirements.

Reducing lighting minimums

62 ☐ ***N* 220.12**

LIGHTING LOADS FOR NON-DWELLING OCCUPANCIES

Added (B) Energy Code / Revised / #4 is new

(A) General. Lighting loads shall be not less than specified in Table 220.12. Motors less than 1/8 HP and connected to a lighting circuit are considered general lighting load.

(B) Energy Code. 2017 NEC, was exception, now revised to positive code language.

1. Power monitoring system installed for general lighting system.
2. Provided with alarm values.
3. Demand factors are not applicable
4. *Continuous load of 125% shall be applied.*

63 ☐ **TABLE 220.12**
GENERAL LTG. LOADS

Revised / Enlarged Table

[a]Armories & Auditoriums = *gyms*
[b]Lodge rooms = *hotels / motels*
[c]Industrial Comm. = *manufacturing / factory*
[d]Banks = *offices*
[e]Storage garages = *parking garages*
[f]Clubs = *restaurants*
[g/H] Barber / Beauty shops / Stores = *retail*

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248 ☐ **2020 NEC COMMERCIAL OVERVIEW**

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)

- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

249 ☐ **2020 NEC RESIDENTIAL OVERVIEW**

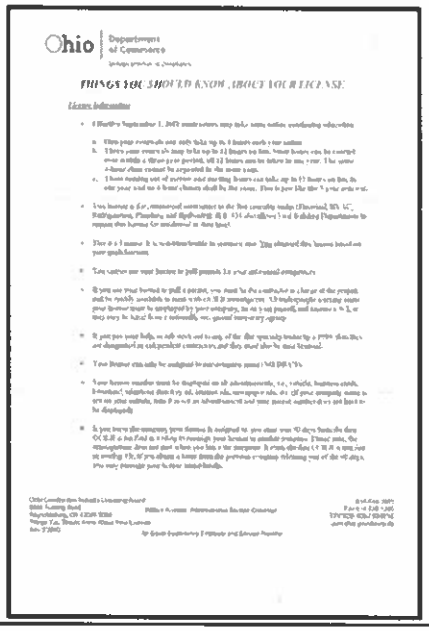
- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

250 ☐

2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Thank You!

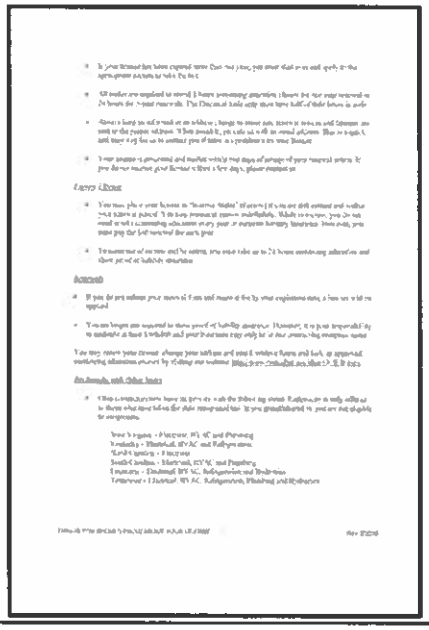
OCILB LICENSE INFORMATION



Ohio | Department of Commerce

THINGS YOU SHOULD KNOW ABOUT YOUR LICENSE

License Information



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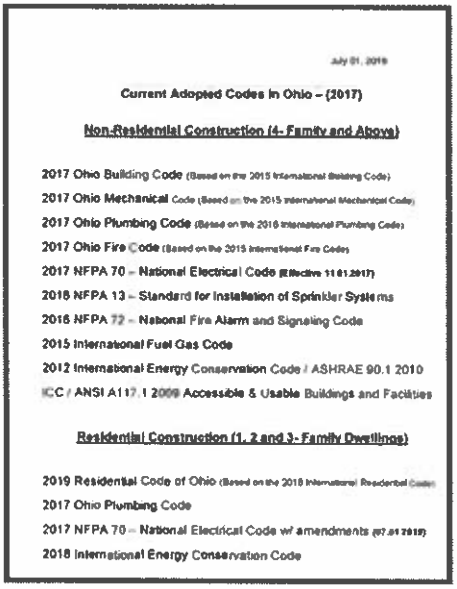
CURRENT ADOPTED CODES



July 01, 2019

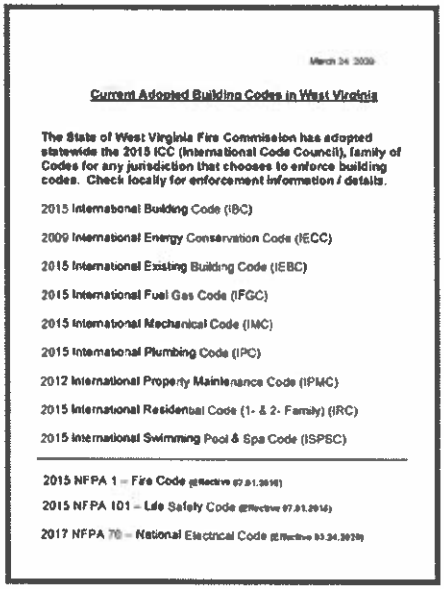
Current Adopted Codes in Ohio – (2017)

Non-Residential Construction (4- Family and Above)

2017 Ohio Building Code (Based on the 2015 International Building Code)
2017 Ohio Mechanical Code (Based on the 2015 International Mechanical Code)
2017 Ohio Plumbing Code (Based on the 2015 International Plumbing Code)
2017 Ohio Fire Code (Based on the 2015 International Fire Code)
2017 NFPA 70 – National Electrical Code (Effective 11.01.2017)
2018 NFPA 13 – Standard for Installation of Sprinkler Systems
2016 NFPA 72 – National Fire Alarm and Signaling Code
2015 International Fuel Gas Code
2012 International Energy Conservation Code / ASHRAE 90.1 2010
ICC / ANSI A117.1 2009 Accessible & Usable Buildings and Facilities

Residential Construction (1, 2 and 3- Family Dwellings)

2019 Residential Code of Ohio (Based on the 2018 International Residential Code)
2017 Ohio Plumbing Code
2017 NFPA 70 – National Electrical Code w/ amendments (07.01.2018)
2018 International Energy Conservation Code



March 24, 2020

Current Adopted Building Codes in West Virginia

The State of West Virginia Fire Commission has adopted statewide the 2015 ICC (International Code Council), family of Codes for any jurisdiction that chooses to enforce building codes. Check locally for enforcement information / details.

2015 International Building Code (IBC)
2009 International Energy Conservation Code (IECC)
2015 International Existing Building Code (IEBC)
2015 International Fuel Gas Code (IFGC)
2015 International Mechanical Code (IMC)
2015 International Plumbing Code (IPC)
2012 International Property Maintenance Code (IPMC)
2015 International Residential Code (1- & 2- Family) (IRC)
2015 International Swimming Pool & Spa Code (ISPSC)

2015 NFPA 1 – Fire Code (Effective 07.01.2016)
2015 NFPA 101 – Life Safety Code (Effective 07.01.2016)
2017 NFPA 70 – National Electrical Code (Effective 03.24.2020)

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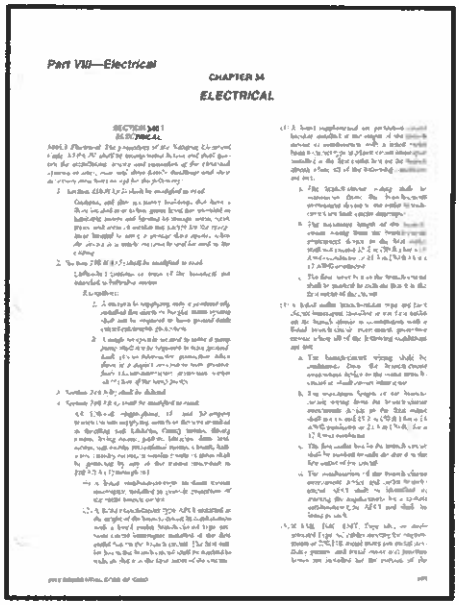
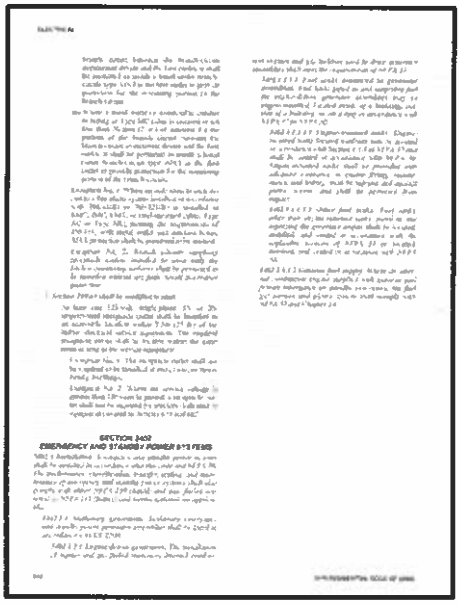
2019 RESIDENTIAL CODE OF OHIO



Part VIII—Electrical

CHAPTER 34

ELECTRICAL



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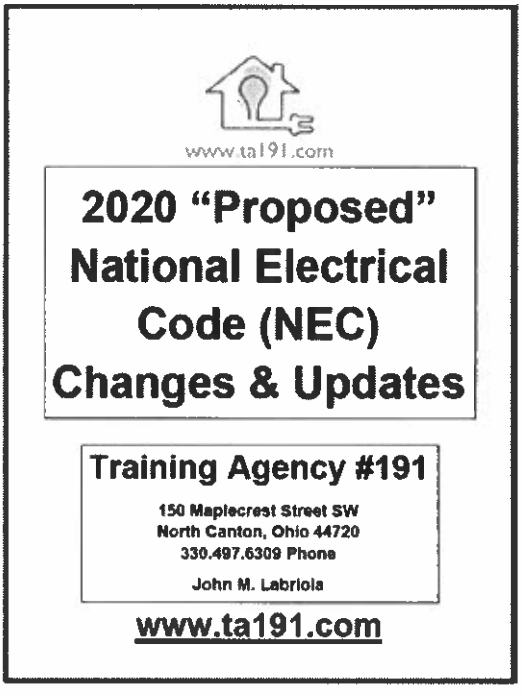

www.ta191.com

2020 "Proposed" National Electrical Code (NEC) Changes & Updates

Training Agency #191

150 Maplecrest Street SW
North Canton, Ohio 44720
330.497.6309 Phone

John M. Labriola

www.ta191.com

2020

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THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

2020

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NFPA 70
National Electrical Code
2020

nec NFPA

NFPA

"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)

Subject to the local or State adoption authority

2020

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OHIO LEGISLATION 3783.02

- Ohio Revised Code Section 3783.02 Exemptions. Effective: November 3, 1989 Legislation: House Bill 222 - 118th General Assembly Nothing in sections 3783.01 to 3783.08 of the Revised Code shall apply to inspection of the design, construction, maintenance, or replacement of any of the following: (A) Installations in ships, watercraft, railway rolling stock, aircraft, or automotive vehicles; (B) Installations underground in mines; (C) Installations of railways for the generation, transformation, transmission, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communication purposes; (D) Installations of communication equipment under control of communication utilities, located outdoors or in building spaces used for such installations; (E) Installations under the control of electric utilities for the purpose of communication, metering, or for the generation, control, transformation, transmission, and distribution of electric energy located in building spaces used by utilities for such purposes or located on property owned or leased by the utility or on public highways, streets, roads, etc., or by established rights on private property; (F) Installations of elevators, dumbwaiters, and escalators as regulated by the bureau of workers' compensation.

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2020 NATIONAL ELECTRICAL CODE (NEC) PROPOSED CHANGES AND UPDATE INFORMATION DETAILS

NFPA MEMBER

Based on the 2020 National Electrical Code (NFPA 70) as published by the National Fire Protection Association (NFPA).

All information contained within this presentation is my personal and professional opinion, based upon over 43 years in the construction industry.

Not Current Code in Ohio

2020

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2020 NATIONAL ELECTRICAL CODE

Identifying Changes throughout the Code

Over 3,700 public inputs / 1,900 comments

New Revision Symbols

Δ before a section number = words in section deleted

Δ to left of table or figure = revision to table or figure

Δ throughout chapter = heavy revision to entire chapter

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2020

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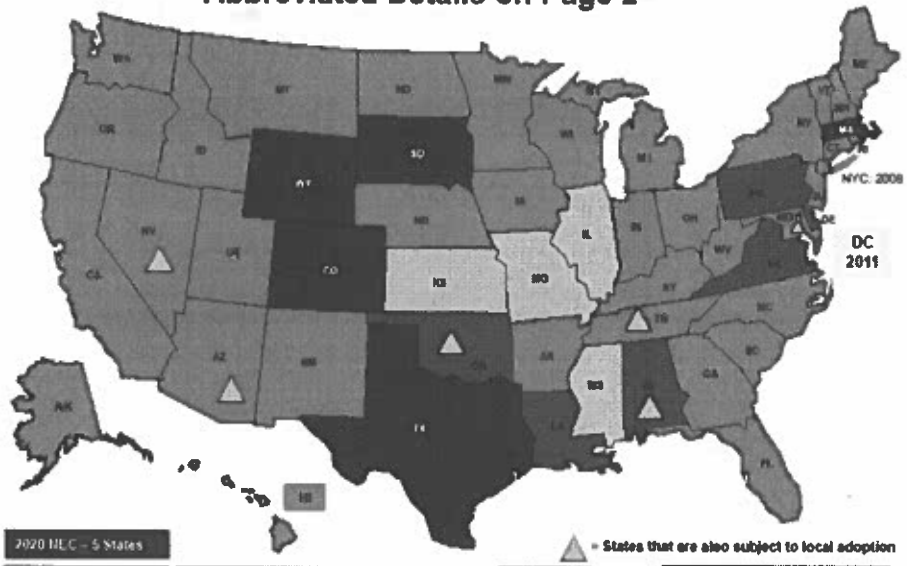
NEC Adoption by State
Abbreviated Details on Page 2

Revised – August 2020



Note: Earlier editions of the NEC may be enforced in states with no statewide adoption or that are subject to local adoption

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State	Adoption	Implementation		State	Adoption	Implementation	
Alabama	7.1.16	See Adoption Report		Montana	12.7.19	12.7.19	
Alaska	5.9.19	5.9.19		Nebraska	5.1.17	8.1.17	
Arizona	Local Adoption	See Adoption Report		Nevada	2.5.19	Local	Majority
Arkansas	9.19.17	1.1.18		New Hampshire	3.1.17	1.1.18	
California	January 2019	1.1.20		New Jersey	9.3.19	9.3.19	
Colorado	5.27.2020	8.1.20		New Mexico	11.15.17	2.1.18	
Connecticut	7.25.18	10.1.18		New York	12.1.19	8.18.20	Ex. NYC
Delaware	3.11.16	3.11.16		North Carolina	12.12.17	6.12.18	
Florida	6.2.20	12.31.20		North Dakota	3.14.17	7.1.17	
Georgia	11.15.17	1.1.18		Ohio	5.26.17	11.1.17	
Hawaii	7.26.18	1.1.19		Oklahoma	6.8.15	11.1.15	
Idaho	7.1.17	7.1.17		Oregon	10.1.17	10.1.17	
Illinois	Local Adoption	See Adoption Report		Pennsylvania	5.1.18	10.1.18	
Indiana	August 2009	9.26.09		Rhode Island	8.1.19	8.1.19	
Iowa	11.3.17	1.1.18		South Carolina	8.22.18	1.1.20	
Kansas	Local Adoption	See Adoption Report		South Dakota	6.9.20	7.1.20	
Kentucky	8.22.18	1.1.19		Tennessee	3.19.18	10.1.18	
Louisiana	12.12.17	2.1.18		Texas	10.1.20	11.1.20	
Maine	11.6.17	11.6.17		Utah	5.8.17	7.1.18	
Maryland	See Adoption Report	Local	State	Vermont	10.1.17	10.1.17	
Massachusetts	12.5.19	1.1.20		Virginia	4.30.18	9.4.18	
Michigan	1/4/19	1.4.19		Washington	7.1.17	7.1.17	
Minnesota	8/1/17	7.1.17		West Virginia	3.24.20	3.24.20	
Mississippi	Local Adoption	See Adoption Report		Wisconsin	4.1.18	8.1.18	
Missouri	Local Adoption	See Adoption Report		Wyoming	2.1.20	7.1.20	

2020

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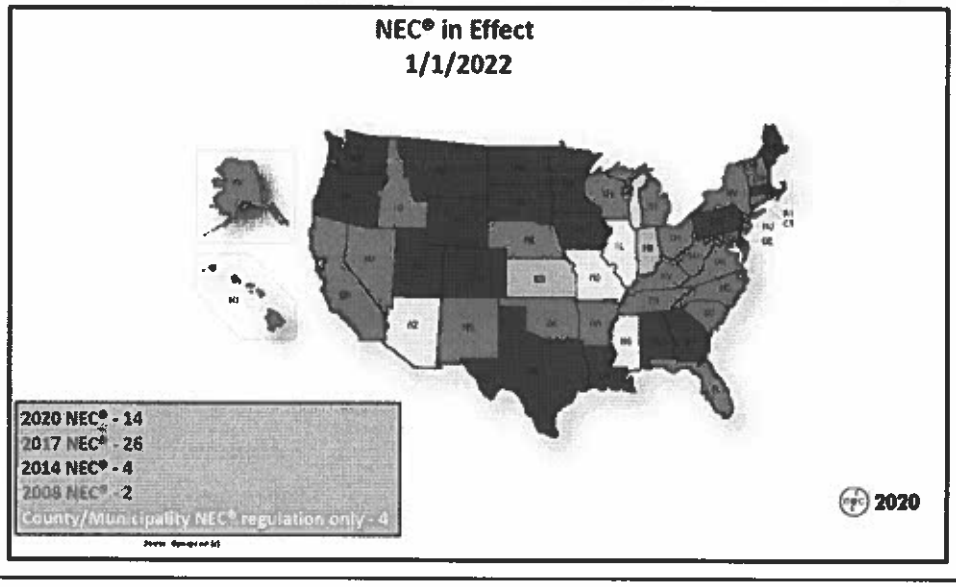
NFPA STATE UPDATE MAP



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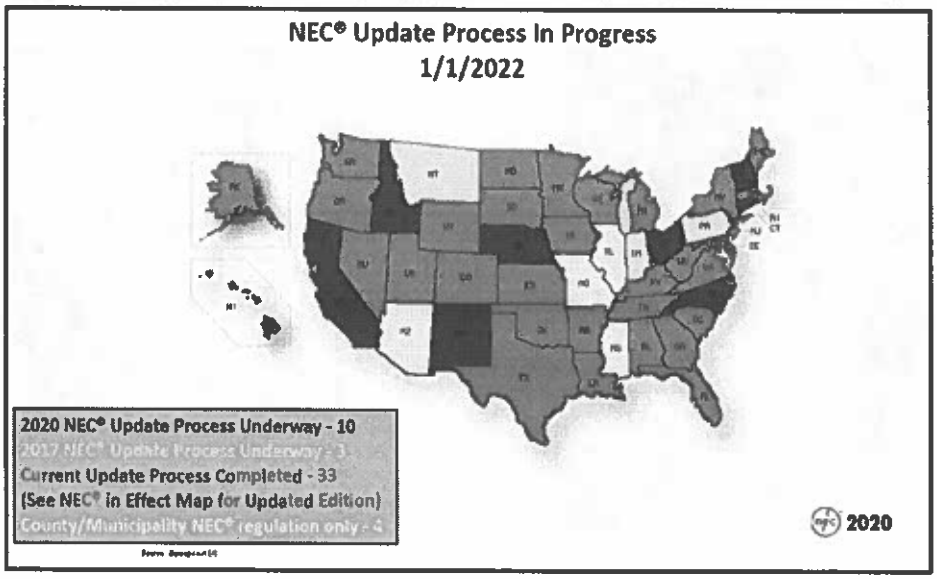
NFPA STATE UPDATE MAP



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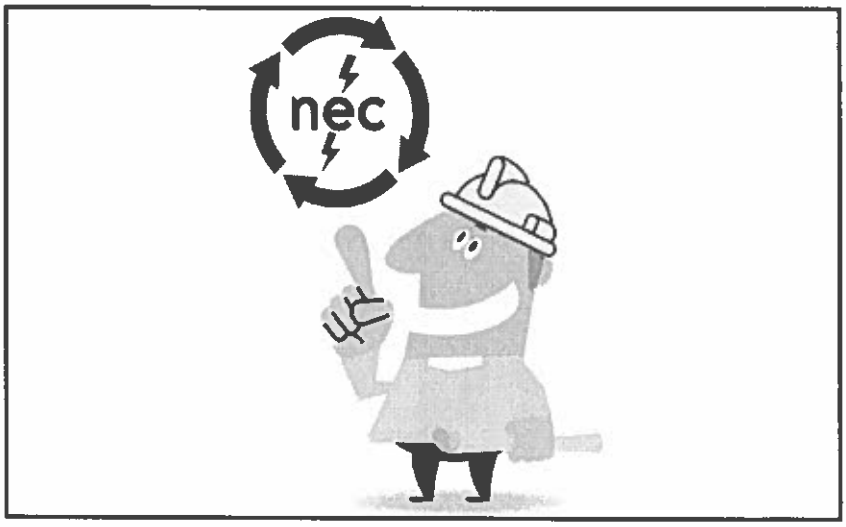
2023 NEC WILL BE HERE SOON!!



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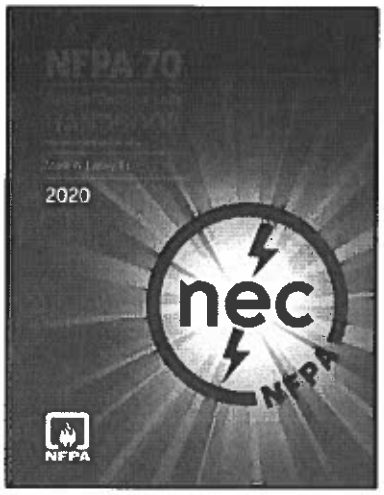
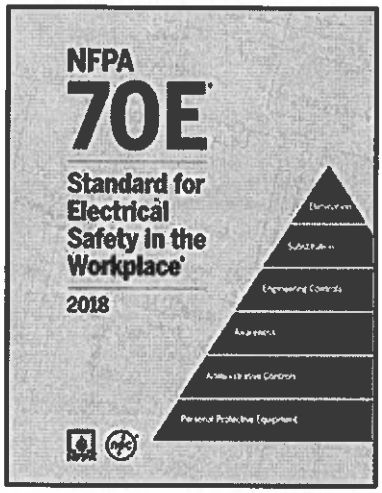
ADDITIONAL USEFUL NFPA PUBLICATIONS





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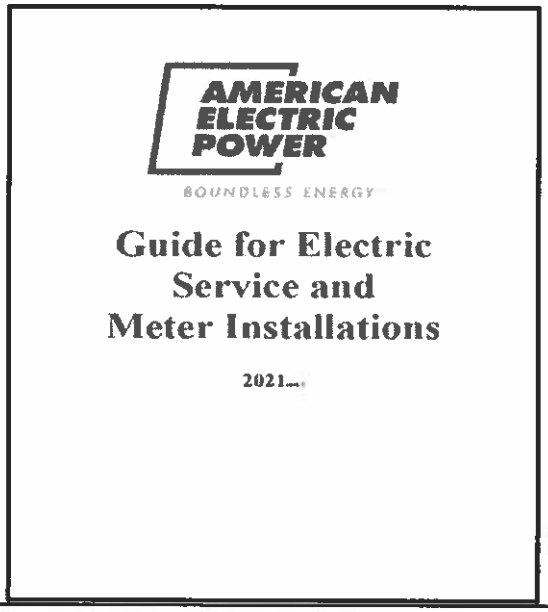
POWER CO. SERVICE GUIDES



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(4) "*NEW*" ARTICLES

Article 242 Overvoltage Protection

Article 311 Medium Voltage Conductors and Cable

Article 337 Type "P" Cable (Hazardous Locations)

Article 805 General Requirements for Communication Systems

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CHAPTER 1

General

Article 100 – Definitions

Article 110 – Requirements for Electrical Installations

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ARTICLE 100- DEFINITIONS

If a definition is utilized in two or more Articles the definition will be in Article 100

Now Three Subparts

Part I. – General
Part II. – Over 1000 Volts. Nominal
Part III. – Hazardous Classified Locations. (CMP-14)

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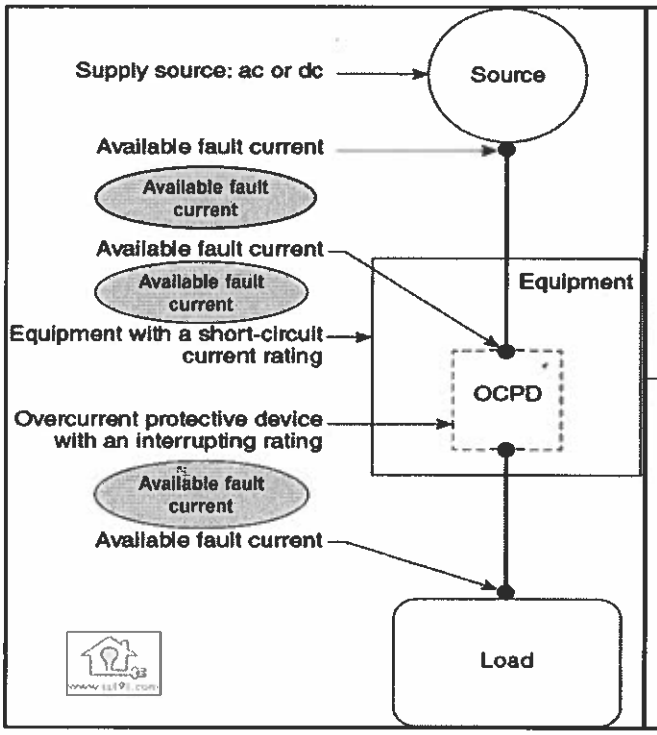

ARTICLE 100 DEFINITIONS

Available Fault Current

Fault Current:

The current delivered at a point on the system during a short-circuit condition. **(CMP-10)**

Available Fault Current:

The largest amount of current capable of being delivered at a point on the system during a short-circuit condition. **(CMP-10)**

Note: AFC is calculated at load-side terminals of the source and line-side terminals of OCPD and all other load locations.

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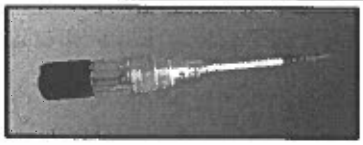
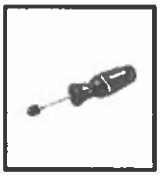
110.14(D) TERMINAL TIGHTENING TORQUE





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 Notes: 1, 2 & 3
Shear bolts, breakaway-style devices with visual indicators
NFPA 70(B)-Electrical Equipment Maintenance

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110.22(A) IDENTIFICATION OF DISCONNECTING MEANS - GENERAL

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. **Re: **ANSI Z535.4 2011 (R2017)****

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110.24(A) AVAILABLE FAULT CURRENT - FIELD MARKING

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 of the calculation was performed and be of sufficient durability to withstand the environment involved.

Information Note 1 – **Recognizes NFPA 70E- 2018**

N Informational Note 2 – Values of AFC current for use in determining appropriate minimum SCCR of SE equipment is available from electric utilities in published or other forms.

Assistance from the local electrical utility

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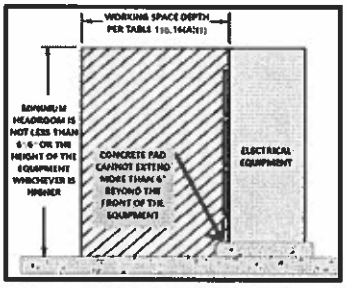
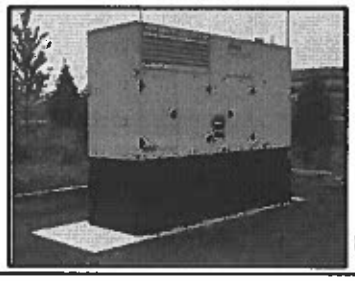
110.26(A)(3) HEIGHT OF WORKING SPACE

Revision

The work space shall be clear and extend from the grade, floor or platform to a height of 78" or the height of equipment, whichever is greater. Within the height requirements of this section, other equipment ***or support structures, such as concrete pads shall not extend more than 6" beyond the front of the electrical equipment.***





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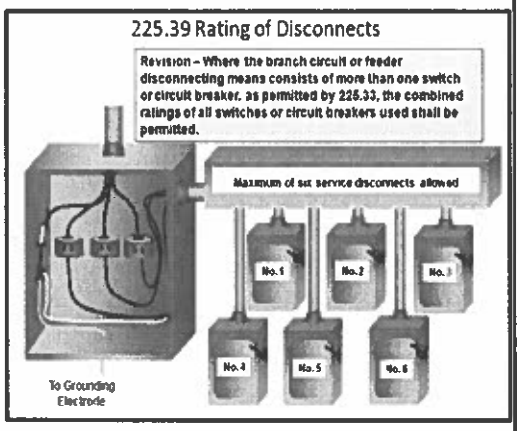
110.26(C)(2) LARGE EQUIPMENT – RATED 1200 AMPERES OR GREATER

Large Equipment is defined as follows:

(1) For equipment rated 1200 amperes or more and over 6' wide.

(2) For SE disconnecting means installed in accordance with 230.71 where the combined ampere rating is 1200 amperes or more and over 6' wide.



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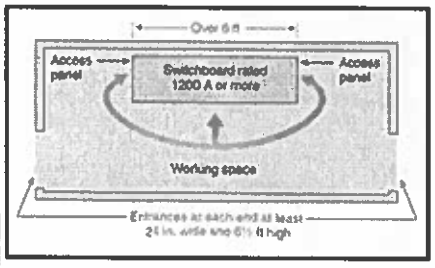
ARTICLE 110.26(C)(2)

The one entrance requirement has been 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 24" wide & 78" high at ***each end of the working space***.



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CHAPTER 2

Wiring and Protection

Article 210 – Branch Circuits

Article 220 – Branch-Circuit, Feeder, and Service Load Calculations

Article 230 – Services

Article 240 – Overcurrent Protection

N **Article 242 – Overvoltage Protection**

Article 250 – Grounding

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210.8 GFCI PROTECTION FOR PERSONNEL

2017 NEC	2020 NEC
(A) Dwelling Units	(A) Dwelling Units
(B) Other Than Dwelling Units	(B) Other than Dwelling Units
(C) Boat Hoists	(C) Crawl Space Ltg. Ckts.
(D) Kitchen D/W Branch Ckt.	(D) Specific Appliances
(E) Crawl Space Lighting Ckt.	(E) Equip. Requiring Servicing
	(F) Outdoor Outlets

Not Current Code in Ohio

2020

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ARTICLE 100 - DEFINITIONS

Receptacle

A contact device installed at the outlet for the connection of an attachment plug or for direct connection of electrical utilization equipment designed to mate with the corresponding contact device. A single receptacle is a single contact device with no other contact device on the same yoke ***or strap***. A multiple receptacle is two or more contact devices on the same yoke ***or strap.*** (CMP-18)

210.8(A) & (B)

Outlet

A point on the wiring system at which current is taken to supply utilization equipment. (CMP-1)

210.8(C) – Crawl Space Ltg. Outlets

N **210.8(D) Specific Appliances**
N **210.8(E) Equip. Requiring Servicing**
N **210.8(F) Outdoor Outlets**

2020

For Informational Purposes Only

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210.8(A) GFCI PROTECTION FOR PERSONNEL- DWELLING UNITS

Significant Expanded Requirements:

This change will now require that *all* 125-v through 250-v "*receptacles*" installed in the locations specified in 210.8(A)(1) through 210.8(A)(11) and supplied by 1ø branch circuits rated 150-v or less to ground shall have GFCI protection for personnel (no maximum amperage noted)

Previous NEC editions were limited to 15- and 20-amp 125-v receptacles.

Bathrooms, *garages*, outdoors, crawl spaces, *basements*, *kitchens*, sinks, boathouses, bathtubs or shower stalls, *laundry areas* or indoor damp and wet locations.

11 Locations / Type "A" GFCI Protection 4 – 6 mA

Not Current Code in Ohio

2020

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210.8(A)(5) DWELLING UNIT GFCI PROTECTION

Basements – Changes the Intent

Removed: "unfinished portions or areas of the basement not intended as habitable rooms".

This change will now require ***all*** receptacles installed in basements will require GFCI protection.

Exception remains for fire alarm / burglar alarm systems.

All **receptacles in dwelling unit basements are subject to dampness, moisture and conductive floors, whether finished or unfinished.**

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210.8(A)(6) DWELLING UNIT KITCHENS

Receptacles rated 125-v to 250-v located to "*serve countertop surfaces*" in kitchens will now be required to be provided with GFCI protection.

No Max. Amperage noted!

Not Current Code in Ohio

2020

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210.8(A)(7) GROUND-FAULT CIRCUIT-INTERRUPTER PROTECTION FOR PERSONNEL

Clarification of Intent

Re: Sinks where receptacles are installed within 6' from the top inside edge of the bowl of the sink.

This change ***deletes referenced text*** in the last paragraph to this section, which was new in the 2017 NEC. "***the shortest path the 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***".

2020 Removes the 6' cord without passing through a "door or doorway"!

ie: Garbage Disposal / Dishwasher / Instant Hot / Compactor receptacle

GFCI / AFCI protection required if within the 6' measurement

2020

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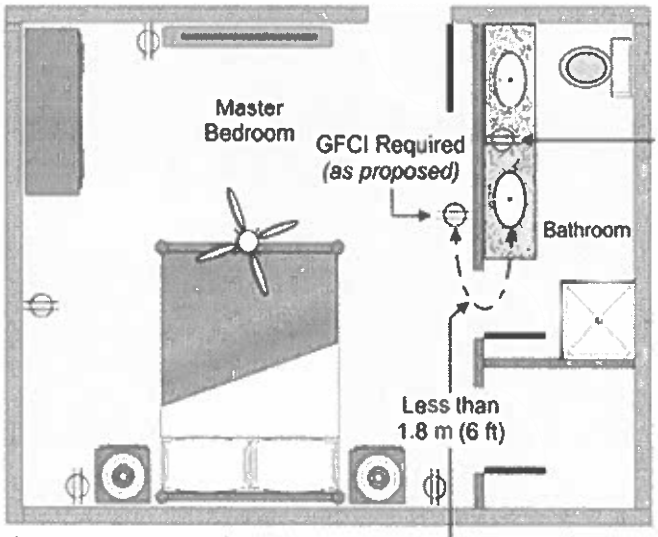
210.8(A)(7) REVISION

Regarding all 125-v through 250-v 1ø, 150-v to ground or less, receptacles installed *within 6' from the top inside edge of a sink.*

Removed reference to all doors (cabinet, personnel or other) and doorway.

210.8 Measurements for GFCI Protection



All 125-volt through 250-volt receptacles installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink requires GFCI protection. *[210.8(A)(7)]*

For the purposes of this section, when determining the distance from receptacles the distance shall be measured as the shortest path the cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or passing through a ~~door, doorway, or~~ window. *[210.8]*

Not Current Code in Ohio

2020

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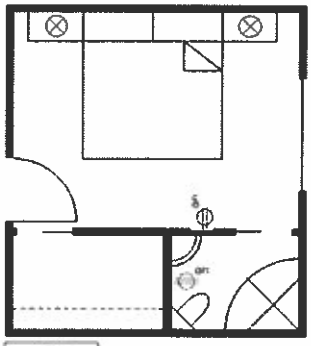
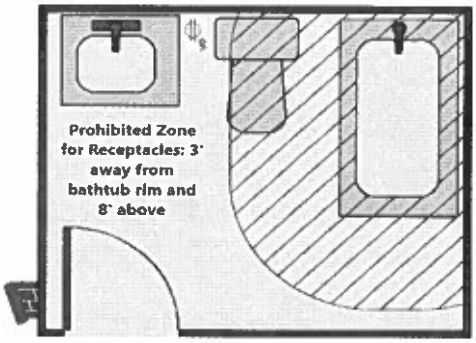
210.8(A) GFCI PROTECTION (CONT'D)

Bathroom Locations





Kitchen Locations

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2020

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210.8(A)(10) DWELLING UNIT LAUNDRY AREAS (ROOMS)

Receptacles rated 125-v to 250-v (1ø 150-v to ground or less) located in laundry area(s) will now be required to be provided with GFCI protection.

No Max. Amperage Noted!

Not Current Code in Ohio

2020

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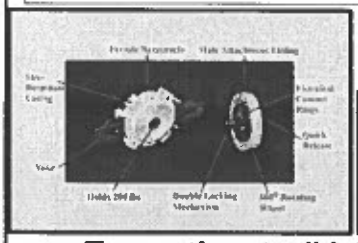
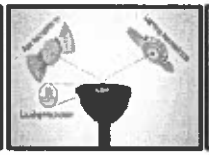
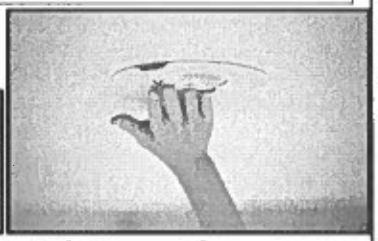
210.8(A) DWELLING UNIT – GFCI PROTECTION



NEW – Exception



***Exception** to #1-3, 5-8 and 10: **Listed locking** support & mounting receptacles utilized in combinations with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not require GFCI protection.* (Safety Quick Ltg. & Fans Corp)

If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

***Applies to**: Bathrooms, Garages, Outdoors, Basements, Kitchens, Sinks, Boathouses and Laundry Areas*

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2020

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210.8(B) GFCI PROTECTION FOR PERSONNEL- OTHER THAN DWELLING UNITS

Expanded Requirements:

The change will require that *all* 125-v through 250-v "*receptacles*" supplied by 1ø branch circuits rated 150-v to ground or less, 50a or less and "*all receptacles*" supplied by 3ø branch circuits rated 150-v to ground, 100a or less, installed in the locations in areas specified in 210.8(B)(1) through 210.8(B)(12) will now require GFCI protection for personnel.

Bathrooms, kitchens, rooftops, outdoors, sinks, indoor *damp and* wet locations, locker rooms with associated showering facilities, garages, *accessory buildings*, service bays, crawl spaces, unfinished *areas of basements*, *laundry areas*, and *bathtubs and shower stalls*.

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12 Locations / Type "A" GFCI Protection 4 – 6 mA

Not Current Code in Ohio

2020

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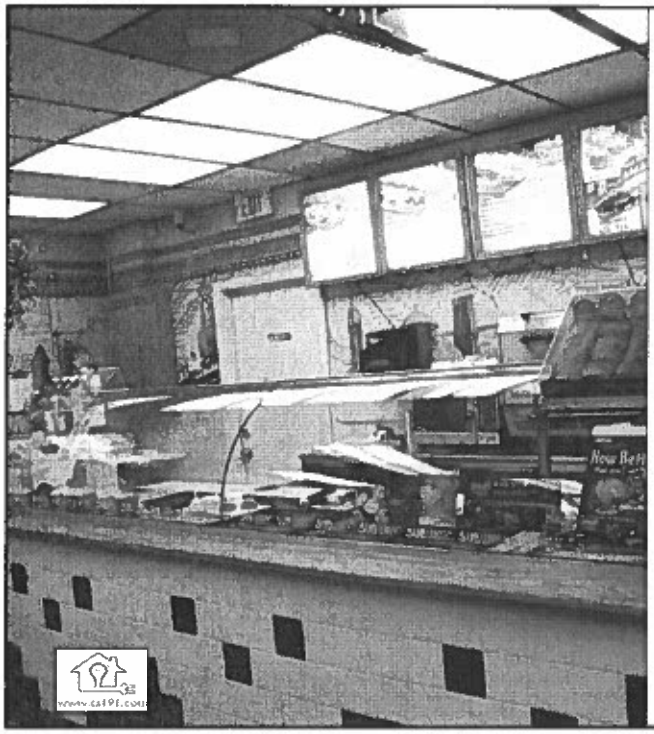

210.8(B)(2) GFCI PROTECTION

OTHER THAN DWELLING UNITS

KITCHENS / *FOOD PREP*

Expanded Requirement

Kitchens *or areas with a sink "and" permanent provisions for either food preparation* or cooking.

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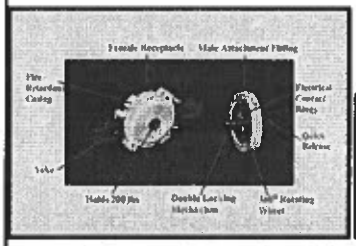
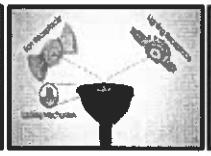
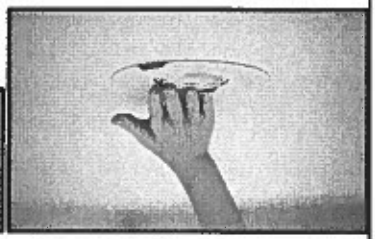
210.8(B) OTHER THAN DWELLING UNITS – GFCI PROTECTION

NEW – Exception







***Exception** to #1-5, 8 and 10: **Listed locking** support & mounting receptacles utilized in combinations with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not require GFCI protection.* (Safety Quick Ltg. & Fans Corp)

If a general-purpose convenience receptacle is integral to the ceiling luminaire or ceiling fan, GFCI protection shall be provided.

Applies to: Bathrooms, Kitchens, Rooftops, Outdoors, Sinks, Garages and unfinished portions of Basements

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2020

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210.8(C) CRAWL SPACE LIGHTING OUTLETS
210.8(D) SPECIFIC APPLIANCES
210.8(E) EQUIPMENT REQUIRING SERVICING
210.8(F) OUTDOOR OUTLETS

(C) Crawl Space Lighting Outlets- 120-v or less

N (D) Specific Appliances- 422.5 all dishwasher *outlets*

N (E) Equipment Requiring Servicing- 210.63

N (F) Outdoor Outlets- all outdoor *outlets* for dwellings, 1ø branch circuits, 150-v or to ground or less, 50a or less

Not Current Code in Ohio

2020

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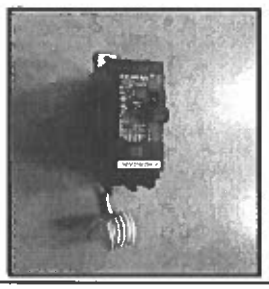
210.8(C) BOAT HOISTS

Removed / Re-directed

2017 NEC – GFCI protection is required per 555.3

2020 NEC – GFCI Protection will be 555.9

Type "A" Protection 4-6mA



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2020

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210.8(D) SPECIFIC APPLIANCES; WAS KITCHEN D/W BRANCH CIRCUIT - DWELLING UNIT

Expanded Requirement

2020 NEC - *Specific Appliances* (now will apply to all dishwasher locations, both ***residential /commercial***). GFCI protection for personnel:

Refer to 422.5(A) & (B)

Type "A" Protection 4 – 6mA

Crawl Space Lighting – GFCI Requirements 2017 NEC 210.8(E) / 2020 NEC 210.8(C)

Not Current Code in Ohio

2020

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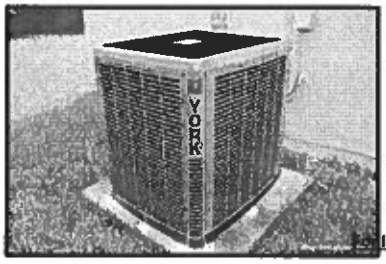
N 210.8(F) OUTDOOR OUTLETS

NEW Requirement – Dwelling Units

All **outdoor *outlets* for dwellings, other than those covered in 210.8(A)(3), exception to (3), that are applied to single-phase branch circuits rated 150-v to ground or less, *50* amps or less, shall have ground-fault circuit-interrupter protection for personnel. (*Exception; Lighting Outlets*)**



2020

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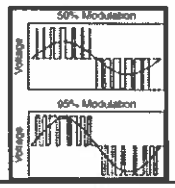
PROPOSED 08.20.2021 OBBS UPDATE RE: OUTDOOR OUTLETS

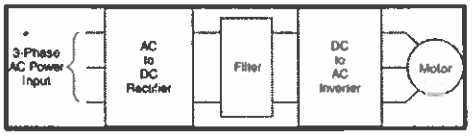
Posted 09.02.2021 OBBS Proposed Amendment

Amendment 20-01 to NFPA 70 210.8(F) to exempt certain HVAC equipment from the GFCI requirement.

- **(VSD's) Variable speed drive motors (peak load conditions)**
- **ECM motors are energy efficient; (electronically commutated motor) (variable / multi-speed, auto reversing motors); typically provided with 20 - 30 SEER equipment (split systems).**

Note: These devices are not compatible with GFCI devices





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OBBS *DRAFT* 4101:1-35-01 CHAPTER 35 REFERENCED STANDARDS

Proposed Amendment to 2020 NFPA 70

National Electrical Code (except that section 210.8(F) does not apply to HVAC units employing power conversion equipment (variable speed drive) as a means to control compressor speed).

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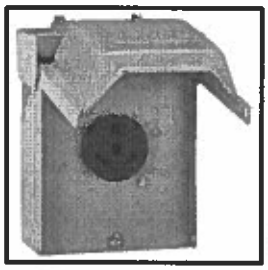
N 210.8(F) OUTDOOR OUTLETS

NEW Requirement – Dwelling Units

All outdoor outlets for dwellings, other than those covered in 210.8(A)(3), exception to (3), that are applied to single-phase branch circuits rated 150-v to ground or less, 50 amps or less, shall have ground-fault circuit-interrupter protection for personnel. (*Exception; Lighting Outlets*)



2020

Not Current Code in Ohio

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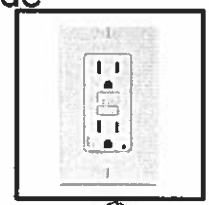
210.12 ARC-FAULT CIRCUIT PROTECTION

(A) Dwelling Units – Clarified Wiring Method / Revision

(5) Metal raceway, ***metal wireways, metal auxiliary gutters, or*** Type MC or Type AC ***cable*** meeting the ***applicable*** requirements of 250.118, ***with*** metal ***boxes***, metal ***conduit bodies***, and metal ***enclosures*** are installed for the portion of the branch-circuit between the OCD and the 1st outlet, it shall be permitted to install a listed outlet branch-circuit type AFCI at the 1st outlet to provide protection for the remaining portion of the branch-circuit.



Clarified AFCI receptacle wiring method / use

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210.12(C) & (D) ARC-FAULT CIRCUIT-INTERRUPTER PROTECTION (AFCI)

Additional Required Locations

(C) Guest Rooms, Guest Suites (added to 2017 NEC), ***and Patient Sleeping Rooms in Nursing Homes and Limited-Care Facilities.*** All 120-v 15- and 20-ampere branch circuits supplying outlets ***and devices*** installed in guest rooms 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).

(D) Branch circuit Extensions or Modifications. – Dwelling Units, Dormitory units, ***and Guest Rooms and Suites.***

Not Current Code in Ohio

2020

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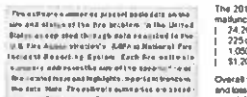
Fire Estimate Summary

Residential Building Electrical Malfunction Fire Trends (2010-2019)

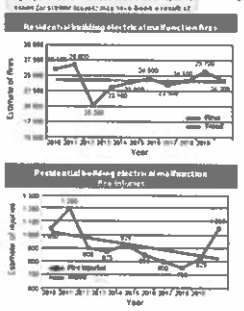


The 2019 national estimates for residential building electrical malfunction fires and losses show that there were

- 24,200 fires
- 225 deaths
- 1,050 injuries
- $1,208,300,000 in dollar loss

Overall trends for residential building electrical malfunction fires and losses for the 10-year period of 2010 to 2019 show the following

- A 0.8% decrease in fires
- A 15% decrease in deaths
- A 20% decrease in injuries
- A 9% increase in dollar loss. In 2018 and 2019 there were 32 and 14 incidents respectively with a reported dollar loss of $1,000,000 or more which may have contributed to the observed increase in fire dollar loss. The 2019 high dollar loss fires included a $26,400,000 hotel fire in New Orleans Louisiana. (Note: This overall constant dollar loss trend takes inflation into account by adjusting each year's dollar loss to its equivalent 2019 value.)



FEMA | U.S. Fire Administration

National Fire Data Center
16825 S. Seton Ave
Emmitsburg, MD 21727
usfa.fema.gov

2020

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210.15 RECONDITIONED EQUIPMENT (NEW)

The following shall not be reconditioned:

(1) Equipment that provides GFCI protection for personnel

(2) Equipment that provides AFCI protection

(3) Equipment that provides GFPE

Not Current Code in Ohio

2020

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210.25(B) COMMON AREA BRANCH CIRCUITS

Branch circuits installed for lighting, central alarm, signal, communications, or other purposes for public or common areas of two-family dwellings, a multifamily dwelling, or multi-occupancy building shall not be supplied from equipment that supplies an individual dwelling unit or tenant space.

***N* New Informational Note**

Informational Note: Examples of public or common areas include, but are not limited to, lobbies, corridors, stairways, laundry rooms, roofs, elevators, washrooms, store rooms, driveways (parking), and mechanical rooms.

For Informational Purposes Only

2020

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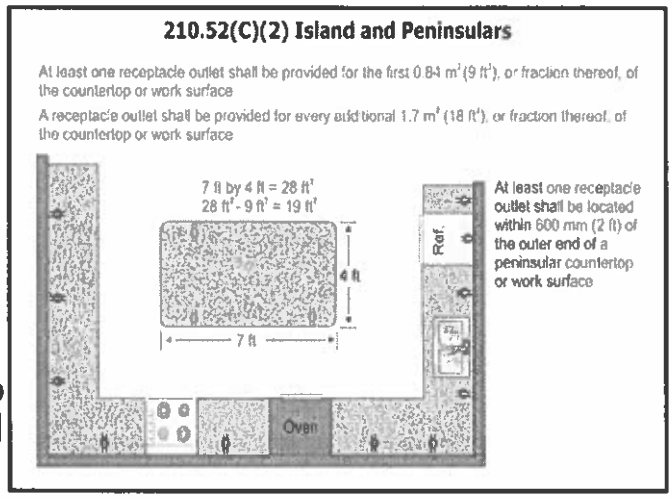
210.52(C)(2) REVISION TO ISLAND & PENINSULAR COUNTERTOPS

2017 NEC required (1) receptacle outlet, no matter the size of peninsular ***(wall outlet)***.

2020 NEC **will require (1) receptacle outlet for the 1st 9 ft² of countertop space. A receptacle outlet is required for every additional 18 ft² or fraction thereof, of countertop space (+ within 2' of outer end for peninsular locations).**



Not Current Code in Ohio

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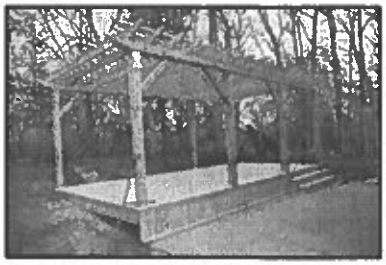
210.52(E)(3) BALCONIES, DECKS, & PORCHES

Balconies, decks, and porches that are ***within 4" horizontally of the dwelling unit*** shall have at least ***one*** receptacle outlet accessible from the balcony, deck or porch.

Clarification / Self-supporting deck



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210.63 EQUIPMENT REQUIRING SERVICING

A 125-v single-phase, 15- or 20-a rated receptacle outlet shall be installed at an accessible location ***within 25' of the equipment*** as specified in 210.63(A) and (B). ***(in same room, area and level)***

N ***210.63(A)*** **Heating, A/C, and refrigeration equipment**

210.63(B) Other Electrical Equipment **(other than 1- and 2-family)**

N ***210.63(B)(1)*** ***Indoor Service Equipment (located in same room)***

N ***210.63(B)(2)*** ***Indoor Equip. Requiring Dedicated Equip. Spaces***

Not connected on load side of disconnecting means!

Not Current Code in Ohio

2020

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210.65 MEETING ROOMS

Rooms 1000 ft² or less – Easier to Understand

210.65(A) – General

210.65(B) – Receptacle Outlets Required; 2' / 6' / 12' (per 210.52)

1. Receptacle outlets; in fixed walls.
2. Floor outlets; applies to rooms greater than 12' in any direction and floor area of 215 ft² shall have at least ***one floor receptacle outlet, or at least one floor outlet to serve receptacle(s). Located at a distance of not less than 6' from any fixed wall for each 215 ft² or major portion of floor space.***

N **2017 NEC / 210.71**

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210.70 LIGHTING OUTLETS REQUIRED

Revised

210.70(A)(1) Habitable Rooms. 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.***

210.70(A)(2) ***Additional Locations. – Remains Same***
210.70(B) ***Guest Rooms or Guest Suites. – Remains same***
210.70(C) ***All Occupancies. – Remains Same***

Control device = switch / occ. sensor / other device

Not Current Code in Ohio

2020

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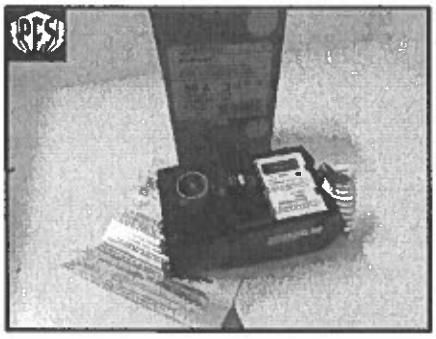
215.9 GROUND FAULT CIRCUIT INTERRUPTER PROTECTION FOR PERSONNEL (FEEDERS)

Proposed revisions to ***update*** this section to allow GFCI protection of feeders to correlate with both 210.8 GFCI protection for personnel and 590.6 Temporary Installations.

Was limited to 15- and 20a branch circuits. (i.e.: electric dryers and ranges)



Not Current Code in Ohio

2020

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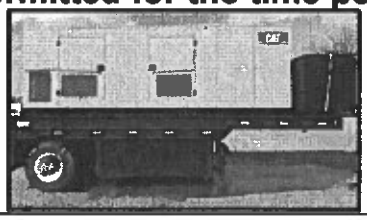
215.10 GROUND-FAULT PROTECTION OF EQUIPMENT

New Exception

N **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.**



AT+T Switching Facility

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2020

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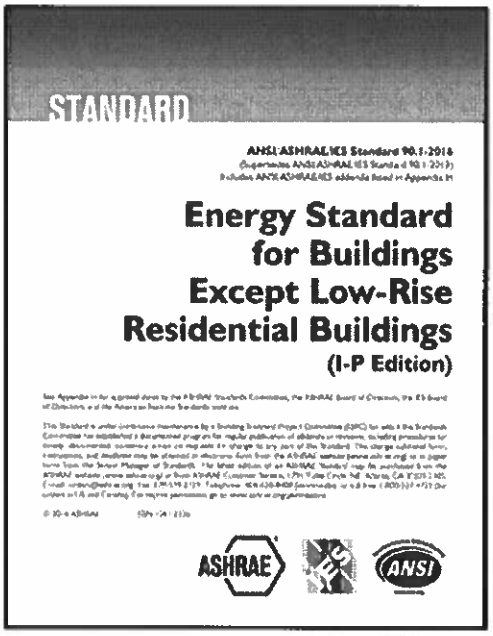
TABLE 220.12 GENERAL LIGHTING LOADS BY OCCUPANCY

Due to lighting system technology (LED) specifically and energy code compliance requirements, ***ASHRAE 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings,*** designers around the Country utilize these requirements and the NEC is updating their requirements.



Reducing lighting minimums

Not Current Code in Ohio

2020

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N 220.12 LIGHTING LOADS FOR NON-DWELLING OCCUPANCIES

Added (B) Energy Code / Revised / #4 is new

(A) General. Lighting loads shall be not less than specified in Table 220.12. Motors less than 1/8 HP and connected to a lighting circuit are considered general lighting load.

(B) Energy Code. 2017 NEC, was exception, now revised to positive code language.

1. **Power monitoring system installed for general lighting system.**
2. **Provided with alarm values.**
3. **Demand factors are not applicable**
4. ***Continuous load of 125% shall be applied.***

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2020

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Table 220.12 General Lighting Loads by Non-Dwelling Occupancy

Type of Occupancy	Unit Load Volt-amperes/ m^2	Unit Load Volt-amperes/ ft^2
Automotive facility	16	1.5
Convention center	15	1.4
Courthouse	15	1.4
Dormitory	16	1.5
Exercise center	15	1.4
Fire station	14	1.3
Gymnasium[a]	18	1.7
Health care clinic	17	1.6
Hospital	17	1.6
Hotels and motels, including apartment houses without provisions for cooking by tenants[b]	18	1.7
Library	16	1.5
Manufacturing facility[c]	24	2.2
Motion picture theater	17	1.6
Museum	17	1.6
Office[d]	14	1.3
Parking garage[e]	3	0.3
Penitentiary	13	1.2
Performing arts theater	16	1.5
Police station	14	1.3
Post office	17	1.6
Religious facility	24	2.2
Restaurant[f]	16	1.5
Retail[g,h]	20	1.9
School/university	33	3
Sports arena	33	3
Town hall	15	1.4
Transportation	13	1.2
Warehouse	13	1.2
Workshop	18	1.7

TABLE 220.12 GENERAL LTG. LOADS

Revised / Enlarged Table

[a]Armories & Auditoriums = ***gyms***

[b]Lodge rooms = ***hotels / motels***

[c]Industrial Comm. = ***manufacturing / factory***

[d]Banks = ***offices***

[e]Storage garages = ***parking garages***

[f]Clubs = ***restaurants***

[g/H] Barber / Beauty shops / Stores = ***retail***

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2020

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2020 NEC COMMERCIAL OVERVIEW

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

Not Current Code in Ohio

2020

248

2020 NEC RESIDENTIAL OVERVIEW

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
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- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

For Informational Purposes Only

2020

249

2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Labriola Training Agency #191
www.ta191.com

John M. Labriola
Principal

150 Maplecrest Street SW
North Canton, Ohio 44720

330.497.6309 Phone
330.606.8098 Cell
john@ta191.com

www.ta191.com

Thank You!

250

File Attachments for Item:

EC-9 2020 NEC Changes and Updates Chapter 5 (Labriola)

All certifications except plumbing (4 hours)

APPLICATION
FOR
Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: John M. Labriola (Contact Name)
Organization: Training Agency #191 (Organization/Company)
Address: 150 Maplecrest St. SW (Include Room Number, Suite, etc.)
City: North Canton State: Ohio Zip: 44720
E-Mail: john@ta191.com
Telephone: 330.497.6309 Fax:
Course Sponsor: None

COURSE INFORMATION:

Course Title: 2020 National Electrical Code Changes & Updates - Chapter 5

New Course Submittal: ■ Update Course: □ Prior Approval Number:

Purpose and Objective:
To provide BBS certified personnel a better understanding of the changes & Updates to the 2020 National electrical Code.
by utilizing a power-point presentation and real-life examples, for no charge to attendees.

Number of Instructional Contact Hours that can be obtained upon completion: 4 Hours

If Multi-Session, Number of Instructional Contact Hours Per Session:

Program Applicable for the Following Participants:

Building Official ■ Master Plans Examiner ■ Building Inspector ■ Fire Protection Inspector ■ Mechanical Inspector ■
Plumbing Plans Exam. □ Plumbing Inspector □
Electrical Plans Exam. ■ Non-Res IU Inspector ■
Mechanical Plans Exam. ■

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ■ Res IU Inspector ■

Electrical Safety Inspectors [x]
Location of ESI Course: Various locations Date(s) of ESI Course(s): TBD

SUBMITTAL CHECKLIST:	Make Sure all of the Following Information is Submitted:	Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr. 1 hr. 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline: list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

RECEIVED
MAY 04 2022
BOARD OF BUILDING STANDARDS

October 16, 2020

John M. Labriola
150 Maplecrest St. SW
North Canton, Ohio 44720

330.497.6309 Home 330.606.8098 Cell

Professional Bio'

Education

2012- 1984	Akron University, Stark State College: Continuing Education
1975	St. Thomas Aquinas High School; Louisville, Ohio
1971	Fairmount Elementary; Canton, Ohio

Building Department Experience

2017 – 2009	Summit County, Ohio; Chief Building Official (retired)
2009 – 2006	City of Canton, Ohio; Chief Building Official
2008 – 1997	City of Alliance, Ohio; Back-up Building and Electrical Inspector
2006 – 1997	City of North Canton, Ohio; Building and Electrical Inspector
1997 – 1986	Stark County, Ohio; Chief Electrical Inspector
1988 – 1984	City of Louisville, Ohio; Part-time Electrical Inspector

Current Certifications Held

International Code Council (ICC)

Accessibility Inspector/ Plans Examiner, Building Inspector, Building Plans Examiner, Certified Building Code Official, Certified Building Official, Certified Electrical Code Official, Certified Mechanical Code Official, Commercial Electrical Inspector, Commercial Mechanical Inspector, Commercial Plumbing Inspector, Electrical Inspector, Electrical Plans Examiner, Fire Plans Examiner, Master Code Professional, Mechanical Inspector, Mechanical Plans Examiner, Property Maintenance and Housing Inspector, Residential Electrical Inspector, Residential Energy Inspector / Plans Examiner, Residential Mechanical Inspector and Residential Plumbing Inspector.

State of Ohio:

Building Inspector, Building Official, Building Plans Examiner, Electrical Plans Examiner, Electrical Safety Inspector, Fire Protection Plans Examiner, Mechanical Plans Examiner and Residential Building Official.

Construction Experience

2007 – 1986	President; Electrical Design and Construction Co.
2004 – Present	State of South Carolina; Licensed Commercial Contractor
1992 – Present	State of Ohio; Licensed Electrical Contractor
1986 – 1981	Owner; Labriola Electric
1981 – 1975	Pedersen Electric; Helper / Apprentice / Journeyman Electrician
1980 – Present	Journeyman Electrician; City of Canton, Ohio

Professional Organization Memberships

2010 – 2017	American Institute of Architects - Akron Chapter (AIA-Akron)
2009 – 2017	Building Officials Code Officials of Northeast Ohio (BOCONEO)
2009 – 2017	National Fire Protection Association (NFPA)
1997 – 2017	Five County Building Officials Association (FBOA)
1997 – 2017	Ohio Building Officials Association (OBOA)
1986 – Present	International Association of Electrical Inspectors (IAEI)

Appointments (Director Positions)

2011 – 2017	Air-Conditioning Contractors Association of Akron / Canton
2011 – 2017	Home Builders Association of Summit and Portage Counties

Teaching Experience

2012 – 2017	Instructor; Home Builders Association of Greater Cleveland
2012 – 2017	Instructor; Home Builders Association of Summit and Portage Counties
2012 – Present	Instructor; National Electrical Contractors Association (NECA); Greater Cleveland, Ohio Division
2011 – Present	Instructor; Northeast Ohio Electrical Contractors Association (NOECA)
2005	Instructor; Clemson University; Clemson, South Carolina
2004 – Present	Instructor; Electrical League of Ohio; Cleveland, Ohio
2000 – 2016	Instructor; Stark State College of Technology: North Canton, Ohio
1999 – Present	Instructor; National Electrical Contractors Association (NECA); Akron, Ohio Division
1991 – 2009	OCILB Approved Contractor Training Agency
1990 – Present	State of Ohio; Approved Electrical Safety Inspector, Instructor

Respectfully,
John M. Labriola
John M. Labriola
OBBS ID #815
john@ta191.com

www.ta191.com

May 02, 2022

Labriola Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720

Ohio Board of Building Standards
6606 Tussing Road – PO Box 4009
Reynoldsburg, Ohio 43068 – 9009

Course Submittal #5 – 4 Hours

Chapter 5

Hazardous Classified Locations

NFPA Codes and Standards

GFCI Protection for Repair / Storage Garages / Aircraft Hangars

Motor Fuel Dispensing Facilities

Healthcare Facilities

Essential Electrical Systems

Resistance / Reactor-Type Dimmer Boards

Agricultural Buildings

Relocated Manufactured Buildings

Electrical Shock Drowning (ESD)

Temporary Installations

2 ☐ **CURRENT ADOPTED CODES**

3 ☐ **2019 RESIDENTIAL CODE OF OHIO**

4 ☐

5 ☐

THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

6 ☐ **"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)**

Subject to the local or State adoption authority

151 ☐ **CHAPTER 5**

Special Occupancies

Article 500 – Hazardous (Classified) Locations, Classes I, II, III, Divisions 1 & 2

Article 511 – Commercial Garages, Repair and Storage

Article 517 – Healthcare Facilities

Article 545 – Manufactured Buildings & Relocatable Structures

Article 555 – Marinas, Boatyards / Commercial and Noncommercial Docking Facilities

Article 590 – Temporary Installations

152 ☐ **ARTICLE 500.4 DOCUMENTATION**

Updated Current NFPA / API Standard References

All areas designated as hazardous (classified) locations shall be properly documented. This documentation shall be available to those authorized to design, install, inspect, maintain, or operate electrical equipment at the location.

NFPA 30-2018 NFPA 32-2016 NFPA 33-2018 NFPA 34-2018
NFPA 35-2016 NFPA 36-2017 NFPA 45-2019 NFPA 55-2016
NFPA 497-2017 NFPA 499-2017 NFPA 820-2016 API 500-2012

153 ☐ **NFPA CODES AND STANDARDS**

NFPA 30- Flammable & Combustible Liquids
NFPA 32- Standard for Drycleaning Plants
NFPA 33- Standard for Spray Application Using Flammable or Combustible Materials
NFPA 34- Standard for Dipping, Coating, & Printing Processes Using Flammable or Combustible Liquids
NFPA 35- Standard for Manufacture of Organic Coatings
NFPA 36- Standard for Solvent Extraction Plants
NFPA 45- Standard on Fire Protection for Laboratories Using Chemicals
NFPA 55- Compressed Gases & Cyrogenic Fluids Code
NFPA 497- Classification of Combustible Liquids, Gases, & Vapors in Chemical Process Areas
NFPA 499- Classification of Combustible Dusts & Hazardous (Classified) Locations in Chemical Process Areas
NFPA 820- Fire Protection in Wastewater Treatment & Collection Facilities
API 500- Classifications of Locations of Electrical Installations at Petroleum Facilities

154 ☐ **501.10 CLASS I & CLASS II LOCATIONS**

1 Listed MC-HL / TC-ER-HL

2

Metal Clad / Tray Cable
MC-HL; Flame resistant cable
TC-ER-HL; Flame resistant tray cable
Gas & vapor-tight provided with metal sheath & polymeric material with separate egc, and proper fittings.
For use in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installations.

3 Listed Type "P" Cable

4

Marine Shipyard Cable
Type "P" – Metal braid armor, with an overall jacket, and terminated with proper fittings.

For use in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installations.

155 ☐ **511.2 (REMOVED / RELOCATED)**
COMMERCIAL GARAGE REPAIR & STORAGE
Revision (Relocated to 210.8(B)(8)

GFCI Protection for Personnel

Removed reference to areas "*where diagnostic equipment, electrical hand tools, or portable lighting equipment*" are to be used (2017 NEC; was limited to 125-v 15- & 20-a receptacles).

Now Reads as indicated in 210.8(B)(1-12)

1ø 50amp and 3ø 100amp 150-v to ground or less receptacles

156 ☐ **513.12 (REMOVED / RELOCATED)**
AIRCRAFT HANGARS
Revision (Relocated to 210.8(B)

GFCI Protection for Personnel

Now Reads as indicated in 210.8(B)(1-12)

1ø 50amp and 3ø 100amp 150-v to ground or less receptacles

157 ☐ **514.11 MOTOR FUEL DISPENSING FACILITIES**
514.11 Circuit Disconnects

(A) Emergency Electrical Disconnects

The emergency shutoff device shall disconnect simultaneously from the source of supply, all conductors of the circuits, including the grounded conductor, if any. *Equipment grounding conductors shall remain connected*.

Switch neutral breaker required including data circuits!

158 ☐ **517.10(B) HEALTH CARE FACILITIES – NOT COVERED**
Not Covered

Proposed changes are intended to clarify that portions of health care facilities used for *intermuscular injections* (drug store flu shots), *psychiatry and psychotherapy*, *alternative medicine and optometry* are *not* required to
comply with Part II of 517.

Redundant Ground wiring!

159 ☐ **517.17 GROUND-FAULT PROTECTION *OF EQUIPMENT***

(D) Testing. Expanded Intent

When ground-fault protection *of equipment* is first installed, each level shall be performance tested to ensure compliance with 517.17(C). *The testing shall be conducted by a qualified person(s) using a test process in accordance with the instruction provided with the equipment. A written record of this testing shall be made and shall be available to the authority having jurisdiction.*

160 ☐ **517.21 HEALTHCARE FACILITIES- GFCI PROTECTION FOR PERSONNEL**

Revision

Category 2 (General Care) & Category 1 (Critical Care) spaces

Receptacles shall *not* be required in bathrooms or toilet rooms. {99:6.3.2.2.2(D)}. Receptacles located in patient bathrooms and toilet rooms in Category 2 (general care) spaces shall have ground-fault circuit-interrupter protection in accordance with 210.8(B)(1).

161 ☐ **517.30 ESSENTIAL ELECTRICAL SYSTEMS**

517.30 Sources of Power

(A) Two Independent Power Sources
(B)
(B) Types of Power Sources
(C)
(1) Generating Units
(2)
(2) Fuel Cell Systems – NEW in 2017 NEC
(3)
N (3) Battery Systems shall be permitted to serve as the alternate source for all or part of an essential electrical system

Lead Acid Batteries in Series

Not Current Code in Ohio

162 ☐ **517.31 REQUIREMENTS FOR THE ESSENTIAL ELECTRICAL SYSTEM**

517.31(A) Separate Branches

517.31(B) Transfer Switches

517.31(C) Separation from Other Circuits

517.31(D) Capacity of Systems

517.31(E) Receptacle Identification

517.31(F) Feeders from Alternate Power Source

517.31(G) Coordination

163 ☐ **517.31(B) TRANSFER SWITCHES**

[1] Greater than 150 kVA

[2] 150 kVA or less

164 ☐ **517.31(C)(1) SEPARATION FROM OTHER CIRCUITS**

Δ Revision D & E Are NEW

(d) Where category 2 (general care) locations are served from *two* separate transfer switches on the essential electrical system in accordance with 517.18(A), Exception No. 3, the category 2 (general care) circuits from the two separate systems *shall* be kept independent of each other.

(e) Where Category 1 (critical care) locations are served from *two* separate transfer switches on the essential electrical system in accordance with 517.19(A), Exception No.2, the critical care circuits from the two separate systems *shall* be kept independent of each other.

165 ☐ **ARTICLE 520 THEATERS & SIMILAR LOCATIONS**

520.25 Resistance- or Reactor-Type Dimmers

Deleted these types of dimmers, as they are outdated and potential fire hazards.

Historical Theaters may have some of these antiquated systems.

166 ☐ **ARTICLE 520 THEATERS & SIMILAR LOCATIONS**

520.68 Conductors for Portable Stage Equipment

Previous editions of the NEC only permitted extra hard usage cords or cables

N (2) Protected Applications. Listed, hard usage (junior hard service) cord or cable shall be permitted where all of the following conditions are met:

(1) Protected from physical damage
(2) Not over 20a overcurrent protective device
(3) Cord or cable is 100' or less in length

For Informational Purposes Only

167 ☐ **ARTICLE 525**
CARNIVALS, CIRCUSES, FAIRS & SIMILAR EVENTS
When open to the Public

Δ 525.20(G) Protection. Shall be arranged to minimize tripping hazards.
Secured to walkway surface or protected in another cable protection method.

Reduce the Hazard!

168 ☐

525.23 WHERE GFCI PROTECTION IS REQUIRED

(A) Where GFCI Protection is Required. *In addition to the requirements of 210.8(B)*, GFCI protection for personnel shall be provided for the following:

(1) All 125-v, 1ø, 15- & 20-a non-locking receptacles readily accessible to the public.

(2) Equipment that is readily accessible to the general public and supplied from a 125-v, 1ø, 15- & 20- ampere branch circuit.
GFCI is permitted to be an integral part of the attachment plug or located in the power-supply cord within 12" of the plug.

169 ☐ **ARTICLE 545**
MANUFACTURED BUILDINGS AND RELOCATABLE STRUCTURES
Part II - NEW

Relocatable Structures

Mobile offices, classrooms, training areas and similar structures are now part of Article 545, rather than Article 550 (dwelling units).

171 ☐ **ARTICLE 550 – MOBILE HOMES, MANUFACTURED HOMES & M/H PARKS**

Δ 550.12(B) Ground-Fault Circuit Interrupters (GFCI).

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(A). GFCI protection shall not be required for other than the 125-v, 15- and 20-ampere receptacles installed *within a mobile or manufactured home* in the following areas:

1. Compartments accessible from outside the unit
2. Bathrooms, including receptacles in luminaires
3. Kitchens, where receptacle are installed to serve countertop surfaces
4. Sinks, where receptacles are installed within 6' *from the top inside* edge of the sink
5. Dishwashers

Δ 550.32(D) Additional Receptacles. – Receptacles located outside a mobile or manufactured home, shall be provided with GFCI protection as specified by 210.8(A).

Receptacles that provide unit power shall not require GFCI protection

172 ☐ **ARTICLE 551 – RV'S & RV PARKS**

N 551.40(D) Reverse Polarity Device.

A reverse polarity indicating device that provides a continuous visible or audible signal shall be installed in the RV in accordance with the installation instructions and shall respond to the reversal of the ungrounded and the grounded conductors in the 120-v ac system.

173 ☐ **"NEW" SOUTHWIRE RV SPD PRODUCTS**

174 ☐ **RV SURGE PROTECTIVE DEVICES**

175 ☐ **MARINAS, BOATYARDS, & COMMERCIAL & NON-COMMERCIAL DOCKING FACILITIES**

N 555.13 Bonding of Non-Current Carrying Metal Parts

All metal parts in contact with the water, all metal piping, and all non-current carrying metal parts that are likely to become energized shall be connected to the grounding bus in the panelboard using solid copper conductors, insulated, covered, or bare, not smaller than #8 AWG. Connections to bonded parts shall be made in accordance with 250.8.

Sounds Like 680.26 Equipotential Bonding Grid

176 ☐ **ARTICLE 555**

MARINAS, BOATYARDS AND COMMERCIAL AND NON-COMMERCIAL DOCKING FACILITIES

Ground-Fault Protection - 555.35 (NEW)

(A)(1)- GFPE shore power receptacles- *30mA (Type "B")*

(A)(2)- GFCI 15a & 20a other than shore power receptacles
(Type "A")

(A)(3)- GFPE Protection of feeders and branch circuits
installed on docking facilities - *100mA (Type "C+"?)*

177 ☐ ***N*** **555.35(B) BOAT SHORE POWER**

Leakage Current Measurement Device

Where more than 3 receptacles supply shore power to boats, a leakage current measurement device shall be available and be used to determine leakage current from each boat that will utilize shore power.

Equipment Leakage Circuit Interrupter (ELCI)

Marine Safety to Prevent ESD; (Electric shock drowning)

178 ☐ **DAMAGED BOAT WIRING CAN CAUSE CURRENT FLOW INTO THE BOAT'S BONDING SYSTEM**

1 Damaged power cord can expose users to hazards
2 Limits potential of energizing water around the boat's frame

179 ☐ **590.8 (NEW) TEMPORARY INSTALLATIONS**
OVERCURRENT PROTECTIVE DEVICES

(A) Where Reused. Where overcurrent protective devices that have been previously used are installed in a temporary installation, these overcurrent protective devices *shall be examined* to ensure these devices have been properly installed, maintained and there is *no evidence* of impending failure.

(B)

(B) Service Overcurrent Protective Devices. Overcurrent protective devices for solidly grounded wye electrical services of more than 150-v to ground but not exceeding 1000-v phase-to-phase shall be current limiting *(fuses)*.

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250 ☐

2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Thank You!

CURRENT ADOPTED CODES

July 01, 2019

Current Adopted Codes in Ohio – (2017)

Non-Residential Construction (4- Family and Above)

2017 Ohio Building Code (Based on the 2015 International Building Code)
2017 Ohio Mechanical Code (Based on the 2015 International Mechanical Code)
2017 Ohio Plumbing Code (Based on the 2015 International Plumbing Code)
2017 Ohio Fire Code (Based on the 2015 International Fire Code)
2017 NFPA 70 – National Electrical Code (Effective 11 01 2017)
2016 NFPA 13 – Standard for Installation of Sprinkler Systems
2016 NFPA 72 – National Fire Alarm and Signaling Code
2015 International Fuel Gas Code
2012 International Energy Conservation Code / ASHRAE 90.1 2010
ICC / ANSI A117.1 2009 Accessible & Usable Buildings and Facilities

Residential Construction (1, 2 and 3- Family Dwellings)

2019 Residential Code of Ohio (Based on the 2015 International Residential Code)
2017 Ohio Plumbing Code
2017 NFPA 70 – National Electrical Code w/ amendments (07.01.2019)
2018 International Energy Conservation Code

March 24 2020

Current Adopted Building Codes in West Virginia

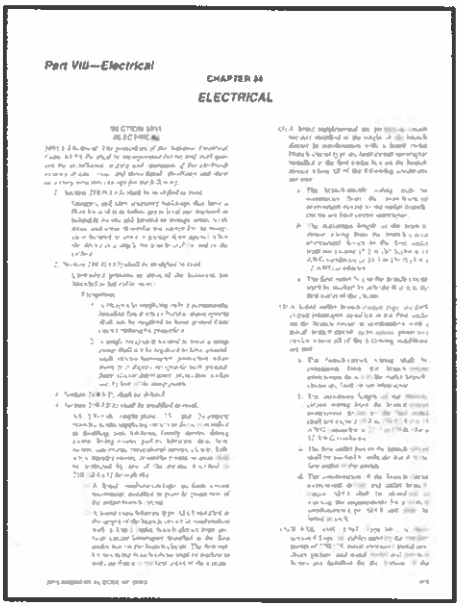
The State of West Virginia Fire Commission has adopted statewide the 2015 ICC (International Code Council), family of Codes for any jurisdiction that chooses to enforce building codes. Check locally for enforcement information / details.

2015 International Building Code (IBC)
2009 International Energy Conservation Code (IECC)
2015 International Existing Building Code (IEBC)
2015 International Fuel Gas Code (IFGC)
2015 International Mechanical Code (IMC)
2015 International Plumbing Code (IPC)
2012 International Property Maintenance Code (IPMC)
2015 International Residential Code (1- & 2- Family) (IRC)
2015 International Swimming Pool & Spa Code (ISPSC)

2015 NFPA 1 – Fire Code (Effective 07 01 2019)
2015 NFPA 101 – Life Safety Code (Effective 07 01 2019)
2017 NFPA 70 – National Electrical Code (Effective 03 24 2020)

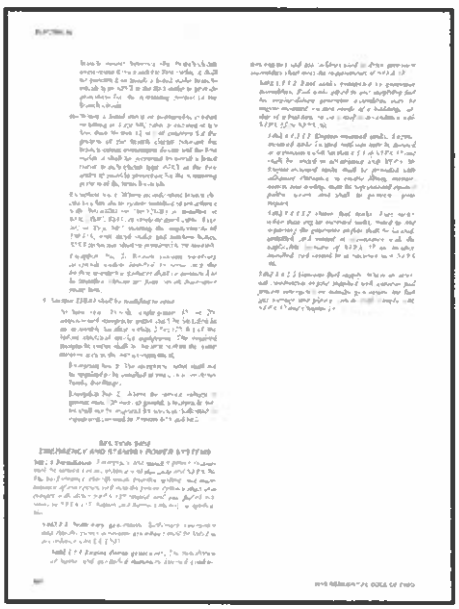
2

2019 RESIDENTIAL CODE OF OHIO


Part VIII—Electrical

CHAPTER 36

ELECTRICAL



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www.ta191.com
2020 "Proposed" National Electrical Code (NEC) Changes & Updates
Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720
330.497.6309 Phone
John M. Labriola
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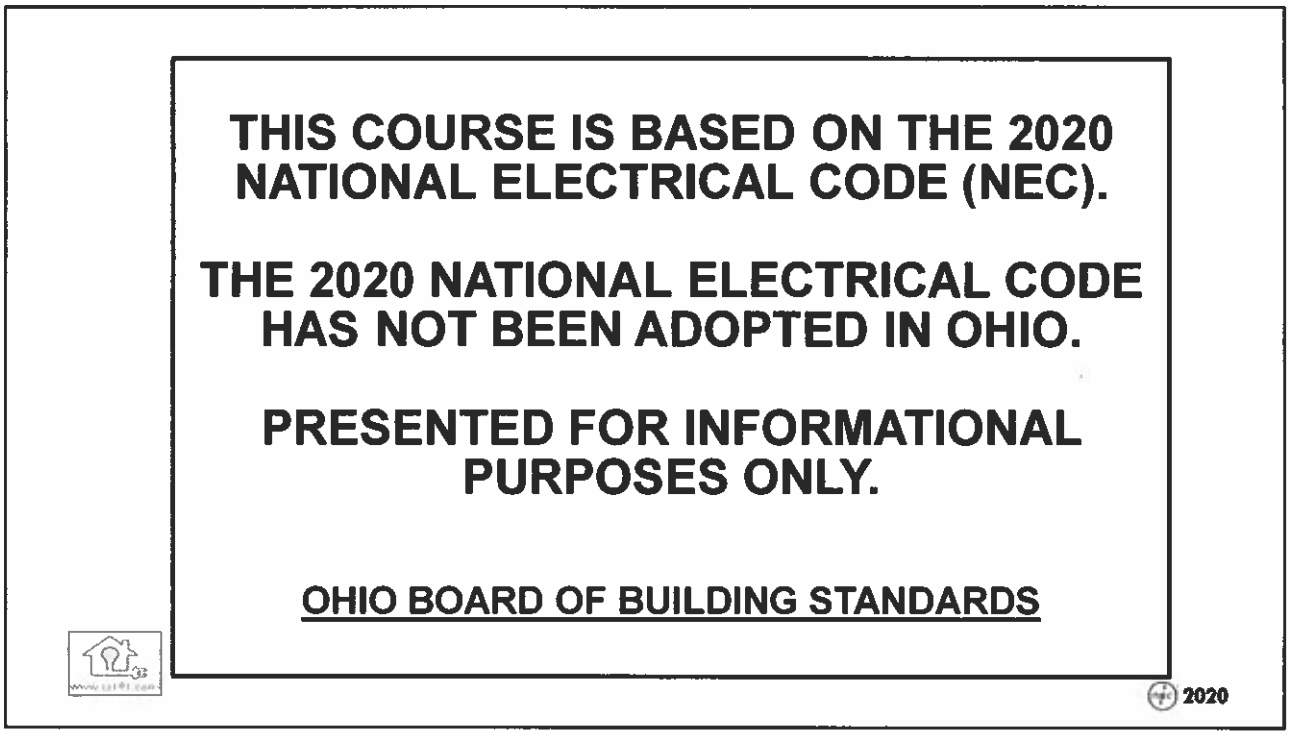
2020

4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OHIO BOARD OF BUILDING STANDARDS
2020

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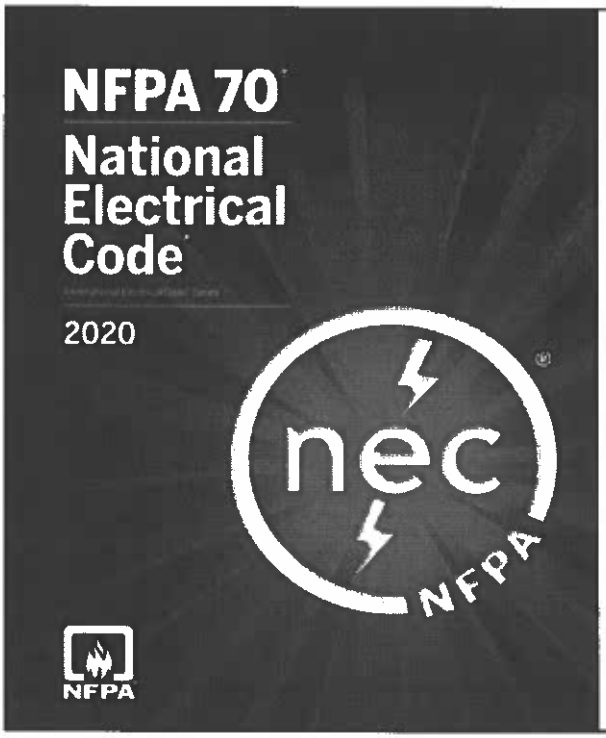

"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)

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2020

6

CHAPTER 5

Special Occupancies

Article 500 – Hazardous (Classified) Locations, Classes I, II, III, Divisions 1 & 2

Article 511 – Commercial Garages, Repair and Storage

Article 517 – Healthcare Facilities

Article 545 – Manufactured Buildings & Relocatable Structures

Article 555 – Marinas, Boatyards / Commercial and Noncommercial Docking Facilities

Article 590 – Temporary Installations

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151

ARTICLE 500.4 DOCUMENTATION

Updated Current NFPA / API Standard References

All areas designated as hazardous (classified) locations shall be properly documented. This documentation shall be available to those authorized to design, install, inspect, maintain, or operate electrical equipment at the location.

NFPA 30-2018	NFPA 32-2016	NFPA 33-2018	NFPA 34-2018
NFPA 35-2016	NFPA 36-2017	NFPA 45-2019	NFPA 55-2016
NFPA 497-2017	NFPA 499-2017	NFPA 820-2016	API 500-2012

Not Current Code in Ohio

2020

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NFPA CODES AND STANDARDS

NFPA 30- Flammable & Combustible Liquids
NFPA 32- Standard for Drycleaning Plants
NFPA 33- Standard for Spray Application Using Flammable or Combustible Materials
NFPA 34- Standard for Dipping, Coating, & Printing Processes Using Flammable or Combustible Liquids
NFPA 35- Standard for Manufacture of Organic Coatings
NFPA 36- Standard for Solvent Extraction Plants
NFPA 45- Standard on Fire Protection for Laboratories Using Chemicals
NFPA 55- Compressed Gases & Cyrogenic Fluids Code
NFPA 497- Classification of Combustible Liquids, Gases, & Vapors in Chemical Process Areas
NFPA 499- Classification of Combustible Dusts & Hazardous (Classified) Locations in Chemical Process Areas
NFPA 820- Fire Protection in Wastewater Treatment & Collection Facilities
API 500- Classifications of Locations of Electrical Installations at Petroleum Facilities

For Informational Purposes Only

2020

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501.10 CLASS I & CLASS II LOCATIONS

Listed MC-HL / TC-ER-HL

Metal Clad / Tray Cable

MC-HL; Flame resistant cable

TC-ER-HL; Flame resistant tray cable

Gas & vapor-tight provided with metal sheath & polymeric material with separate egc, and proper fittings.

For use in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installations.

Listed Type "P" Cable

Marine Shipyard Cable

Type "P" – Metal braid armor, with an overall jacket, and terminated with proper fittings.

For use in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installations.

Not Current Code in Ohio

2020

154

511.2 (REMOVED / RELOCATED) COMMERCIAL GARAGE REPAIR & STORAGE

Revision (Relocated to 210.8(B)(8)

GFCI Protection for Personnel

Removed reference to areas "***where diagnostic equipment, electrical hand tools, or portable lighting equipment***" are to be used (2017 NEC; was limited to 125-v 15- & 20-a receptacles).

Now Reads as indicated in 210.8(B)(1-12)

1ø 50amp and 3ø 100amp 150-v to ground or less receptacles

For Informational Purposes Only

2020

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513.12 (REMOVED / RELOCATED) AIRCRAFT HANGARS

Revision (Relocated to 210.8(B)

GFCI Protection for Personnel

Now Reads as indicated in 210.8(B)(1-12)

1ø 50amp and 3ø 100amp 150-v to ground or less receptacles

Not Current Code in Ohio

2020

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514.11 MOTOR FUEL DISPENSING FACILITIES

514.11 Circuit Disconnects

(A)Emergency Electrical Disconnects

The emergency shutoff device shall disconnect simultaneously from the source of supply, all conductors of the circuits, including the grounded conductor, if any. *Equipment grounding conductors shall remain connected*.

Switch neutral breaker required including data circuits!

For Informational Purposes Only

2020

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517.10(B) HEALTH CARE FACILITIES – NOT COVERED

Not Covered

Proposed changes are intended to clarify that portions of health care facilities used for ***intermuscular injections*** (drug store flu shots), ***psychiatry and psychotherapy***, ***alternative medicine and optometry*** are ***not*** required to comply with Part II of 517.

Redundant Ground wiring!

For Informational Purposes Only

158

517.17 GROUND-FAULT PROTECTION *OF EQUIPMENT*

(D) Testing. Expanded Intent

When ground-fault protection ***of equipment*** is first installed, each level shall be performance tested to ensure compliance with 517.17(C). ***The testing shall be conducted by a qualified person(s) using a test process in accordance with the instruction provided with the equipment. A written record of this testing shall be made and shall be available to the authority having jurisdiction.***

Not Current Code in Ohio

2020

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517.21 HEALTHCARE FACILITIES- GFCI PROTECTION FOR PERSONNEL

Revision

Category 2 (General Care) & Category 1 (Critical Care) spaces

Receptacles shall *not* be required in bathrooms or toilet rooms. {99:6.3.2.2.2(D)}. Receptacles located in patient bathrooms and toilet rooms in Category 2 (general care) spaces shall have ground-fault circuit-interrupter protection in accordance with 210.8(B)(1).

For Informational Purposes Only

2020

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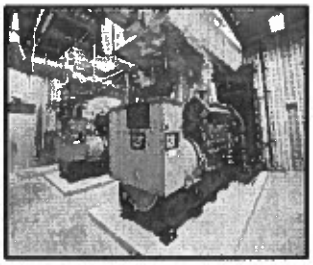
517.30 ESSENTIAL ELECTRICAL SYSTEMS



517.30 Sources of Power

(A) Two Independent Power Sources

(B) Types of Power Sources

(1) Generating Units

(2) Fuel Cell Systems – **NEW in 2017 NEC**

***N* (3) Battery Systems shall be permitted to serve as the alternate source for all or part of an essential electrical system**

Lead Acid Batteries in Series

Not Current Code in Ohio

2020

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517.31 REQUIREMENTS FOR THE ESSENTIAL ELECTRICAL SYSTEM

517.31(A) Separate Branches

517.31(B) Transfer Switches

517.31(C) Separation from Other Circuits

517.31(D) Capacity of Systems

517.31(E) Receptacle Identification

517.31(F) Feeders from Alternate Power Source

517.31(G) Coordination

For Informational Purposes Only

2020

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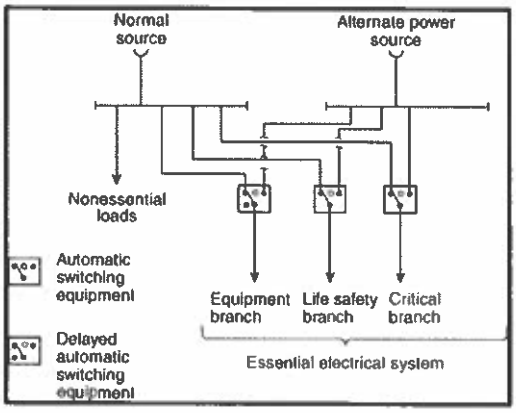
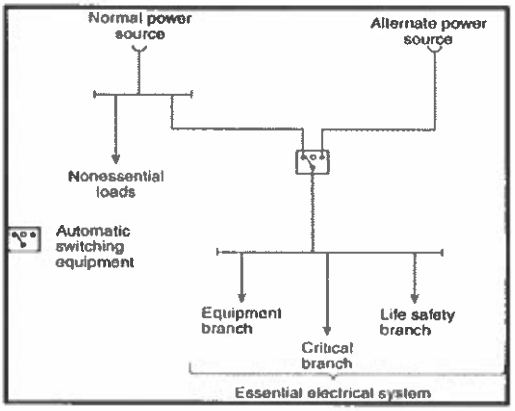
517.31(B) TRANSFER SWITCHES

Greater than 150 kVA



150 kVA or less



Not Current Code in Ohio

2020

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517.31(C)(1) SEPARATION FROM OTHER CIRCUITS

Δ Revision D & E Are NEW

(d) Where category 2 (general care) locations are served from *two* separate transfer switches on the essential electrical system in accordance with 517.18(A), Exception No. 3, the category 2 (general care) circuits from the two separate systems *shall* be kept independent of each other.

(e) Where Category 1 (critical care) locations are served from *two* separate transfer switches on the essential electrical system in accordance with 517.19(A), Exception No.2, the critical care circuits from the two separate systems *shall* be kept independent of each other.

For Informational Purposes Only

2020

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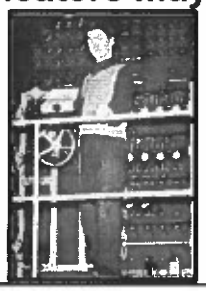
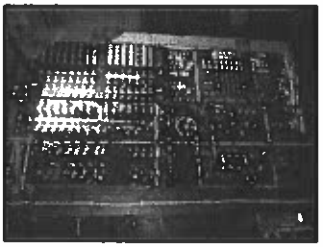
ARTICLE 520 THEATERS & SIMILAR LOCATIONS

520.25 Resistance- or Reactor-Type Dimmers

Deleted these types of dimmers, as they are outdated and potential fire hazards.

Historical Theaters may have some of these antiquated systems.





Not Current Code in Ohio

2020

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ARTICLE 520
THEATERS & SIMILAR LOCATIONS

520.68 Conductors for Portable Stage Equipment

Previous editions of the NEC only permitted extra hard usage cords or cables

N **(2) Protected Applications. Listed, hard usage (junior hard service) cord or cable shall be permitted where all of the following conditions are met:**

(1) Protected from physical damage
(2) Not over 20a overcurrent protective device
(3) Cord or cable is 100' or less in length

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2020

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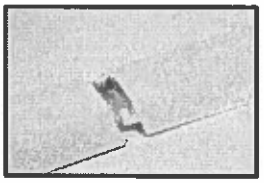
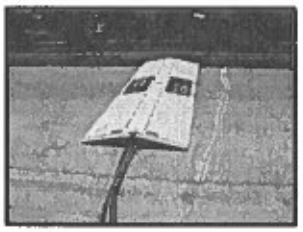
ARTICLE 525
CARNIVALS, CIRCUSES, FAIRS & SIMILAR EVENTS

When open to the Public

Δ 525.20(G) Protection. Shall be arranged to minimize tripping hazards. ***Secured to walkway surface or protected in another cable protection method.***





Reduce the Hazard!

Not Current Code in Ohio

2020

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525.23 WHERE GFCI PROTECTION IS REQUIRED

(A) Where GFCI Protection is Required. ***In addition to the requirements of 210.8(B)***, GFCI protection for personnel shall be provided for the following:

(1) All 125-v, 1ø, 15- & 20-a non-locking receptacles readily accessible to the public.

(2) Equipment that is readily accessible to the general public and supplied from a 125-v, 1ø, 15- & 20-ampere branch circuit.

GFCI is permitted to be an integral part of the attachment plug or located in the power-supply cord within 12" of the plug.

For Informational Purposes Only

2020

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ARTICLE 545 MANUFACTURED BUILDINGS AND RELOCATABLE STRUCTURES

Part II - NEW

Relocatable Structures

Mobile offices, classrooms, training areas and similar structures are now part of Article 545, rather than Article 550 (dwelling units).

Not Current Code in Ohio

2020

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ARTICLE 550 – MOBILE HOMES, MANUFACTURED HOMES & M/H PARKS

Δ **550.12(B) Ground-Fault Circuit Interrupters (GFCI).**

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(A). GFCI protection shall not be required for other than the 125-v, 15- and 20-ampere receptacles installed ***within a mobile or manufactured home*** in the following areas:

1. Compartments accessible from outside the unit
2. Bathrooms, including receptacles in luminaires
3. Kitchens, where receptacle are installed to serve countertop surfaces
4. Sinks, where receptacles are installed within 6' ***from the top inside*** edge of the sink
5. Dishwashers

Δ **550.32(D) Additional Receptacles**. – Receptacles located outside a mobile or manufactured home, shall be provided with GFCI protection as specified by 210.8(A).

Receptacles that provide unit power shall not require GFCI protection

Not Current Code in Ohio

2020

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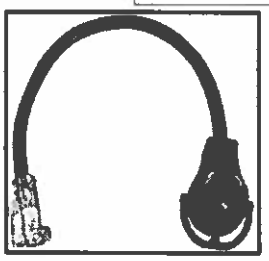
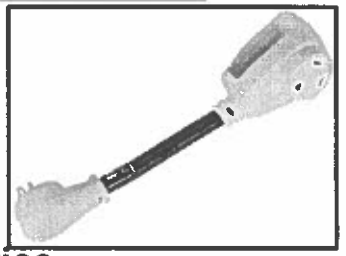
ARTICLE 551 – RV'S & RV PARKS





N **551.40(D) Reverse Polarity Device.**

A reverse polarity indicating device that provides a continuous visible or audible signal shall be installed in the RV in accordance with the installation instructions and shall respond to the reversal of the ungrounded and the grounded conductors in the 120-v ac system.

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2020

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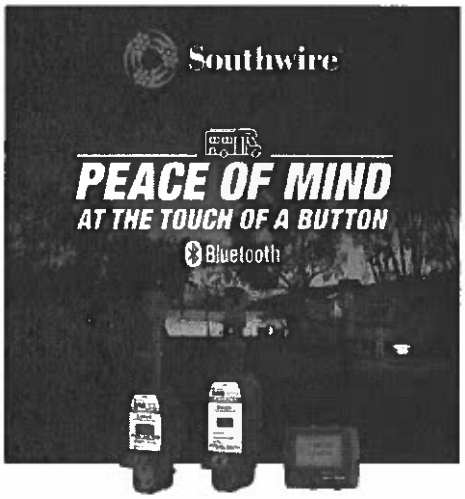
"NEW" SOUTHWIRE RV SPD PRODUCTS



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RV SURGE PROTECTIVE DEVICES

174

MARINAS, BOATYARDS, & COMMERCIAL & NON-COMMERCIAL DOCKING FACILITIES

N 555.13 Bonding of Non-Current Carrying Metal Parts

All metal parts in contact with the water, all metal piping, and all non-current carrying metal parts that are likely to become energized shall be connected to the grounding bus in the panelboard using solid copper conductors, insulated, covered, or bare, not smaller than #8 AWG. Connections to bonded parts shall be made in accordance with 250.8.

Sounds Like 680.26 Equipotential Bonding Grid

Not Current Code in Ohio

2020

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ARTICLE 555

Device	mA trip setting	Common Use	Code Section
GFCI - Class A	4 - 6	Branch circuits	210 8
ECFPD	6 - 50	Snow melting equip	426 28
GFPE	adjustable	Main OCPD	230 95

MARINAS, BOATYARDS AND COMMERCIAL AND NON-COMMERCIAL DOCKING FACILITIES

Ground-Fault Protection - 555.35 (NEW)

(A)(1)- GFPE shore power receptacles- ***30mA (Type "B")***

(A)(2)- GFCI 15a & 20a other than shore power receptacles ***(Type "A")***

(A)(3)- GFPE Protection of feeders and branch circuits installed on docking facilities - ***100mA (Type "C+"?)***

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2020

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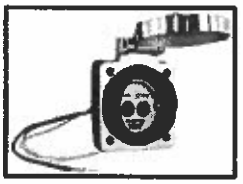
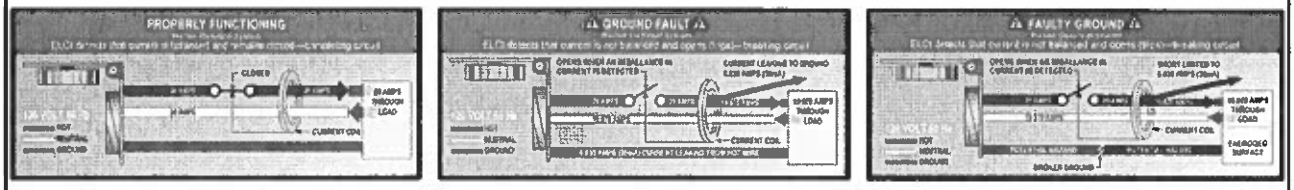
N 555.35(B) BOAT SHORE POWER

Leakage Current Measurement Device



Where more than 3 receptacles supply shore power to boats, a leakage current measurement device shall be available and be used to determine leakage current from each boat that will utilize shore power.



Equipment Leakage Circuit Interrupter **(ELCI)**

Marine Safety to Prevent ESD; (Electric shock drowning)

Not Current Code in Ohio

2020

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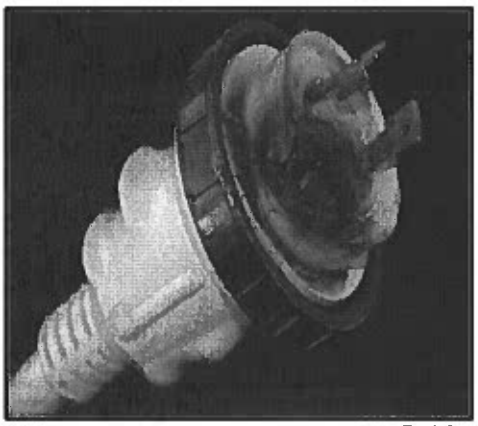
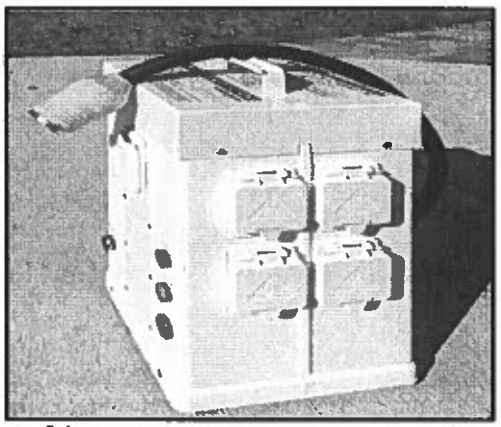
DAMAGED BOAT WIRING CAN CAUSE CURRENT FLOW INTO THE BOAT'S BONDING SYSTEM

Damaged power cord can expose users to hazards



Limits potential of energizing water around the boat's frame



2020

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590.8 (NEW) TEMPORARY INSTALLATIONS OVERCURRENT PROTECTIVE DEVICES

(A) **Where Reused**. Where overcurrent protective devices that have been previously used are installed in a temporary installation, these overcurrent protective devices ***shall be examined*** to ensure these devices have been properly installed, maintained and there is ***no evidence*** of impending failure.

(B) **Service Overcurrent Protective Devices**. Overcurrent protective devices for solidly grounded wye electrical services of more than 150-v to ground but not exceeding 1000-v phase-to-phase shall be current limiting ***(fuses)***.

Not Current Code in Ohio

2020

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2020 NEC COMMERCIAL OVERVIEW

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

Not Current Code in Ohio

2020

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2020 NEC RESIDENTIAL OVERVIEW

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

For Informational Purposes Only

2020

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2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Labriola Training Agency #191
www.ta191.com

John M. Labriola
Principal

150 Maplecrest Street SW
North Canton, Ohio 44720

330.497.6309 Phone
330.606.8098 Cell
john@ta191.com

www.ta191.com

Thank You!

250

File Attachments for Item:

EC-10 2020 NEC Changes and Updates Chapters 3 and 4 (Labriola)

All certifications except plumbing (4 hours)

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER

Course Submitter: John M. Labriola (Contact Name)

Organization: Training Agency #191 (Organization/Company)

Address: 150 Maplecrest St. SW (Include Room Number, Suite, etc.)

City: North Canton State: Ohio Zip: 44720

E-Mail: john@ta191.com

Telephone: 330.497.6309 Fax:

Course Sponsor: None

COURSE INFORMATION

Course Title: 2020 National Electrical Code Changes & Updates - Chapters 3 & 4

New Course Submittal: ■ Update Course: ☐ Prior Approval Number:

Purpose and Objective:
To provide BBS certified personnel a better understanding of the changes & Updates to the 2020 National electrical Code.
by utilizing a power-point presentation and real-life examples, for no charge to attendees.

Number of Instructional Contact Hours that can be obtained upon completion: 4 Hours

If Multi-Session, Number of Instructional Contact Hours Per Session:

Program Applicable for the Following Participants:

Building Official ■	Master Plans Examiner ■	Building Inspector ■	Fire Protection Inspector ■	Mechanical Inspector ■
	Plumbing Plans Exam. ☐			Plumbing Inspector ☐
	Electrical Plans Exam. ■			Non-Res IU Inspector ■
	Mechanical Plans Exam. ■			

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ■ Res IU Inspector ■

Electrical Safety Inspectors [x]
Location of ESI Course: Various locations Date(s) of ESI Course(s): TBD

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

RECEIVED

MAY 04 2022

BOARD OF BUILDING STANDARDS

BBS 5102/2/10

October 16, 2020

John M. Labriola
150 Maplecrest St. SW
North Canton, Ohio 44720

330.497.6309 Home 330.606.8098 Cell

Professional Bio'

Education

2012- 1984	Akron University, Stark State College: Continuing Education
1975	St. Thomas Aquinas High School; Louisville, Ohio
1971	Fairmount Elementary; Canton, Ohio

Building Department Experience

2017 – 2009	Summit County, Ohio; Chief Building Official (retired)
2009 – 2006	City of Canton, Ohio; Chief Building Official
2008 – 1997	City of Alliance, Ohio; Back-up Building and Electrical Inspector
2006 – 1997	City of North Canton, Ohio; Building and Electrical Inspector
1997 – 1986	Stark County, Ohio; Chief Electrical Inspector
1988 – 1984	City of Louisville, Ohio; Part-time Electrical Inspector

Current Certifications Held

International Code Council (ICC)

Accessibility Inspector/ Plans Examiner, Building Inspector, Building Plans Examiner, Certified Building Code Official, Certified Building Official, Certified Electrical Code Official, Certified Mechanical Code Official, Commercial Electrical Inspector, Commercial Mechanical Inspector, Commercial Plumbing Inspector, Electrical Inspector, Electrical Plans Examiner, Fire Plans Examiner, Master Code Professional, Mechanical Inspector, Mechanical Plans Examiner, Property Maintenance and Housing Inspector, Residential Electrical Inspector, Residential Energy Inspector / Plans Examiner, Residential Mechanical Inspector and Residential Plumbing Inspector.

State of Ohio:

Building Inspector, Building Official, Building Plans Examiner, Electrical Plans Examiner, Electrical Safety Inspector, Fire Protection Plans Examiner, Mechanical Plans Examiner and Residential Building Official.

Construction Experience

2007 – 1986	President; Electrical Design and Construction Co.
2004 – Present	State of South Carolina; Licensed Commercial Contractor
1992 – Present	State of Ohio; Licensed Electrical Contractor
1986 – 1981	Owner; Labriola Electric
1981 – 1975	Pedersen Electric; Helper / Apprentice / Journeyman Electrician
1980 – Present	Journeyman Electrician; City of Canton, Ohio

Professional Organization Memberships

2010 – 2017	American Institute of Architects - Akron Chapter (AIA-Akron)
2009 – 2017	Building Officials Code Officials of Northeast Ohio (BOCONEO)
2009 – 2017	National Fire Protection Association (NFPA)
1997 – 2017	Five County Building Officials Association (FBOA)
1997 – 2017	Ohio Building Officials Association (OBOA)
1986 – Present	International Association of Electrical Inspectors (IAEI)

Appointments (Director Positions)

2011 – 2017	Air-Conditioning Contractors Association of Akron / Canton
2011 – 2017	Home Builders Association of Summit and Portage Counties

Teaching Experience

2012 – 2017	Instructor; Home Builders Association of Greater Cleveland
2012 – 2017	Instructor; Home Builders Association of Summit and Portage Counties
2012 – Present	Instructor; National Electrical Contractors Association (NECA); Greater Cleveland, Ohio Division
2011 – Present	Instructor; Northeast Ohio Electrical Contractors Association (NOECA)
2005	Instructor; Clemson University; Clemson, South Carolina
2004 – Present	Instructor; Electrical League of Ohio; Cleveland, Ohio
2000 – 2016	Instructor; Stark State College of Technology: North Canton, Ohio
1999 – Present	Instructor; National Electrical Contractors Association (NECA); Akron, Ohio Division
1991 – 2009	OCILB Approved Contractor Training Agency
1990 – Present	State of Ohio; Approved Electrical Safety Inspector, Instructor

Respectfully,
John M. Labriola
John M. Labriola
OBBS ID #815
john@ta191.com

www.ta191.com

May 02, 2022

Labriola Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720

Ohio Board of Building Standards
6606 Tussing Road – PO Box 4009
Reynoldsburg, Ohio 43068 – 9009

Course Submittal #4 – 4 Hours

Chapters 3 & 4

Raceways exposed to different raceways

Exit Enclosures (Stairwells)

Table 310.12

Medium Voltage Conductors & Cables

Box Fill Calculations

MC & AC Cables Installed in Enclosed Areas

Class "P" Cable

Replacement Receptacles that Requirement AFCI Protection

Appliance GFCI Protection (Dishwashers)

Adjustable-speed Drives (Conductor Types)

Emergency Generator Shutdown (Dwelling Unit)

2 ☐ **CURRENT ADOPTED CODES**

3 ☐ **2019 RESIDENTIAL CODE OF OHIO**

4 ☐

5 ☐

THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

6 ☐ **"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)**

Subject to the local or State adoption authority

108 ☐ **CHAPTER 3**
Wiring Methods and Materials

Article 300 – General Requirements for Wiring Methods & Materials

Article 310 – Conductors for General Wiring

N Article 311 – Medium Voltage Conductors and Cable

Article 314 – Outlet, Device, Pull & Junction Boxes, Conduit Bodies, Fittings & Handholes

N Article 337 – Type "P" Cable

109 ☐ **300.4(G) FITTINGS.**
PROTECTION FROM PHYSICAL DAMAGE
Revised, Clarified and Expanded.

Where raceways contain #4 AWG and larger insulated circuit conductors, and these

conductors enter a cabinet, box, enclosure, or raceway shall be protected by any of the following:

1. Identified fitting, with smooth, identified, insulating surface
2. A listed metal fitting with smooth, rounded edges
3. Separation from raceway by a fitting secured in place
4. Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure or raceway with a smooth rounded edge or flared entry *(2017 NEC exception)*

110 ☐ **300.7**
RACEWAYS EXPOSED TO DIFFERENT TEMPERATURES
Expanded Requirement

(A) Sealing. Where portions of a raceway or sleeve are known to be subjected to different temperatures, and where condensation is known to be a problem, *(cold storage areas, interior to exterior locations)* shall be sealed to prevent the circulation of warm air to a colder section of the raceway. *Sealants shall be identified for use with the cable or conductor insulation, bare conductor, shield, or other components.*

Now reads similar to 300.5

111 ☐ **300.22(D) INFORMATION TECHNOLOGY EQUIPMENT**
Revised

Where the installation complies with the special requirements in *645.4*, electrical wiring in air-handling areas beneath raised floors, shall be permitted in accordance with *645.5(E)*.

112 ☐ ***N*** **300.25**
EXIT ENCLOSURES (STAIR TOWERS)
Where an exit enclosure is required to be separated from the building, *only* electrical wiring methods serving equipment permitted by the authority having jurisdiction in the exit enclosure shall be installed within the exit enclosure.

113 ☐ **300.45 DANGER SIGNS**

Requirements for over 1000-volts Nominal
Revised
Danger signs shall be conspicuously posted at points of access to conductors in all raceway and cable systems. The signs shall meet the requirements in 110.21(B), shall be readily visible, and shall read:
Danger – High Voltage – Keep Out
ANSI Z535.4 2011 (R2017)

114 ☐ **ARTICLE 310**
CONDUCTORS FOR GENERAL WIRING

This Article has been extensively re-organized

Most Tables were updated with additional conductor types:

PFA – Perfluoroalkoxy (High Temp- Teflon Conductors) Appl. & Elec.
XHHN – Flame Retardant Thermoset (90°C Dry & Damp) Bldg. Wire
XHWN – FR, Moisture Resistant Thermoset (75°C Dry & Wet)
XHWN-2 – FR, Moisture Resistant Thermoset (90°C Dry & Wet)

All tables now refer to Ampacities was "Allowable Ampacities"

For Informational Purposes Only

115 ☐ **ARTICLE 310**
CONDUCTORS FOR GENERAL WIRING
Re-organization Continued

1. 310.3 Conductors – 2017 NEC 310.160
2.
2. 310.4 Construction Applications – 2017 NEC 310.104
3.
3. 310.12 1ø Dwelling Services & Feeders – 2017 NEC 310.15
4.
4. 310.16 Ampacities of Insulated Conductors, Single-Insulated Conductors in Free Air, Insulated Conductors in Raceway or Cable, Single-Insulated Conductors in Free Air, Conductors Supported on a Messenger, Bare or Covered Conductors in Free Air, – 2017 NEC 310.15

116 ☐ **310.12 TABLE**
SINGLE-PHASE 120/240-V DWELLING SERVICES
& FEEDERS + 208Y/120-V SYSTEMS
Relocated 310.15(7)

The table is back for

100a – 400a Services & Feeders

83% Ampacity remains

Removed Table in 2014

117 ☐

118 ☐ **ARTICLE 311 (NEW)**
MEDIUM VOLTAGE CONDUCTORS AND CABLE

Covers construction, use installation and ampacities for medium voltage conductors and cables (MV).

Relocated from Article 310 & 328

2001v – 35kv ratings
Both shielded & non-shielded

119 ☐ **ARTICLE 314.16(B)(5)**
REVISION

EGC Conductor Fill

Where up to "4" egc's / ebc's enter a box, a *single* volume allowance shall be made based on the largest egc / ebc entering the box. *A ¼" volume allowance for each additional egc / ebc installed in a box shall be calculated.*
Applies to all cable methods
Not Current Code in Ohio

120 ☐ **314.27(C) REVISION**
BOXES AT CEILING-SUSPENDED
(PADDLE) FAN OUTLETS

Revision to this section will now require *all* outlet boxes in *habitable room locations* designed for future paddle fan installation, shall require the box to be listed as sole support of ceiling-suspended (paddle) fans or supported by structural framing members.

Removed spare or separate switch referenced locations!

121 ☐ **320.80 AMPACITY; ARMORED CABLE (AC CABLE)**
When Installed in Thermal Insulation / 2nd Paragraph *N*

(A) Thermal Insulation. Conductors installed shall be rated 90°C. Their ampacity shall not exceed the 60°C rating, 90°C shall be used to determine the adjustment / correction factors only.

Where more than 2 Type AC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with

Table 310.15(C)(1).

122 ☐ **330.80 AMPACITY; METAL CLAD CABLE (MC CABLE)**
When Installed in Thermal Insulation *N*

Where more than 2 Type MC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

123 ☐ ***N* 330.130 HAZARDOUS (CLASSIFIED) LOCATIONS**

N Where required to be marked MC-HL, the cable shall be listed and shall have a gas / vapor tight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor.

124 ☐ **NON-METALLIC-SHEATHED CABLE (NM) 334.30 SECURING AND SUPPORTING**
Revised / Relaxing the Rules

NM cable shall be supported and secured by staples, cable ties listed and identified for securement and support, or straps, hangers, or similar fittings every 4½' and within 12" of every enclosure. *The cable length between the cable entry and the closest cable support shall not exceed 18".*

125 ☐ **ARTICLE 337 (NEW)**
CLASS P CABLE
Hazardous location cable up to 600-v, both armored and unarmored.

Typically, tinned copper conductor with a polyester tape separator. Insulation is chemically cross-linked polyolefin and the jacket is Arctic Neoprene.

Used for power, control, signaling and instrumentation for offshore drilling rigs. Severe cold durability, flame retardant and oil resistant

Cable tray installation and high strand count

Approved for Class I Div. 1 / Div. 2 locations

Class II Div. 1 / Div. 2 Locations

ANSI / UL 1309-2017 Marine Shipyard Cable

126 ☐ **TYPE "P" CABLE DESIGNED FOR THE OIL AND GAS INDUSTRY**

Numerous manufacturer's offer Type "P" cable.

Designed for harsh environments:

Oil and moisture resistant, severe temperature conditions, mechanical stress and drilling mud.
Uses include, drilling rigs, marine both onshore and offshore platform sites.
Available in both armored and sheathed

127 ☐ **CHAPTER 4**

Equipment for General Use

Article 404 – Switches

Article 406 – Receptacles, Cord Connectors, & Attachment Plugs

Article 408 – Switchboards, Switchgear & Panelboards

Article 410 – Luminaires, Lampholders, & Lamps

Article 422 – Appliances

Article 430 – Motors, Motor Circuits, & Controllers

Article 440 – A/C and Refrigeration Equipment

Article 445- Generators

128 ☐ **404.2(C) SWITCHES CONTROLLING LIGHTING LOADS**

Further Clarification

The grounded circuit conductor for controlled lighting circuit shall be installed at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit serving bathrooms, hallway stairways, *and habitable rooms or occupiable spaces* as defined in the applicable building code.

2019 RCO – Habitable Space. A space in a building for living, sleeping, eating or cooking.

129 ☐ **404.2(C) EXCEPTION**

Exception: The connection requirement shall become effective on January 1, 2020. *It shall not apply* to replacement or retrofit switches installed in locations prior to local adoption of *404.2(C) and where the grounded conductor cannot be extended without removing finish materials*. *The number of electronic control switches on a branch circuit shall not exceed 5, and the number connected to any feeder on the load side of a system or main bonding jumper shall not exceed 25*. For the purpose of this exception, a neutral busbar, in compliance with 200.2(B) and to which a main or system bonding jumper is connected shall not be limited as to the number of electronic lighting control switches connected.

2017 NEC Code Change Remains / when grounded conductor not able to be extended

130 ☐ **406.4 RECEPTACLE REPLACEMENTS. GROUNDING (D)(1); NON-GROUNDING (D)(2); GFCI (D)(3); AND AFCI (D)(4);**

Reference to 210.12 (A), (B) & (C) Required "AFCI" Locations

2020 NEC 406.4(D) Arc-Fault Circuit-Interrupter (AFCI); Replacement Types

(1) Listed outlet branch-circuit AFCI type receptacle
(2) Receptacle protected by listed outlet branch-circuit type AFCI receptacle
(3) A receptacle protected by a listed combination type AFCI circuit breaker

210.12(D) Ex: *Branch Circuit Extensions or Modifications* – Dwelling Units, Dormitory Units, and Guest Rooms and Guest Suites locations only.

(1) 210.12 (A) Dwelling Units. (1-6)
(2) Listed outlet branch-circuit type AFCI at 1st outlet of existing circuit

131 ☐

132 ☐ **AFCI TYPE DEVICES**

[1] AFCI "TR" Outlet
[2] AFCI / GFCI "TR" Outlet

133 ☐ **AFCI TYPE DEVICES**

[1] AFCI "Deadfront"
[2] 20a Hospital Grade AFCI / GFCI "TR" Outlet (Red)

134 ☐ **406.5(G)(2) NEW**
RECEPTACLE ORIENTATION UNDER SINKS

Receptacle outlets are prohibited from being installed face-up in or on countertop surfaces, unless they are listed for such installations.

The proposal will include prohibiting face-up installations in under sink locations as well.

Readily Accessible?

135 ☐ **406.9(C)**
BATHTUB & SHOWER SPACE
EXPANDED DETAILS

Receptacles shall *not* be installed *within a zone measured 3' horizontally and 8' vertically from the top of the bathtub rim or shower stall threshold.* The identified zone is all-encompassing and *shall include* the space directly over the tub or shower stall.

Exception: In bathrooms with less than the required zone, the receptacle(s) shall be permitted to be installed opposite the bathtub rim or shower stall threshold on the farthest wall within the room.

Same as light fixtures 410.10(D)

136 ☐ **406.12 TAMPER RESISTANT RECEPTACLES**
Additional Location Requirements

All 15- and 20-ampere, 125-v and 250-v nonlocking type receptacles in the areas specified 406.12(1) through *(8)* shall be listed
tamper-resistant receptacles.

(1) Dwelling units, *including attached & detached garages accessory buildings to dwelling units, & common areas of multifamily dwellings specified in 210.52 & 550.13.*
(2) Guest rooms & guest suites of hotels, *motels & common areas.*
(6) Assembly areas; including places *awaiting transportation...*
(7) Dormitory *units*
(*8*) *Assisted living facilities (NEW)*

137 ☐ ***N*** **406.13 RECEPTACLES, CORD CONNECTORS, AND CAPS**
Single-Pole Separable-Connector Type.

Single-pole separable connectors shall be listed and labeled and shall comply with 406.13(A) – (D).

(A) Locking or Latching Type
(B) Identification
(C) Interchangeability

(D) Connecting and Disconnecting

138 ☐ **408.4**
CIRCUIT DIRECTORY OR CIRCUIT IDENTIFICATION
Revision

Currently, the legible circuit directory is required to be located inside the panel door or face of the panelboard. New revision text states "*inside of, or in an approved location adjacent to*" the panel door.

Due to other information located on the panel, energy compliance certificate, AFC, inspection stickers, energy management info, etc..
2019 Residential Code of Ohio – 1101.14 Certificate

139 ☐ ***N*** **408.6 SWITCHBOARDS, SWITCHGEAR AND PANELBOARDS**

Short-Circuit Current Rating

Switchboards, switchgear & panelboards *shall* have a SCCR not less than the available fault current in other than one- and two-family dwellings, the available fault current and the date the calculation was performed shall be field marked on the enclosure at the point of supply. The marking shall comply with 110.21(B)(3). ***ANSI Z535.4 2011 (R2017)***

140 ☐

141 ☐ **ALL ABOUT SAFETY!**

110.10 – Short Circuit Current Ratings. The equipment short-circuit current ratings and other characteristics of the circuit to be protected shall be selected and coordinated to permit the circuit protective devices used to clear a fault, to do so without extensive damage to the electrical equipment of the circuit. *SCCR is Not overcurrent protection.*

Installing Properly Rated Overcurrent Protective Devices

Overcurrent protective devices (breakers or fuses) shall be rated greater than the maximum available fault current available at the line side terminals of the equipment *(load)* served.

142 ☐ **408.43 PANELBOARD ORIENTATION**

The intent is to prohibit mounting panelboards from being installed in the face-up position.

Debris can accumulate and damage to the bus and OCD's can occur.
For Informational Purposes Only

143 ☐ ***N*** **PART XVI. SPECIAL PROVISIONS FOR HORTICULTURAL LIGHTING EQUIPMENT**

410.172 Listing
410.174 Installation and Use
410.176 Locations Not Permitted
410.184 Ground-Fault Circuit-Interrupter Protection

Damp or Wet Location Listed / Labeled? / Light Spectrum
Fruits / Vegetables / Cannabis

144 ☐ **422.5(A)**
GFCI REQUIREMENTS FOR APPLIANCES
Revised

Removed the requirement "*provided for public use*" for both vacuum and tire inflation machines, GFCI protection is required.

Applies to all locations!

145 ☐ **ARTICLE 422 APPLIANCES**

GROUND-FAULT CIRCUIT-INTERRUPTER (GFCI) PROTECTION FOR PERSONNEL
422.5 General.

(1) Automotive Vacuum machines
(2) Drinking water coolers and bottle fill stations
(3) Cord-and-plug connected high-pressure spray washing machines
(4) Tire inflation machines
(5) Vending Machines
(6) Sump pumps
(7) Dishwashers

N Informational Note: Section 210.8 specifies requirements for GFCI protection for the branch-circuit outlet where the covered location warrants such protection.

146 ☐ **ARTICLE 430 – MOTORS, MOTOR CIRCUITS & CONTROLLERS**
New Terminology – Electronically Protected

430.32 (A) Thermal Protector or "*Electronically Protected*" (designed for fractional motors).

An electronically protected motor shall be approved for use on the basis that it will prevent dangerous overheating due to the failure of the *electronic control*, overload, or failure to start the motor.

Terminology throughout Article 430

147 ☐ **430.122**
CONDUCTORS – MINIMUM SIZE & AMPACITY

New Informational Note No. 2

Relates to adjustable-speed drive systems

Circuit conductors on the output of an adjustable-speed drive system are susceptible to breakdown under certain conditions due to the characteristics of the output waveform of the drive. Factors affecting the conductors include but not limited to the output voltage, frequency, & current, the length of the conductors, the spacing between the conductors, and *the dielectric strength of the conductor insulation*. Methods to mitigate breakdown include consideration of one or more of these factors.

ie: XHHW / XHHN Type Conductors

148 ☐ **440.9 A/C & REFRIGERATION EQUIPMENT**

Clarification

All A/C & Refrigeration equipment installed outdoors on a roof, in a metallic raceway that utilizes *compression-type* fittings/connectors require a wire type equipment grounding conductor.

Was non-threaded fittings

149 ☐

445.18(D) NEW EMERGENCY SHUTDOWN IN
1- & 2-FAMILY DWELLING UNITS

Generators

Generators other than cord-and-plug connected portable type, *shall be provided* with an emergency shutdown device, located on the *outside* of 1- and 2-family dwelling units.

Not Current Code in Ohio

150 ☐ **PORTABLE GENERATOR SET-UP**

1 GE 50a Twist Lock Power Inlet
2 50a Twist Lock Power Cord

248 ☐ **2020 NEC COMMERCIAL OVERVIEW**

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

249 ☐ **2020 NEC RESIDENTIAL OVERVIEW**

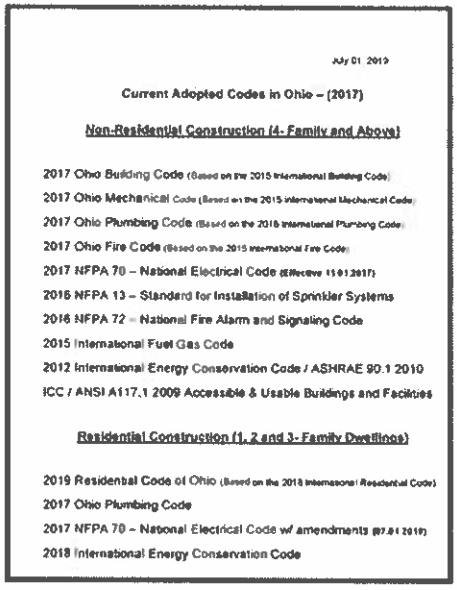
- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

250 ☐

2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Thank You!

CURRENT ADOPTED CODES



July 01 2019

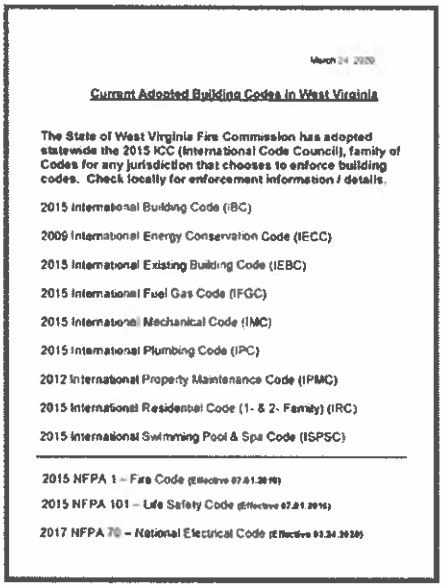
Current Adopted Codes in Ohio – (2017)

Non-Residential Construction (4- Family and Above)

2017 Ohio Building Code (Based on the 2015 International Building Code)
2017 Ohio Mechanical Code (Based on the 2015 International Mechanical Code)
2017 Ohio Plumbing Code (Based on the 2015 International Plumbing Code)
2017 Ohio Fire Code (Based on the 2015 International Fire Code)
2017 NFPA 70 – National Electrical Code (Effective 11 01 2017)
2016 NFPA 13 – Standard for Installation of Sprinkler Systems
2016 NFPA 72 – National Fire Alarm and Signaling Code
2015 International Fuel Gas Code
2012 International Energy Conservation Code / ASHRAE 90.1 2010
ICC / ANSI A117.1 2009 Accessible & Usable Buildings and Facilities

Residential Construction (1, 2 and 3- Family Dwellings)

2019 Residential Code of Ohio (Based on the 2018 International Residential Code)
2017 Ohio Plumbing Code
2017 NFPA 70 – National Electrical Code w/ amendments (07 01 2019)
2018 International Energy Conservation Code



March 24 2020

Current Adopted Building Codes in West Virginia

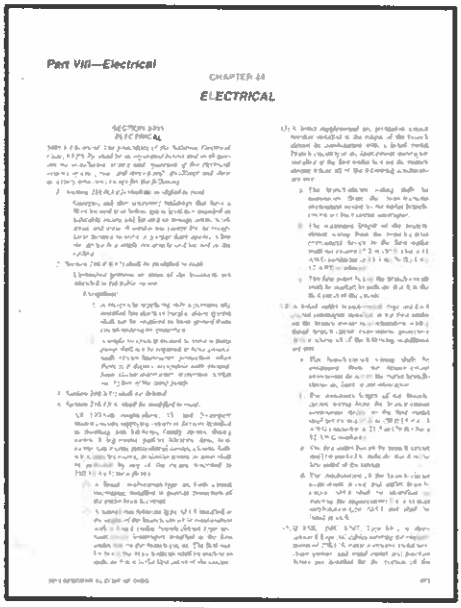
The State of West Virginia Fire Commission has adopted statewide the 2015 ICC (International Code Council), family of Codes for any jurisdiction that chooses to enforce building codes. Check locally for enforcement information / details.

2015 International Building Code (IBC)
2009 International Energy Conservation Code (IECC)
2015 International Existing Building Code (IEBC)
2015 International Fuel Gas Code (IFGC)
2015 International Mechanical Code (IMC)
2015 International Plumbing Code (IPC)
2012 International Property Maintenance Code (IPMC)
2015 International Residential Code (1- & 2- Family) (IRC)
2015 International Swimming Pool & Spa Code (ISPSC)

2015 NFPA 1 – Fire Code (Effective 07 01 2016)
2015 NFPA 101 – Life Safety Code (Effective 07 01 2016)
2017 NFPA 70 – National Electrical Code (Effective 03 24 2020)

2

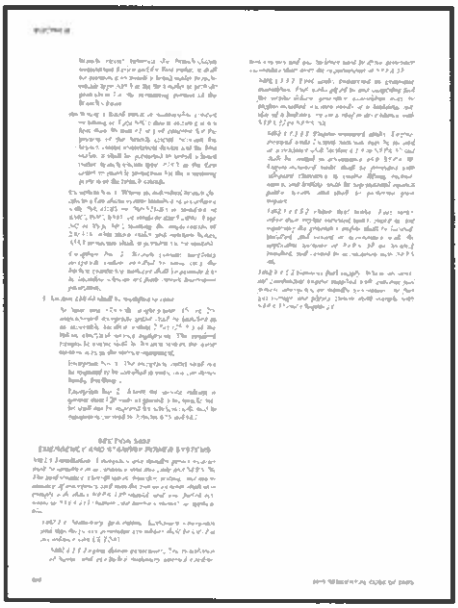
2019 RESIDENTIAL CODE OF OHIO



Part VIII—Electrical

CHAPTER 44

ELECTRICAL



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www.ta191.com
2020 "Proposed" National Electrical Code (NEC) Changes & Updates
Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720
330.497.6309 Phone
John M. Labriola
www.ta191.com
2020

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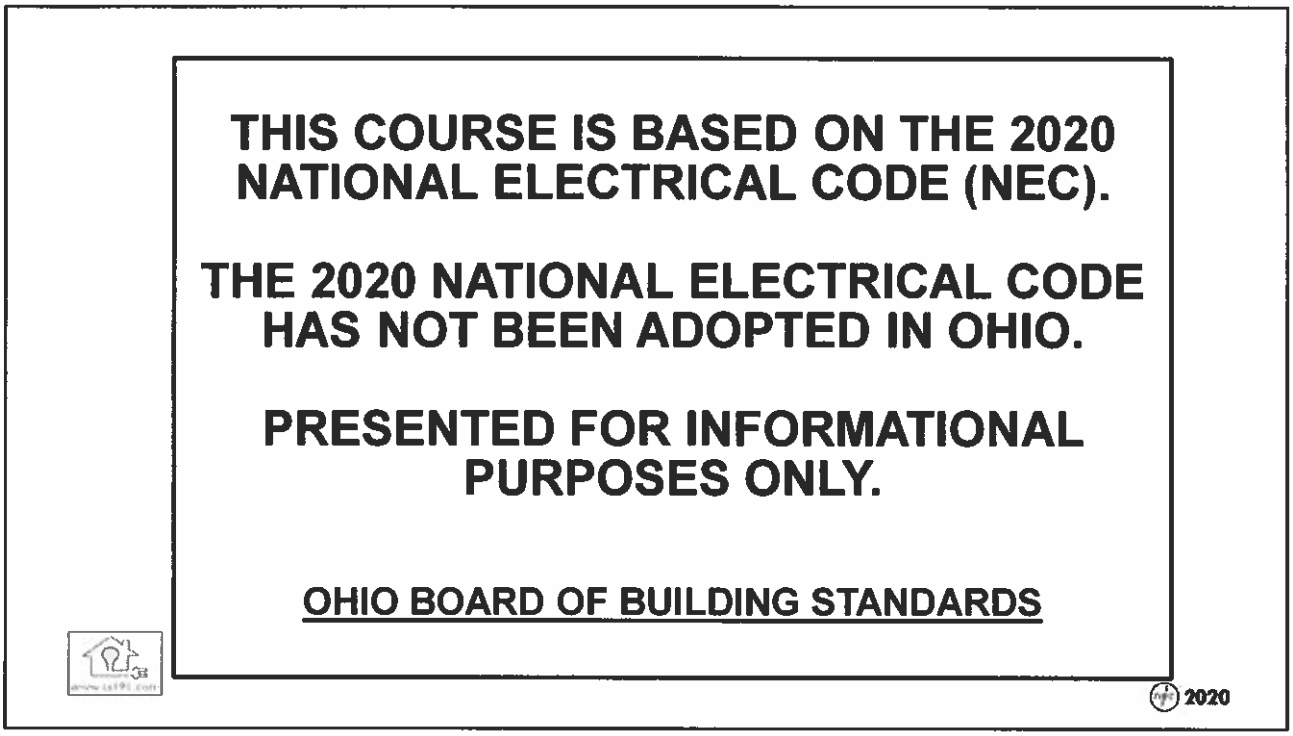
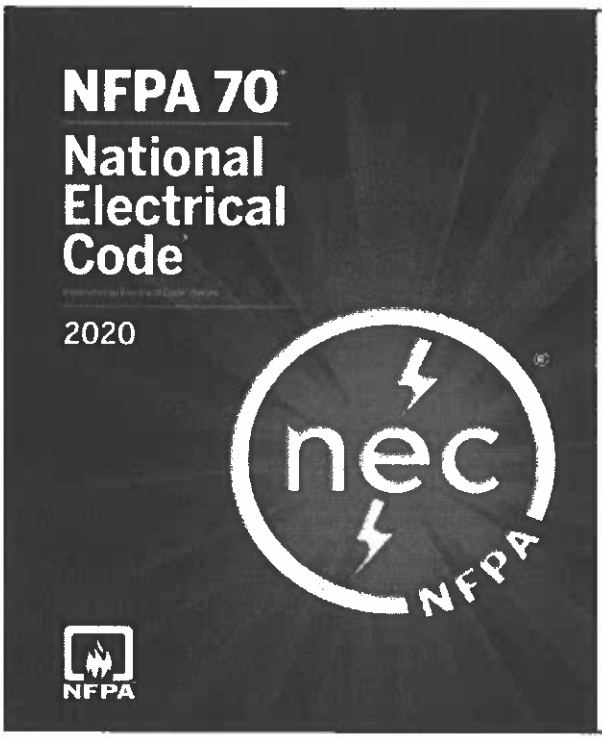

THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).
THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.
PRESENTED FOR INFORMATIONAL PURPOSES ONLY.
OHIO BOARD OF BUILDING STANDARDS
2020

5



"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)

Subject to the local or State adoption authority

2020

6

CHAPTER 3

Wiring Methods and Materials

Article 300 – General Requirements for Wiring Methods & Materials

Article 310 – Conductors for General Wiring

N Article 311 – Medium Voltage Conductors and Cable

Article 314 – Outlet, Device, Pull & Junction Boxes, Conduit Bodies, Fittings & Handholes

N Article 337 – Type "P" Cable

2020

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300.4(G) FITTINGS. PROTECTION FROM PHYSICAL DAMAGE

Revised, Clarified and Expanded.

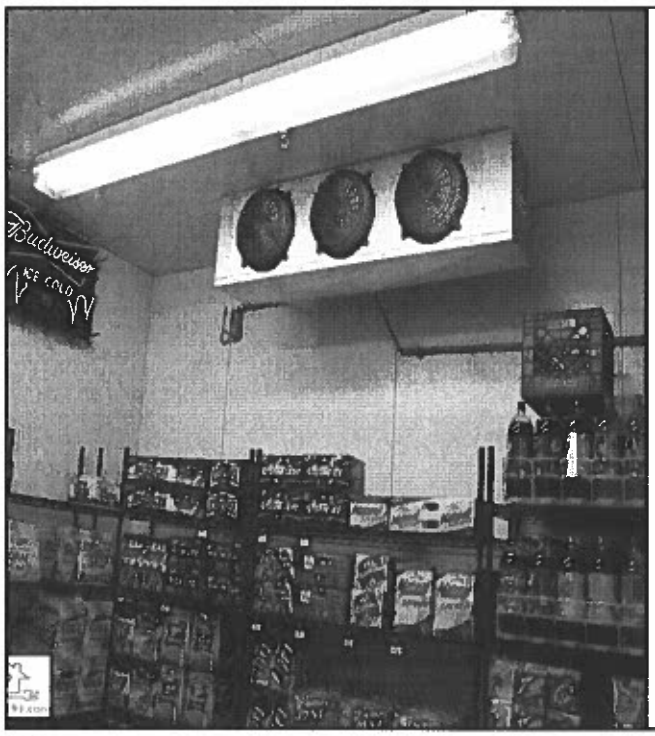
Where raceways contain #4 AWG and larger insulated circuit conductors, and these conductors enter a cabinet, box, enclosure, or raceway shall be protected by any of the following:

1. Identified fitting, with smooth, identified, insulating surface
2. A listed metal fitting with smooth, rounded edges
3. Separation from raceway by a fitting secured in place
4. Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure or raceway with a smooth rounded edge or flared entry ***(2017 NEC exception)***

Not Current Code in Ohio

2020

109



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Expanded Requirement

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Now reads similar to 300.5

For Informational Purposes Only

2020

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300.22(D) INFORMATION TECHNOLOGY EQUIPMENT

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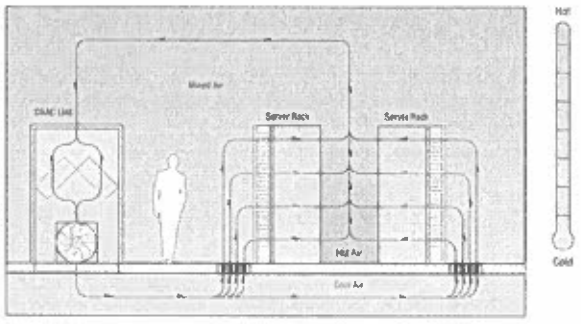
Traditional Cooling Diagram



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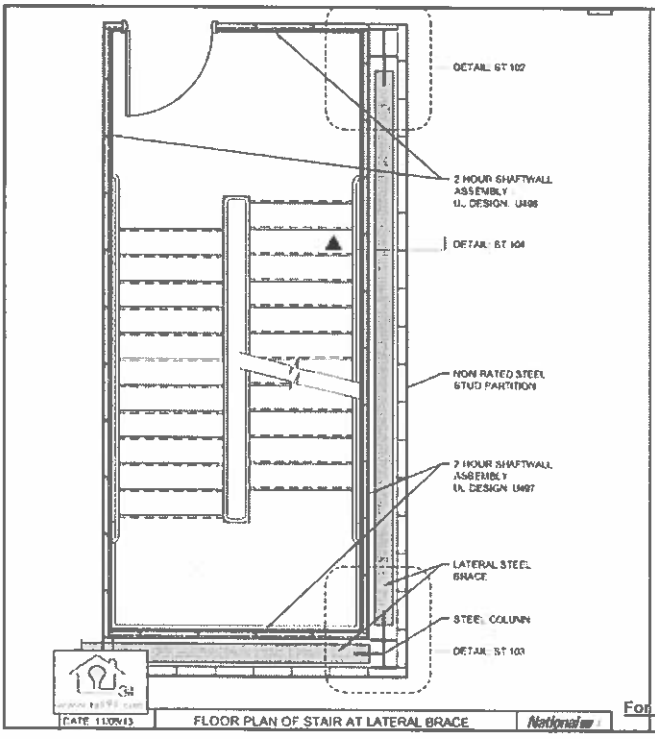

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For Informational Purposes Only

2020

112

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Requirements for over 1000-volts Nominal

Revised

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****ANSI Z535.4 2011 (R2017)****

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Not Current Code in Ohio

2020

115

310.12 TABLE
SINGLE-PHASE 120/240-V DWELLING SERVICES & FEEDERS + 208Y/120-V SYSTEMS

Relocated 310.15(7)

The table is back for

100a – 400a Services & Feeders

83% Ampacity remains

Removed Table in 2014

Amperes	Copper	Alum
100	4	2
110	3	1
125	2	1/0
150	1	2/0
175	1/0	3/0
200	2/0	4/0
225	3/0	250
250	4/0	300
300	250	350
350	350	500
400	400	600

For Informational Purposes Only

2020

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Table 310.16 Ampacities of Insulated Conductors with Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried)

Size AWG or kcmil	Temperature Rating of Conductor (See Table 310.4(A))						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)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, PFA, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, XHHN, Z, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, XHWN, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, XHHN	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
18*	—	—	14	—	—	—	—
16*	—	—	18	—	—	—	—
14*	15	20	25	—	—	—	—
12*	20	25	30	15	20	25	12*
10*	30	35	40	25	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	115	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	145	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	195	230	250	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	350	420	475	285	340	385	600
700	385	460	520	315	375	425	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	445	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	525	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	555	665	750	470	560	630	2000

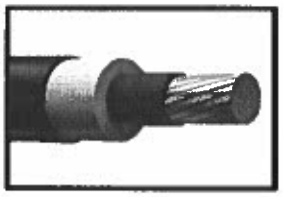
117

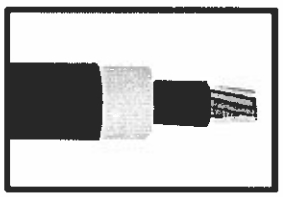
ARTICLE 311 (NEW) MEDIUM VOLTAGE CONDUCTORS AND CABLE

Covers construction, use installation and ampacities for medium voltage conductors and cables (MV).

Relocated from Article 310 & 328

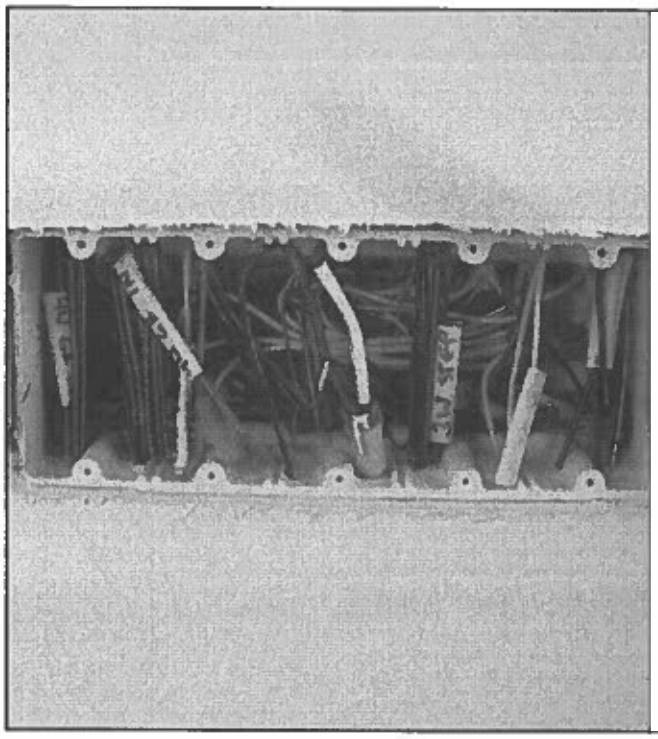
2001v – 35kv ratings
Both shielded & non-shielded





For Informational Purposes Only

118



ARTICLE 314.16(B)(5) REVISION

EGC Conductor Fill

Where up to "4" egc's / ebc's enter a box, a ***single*** volume allowance shall be made based on the largest egc / ebc entering the box. ***A ¼" volume allowance for each additional egc / ebc installed in a box shall be calculated.***

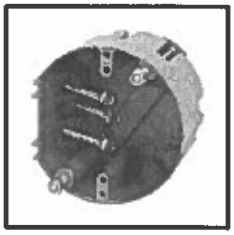
Applies to all cable methods

Not Current Code in Ohio

119

314.27(C) REVISION BOXES AT CEILING-SUSPENDED (PADDLE) FAN OUTLETS

Revision to this section will now require ***all*** outlet boxes in ***habitable room locations*** designed for future paddle fan installation, shall require the box to be listed as sole support of ceiling-suspended (paddle) fans or supported by structural framing members.



Removed spare or separate switch referenced locations!

For Informational Purposes Only

2020

120

320.80 AMPACITY; ARMORED CABLE (AC CABLE)

When Installed in Thermal Insulation / 2nd Paragraph *N*

(A) Thermal Insulation. Conductors installed shall be rated 90°C. Their ampacity shall not exceed the 60°C rating, 90°C shall be used to determine the adjustment / correction factors only.

Where more than 2 Type AC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

Not Current Code in Ohio

2020

121

330.80 AMPACITY; METAL CLAD CABLE (MC CABLE)

When Installed in Thermal Insulation *N*

Where more than 2 Type MC cables containing two or more current-carrying conductors in each cable are installed in contact with thermal insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

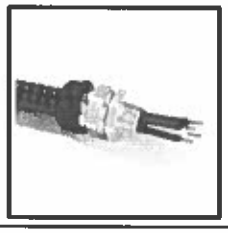
For Informational Purposes Only

2020

122

N 330.130 HAZARDOUS (CLASSIFIED) LOCATIONS

N ***Where required to be marked MC-HL, the cable shall be listed and shall have a gas / vapor tight continuous corrugated metallic sheath, an overall jacket of suitable polymeric material, and a separate equipment grounding conductor.***



Not Current Code in Ohio

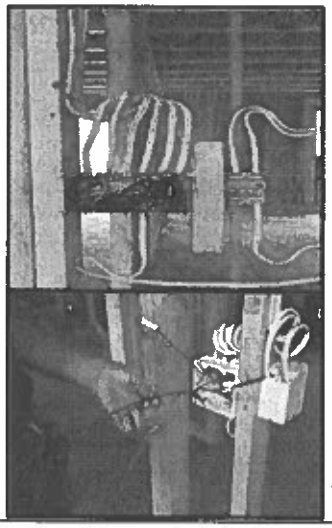
2020

123

NON-METALLIC-SHEATHED CABLE (NM) 334.30 SECURING AND SUPPORTING

Revised / Relaxing the Rules

NM cable shall be supported and secured by staples, cable ties listed and identified for securement and support, or straps, hangers, or similar fittings every 4½' and within 12" of every enclosure. ***The cable length between the cable entry and the closest cable support shall not exceed 18".***



For Informational Purposes Only

2020

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ARTICLE 337 (NEW) CLASS P CABLE

Hazardous location cable up to 600-v, both armored and unarmored.

Typically, tinned copper conductor with a polyester tape separator. Insulation is chemically cross-linked polyolefin and the jacket is Arctic Neoprene.

Used for power, control, signaling and instrumentation for offshore drilling rigs. Severe cold durability, flame retardant and oil resistant

Cable tray installation and high strand count

Approved for Class I Div. 1 / Div. 2 locations

Class II Div. 1 / Div. 2 Locations

ANSI / UL 1309-2017 Marine Shipyard Cable

Not Current Code in Ohio

2020

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BOSTRIG™ 125 TYPE P POWER CABLE

APPLICATIONS

FEATURES

CONSTRUCTION

RATINGS

APPROVALS

TYPE "P" CABLE DESIGNED FOR THE OIL AND GAS INDUSTRY

Numerous manufacturer's offer Type "P" cable.

Designed for harsh environments:

Oil and moisture resistant, severe temperature conditions, mechanical stress and drilling mud.

Uses include, drilling rigs, marine both onshore and offshore platform sites.

Available in both armored and sheathed

2020

For Informational Purposes Only

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CHAPTER 4

Equipment for General Use

Article 404 – Switches

Article 406 – Receptacles, Cord Connectors, & Attachment Plugs

Article 408 – Switchboards, Switchgear & Panelboards

Article 410 – Luminaires, Lampholders, & Lamps

Article 422 – Appliances

Article 430 – Motors, Motor Circuits, & Controllers

Article 440 – A/C and Refrigeration Equipment

Article 445- Generators

For Informational Purposes Only

2020

127

404.2(C) SWITCHES CONTROLLING LIGHTING LOADS

Further Clarification

The grounded circuit conductor for controlled lighting circuit shall be installed at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit serving bathrooms, hallway stairways, ***and habitable rooms or occupiable spaces*** as defined in the applicable building code.

2019 RCO – Habitable Space. **A space in a building for living, sleeping, eating or cooking.**

Not Current Code in Ohio

2020

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404.2(C) EXCEPTION

Exception: The connection requirement shall become effective on January 1, 2020. ***It shall not apply*** to replacement or retrofit switches installed in locations prior to local adoption of ***404.2(C) and where the grounded conductor cannot be extended without removing finish materials***. ***The number of electronic control switches on a branch circuit shall not exceed 5, and the number connected to any feeder on the load side of a system or main bonding jumper shall not exceed 25***. For the purpose of this exception, a neutral busbar, in compliance with **200.2(B)** and to which a main or system bonding jumper is connected shall not be limited as to the number of electronic lighting control switches connected.

2017 NEC Code Change Remains / when grounded conductor not able to be extended

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2020

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406.4 RECEPTACLE REPLACEMENTS. GROUNDING (D)(1); NON-GROUNDING (D)(2); GFCI (D)(3); AND AFCI (D)(4);

Reference to 210.12 (A), (B) & (C) Required "**AFCI**" Locations

2020 NEC 406.4(D) Arc-Fault Circuit-Interrupter (AFCI); Replacement Types

(1) Listed outlet branch-circuit AFCI type receptacle
(2) Receptacle protected by listed outlet branch-circuit type AFCI receptacle
(3) A receptacle protected by a listed combination type AFCI circuit breaker

210.12(D) Ex*: Branch Circuit Extensions or Modifications* – Dwelling Units, Dormitory Units, and Guest Rooms and Guest Suites locations only.

(1) 210.12 (A) Dwelling Units. (1-6)
(2) Listed outlet branch-circuit type AFCI at 1st outlet of existing circuit

Not Current Code in Ohio

2020

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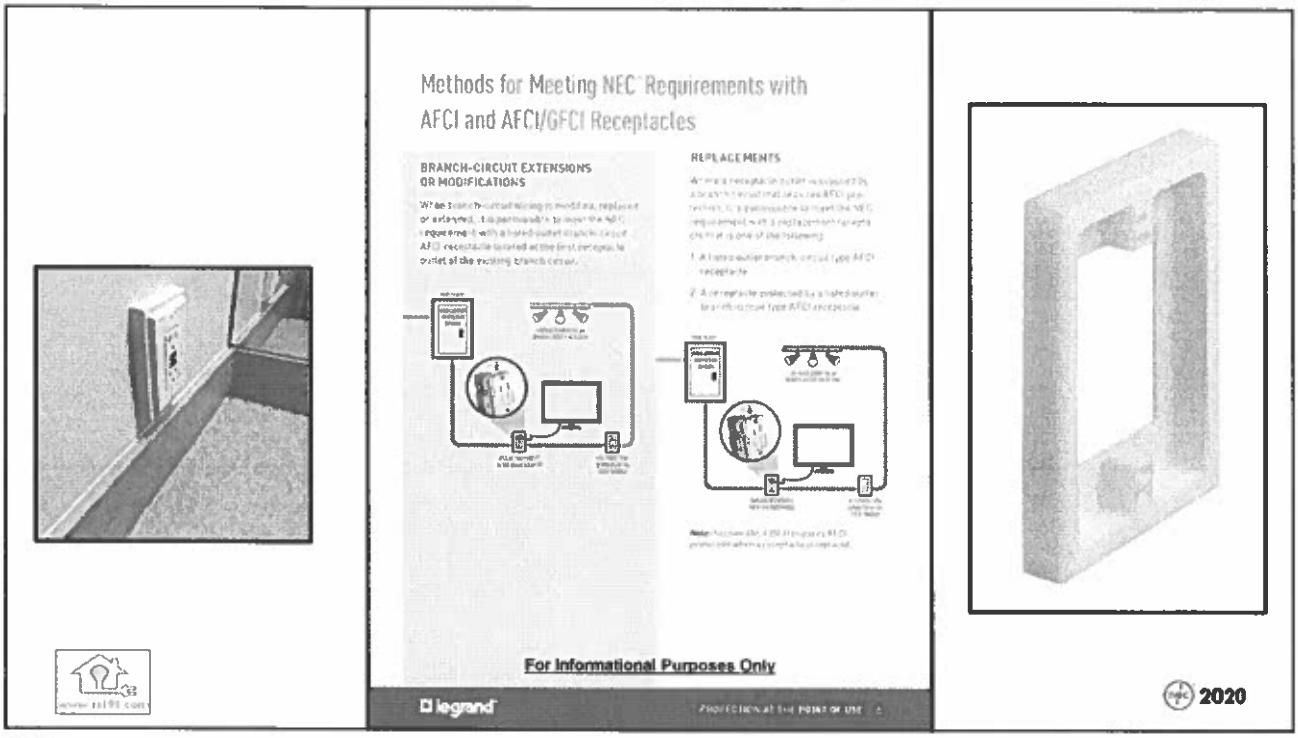
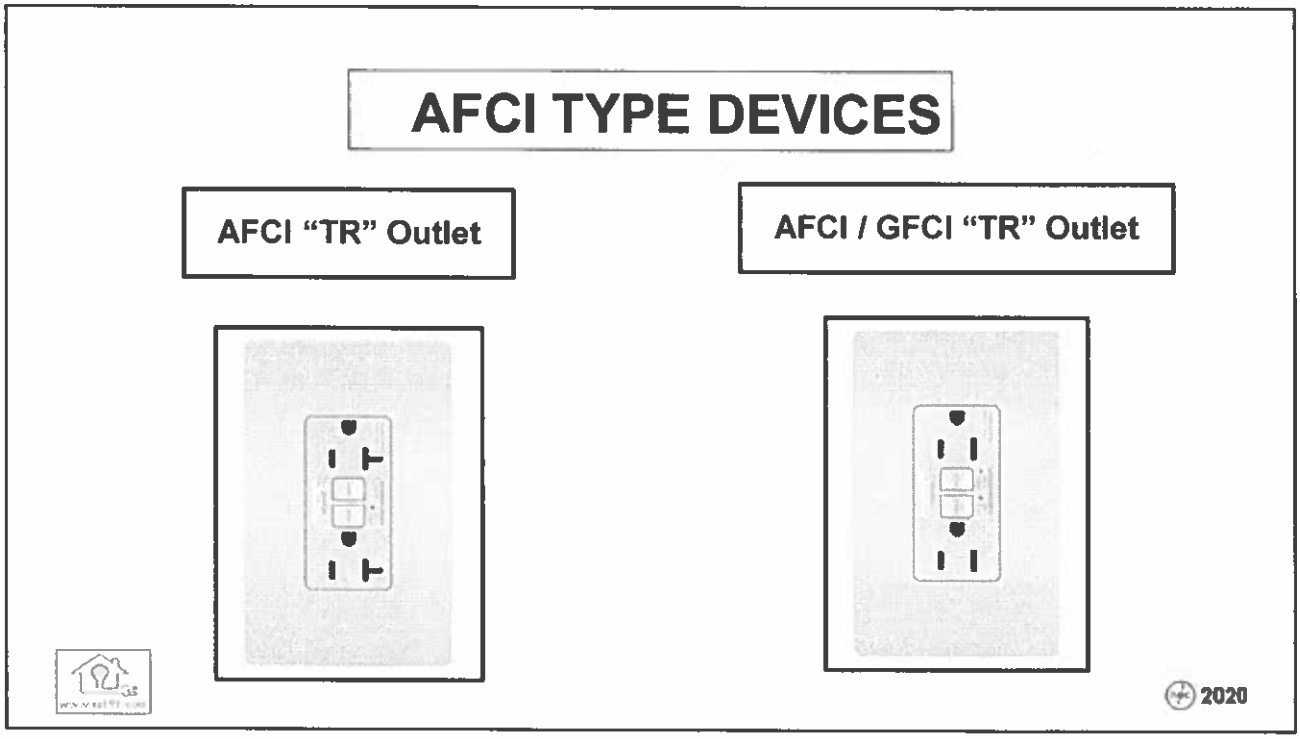

Methods for Meeting NEC® Requirements with AFCI and AFCI/GFCI Receptacles
BRANCH-CIRCUIT EXTENSIONS OR MODIFICATIONS
REPLACEMENTS
For Informational Purposes Only
legrand
2020

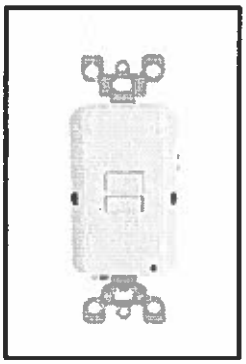
131


AFCI TYPE DEVICES
AFCI "TR" Outlet
AFCI / GFCI "TR" Outlet
2020

132

AFCI TYPE DEVICES

AFCI "Deadfront"



20a Hospital Grade AFCI / GFCI "TR" Outlet (Red)

2020

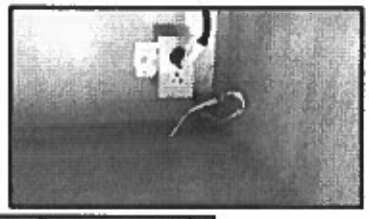
133

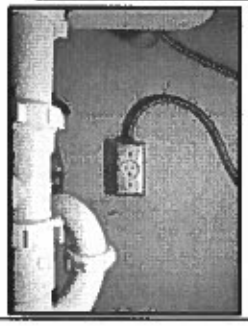
406.5(G)(2) NEW RECEPTACLE ORIENTATION UNDER SINKS

Receptacle outlets are prohibited from being installed face-up in or on countertop surfaces, unless they are listed for such installations.

The proposal will include prohibiting face-up installations in under sink locations as well.

Readily Accessible?





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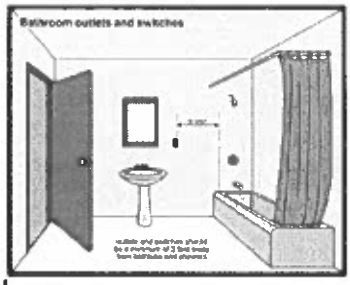
2020

134

406.9(C) BATHTUB & SHOWER SPACE EXPANDED DETAILS



Receptacles shall ***not*** be installed ***within a zone measured 3' horizontally and 8' vertically from the top of the bathtub rim or shower stall threshold.*** The identified zone is all-encompassing and ***shall include*** the space directly over the tub or shower stall.

Exception: In bathrooms with less than the required zone, the receptacle(s) shall be permitted to be installed opposite the bathtub rim or shower stall threshold on the farthest wall within the room.

Same as light fixtures 410.10(D)

Not Current Code in Ohio

2020

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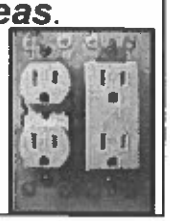
406.12 TAMPER RESISTANT RECEPTACLES

Additional Location Requirements

All 15- and 20-ampere, 125-v and 250-v nonlocking type receptacles in the areas specified 406.12(1) through ***(8)*** shall be listed tamper-resistant receptacles.

(1) Dwelling units, ***including attached & detached garages accessory buildings to dwelling units, & common areas of multifamily dwellings specified in 210.52 & 550.13.***
(2) Guest rooms & guest suites of hotels, ***motels & common areas***.
(6) Assembly areas; including places ***awaiting*** *transportation…*
(7) Dormitory ***units***
(***8***) ***Assisted living facilities (NEW)***



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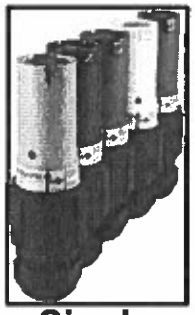
2020

136

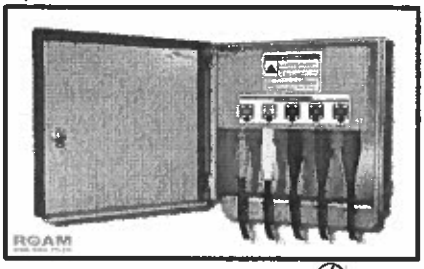


N 406.13 RECEPTACLES, CORD CONNECTORS, AND CAPS

Single-Pole Separable-Connector Type.

Single-pole separable connectors shall be listed and labeled and shall comply with 406.13(A) – (D).

- **(A) Locking or Latching Type**
- **(B) Identification**
- **(C) Interchangeability**
- **(D) Connecting and Disconnecting**



Not Current Code in Ohio

2020

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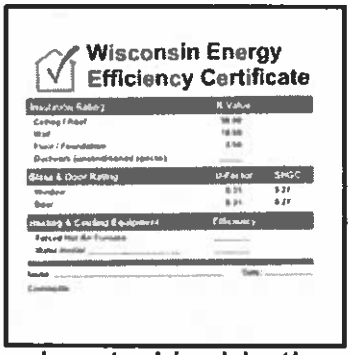
408.4 CIRCUIT DIRECTORY OR CIRCUIT IDENTIFICATION



Revision

Currently, the legible circuit directory is required to be located inside the panel door or face of the panelboard. **New revision text states "*inside of, or in an approved location adjacent to*"** the panel door.

Due to other information located on the panel, energy compliance certificate, AFC, inspection stickers, energy management info, etc..

2019 Residential Code of Ohio – 1101.14 Certificate

For Informational Purposes Only

2020

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N 408.6 SWITCHBOARDS, SWITCHGEAR AND PANELBOARDS

Short-Circuit Current Rating

Switchboards, switchgear & panelboards *shall* have a SCCR not less than the available fault current in other than one- and two-family dwellings, the available fault current and the date the calculation was performed shall be field marked on the enclosure at the point of supply. The marking shall comply with 110.21(B)(3). **ANSI Z535.4 2011 (R2017)**

Not Current Code in Ohio

2020

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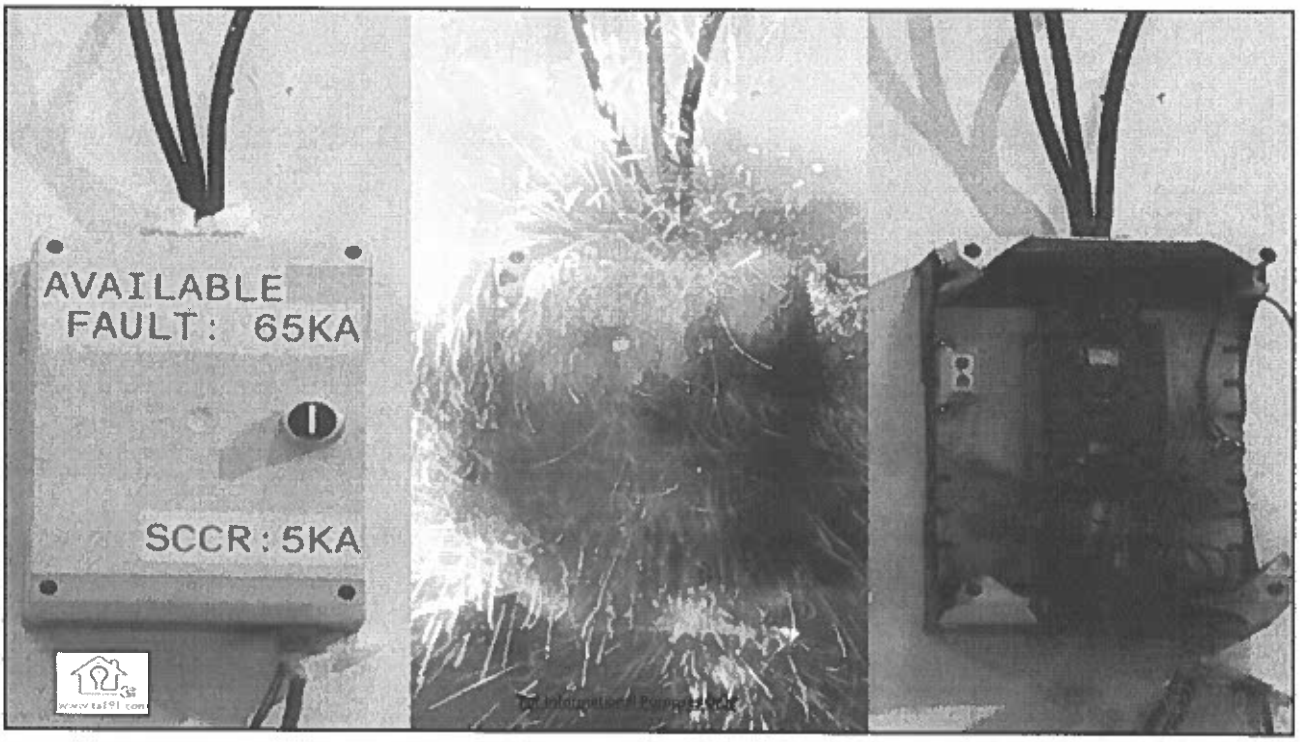

140

ALL ABOUT SAFETY!

110.10 – Short Circuit Current Ratings. The equipment short-circuit current ratings and other characteristics of the circuit to be protected **shall be selected and coordinated** to permit the circuit protective devices used to clear a fault, to do so without extensive damage to the electrical equipment of the circuit. ***SCCR is Not overcurrent protection.***

Installing Properly Rated Overcurrent Protective Devices

Overcurrent protective devices (breakers or fuses) shall be rated greater than the maximum available fault current available at the line side terminals of the equipment ***(load)*** served.

Not Current Code in Ohio

2020

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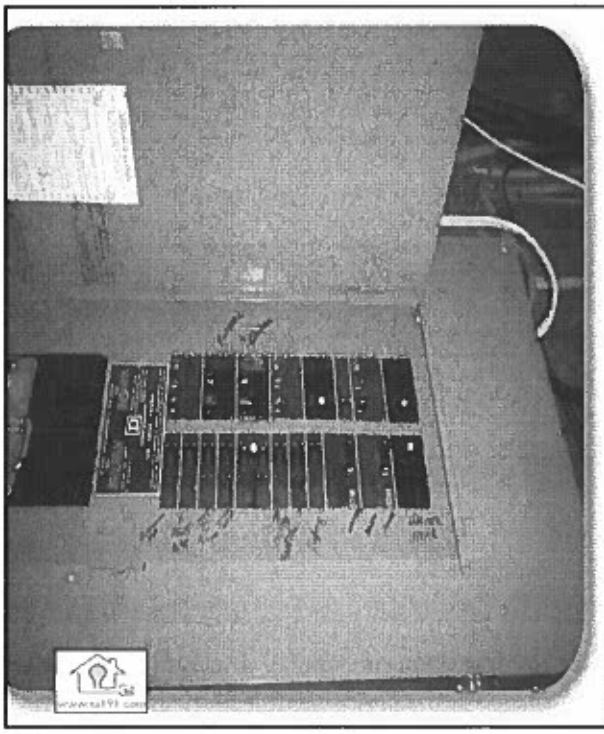

408.43 PANELBOARD ORIENTATION

The intent is to prohibit mounting panelboards from being installed in the face-up position.

Debris can accumulate and damage to the bus and OCD's can occur.

For Informational Purposes Only

2020

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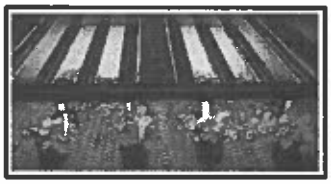
N PART XVI. SPECIAL PROVISIONS FOR HORTICULTURAL LIGHTING EQUIPMENT

410.172 Listing
410.174 Installation and Use
410.176 Locations Not Permitted
410.184 Ground-Fault Circuit-Interrupter Protection





Damp or Wet Location Listed / Labeled? / Light Spectrum
Fruits / Vegetables / Cannabis

Not Current Code in Ohio

2020

143

422.5(A) GFCI REQUIREMENTS FOR APPLIANCES

Revised

Removed the requirement "***provided for public use***" for both vacuum and tire inflation machines, GFCI protection is required.

Applies to all locations!

For Informational Purposes Only

2020

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ARTICLE 422 APPLIANCES

GROUND-FAULT CIRCUIT-INTERRUPTER (GFCI) PROTECTION FOR PERSONNEL

422.5 General.

(1) Automotive Vacuum machines
(2) Drinking water coolers **and bottle fill stations**
(3) **Cord-and-plug connected high**-pressure spray washing machines
(4) Tire inflation machines
(5) Vending Machines
(6) **Sump pumps**
(7) **Dishwashers**

***N* Informational Note: Section 210.8 specifies requirements for GFCI protection for the branch-circuit outlet where the covered location warrants such protection.**

Not Current Code in Ohio

2020

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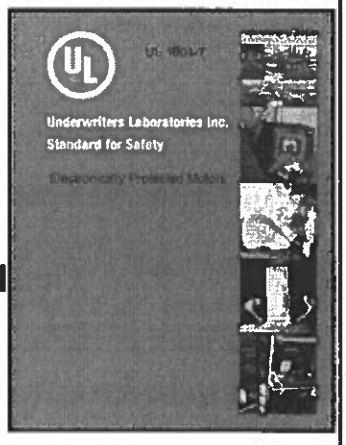
ARTICLE 430 – MOTORS, MOTOR CIRCUITS & CONTROLLERS

New Terminology – Electronically Protected



430.32 (A) Thermal Protector or "*Electronically Protected*" (designed for fractional motors).

An electronically protected motor shall be approved for use on the basis that it will prevent dangerous overheating due to the failure of the *electronic control*, overload, or failure to start the motor.

Terminology throughout Article 430

For Informational Purposes Only

2020

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430.122
CONDUCTORS – MINIMUM SIZE & AMPACITY

New Informational Note No. 2

Relates to adjustable-speed drive systems

Circuit conductors on the output of an adjustable-speed drive system are susceptible to breakdown under certain conditions due to the characteristics of the output waveform of the drive. Factors affecting the conductors include but not limited to the output voltage, frequency, & current, the length of the conductors, the spacing between the conductors, and *the dielectric strength of the conductor insulation*. Methods to mitigate breakdown include consideration of one or more of these factors.

ie: XHHW / XHHN Type Conductors

Not Current Code in Ohio

2020

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440.9 A/C & REFRIGERATION EQUIPMENT

Clarification

All A/C & Refrigeration equipment installed outdoors on a roof, in a metallic raceway that utilizes ***compression-type*** fittings/connectors require a wire type equipment grounding conductor.

Was non-threaded fittings

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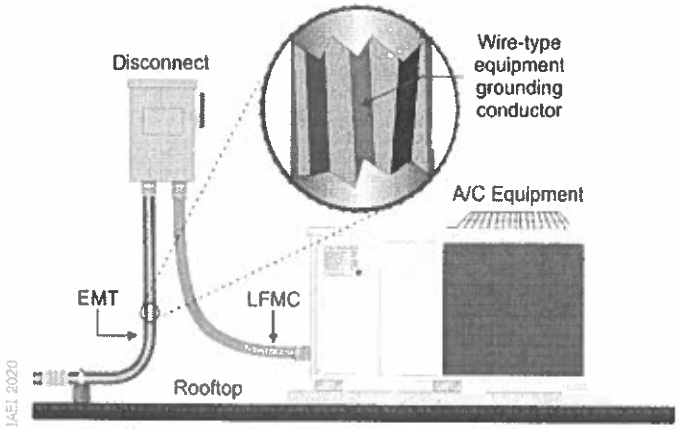
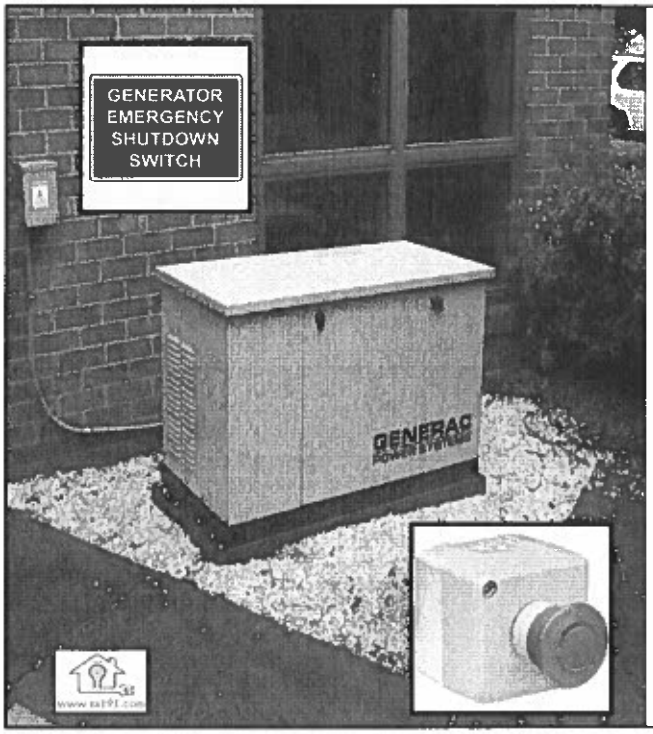
2020

440.9 Grounding and Bonding-Rooftop Equipment



Where ~~multimeter and combination-load~~ equipment is installed outdoors on a roof, an equipment grounding conductor of the wire type shall be installed in outdoor portions of metallic raceway systems that use ~~non-threaded~~ compression-type fittings

148



445.18(D) NEW EMERGENCY SHUTDOWN IN 1- & 2-FAMILY DWELLING UNITS

Generators

Generators other than cord-and-plug connected portable type, ***shall be provided*** with an emergency shutdown device, located on the ***outside*** of 1- and 2-family dwelling units.

Not Current Code in Ohio

2020

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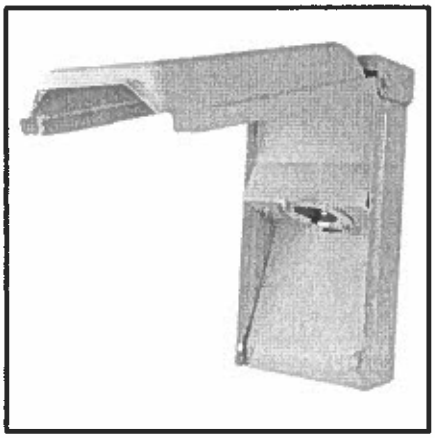
PORTABLE GENERATOR SET-UP

GE 50a Twist Lock Power Inlet



50a Twist Lock Power Cord

Not Current Code in Ohio

2020

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2020 NEC COMMERCIAL OVERVIEW

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

Not Current Code in Ohio

2020

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2020 NEC RESIDENTIAL OVERVIEW

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

For Informational Purposes Only

2020

249

2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Labriola Training Agency #191
www.ta191.com

John M. Labriola
Principal

150 Maplecrest Street SW
North Canton, Ohio 44720

330.497.6309 Phone
330.606.8098 Cell
john@ta191.com

www.ta191.com

Thank You!

250

File Attachments for Item:

EC-11 2020 NEC Changes and Updates Chapters 5-8 (Labriola)

All certifications except NRIUI and plumbing

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: John M. Labriola (Contact Name)
Organization: Training Agency #191 (Organization/Company)
Address: 150 Maplecrest St. SW (Include Room Number, Suite, etc.)
City: North Canton State: Ohio Zip: 44720
E-Mail: john@ta191.com
Telephone: 330.497.6309 Fax:
Course Sponsor: None

COURSE INFORMATION:

Course Title: 2020 National Electrical Code Changes & Updates - Chapters 5 - 8

New Course Submittal: ■ Update Course: ☐ Prior Approval Number:

Purpose and Objective:
To provide BBS certified personnel a better understanding of the changes & Updates to the 2020 National electrical Code.
by utilizing a power-point presentation and real-life examples, for no charge to attendees.

Number of Instructional Contact Hours that can be obtained upon completion: 8 Hours

If Multi-Session, Number of Instructional Contact Hours Per Session:

Program Applicable for the Following Participants:

Building Official ■	Master Plans Examiner ■	Building Inspector ■	Fire Protection Inspector ■	Mechanical Inspector ■
	Plumbing Plans Exam. ☐			Plumbing Inspector ☐
	Electrical Plans Exam. ■			Non-Res IU Inspector ☐
	Mechanical Plans Exam. ■			

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ■ Res IU Inspector ■

Electrical Safety Inspectors [X]
Location of ESI Course: Various locations Date(s) of ESI Course(s): TBD

SUBMITTAL CHECKLIST: **Make Sure all of the Following Information is Submitted:**		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

RECEIVED
MAY 04 2022
BOARD OF BUILDING STANDARDS

October 16, 2020

John M. Labriola
150 Maplecrest St. SW
North Canton, Ohio 44720

330.497.6309 Home 330.606.8098 Cell

Professional Bio'

Education

2012- 1984	Akron University, Stark State College: Continuing Education
1975	St. Thomas Aquinas High School; Louisville, Ohio
1971	Fairmount Elementary; Canton, Ohio

Building Department Experience

2017 – 2009	Summit County, Ohio; Chief Building Official (retired)
2009 – 2006	City of Canton, Ohio; Chief Building Official
2008 – 1997	City of Alliance, Ohio; Back-up Building and Electrical Inspector
2006 – 1997	City of North Canton, Ohio; Building and Electrical Inspector
1997 – 1986	Stark County, Ohio; Chief Electrical Inspector
1988 – 1984	City of Louisville, Ohio; Part-time Electrical Inspector

Current Certifications Held

International Code Council (ICC)

Accessibility Inspector/ Plans Examiner, Building Inspector, Building Plans Examiner, Certified Building Code Official, Certified Building Official, Certified Electrical Code Official, Certified Mechanical Code Official, Commercial Electrical Inspector, Commercial Mechanical Inspector, Commercial Plumbing Inspector, Electrical Inspector, Electrical Plans Examiner, Fire Plans Examiner, Master Code Professional, Mechanical Inspector, Mechanical Plans Examiner, Property Maintenance and Housing Inspector, Residential Electrical Inspector, Residential Energy Inspector / Plans Examiner, Residential Mechanical Inspector and Residential Plumbing Inspector.

State of Ohio:

Building Inspector, Building Official, Building Plans Examiner, Electrical Plans Examiner, Electrical Safety Inspector, Fire Protection Plans Examiner, Mechanical Plans Examiner and Residential Building Official.

Construction Experience

2007 – 1986	President; Electrical Design and Construction Co.
2004 – Present	State of South Carolina; Licensed Commercial Contractor
1992 – Present	State of Ohio; Licensed Electrical Contractor
1986 – 1981	Owner; Labriola Electric
1981 – 1975	Pedersen Electric; Helper / Apprentice / Journeyman Electrician
1980 – Present	Journeyman Electrician; City of Canton, Ohio

Professional Organization Memberships

2010 – 2017	American Institute of Architects - Akron Chapter (AIA-Akron)
2009 – 2017	Building Officials Code Officials of Northeast Ohio (BOCONEO)
2009 – 2017	National Fire Protection Association (NFPA)
1997 – 2017	Five County Building Officials Association (FBOA)
1997 – 2017	Ohio Building Officials Association (OBOA)
1986 – Present	International Association of Electrical Inspectors (IAEI)

Appointments (Director Positions)

2011 – 2017	Air-Conditioning Contractors Association of Akron / Canton
2011 – 2017	Home Builders Association of Summit and Portage Counties

Teaching Experience

2012 – 2017	Instructor; Home Builders Association of Greater Cleveland
2012 – 2017	Instructor; Home Builders Association of Summit and Portage Counties
2012 – Present	Instructor; National Electrical Contractors Association (NECA); Greater Cleveland, Ohio Division
2011 – Present	Instructor; Northeast Ohio Electrical Contractors Association (NOECA)
2005	Instructor; Clemson University; Clemson, South Carolina
2004 – Present	Instructor; Electrical League of Ohio; Cleveland, Ohio
2000 – 2016	Instructor; Stark State College of Technology: North Canton, Ohio
1999 – Present	Instructor; National Electrical Contractors Association (NECA); Akron, Ohio Division
1991 – 2009	OCILB Approved Contractor Training Agency
1990 – Present	State of Ohio; Approved Electrical Safety Inspector, Instructor

Respectfully,
John M. Labriola
John M. Labriola
OBBS ID #815
john@ta191.com

www.ta191.com

May 02, 2022

Labriola Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720

Ohio Board of Building Standards
6606 Tussing Road – PO Box 4009
Reynoldsburg, Ohio 43068 – 9009

Course Submittal #9 – 8 Hours

Chapters 5 / 6 / 7 / & 8

Hazardous Classified Locations

NFPA Codes and Standards

GFCI Protection for Repair / Storage Garages / Aircraft Hangars

Motor Fuel Dispensing Facilities

Healthcare Facilities

Essential Electrical Systems

Resistance / Reactor-Type Dimmer Boards

Agricultural Buildings

Relocated Manufactured Buildings

Electrical Shock Drowning (ESD)

Temporary Installations

Elevator Sump Pump Pit Locations

Electric Vehicle Charging Stations

Ford Lighting Vehicle

Swimming Pool Motors

Storable / Immersion Pools

Solar Photovoltaic (PV) Systems

Emergency Systems

Remote-Control Signaling & Power Limited Circuits

Transmission of Power and Data

Power over Ethernet (PoE)

Communication Systems

8/5-8

2 ☐ **CURRENT ADOPTED CODES**

3 ☐ **2019 RESIDENTIAL CODE OF OHIO**

4 ☐

5 ☐

THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

6 ☐ **"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)**

Subject to the local or State adoption authority

151 ☐ **CHAPTER 5**

Special Occupancies

Article 500 – Hazardous (Classified) Locations, Classes I, II, III, Divisions 1 & 2

Article 511 – Commercial Garages, Repair and Storage

Article 517 – Healthcare Facilities

Article 545 – Manufactured Buildings & Relocatable Structures

Article 555 – Marinas, Boatyards / Commercial and Noncommercial Docking Facilities

Article 590 – Temporary Installations

152 ☐ **ARTICLE 500.4 DOCUMENTATION**

Updated Current NFPA / API Standard References

All areas designated as hazardous (classified) locations shall be properly documented. This documentation shall be available to those authorized to design, install, inspect, maintain, or operate electrical equipment at the location.

NFPA 30-2018 NFPA 32-2016 NFPA 33-2018 NFPA 34-2018
NFPA 35-2016 NFPA 36-2017 NFPA 45-2019 NFPA 55-2016
NFPA 497-2017 NFPA 499-2017 NFPA 820-2016 API 500-2012

153 ☐ **NFPA CODES AND STANDARDS**

NFPA 30- Flammable & Combustible Liquids
NFPA 32- Standard for Drycleaning Plants
NFPA 33- Standard for Spray Application Using Flammable or Combustible Materials
NFPA 34- Standard for Dipping, Coating, & Printing Processes Using Flammable or Combustible Liquids
NFPA 35- Standard for Manufacture of Organic Coatings
NFPA 36- Standard for Solvent Extraction Plants
NFPA 45- Standard on Fire Protection for Laboratories Using Chemicals
NFPA 55- Compressed Gases & Cyrogenic Fluids Code
NFPA 497- Classification of Combustible Liquids, Gases, & Vapors in Chemical Process Areas
NFPA 499- Classification of Combustible Dusts & Hazardous (Classified) Locations in Chemical Process Areas
NFPA 820- Fire Protection in Wastewater Treatment & Collection Facilities
API 500- Classifications of Locations of Electrical Installations at Petroleum Facilities

154 ☐ **501.10 CLASS I & CLASS II LOCATIONS**

[1] Listed MC-HL / TC-ER-HL

[2]

Metal Clad / Tray Cable
MC-HL; Flame resistant cable
TC-ER-HL; Flame resistant tray cable
Gas & vapor-tight provided with metal sheath & polymeric material with separate egc, and proper fittings.
For use in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installations.

[3] Listed Type "P" Cable

[4]

Marine Shipyard Cable
Type "P" – Metal braid armor, with an overall jacket, and terminated with proper fittings.

For use in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installations.

155 ☐ **511.2 (REMOVED / RELOCATED)**
COMMERCIAL GARAGE REPAIR & STORAGE
Revision (Relocated to 210.8(B)(8)

GFCI Protection for Personnel

Removed reference to areas "*where diagnostic equipment, electrical hand tools, or portable lighting equipment*" are to be used (2017 NEC; was limited to 125-v 15- & 20-a receptacles).

Now Reads as indicated in 210.8(B)(1-12)

1ø 50amp and 3ø 100amp 150-v to ground or less receptacles

156 ☐ **513.12 (REMOVED / RELOCATED)**
AIRCRAFT HANGARS
Revision (Relocated to 210.8(B)

GFCI Protection for Personnel

Now Reads as indicated in 210.8(B)(1-12)

1ø 50amp and 3ø 100amp 150-v to ground or less receptacles

157 ☐ **514.11 MOTOR FUEL DISPENSING FACILITIES**
514.11 Circuit Disconnects

(A) Emergency Electrical Disconnects

The emergency shutoff device shall disconnect simultaneously from the source of supply, all conductors of the circuits, including the grounded conductor, if any. *Equipment grounding conductors shall remain connected*.

Switch neutral breaker required including data circuits!

158 ☐ **517.10(B) HEALTH CARE FACILITIES – NOT COVERED**
Not Covered

Proposed changes are intended to clarify that portions of health care facilities used for *intermuscular injections* (drug store flu shots), *psychiatry and psychotherapy*, *alternative medicine and optometry* are *not* required to
comply with Part II of 517.

Redundant Ground wiring!

159 ☐ **517.17 GROUND-FAULT PROTECTION *OF EQUIPMENT***

(D) Testing. Expanded Intent

When ground-fault protection *of equipment* is first installed, each level shall be performance tested to ensure compliance with 517.17(C). *The testing shall be conducted by a qualified person(s) using a test process in accordance with the instruction provided with the equipment. A written record of this testing shall be made and shall be available to the authority having jurisdiction.*

160 ☐ **517.21 HEALTHCARE FACILITIES- GFCI PROTECTION FOR PERSONNEL**

Revision

Category 2 (General Care) & Category 1 (Critical Care) spaces

Receptacles shall *not* be required in bathrooms or toilet rooms. (99:6.3.2.2.2(D)). Receptacles located in patient bathrooms and toilet rooms in Category 2 (general care) spaces shall have ground-fault circuit-interrupter protection in accordance with 210.8(B)(1).

161 ☐ **517.30 ESSENTIAL ELECTRICAL SYSTEMS**

517.30 Sources of Power

(A) Two Independent Power Sources
(B)
(B) Types of Power Sources
(C)
(1) Generating Units
(2)
(2) Fuel Cell Systems – NEW in 2017 NEC
(3)
N (3) Battery Systems shall be permitted to serve as the alternate source for all or part of an essential electrical system

Lead Acid Batteries in Series

Not Current Code in Ohio

162 ☐ **517.31 REQUIREMENTS FOR THE ESSENTIAL ELECTRICAL SYSTEM**

517.31(A) Separate Branches

517.31(B) Transfer Switches

517.31(C) Separation from Other Circuits

517.31(D) Capacity of Systems

517.31(E) Receptacle Identification

517.31(F) Feeders from Alternate Power Source

517.31(G) Coordination

163 ☐ **517.31(B) TRANSFER SWITCHES**

[1] Greater than 150 kVA

[2] 150 kVA or less

164 ☐ **517.31(C)(1) SEPARATION FROM OTHER CIRCUITS**

Δ Revision D & E Are NEW

(d) Where category 2 (general care) locations are served from *two* separate transfer switches on the essential electrical system in accordance with 517.18(A), Exception No. 3, the category 2 (general care) circuits from the two separate systems *shall* be kept independent of each other.

(e) Where Category 1 (critical care) locations are served from *two* separate transfer switches on the essential electrical system in accordance with 517.19(A), Exception No.2, the critical care circuits from the two separate systems *shall* be kept independent of each other.

165 ☐ **ARTICLE 520**
THEATERS & SIMILAR LOCATIONS

520.25 Resistance- or Reactor-Type Dimmers

Deleted these types of dimmers, as they are outdated and potential fire hazards.

Historical Theaters may have some of these antiquated systems.

166 ☐ **ARTICLE 520**
THEATERS & SIMILAR LOCATIONS

520.68 Conductors for Portable Stage Equipment

Previous editions of the NEC only permitted extra hard usage cords or cables

N (2) Protected Applications. Listed, hard usage (junior hard service) cord or cable shall be permitted where all of the following conditions are met:

(1) Protected from physical damage
(2) Not over 20a overcurrent protective device
(3) Cord or cable is 100' or less in length

For Informational Purposes Only

167 ☐ **ARTICLE 525**
CARNIVALS, CIRCUSES, FAIRS & SIMILAR EVENTS
When open to the Public

Δ 525.20(G) Protection. Shall be arranged to minimize tripping hazards.
Secured to walkway surface or protected in another cable protection method.

Reduce the Hazard!

168 ☐

525.23 WHERE GFCI PROTECTION IS REQUIRED

(A) Where GFCI Protection is Required. *In addition to the requirements of 210.8(B),* GFCI protection for personnel shall be provided for the following:

(1) All 125-v, 1ø, 15- & 20-a non-locking receptacles readily accessible to the public.

(2) Equipment that is readily accessible to the general public and supplied from a 125-v, 1ø, 15- & 20- ampere branch circuit.
GFCI is permitted to be an integral part of the attachment plug or located in the power-supply cord within 12" of the plug.

169 ☐ **ARTICLE 545**
MANUFACTURED BUILDINGS AND RELOCATABLE STRUCTURES
Part II - NEW

Relocatable Structures

Mobile offices, classrooms, training areas and similar structures are now part of Article 545, rather than Article 550 (dwelling units).

170 ☐ **ARTICLE 547 – AGRICULTURAL BUILDINGS**

547.5 Wiring Methods.

Δ (G) Receptacles. *Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B). GFCI protection shall not be required* for other than the 125-v, 15- and 20-ampere receptacles installed *within* the following areas:

1. Areas having an equipotential plane
2. Outdoors
3. Damp or wet locations
4. Dirt confinement areas for livestock

171 ☐ **ARTICLE 550 – MOBILE HOMES, MANUFACTURED HOMES & M/H PARKS**

Δ 550.12(B) Ground-Fault Circuit Interrupters (GFCI).

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(A). GFCI protection shall not be required for other than the 125-v, 15- and 20-ampere receptacles installed *within a mobile or manufactured home* in the following areas:

1. Compartments accessible from outside the unit
2. Bathrooms, including receptacles in luminaires
3. Kitchens, where receptacle are installed to serve countertop surfaces
4. Sinks, where receptacles are installed within 6' *from the top inside* edge of the sink
5. Dishwashers

Δ 550.32(D) Additional Receptacles. – Receptacles located outside a mobile or manufactured home, shall be provided with GFCI protection as specified by 210.8(A).

Receptacles that provide unit power shall not require GFCI protection

172 ☐ **ARTICLE 551 – RV'S & RV PARKS**

N 551.40(D) Reverse Polarity Device.

A reverse polarity indicating device that provides a continuous visible or audible signal shall be installed in the RV in accordance with the installation instructions and shall respond to the reversal of the ungrounded and the grounded conductors in the 120-v ac system.

173 ☐ **"NEW" SOUTHWIRE RV SPD PRODUCTS**

174 ☐ **RV SURGE PROTECTIVE DEVICES**

175 ☐ **MARINAS, BOATYARDS, & COMMERCIAL & NON-COMMERCIAL DOCKING FACILITIES**

N 555.13 Bonding of Non-Current Carrying Metal Parts

All metal parts in contact with the water, all metal piping, and all non-current carrying metal parts that are likely to become energized shall be connected to the grounding bus in the panelboard using solid copper conductors, insulated, covered, or bare, not smaller than #8 AWG. Connections to bonded parts shall be made in accordance with 250.8.

Sounds Like 680.26 Equipotential Bonding Grid

176 ☐ **ARTICLE 555**

MARINAS, BOATYARDS AND COMMERCIAL AND NON-COMMERCIAL DOCKING FACILITIES

Ground-Fault Protection - 555.35 (NEW)

(A)(1)- GFPE shore power receptacles - *30mA (Type "B")*

(A)(2)- GFCI 15a & 20a other than shore power receptacles
(Type "A")

(A)(3)- GFPE Protection of feeders and branch circuits
installed on docking facilities - *100mA (Type "C+"?)*

177 ☐ ***N*** **555.35(B) BOAT SHORE POWER**

Leakage Current Measurement Device

Where more than 3 receptacles supply shore power to boats, a leakage current measurement device shall be available and be used to determine leakage current from each boat that will utilize shore power.

Equipment Leakage Circuit Interrupter (ELCI)

Marine Safety to Prevent ESD; (Electric shock drowning)

178 ☐ **DAMAGED BOAT WIRING CAN CAUSE CURRENT FLOW INTO THE BOAT'S BONDING SYSTEM**

1 Damaged power cord can expose users to hazards
2 Limits potential of energizing water around the boat's frame

179 ☐ **590.8 (NEW) TEMPORARY INSTALLATIONS**
OVERCURRENT PROTECTIVE DEVICES

(A) Where Reused. Where overcurrent protective devices that have been previously used are installed in a temporary installation, these overcurrent protective devices *shall be examined* to ensure these devices have been properly installed, maintained and there is *no evidence* of impending failure.

(B)

(B) Service Overcurrent Protective Devices. Overcurrent protective devices for solidly grounded wye electrical services of more than 150-v to ground but not exceeding 1000-v phase-to-phase shall be current limiting *(fuses)*.

180 ☐ **CHAPTER 6**

Special Equipment

Article 620 – Elevators, Dumbwaiters, Escalators....

Article 625 – Electric Vehicle Power Transfer System

Article 645 – Information Technology Equipment

Article 680 – Swimming Pools, Fountains, & Similar Installations

Article 690 – Solar Photovoltaic (PV) Systems

Article 695 – Fire Pumps

181 ☐ ***N*** **620.6 GFCI PROTECTION FOR PERSONNEL**

New Section

Ground- Fault Circuit- Interrupter Protection for Personnel

Each 125-v, 1ø, 15 and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters, ... shall be of the GFCI type. Re: 620.85 2017 NEC

Added *machinery spaces* / to have GFCI protection of 125-v receptacles

A permanently installed sump pump *shall* be permanently wired or shall be supplied by a single receptacle that is GFCI protected.

Hardwired sump pumps; GFCI protection not required!

182 ☐ ***N* 620.65 SELECTIVE COORDINATION "SIGNAGE"**

Equipment enclosures containing selectively coordinated overcurrent devices shall be legibly marked in the field to indicate that the overcurrent devices are selectively coordinated. The marking shall meet the requirements of 110.21(B), shall be readily visible, and shall state the following:

"CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED"

Applies to where more than one driving machine disconnect is supplied by the same source!

183 ☐ **08.05.2021 PRESIDENT JOE BIDEN SIGNS EXECUTIVE ORDER**

-
-
-
-
- August 05, 2021

President Biden signs executive order (goal), that 50% of vehicles sold in the US to be EV's by 2030. Intended to cut carbon emissions.
Currently 2%

184 ☐ **NEW - EV CHARGING STATIONS**

Federal Government Initiative – Infrastructure Plan

Construct 500,000 new charging stations throughout the USA

DOE Goal: 40 Level 2 charging ports / 1000 EVs
3.4 DC fast charging ports / 1000 EVs
5 Billion Dollars / 10,000 For each State
5,000,000,000 / 500,000 = 10,000 each
By the year 2030 number of EVs expected to be 35 million

185 ☐ **ARTICLE 625 – ELECTRIC VEHICLE POWER TRANSFER EQUIPMENT**

N 625.2 Definitions

Electric Vehicle Connector. – A device that, when electrically coupled (conductive or inductive)

to an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of power transfer and informational exchange.

Electric Vehicle Power Export Equipment (EVPE). – The equipment, including the outlet on the vehicle, that is used to provide electrical power at voltages greater than or equal to 30Vac or 60Vdc to loads external to the vehicle, using the vehicle as the source of supply.

186 ☐ **Δ 625.54 GFCI PROTECTION FOR PERSONNEL**

In addition to the requirements in 210.8, all receptacles installed for the connection of electric vehicle charging shall have ground-fault circuit-interrupter protection for personnel. (Type A)

187 ☐ **P&S LEGRAND EV CHARGING STATION**

188 ☐ **GE CHARGING STATION DETAILS**

189 ☐ **GE EV WIRING DIAGRAM**

190 ☐ **CHARGING STATION 1-LINE DRAWING**

191 ☐

192 ☐

193 ☐ **EV CHARGING STATIONS**

Manufactured Charging Stations

Inherent (Built-In) GFCI protection
20mA CCID "Type C" Protection

CCID = Charge Current Interrupting Device

194 ☐

195 ☐ **ELECTRIC VEHICLE RECEPTACLE ROUGH-IN**

196 ☐ **ARTICLE 625 ELECTRIC VEHICLE POWER TRANSFER SYSTEM**

1 30 Minute Charge
2 Estimated Charging Cost:
3 Charging Station Fees

- Fast Charge $1.50 minute

- Approximately .30 minute for Level 1 or Level 2
-
- Typically, a Tesla vehicle will require a separate adapter or specific Tesla charging station

197 ☐ **PUBLIC EVSE STATIONS / PORTS BY STATE (DOE)**
US / LEVEL 1 – 1,331 / LEVEL 2 – 86,095 / DC FAST 18,895

1 •

- Ohio – 770 / 1,680
- West Virginia – 88 / 254
- Virginia – 898 / 2,471
- Pennsylvania – 1,008 / 2,377
- Kentucky – 163 / 388
- Indiana – 294 /810
- Illinois – 875 / 2,192
- North Carolina – 918 / 2,158
- Tennessee – 584 / 1,334

2 •

- California – 13,088 / 33,461
- New York – 2,563 / 6,235
- Florida – 2,256 / 5,529
- Texas – 2,077 / 4,849
- Massachusetts – 1,771 / 3,916
- Washington – 1,518 / 3,716
- Georgia – 1,483 / 3,669
- Colorado – 1,363 / 3,208
- Entire US – 43,413 / 106,321

198 ☐ **TOTAL STATION LOCATIONS COUNTS IN US**

Alternative Fuel Types:

- Biodiesel – 313
- CNG – 851
- E85 – 3,905
- Electric – 43,413 / 106,321
- Hydrogen – 49
- LNG – 55
- Propane – 1,233 Primary / 1,243 Secondary / Total 2,576

Total 114,070

199 ☐ ***N* 625.60 AC RECEPTACLE OUTLETS USED FOR EVPE**

EVPE = Electric Vehicle Power Export Equipment

AC receptacles installed in electric vehicles and intended to allow for connection of off-board utilization equipment shall comply with 625.60 (A) – (D).

(A) Type. The receptacle shall be listed
(B) Rating. Outlet shall be rated 250-v max, 1ø, 50a max
(C) Overcurrent Protection. Integral to power export system
(D) GFCI Protection for Personnel. All receptacles shall be GFCI protected,

indication and reset shall be accessible

200 ☐ **2022 FORD F-150 LIGHTNING PICK-UP**

All-Electric. All F-150

Available features include Backup Power that can provide full-home power for up to 3 days, on a fully charge battery and 80-amp Ford Charge station Pro. *When home is properly equipped & home transfer switch disconnects home from the grid*. Based on 30 kWh used per day. Turn your truck into a generator. Pro Power Onboard offers an available 9.6kw max power provided through 11 outlets. (4) 120v outlets in front trunk, (2) in the cab (4) in the bed, and (1) 240-v outlet for tougher tasks.

201 ☐ **ARTICLE 645**
INFORMATION TECHNOLOGY EQUIPMENT

645.5 Supply Circuits and Interconnecting Cables

Δ 645.5 (E) Under Raised Floors. Where the area under the floor is accessible and openings minimize the entrance of debris beneath the floor, power cables, *communications cables,* connection cables, interconnecting cables, cord-and-plug connections and receptacles with the IT equipment. *Typically protected with a Halon (clean agent) fire suppression system or Fm200 system.*

202 ☐ **THERE ARE "8" PARTS TO**
ARTICLE 680

Part 1 General (Page 564)
Part 2 Permanently Installed Pools (Page 567)
Part 3 Storable Pools, Spas, Hot Tubs (Page 573)
Part 4 Spas, Hot Tubs & Immersion Pools (Page 574)
Part 5 Fountains (Page 576)
Part 6 Pools and Tubs for Therapeutic Use (Page 578)
Part 7 Hydromassage Bathtubs (Page 578)
Part 8 Electrically Powered Pool Lifts (Page 579)

203 ☐ **680.2 NEW DEFINITIONS**

N Corrosive Environment. Areas where pool sanitation chemicals are stored, handled, or dispensed, and confined areas under decks adjacent to such areas, as well as areas with circulation pumps, automatic chlorinators, filters, open areas under decks adjacent to or abutting the pool structure, and similar locations. (Refer to 680.14)

N Immersion Pool. A pool for ceremonial or ritual immersion of users, which is designed and intended to have its contents drained or discharged.

N Splash Pad. A fountain with a pool depth of 1" or less, intended for recreational use by pedestrians. This definition does not include showers intended for hygienic rinsing prior to use of a pool, spa, or other water feature.

204 ☐ **680.2 / 680.50 SPLASH PAD**

NEW Definition / Requirements

Definition: A fountain with a pool depth of 1" or less, intended for recreational use by pedestrians.

Requirements of splash pads will need to comply with Parts I (*general*), II (*permanently installed pools*), and V (*fountains*) of Article 680

205 ☐ ***N*** **680.4 INSPECTION AFTER INSTALLATION**

N Section

The authority having jurisdiction shall be permitted to require periodic inspection and testing.

206 ☐ **680.21 MOTORS**

Δ 680.21 Wiring Methods. The wiring to a pool motor shall comply with 680.21(A)(1) unless modified for specific circumstances to (A)(2) or (A)(3).

Δ 680.21 (A)(1) General.
Wiring methods installed in a corrosive environment shall comply with (680.14) or shall be Type MC cable listed for the location, wiring methods in these locations shall include an insulated equipment grounding conductor, sized per Table (250.122), but not smaller than 12 AWG.

Where installed in noncorrosive environments, the wiring methods of branch circuits shall comply with the general requirements of Chapter 3.

2017 NEC Removed Interior of 1-Family

207 ☐ **ARTICLE 680.21(C) – PART II.**

PERMANENTLY INSTALLED POOLS

Expanded GFCI Protection of Pool Motors

Outlets supplying *all* pool *motors on branch circuits rated 150-v or less to ground and 60 amperes or less, single or 3-phase shall be provided with Class "A"* ground-fault circuit-interrupter protection.

Was 120-v through 240-v motors / + added 3-phase Motors

208 ☐ **ARTICLE 680.22**
RECEPTACLE OUTLET LOCATIONS

2020 NEC: 15 and 20- ampere 125-v Outlets

680.22 (A)(1) – Required Outlet; (1) <6' – >20'
680.22 (A)(2) – Circulation pump; <6'
680.22 (A)(3) – Other Receptacles; – <6'
680.22 (A)(4) – GFCI Protection; – All 15 & 20a; within 20'
N 680.22(A)(5) – Pool Equipment Room; (1) GFCI outlet
680.34 – Storable pool, Spa, & Hot Tub outlets; – 6'
680.43 (A) – Indoor Spa & Hot Tub outlets; <6' – >10'
680.62 (E) – Therapeutic Tubs and pools – 6'
680.71 – Hydromassage Bathtubs – 30a or less; 6'

Type "A" GFCI Protection Required

209 ☐ **680.23(F) UNDERWATER LUMINAIRES**

Branch Circuit Wiring for Underwater Luminaires

Branch circuits supplying underwater luminaires (Refer to 680.2) *shall include an insulated equipment grounding conductor, minimum size #12 CU. (Only permitted wiring methods are RMC, IMC, PVC and RTRC. (Refer to 680.14)*

Relaxing the requirements; Only the portion of the branch circuit in the "corrosive environment" requires an insulated equipment grounding conductor.

210 ☐ **680.26 EQUIPOTENTIAL BONDING**
(B)(2) PERIMETER SURFACES.

Copper Ring. Was alternative means.

(1) Minimum #8 bare solid CU conductor.
(2) Follow contour of pool perimeter surface
(3) Listed *splicing devices or exothermic welding*
(4) 18" – 24" from the inside wall of the pool
(5) Secured under 4" – 6" below the subgrade

(C) Copper Grid.

(1) #8 bare solid CU conductor
(2) Follow contour of pool; 3' horizontally beyond pool
(3) Only listed splicing devices or exothermic welding
(4) Secured under 4" to 6" below the subgrade

211 ☐ **"VOLTAGE GRADIENTS"**

-
- Corrected the wording regarding the performance and design of the Equipotential Bonding Grid.
-
- Replaced the word *eliminate* (which may be impossible to achieve) to the realistic term of *"reduce"* voltage gradients.
-

- *The goal would be to keep the pool and all surrounding areas at or near the same potential.*
-
-
-
-

212 ☐ **680.31 / 32 STORABLE POOLS**

Manufacturer Requirement

-

Cord-connected pool filter pumps "shall" be provided with a ground-fault circuit interrupter that is an integral part of the attachment plug or located in the power supply cord within 12" of the attachment plug.

-

Contractors Note: You are responsible to provide GFCI protection for the filter pump as well, if you add a new circuit, or replace a device on an existing circuit! Homeowners can and will plug the filter pump into a non-GFCI protected outlet.

-
-

213 ☐ **680.35 STORABLE & PORTABLE IMMERSION POOLS**

N New Section / Requirements

(A) Cord Connection
(B) Pumps
(C) Heaters
(D) Audio Equipment
(E) Luminaires, Lighting Outlets & Fans
(F) Switches
(G) Receptacles

214 ☐ **680.45 IMMERSION POOLS**

N New Section / Requirements

(A) Cord and Plug Connections
(B) Pumps
(C) Heaters
(D) Audio Equipment

215 ☐ **680.35 / 680.45**

IMMERSION POOLS

NEW / & Clarification Info

680.35 Storable / portable immersion pools.

680.45 Permanently installed immersion pools

Addressing both custom built (on-site) and pre-packaged units.

216 ☐ **680.59 GFCI PROTECTION FOR PERMANENTLY INSTALLED NON-SUBMERSIBLE PUMPS**

Re: Fountains / New Section

Outlets supplying all permanently installed non-submersible pump motors rated 250-v or less and 60a or less, 1ø or 3ø, shall be provided with ground-fault circuit interrupter protection.

217 ☐ **680.74(A) BONDING**

Re: Hydromassage Bathtubs

(3) Added metal raceways within 5'
(3)
(5) Non-current-carrying metal parts of electrical devices and controls that are not associated with the hydromassage tubs within 5'.

218 ☐ **SOLAR PHOTOVOLTAIC (PV) SYSTEMS**

690.1 Scope

This article applies to solar PV systems, other than those covered by Article 691, including the array circuit(s), inverter(s), & controller(s) for such systems. The systems covered by this article *include those* interactive with *electric* power production sources or stand-alone, *or both.* These PV systems may have ac or dc output for utilization.

219 ☐ **TESLA POWERWALL HOME BATTERY SYSTEM**

220 ☐ **TESLA POWER WALL**

221 ☐ **690.8 CIRCUIT SIZING AND CURRENT**

N 690.8(A)(2)

Circuits Connected to the Input of Electronic Power Converters

Where a circuit is protected with an overcurrent device not exceeding the conductor ampacity, the maximum current shall be permitted to be the rated input current of the electronic power converter input to which it is connected. *(Significant change for commercial installations)*

8.62 x 125% = 10.775a x (6) = 64.65a Input 33a x 125% = 41.25a

#4 CU 2017 NEC

(6) 250-watt modules = (the string)	24 kW Inverter 75°C terminals #8 CU / 50a ocd 41.25amps = Continuous duty

222 ☐ **ARTICLE 690**
SOLAR PHOTOVOLTAIC (PV) SYSTEMS
This Article has been extensively revised and updated

690.13(A) – The PV system disconnecting means shall be located in a readily accessible location. *Where disconnecting means of systems above 30-v are readily accessible to "unqualified" persons, any enclosure door or hinged cover that exposes live parts when open shall be "locked" or require a tool to open.*

Limit unintentional contact

690.15(A) Reads the same for Isolating PV Equipment

223 ☐ **690.12 RAPID SHUTDOWN OF PV SYSTEMS ON BUILDINGS**
PV system circuits *installed on or in buildings* shall include a rapid shutdown *function to reduce shock hazard for firefighters* in accordance with 690.12(A) through (D). UL3741

224 ☐ **690.12(B)(1)(2) RAPID SHUTDOWN FOR PV SYSTEMS *ON OR IN* BUILDINGS FOR FIREFIGHTERS**
Outside the boundary = >3' from the array, from point of entry, requires rapid shutdown.
Inside the boundary = <1 from array, requires rapid shutdown.
PV Hazard Control System / <80v in 30seconds / or integrated roof shingles / UL 3741 Standard

225 ☐ **LABEL FOR ROOF MOUNTED PV SYSTEMS WITH RAPID SHUTDOWN**

226 ☐ **FIRE PUMPS**
695.3(C)(2) SELECTIVE COORDINATION
Expanded Requirement (Revised)

Overcurrent protective device(s) shall be selectively coordinated with *all* supply-side overcurrent protective devices(s).

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, maintain, and operate the system.

Similar to 700.32 Emergency Systems

227 ☐ **CHAPTER 7**

Special Conditions

Article 700 – Emergency Systems

Article 725 – Class 1, 2, & 3 Power Limiting Cables

Article – 760 Fire Alarm Systems

228 ☐ **700.2 EMERGENCY SYSTEMS**

N Emergency Systems. *This definition shall apply within this article and throughout the Code.*

Informational Note: Emergency systems are generally installed in places of assembly where artificial illumination is required for safe exiting and for panic control in buildings subject to occupancy by large numbers of persons, such as hotels theaters, sports arenas, healthcare facilities, and similar installations. Emergency systems may also provide power for such functions as ventilation where essential to maintain life, fire detection and *alarm systems*, elevators, fire pumps, public safety communications systems, industrial processes where current interruption would produce serious life-safety or health hazards, and similar functions.

Definition Modified / Clarified!

229 ☐ **ARTICLE 700 – PART 4**
EMERGENCY SYSTEM CIRCUITS
FOR LIGHTING AND POWER

700.16 Emergency Illumination – Rewritten (Clarification)

N (B) *System Reliability*. Emergency lighting systems shall be designed and installed *so that the failure of any illumination source* cannot leave in total darkness any space that requires emergency illumination. Control devices in the emergency lighting system shall be listed for use in emergency system. Listed unit equipment in accordance with 700.12(F) shall be considered as meeting the provisions of this section.

Removed reference to burning out of a lamp
(due to the use of LED's luminaires)

230 ☐ ***N*** **700.32 SELECTIVE COORDINATION**

INFORMATIONAL NOTE

Informational Note: See Informational Note Figure Note 701.32 for an example of how legally required standby system overcurrent protective devices (OCPDs) selectively coordinate with all supply-side OCPDs.

OCPD "D" selectively coordinates with OCPD's C, F, E, B, and A.

OCPD "C" selectively coordinates with OCPD's F, E, B, and A.

OCPD "F" selectively coordinates with OCPD E.

OCPD "B" is not required to selectively coordinate with OCPD A because OCPD B is not a legally required standby system OCPD.

231 ☐ **ARTICLE 720 – CIRCUITS & EQUIPMENT OPERATING AT LESS THAN 50 VOLTS**

720.1 Scope. This article covers installations operating at less than 50 volts, direct current or alternating current.

720.2 Other Articles. Direct current or alternating-current installations operating at less than 50 volts, as covered in Articles 411, 517, 551, 552, 650, 669, 690 and 760.... "Parts I, II, and III of Article 725, *shall not be required to comply with this article*".

232 ☐ **ARTICLE 725 CLASS 1, 2, & 3 REMOTE CONTROL, SIGNALING & POWER LIMITED CIRCUITS**

There are two types of Class 1 circuits:

1. Power-limited; supplied by a transformer, limited to 30v and 1000VA, have a current limiter (OCPD) that limits the amount of supply current on the circuit, due to an overload, short-circuit or ground-fault.

2. Remote-control & signaling; maximum voltage is 600 and limited on the power output of the source.

Note: Class 1 circuits are permitted to occupy the same cable, raceway or enclosure of power and lighting circuits (whether A/C or D/C), when installed in associated equipment, and conductors are properly insulated. (watch de-rating).

233 ☐ **CLASS 2 & 3 CIRCUITS**

Both Class 2 & 3 circuits have power limitations as identified in Chapter 9 of the 2020 National

Electrical Code;
Table 11(a) Alternating Current Limitations
Table 11(b) Direct Current Limitations
Class 2 Note: Typical operating voltage is 48v, not exceeding 100VA, with a listed power supply. (limited in length due to voltage drop)
Class 3 Note: Have higher current thresholds than Class 2 circuits, therefore have additional requirements. (can run longer lengths than Class 2 circuits)

234 ☐ **725.144 TRANSMISSION OF POWER & DATA**

New in 2017 NEC
Typically, referred as Power over Ethernet (PoE). A common use is for video cameras, that have a class 2 power supply, that will also utilize conductors within the same cable for video transmission (network cable).
Ampacity ratings of these cables are based on 86°F. As current flow in these bundled or bunched cables can increase the temperature and therefore can degrade the insulation of the cables (overheating).
Generally operating @ 48v / connectors rated @ 1.3 amperes maximum

235 ☐ **POE TERMINOLOGY**

- IEEE 802.3 PoE Standard; *(48v and up to 15.4W)*

Typically, Cat 5 Cable contains 8 wires; as 4 twisted pairs of conductors 2 pairs are used for data (data pairs), 1 pair can be used for power 48v DC
PSE = Power Sourcing Equipment; Equipment that provides power to the cable. (WAP); Wired Access Points (IP); Security Cameras
PD = Powered Device; Device that receives power from the cable
PSE = Power Sourcing Equipment; Devices that send power and data over ethernet cable to a connected PD. (midpoint, endpoint or span); no additional power source required.
VOIP = Voice over internet phone; PoE is needed to power the phone, via the network.

236 ☐ **POWER OVER ETHERNET (POE) NEW IN THE 2017 NEC**

Applies to both Class 2 & Class 3 Circuits

IN #1 – Applies to *CCTV cameras*
IN #2 – Used in Powered *Communication systems*
IN #3 – 4 Pair copper balanced twisted conductors
IN #4 – Guidelines for supporting power delivery over balanced twisted conductors
IN #5 – Minimum Requirements for *PoE lighting systems*
IN #6 – Rated current for power sources; designed to deliver

237 ☐ **725.144 TRANSMISSION OF POWER & DATA**

Power over Ethernet (PoE)

Section 725.144(A) & (B) shall apply to Class 2 & Class 3 circuits that transmit power and data to a powered device. Section 300.11 and Parts I and III of Article 725 shall apply to Class 2 & Class 3 circuits that transmit power and data. Conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

238 ☐ **NETWORK CABLES THAT CARRY ELECTRIC POWER**

239 ☐

240 ☐

241 ☐ **ADDITIONAL USES**

Integrating Building Systems

Heating, Ventilation & A/C Systems (VAV Boxes)
Lighting System Sensors
Security Camera Systems
Automation, Control Systems & Energy Savings
Refer to Chapter 9 Tables 11(a) & (b)

242 ☐ **CLASS 2 & CLASS 3 NETWORK CABLING**

Data and Power Circuits

1.Cable Listing & Compliance
2. Structured Cabling
3. Data Centers
4. Power over Ethernet (PoE)
5. Uses Cat 5 or Cat 6 Cable

243 ☐ **EXAMPLES OF CAT 5 / 6 CABLES / USES**

244 ☐ **CHAPTER 8**

Communications Systems

N Article 805 – Communication Circuits

245 ☐ **ARTICLE 805 (NEW)**
GENERAL REQUIREMENTS FOR COMMUNICATION SYSTEMS
General info for Articles;

800, 820, 830 and 840 combined in one location.

800 – Communication Circuits
820 – CATV & Radio Dist. Systems
830 – Network Powered Broadband Comm. Systems
840 – Premises-Powered Broadband Comm. Systems

246 ☐ **CHAPTER 9**

Tables

Table 1 – Conduit Fill

Informative Annex I – Recommended Tightening Torque Tables from UL Standard 486A – 486B

247 ☐ **CHAPTER 9 – TABLES**

Table 1

Conduit Fill / Cross Sectional Area (%)

1 Conductor = 53% Cross Sectional Fill
2 Conductors = 31% Cross Sectional Fill
Over 2 Conductors = 40% Cross Sectional Fill

Notes to Tables:

(3) EGC's / bonding conductors *to be included* in calculating conduit fill

(4) Where conduit or tubing nipples having a maximum length not to exceed *24"* are installed between boxes, cabinets, and similar enclosures, the nipples shall be permitted to be filled to *60%* of their cross-sectional area, and 310.15(C)(1) adjustment factors need not apply to this condition. *(no de-rating required)*

248 ☐ **2020 NEC COMMERCIAL OVERVIEW**

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements

- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

249 **2020 NEC RESIDENTIAL OVERVIEW**

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

250 **2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES**

Thank You!

CURRENT ADOPTED CODES

July 01, 2019

Current Adopted Codes in Ohio – (2017)

Non-Residential Construction (4- Family and Above)

2017 Ohio Building Code (Based on the 2015 International Building Code)
2017 Ohio Mechanical Code (Based on the 2015 International Mechanical Code)
2017 Ohio Plumbing Code (Based on the 2015 International Plumbing Code)
2017 Ohio Fire Code (Based on the 2015 International Fire Code)
2017 NFPA 70 – National Electrical Code (Effective 11.01.2017)
2018 NFPA 13 – Standard for Installation of Sprinkler Systems
2016 NFPA 72 – National Fire Alarm and Signaling Code
2015 International Fuel Gas Code
2012 International Energy Conservation Code / ASHRAE 90.1 2010
ICC / ANSI A117.1 2009 Accessible & Usable Buildings and Facilities

Residential Construction (1, 2 and 3- Family Dwellings)

2019 Residential Code of Ohio (Based on the 2015 International Residential Code)
2017 Ohio Plumbing Code
2017 NFPA 70 – National Electrical Code w/ amendments (07.01.2019)
2018 International Energy Conservation Code

March 24, 2020

Current Adopted Building Codes in West Virginia

The State of West Virginia Fire Commission has adopted statewide the 2015 ICC (International Code Council), family of Codes for any jurisdiction that chooses to enforce building codes. Check locally for enforcement information / details.

2015 International Building Code (IBC)
2009 International Energy Conservation Code (IECC)
2015 International Existing Building Code (IEBC)
2015 International Fuel Gas Code (IFGC)
2015 International Mechanical Code (IMC)
2015 International Plumbing Code (IPC)
2012 International Property Maintenance Code (IPMC)
2015 International Residential Code (1- & 2- Family) (IRC)
2015 International Swimming Pool & Spa Code (ISPSC)

2015 NFPA 1 – Fire Code (Effective 07.01.2018)
2015 NFPA 101 – Life Safety Code (Effective 07.01.2016)
2017 NFPA 70 – National Electrical Code (Effective 09.24.2020)

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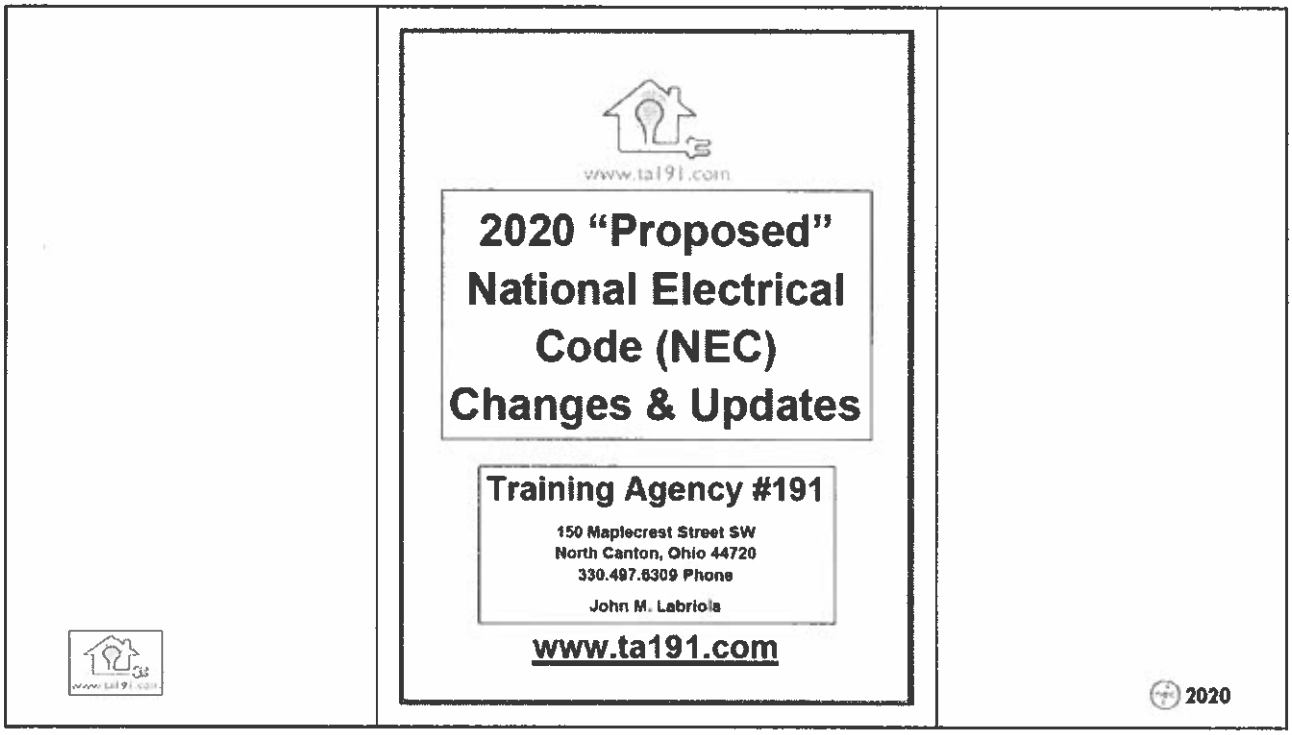
2019 RESIDENTIAL CODE OF OHIO

Part VIII—Electrical

CHAPTER 34

ELECTRICAL

3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150 Maplecrest Street SW
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330.497.6309 Phone
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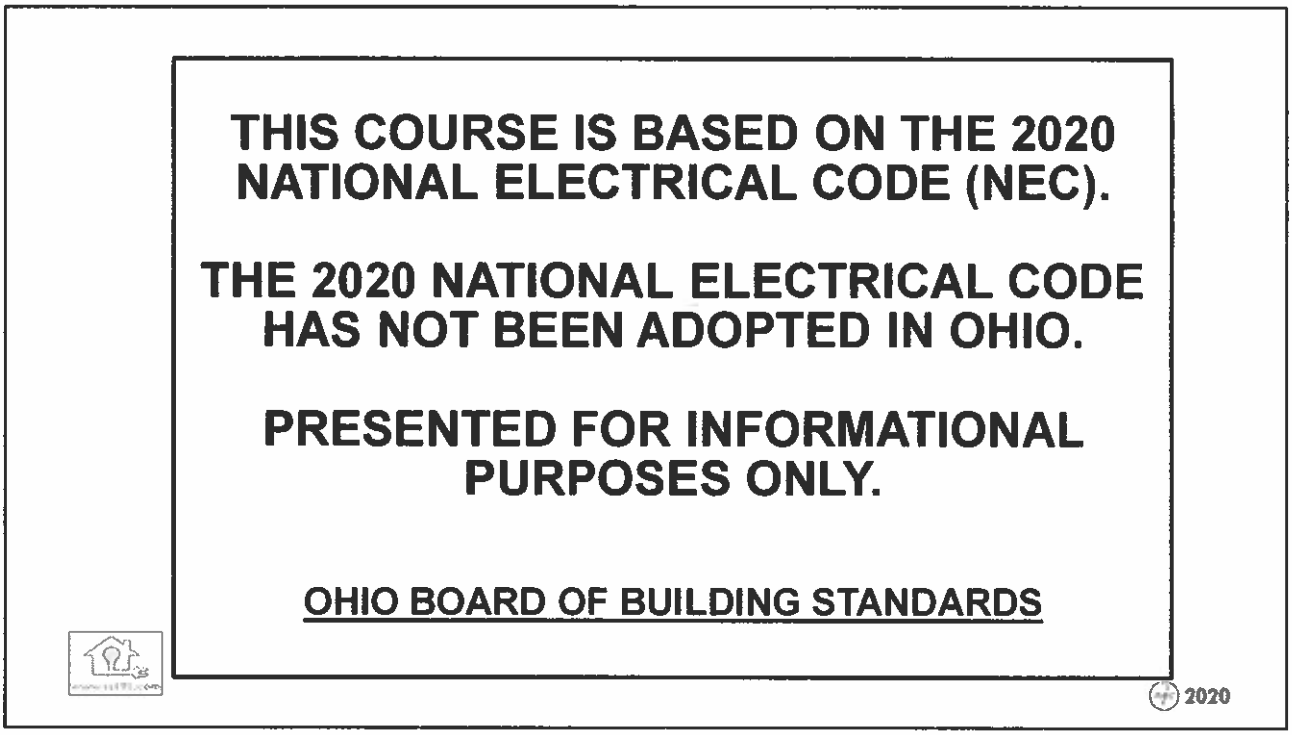
THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).
THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.
PRESENTED FOR INFORMATIONAL PURPOSES ONLY.
OHIO BOARD OF BUILDING STANDARDS
2020

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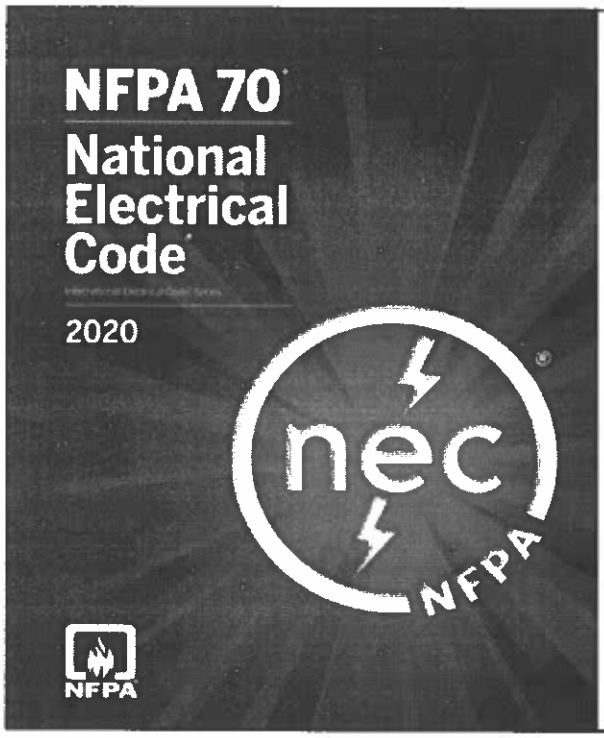

"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)

Subject to the local or State adoption authority

2020

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CHAPTER 5

Special Occupancies

Article 500 – Hazardous (Classified) Locations, Classes I, II, III, Divisions 1 & 2

Article 511 – Commercial Garages, Repair and Storage

Article 517 – Healthcare Facilities

Article 545 – Manufactured Buildings & Relocatable Structures

Article 555 – Marinas, Boatyards / Commercial and Noncommercial Docking Facilities

Article 590 – Temporary Installations

For Informational Purposes Only

2020

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ARTICLE 500.4 DOCUMENTATION

Updated Current NFPA / API Standard References

All areas designated as hazardous (classified) locations shall be properly documented. This documentation shall be available to those authorized to design, install, inspect, maintain, or operate electrical equipment at the location.

NFPA 30-2018	NFPA 32-2016	NFPA 33-2018	NFPA 34-2018
NFPA 35-2016	NFPA 36-2017	NFPA 45-2019	NFPA 55-2016
NFPA 497-2017	NFPA 499-2017	NFPA 820-2016	API 500-2012

Not Current Code in Ohio

2020

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NFPA CODES AND STANDARDS

NFPA 30- Flammable & Combustible Liquids
NFPA 32- Standard for Drycleaning Plants
NFPA 33- Standard for Spray Application Using Flammable or Combustible Materials
NFPA 34- Standard for Dipping, Coating, & Printing Processes Using Flammable or Combustible Liquids
NFPA 35- Standard for Manufacture of Organic Coatings
NFPA 36- Standard for Solvent Extraction Plants
NFPA 45- Standard on Fire Protection for Laboratories Using Chemicals
NFPA 55- Compressed Gases & Cyrogenic Fluids Code
NFPA 497- Classification of Combustible Liquids, Gases, & Vapors in Chemical Process Areas
NFPA 499- Classification of Combustible Dusts & Hazardous (Classified) Locations in Chemical Process Areas
NFPA 820- Fire Protection in Wastewater Treatment & Collection Facilities
API 500- Classifications of Locations of Electrical Installations at Petroleum Facilities

For Informational Purposes Only

2020

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501.10 CLASS I & CLASS II LOCATIONS

Listed MC-HL / TC-ER-HL

Metal Clad / Tray Cable

MC-HL; Flame resistant cable

TC-ER-HL; Flame resistant tray cable

Gas & vapor-tight provided with metal sheath & polymeric material with separate egc, and proper fittings.

For use in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installations.

Listed Type "P" Cable

Marine Shipyard Cable

Type "P" – Metal braid armor, with an overall jacket, and terminated with proper fittings.

For use in industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installations.

Not Current Code in Ohio

2020

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511.2 (REMOVED / RELOCATED) COMMERCIAL GARAGE REPAIR & STORAGE

Revision (Relocated to 210.8(B)(8)

GFCI Protection for Personnel

Removed reference to areas "***where diagnostic equipment, electrical hand tools, or portable lighting equipment***" are to be used (2017 NEC; was limited to 125-v 15- & 20-a receptacles).

Now Reads as indicated in 210.8(B)(1-12)

1ø 50amp and 3ø 100amp 150-v to ground or less receptacles

For Informational Purposes Only

2020

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513.12 (REMOVED / RELOCATED) AIRCRAFT HANGARS

Revision (Relocated to 210.8(B)

GFCI Protection for Personnel

Now Reads as indicated in 210.8(B)(1-12)

1ø 50amp and 3ø 100amp 150-v to ground or less receptacles

Not Current Code in Ohio

2020

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514.11 MOTOR FUEL DISPENSING FACILITIES

514.11 Circuit Disconnects

(A)Emergency Electrical Disconnects

The emergency shutoff device shall disconnect simultaneously from the source of supply, all conductors of the circuits, including the grounded conductor, if any. *Equipment grounding conductors shall remain connected*.

Switch neutral breaker required including data circuits!

For Informational Purposes Only

2020

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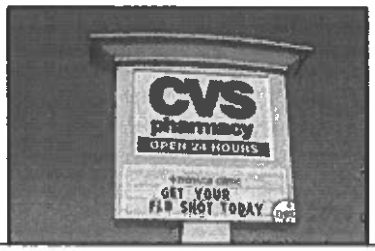
517.10(B) HEALTH CARE FACILITIES – NOT COVERED

Not Covered

Proposed changes are intended to clarify that portions of health care facilities used for ***intermuscular injections*** (drug store flu shots), ***psychiatry and psychotherapy***, ***alternative medicine and optometry*** are ***not*** required to comply with Part II of 517.



Redundant Ground wiring!

For Informational Purposes Only

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517.17 GROUND-FAULT PROTECTION *OF EQUIPMENT*

(D) Testing. Expanded Intent

When ground-fault protection ***of equipment*** is first installed, each level shall be performance tested to ensure compliance with 517.17(C). ***The testing shall be conducted by a qualified person(s) using a test process in accordance with the instruction provided with the equipment. A written record of this testing shall be made and shall be available to the authority having jurisdiction***.

Not Current Code in Ohio

2020

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517.21 HEALTHCARE FACILITIES- GFCI PROTECTION FOR PERSONNEL

Revision

Category 2 (General Care) & Category 1 (Critical Care) spaces

Receptacles shall *not* be required in bathrooms or toilet rooms. {99:6.3.2.2.2(D)}. Receptacles located in patient bathrooms and toilet rooms in Category 2 (general care) spaces shall have ground-fault circuit-interrupter protection in accordance with 210.8(B)(1).

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2020

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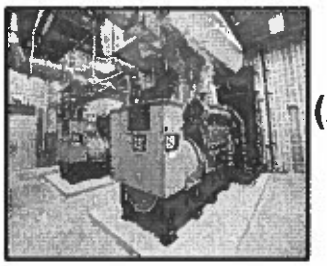
517.30 ESSENTIAL ELECTRICAL SYSTEMS



517.30 Sources of Power

(A) Two Independent Power Sources

(B) Types of Power Sources

(1) Generating Units

(2) Fuel Cell Systems – **NEW in 2017 NEC**

***N* (3) Battery Systems shall be permitted to serve as the alternate source for all or part of an essential electrical system**

Lead Acid Batteries in Series

Not Current Code in Ohio

2020

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517.31 REQUIREMENTS FOR THE ESSENTIAL ELECTRICAL SYSTEM

517.31(A) Separate Branches

517.31(B) Transfer Switches

517.31(C) Separation from Other Circuits

517.31(D) Capacity of Systems

517.31(E) Receptacle Identification

517.31(F) Feeders from Alternate Power Source

517.31(G) Coordination

For Informational Purposes Only

2020

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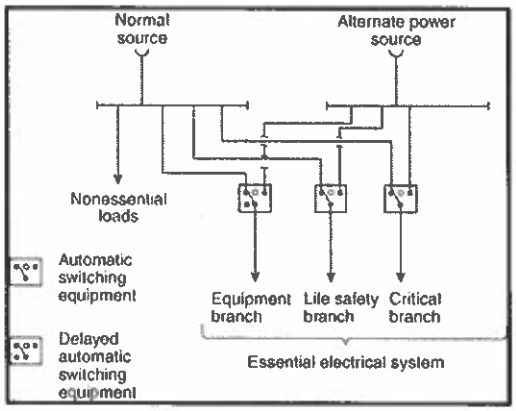
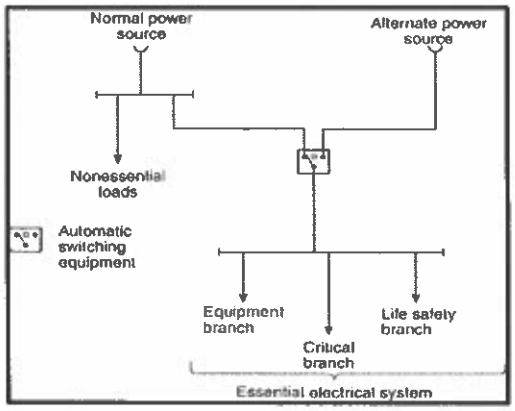
517.31(B) TRANSFER SWITCHES

Greater than 150 kVA



150 kVA or less



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2020

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517.31(C)(1) SEPARATION FROM OTHER CIRCUITS

Δ Revision D & E Are NEW

(d) Where category 2 (general care) locations are served from *two* separate transfer switches on the essential electrical system in accordance with 517.18(A), Exception No. 3, the category 2 (general care) circuits from the two separate systems *shall* be kept independent of each other.

(e) Where Category 1 (critical care) locations are served from *two* separate transfer switches on the essential electrical system in accordance with 517.19(A), Exception No.2, the critical care circuits from the two separate systems *shall* be kept independent of each other.

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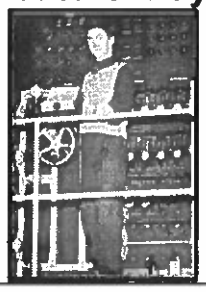
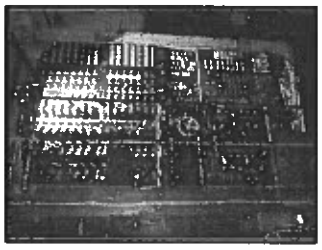
ARTICLE 520 THEATERS & SIMILAR LOCATIONS

520.25 Resistance- or Reactor-Type Dimmers

Deleted these types of dimmers, as they are outdated and potential fire hazards.

Historical Theaters may have some of these antiquated systems.





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2020

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ARTICLE 520
THEATERS & SIMILAR LOCATIONS

520.68 Conductors for Portable Stage Equipment

Previous editions of the NEC only permitted extra hard usage cords or cables

N **(2) Protected Applications. Listed, hard usage (junior hard service) cord or cable shall be permitted where all of the following conditions are met:**

(1) Protected from physical damage
(2) Not over 20a overcurrent protective device
(3) Cord or cable is 100' or less in length

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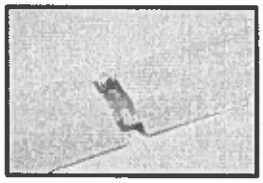
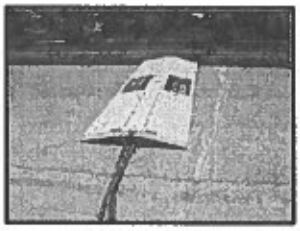
ARTICLE 525
CARNIVALS, CIRCUSES, FAIRS & SIMILAR EVENTS

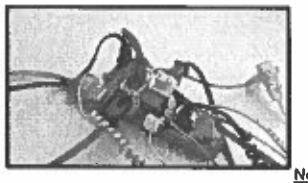
When open to the Public

Δ 525.20(G) Protection. Shall be arranged to minimize tripping hazards. ***Secured to walkway surface or protected in another cable protection method.***

Reduce the Hazard!







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525.23 WHERE GFCI PROTECTION IS REQUIRED

(A) Where GFCI Protection is Required. ***In addition to the requirements of 210.8(B)***, GFCI protection for personnel shall be provided for the following:

(1) All 125-v, 1ø, 15- & 20-a non-locking receptacles readily accessible to the public.

(2) Equipment that is readily accessible to the general public and supplied from a 125-v, 1ø, 15- & 20-ampere branch circuit.

GFCI is permitted to be an integral part of the attachment plug or located in the power-supply cord within 12" of the plug.

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ARTICLE 545 MANUFACTURED BUILDINGS AND RELOCATABLE STRUCTURES

Part II - NEW

Relocatable Structures

Mobile offices, classrooms, training areas and similar structures are now part of Article 545, rather than Article 550 (dwelling units).

Not Current Code in Ohio

2020

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ARTICLE 547 – AGRICULTURAL BUILDINGS

547.5 Wiring Methods.

Δ **(G) Receptacles.** ***Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B). GFCI protection shall not be required*** for other than the 125-v, 15- and 20-ampere receptacles installed ***within*** the following areas:

1. Areas having an equipotential plane
2. Outdoors
3. Damp or wet locations
4. Dirt confinement areas for livestock

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ARTICLE 550 – MOBILE HOMES, MANUFACTURED HOMES & M/H PARKS

Δ **550.12(B) Ground-Fault Circuit Interrupters (GFCI).**

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(A). GFCI protection shall not be required for other than the 125-v, 15- and 20-ampere receptacles installed ***within a mobile or manufactured home*** in the following areas:

1. Compartments accessible from outside the unit
2. Bathrooms, including receptacles in luminaires
3. Kitchens, where receptacle are installed to serve countertop surfaces
4. Sinks, where receptacles are installed within 6' ***from the top inside*** edge of the sink
5. Dishwashers

Δ **550.32(D) Additional Receptacles**. – Receptacles located outside a mobile or manufactured home, shall be provided with GFCI protection as specified by 210.8(A).

Receptacles that provide unit power shall not require GFCI protection

Not Current Code in Ohio

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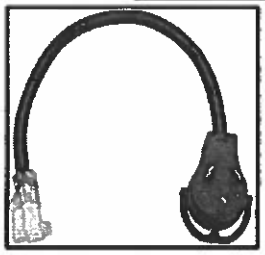
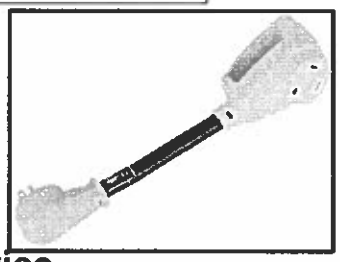
ARTICLE 551 – RV'S & RV PARKS





N **551.40(D) Reverse Polarity Device.**

A reverse polarity indicating device that provides a continuous visible or audible signal shall be installed in the RV in accordance with the installation instructions and shall respond to the reversal of the ungrounded and the grounded conductors in the 120-v ac system.

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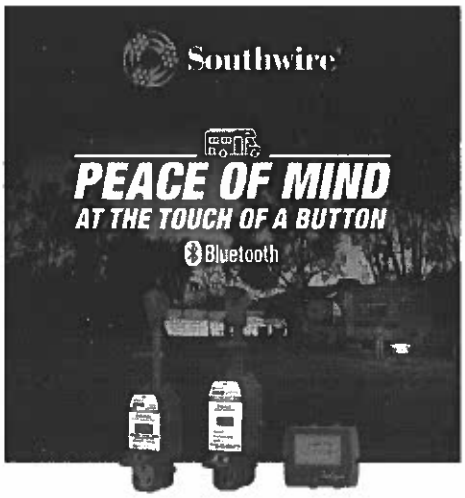
"NEW" SOUTHWIRE RV SPD PRODUCTS



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RV SURGE PROTECTIVE DEVICES

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MARINAS, BOATYARDS, & COMMERCIAL & NON-COMMERCIAL DOCKING FACILITIES

N 555.13 Bonding of Non-Current Carrying Metal Parts

All metal parts in contact with the water, all metal piping, and all non-current carrying metal parts that are likely to become energized shall be connected to the grounding bus in the panelboard using solid copper conductors, insulated, covered, or bare, not smaller than #8 AWG. Connections to bonded parts shall be made in accordance with 250.8.

Sounds Like 680.26 Equipotential Bonding Grid

Not Current Code in Ohio

2020

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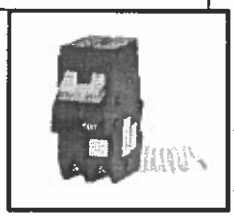
ARTICLE 555

Device	mA trip setting	Common Use	Code Section
GFCI - Class A	4 - 6	Branch circuits	210.8
ECFPD	6 - 50	Snow melting equip	426.28
GPPE	adjustable	Main OCPD	230.95

MARINAS, BOATYARDS AND COMMERCIAL AND NON-COMMERCIAL DOCKING FACILITIES



Ground-Fault Protection - 555.35 (NEW)

(A)(1)- GFPE shore power receptacles- ***30mA (Type "B")***

(A)(2)- GFCI 15a & 20a other than shore power receptacles ***(Type "A")***

(A)(3)- GFPE Protection of feeders and branch circuits installed on docking facilities - ***100mA (Type "C+"?)***

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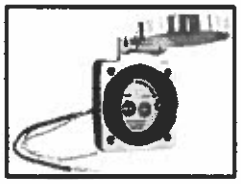
N 555.35(B) BOAT SHORE POWER

Leakage Current Measurement Device



Where more than 3 receptacles supply shore power to boats, a leakage current measurement device shall be available and be used to determine leakage current from each boat that will utilize shore power.

Equipment Leakage Circuit Interrupter **(ELCI)**

Marine Safety to Prevent ESD; (Electric shock drowning)

Not Current Code in Ohio

2020

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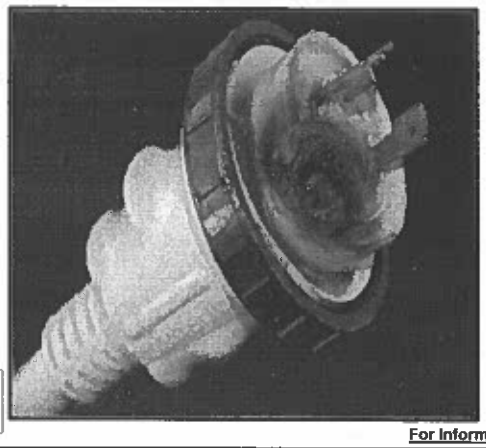
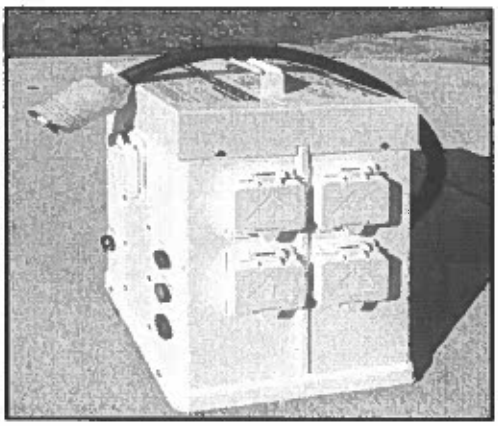
DAMAGED BOAT WIRING CAN CAUSE CURRENT FLOW INTO THE BOAT'S BONDING SYSTEM

Damaged power cord can expose users to hazards



Limits potential of energizing water around the boat's frame



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590.8 (NEW) TEMPORARY INSTALLATIONS OVERCURRENT PROTECTIVE DEVICES

(A) **Where Reused.** Where overcurrent protective devices that have been previously used are installed in a temporary installation, these overcurrent protective devices ***shall be examined*** to ensure these devices have been properly installed, maintained and there is ***no evidence*** of impending failure.

(B) **Service Overcurrent Protective Devices.** Overcurrent protective devices for solidly grounded wye electrical services of more than 150-v to ground but not exceeding 1000-v phase-to-phase shall be current limiting ***(fuses)***.

Not Current Code in Ohio

2020

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CHAPTER 6

Special Equipment

Article 620 – Elevators, Dumbwaiters, Escalators….

Article 625 – Electric Vehicle Power Transfer System

Article 645 – Information Technology Equipment

Article 680 – Swimming Pools, Fountains, & Similar Installations

Article 690 – Solar Photovoltaic (PV) Systems

Article 695 – Fire Pumps

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N 620.6 GFCI PROTECTION FOR PERSONNEL

New Section

Ground- Fault Circuit- Interrupter Protection for Personnel

Each 125-v, 1ø, 15 and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters, …. shall be of the GFCI type.
Re: 620.85 2017 NEC

Added ***machinery spaces*** / to have GFCI protection of 125-v receptacles

A permanently installed sump pump ***shall*** be permanently wired or **shall be supplied by a single receptacle that is GFCI protected**.

Hardwired sump pumps; GFCI protection not required!

Not Current Code in Ohio

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N 620.65 SELECTIVE COORDINATION "SIGNAGE"

Equipment enclosures containing selectively coordinated overcurrent devices shall be legibly marked in the field to indicate that the overcurrent devices are selectively coordinated. The marking shall meet the requirements of 110.21(B), shall be readily visible, and shall state the following:

"CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED"

Applies to where more than one driving machine disconnect is supplied by the same source!

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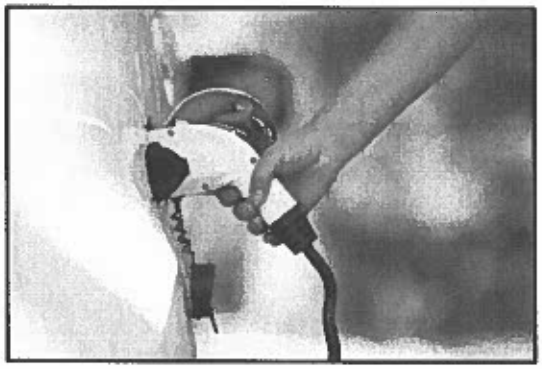
08.05.2021 PRESIDENT JOE BIDEN SIGNS EXECUTIVE ORDER



President Biden signs executive order (goal), that 50% of vehicles sold in the US to be EV's by 2030. Intended to cut carbon emissions.

Currently 2%

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NEW - EV CHARGING STATIONS

Federal Government Initiative – Infrastructure Plan

Construct 500,000 new charging stations throughout the USA

DOE Goal: 40 Level 2 charging ports / 1000 EVs

3.4 DC fast charging ports / 1000 EVs

5 Billion Dollars / 10,000 For each State

5,000,000,000 / 500,000 = 10,000 each

By the year 2030 number of EVs expected to be 35 million

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ARTICLE 625 – ELECTRIC VEHICLE POWER TRANSFER EQUIPMENT

N 625.2 Definitions

Electric Vehicle Connector. – A device that, when electrically coupled (conductive or inductive) to an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of power transfer and informational exchange.

Electric Vehicle Power Export Equipment (EVPE). – The equipment, including the outlet on the vehicle, that is used to provide electrical power at voltages greater than or equal to 30Vac or 60Vdc to loads external to the vehicle, using the vehicle as the source of supply.

Not Current Code in Ohio

2020

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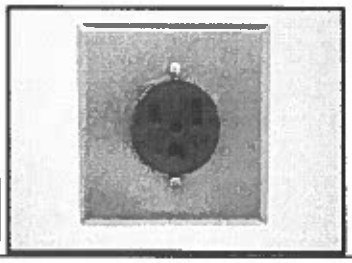
Δ 625.54 GFCI PROTECTION FOR PERSONNEL

In addition to the requirements in 210.8, <u>all</u> **receptacles installed for the connection of electric vehicle charging shall have ground-fault circuit-interrupter protection for personnel. (Type A)**



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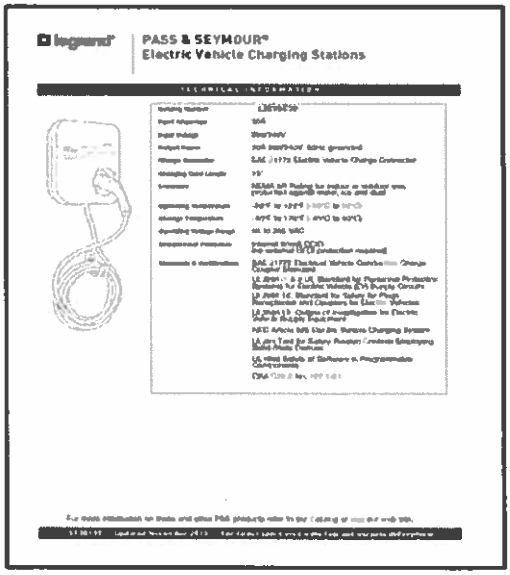
P&S LEGRAND EV CHARGING STATION



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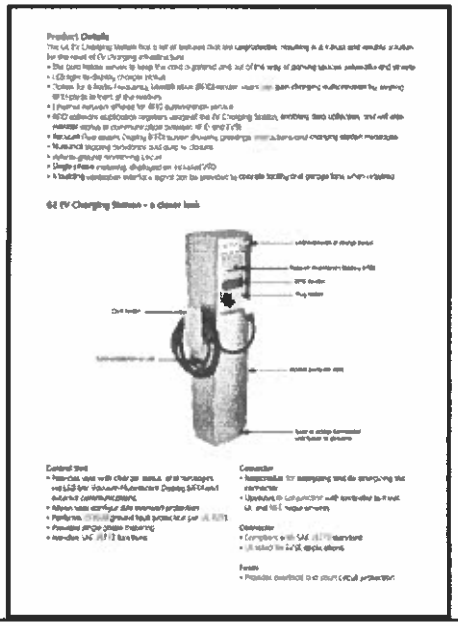
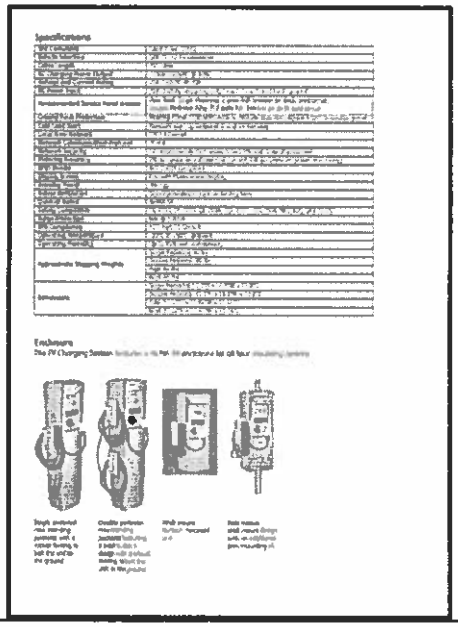
GE CHARGING STATION DETAILS





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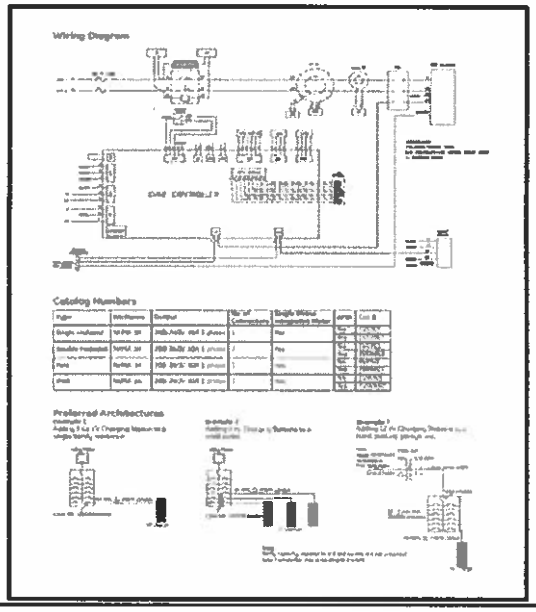
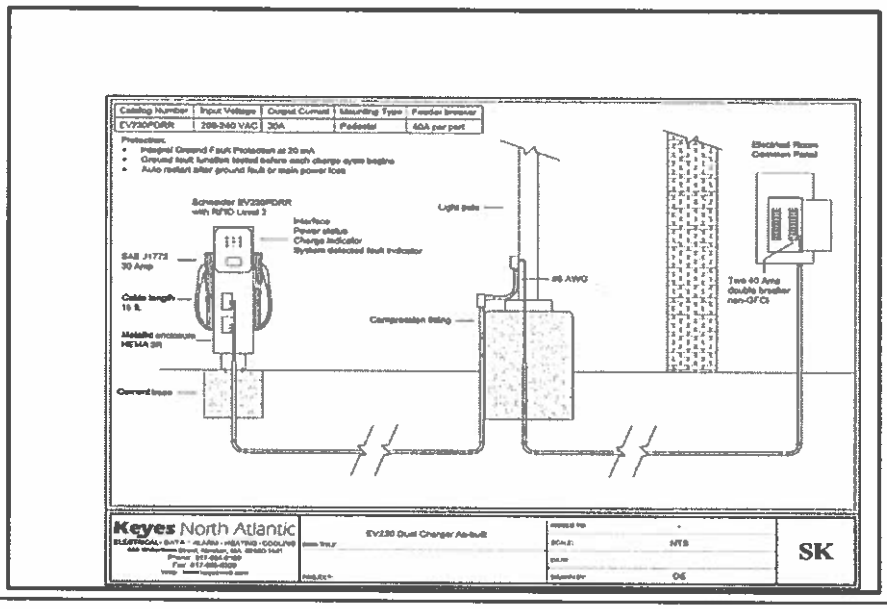
GE EV WIRING DIAGRAM



189

CHARGING STATION 1-LINE DRAWING



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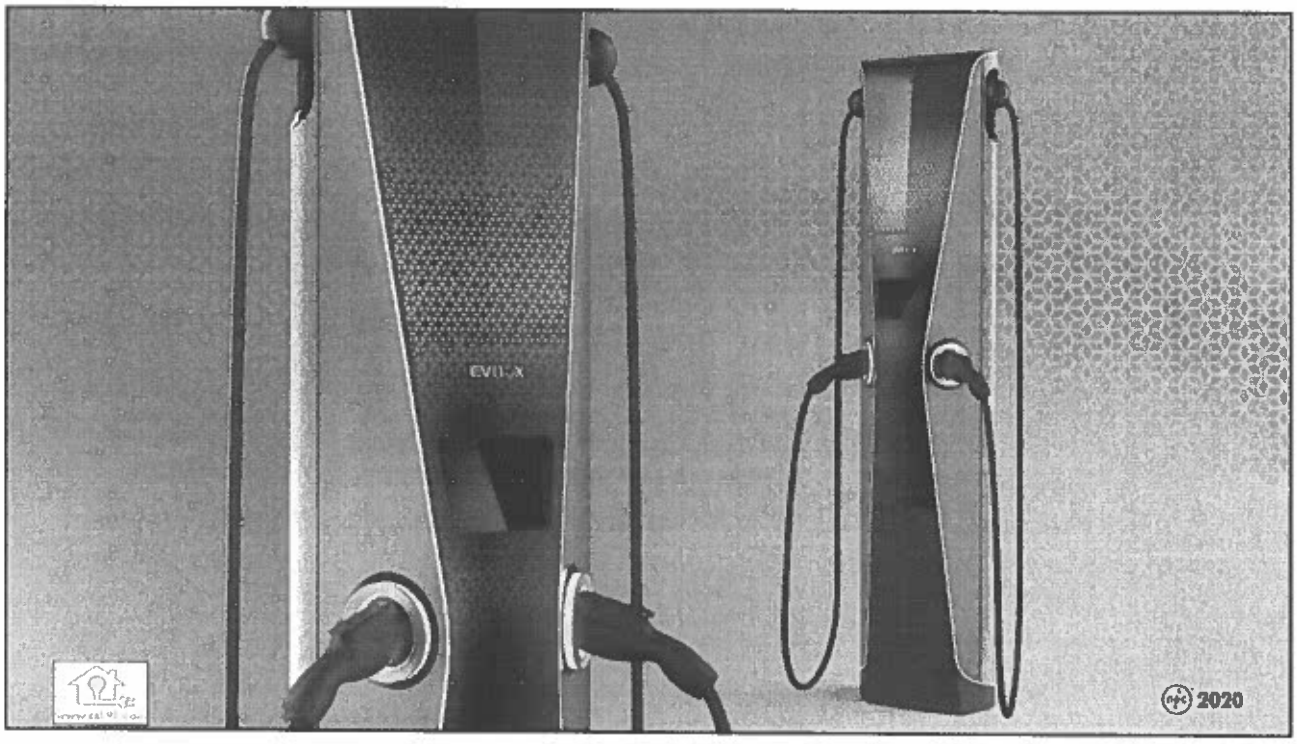

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SamaConnect

Series 8 EV Charging Station
Technical Specification

Power Specs	
AC Power Output, maximum (per port)	Level II: 7.2kW (240VAC@30A)
AC Power Input (per port)	Level II: 30A; Line 1, Line 2 and GND (no neutral)
Ports Per Charging Station	Two
Vehicle to Charger Connection (per port)	SAE J1772 6' Connector, 18ft Cable
Energy Metering Accuracy	+/- 1%
Standby Power	6.5W typical
Service Panel Breaker (per port)	Dual-pole trip 40A breaker, dedicated circuit
Safety Specs	
Safety, Ground Fault Circuit Interrupt	20mA CCID with auto retry (every 15 seconds)
Automatic Plug-Out Detection	Per terminated per SAE J1772 spec. SMS-Armed
General Safety Compliance	UL 2231-1, 2231-2, UL2594 and NEC Article 625
Network Specs	
Data Communication Cellular	Cellular 4G LTE
Network Communication Protocol	OCPP
Network Security	HTTPS-WS 1:128 bit AES Encryption
Communication Device Specs	
LED Array	High visibility, multi-color visual status indication
Display	Color LCD, 480 x 272
Operating Temperature	-30 degree C to +50 degree C ambient
Environmental Specs	
Outdoor Rated	NEMA 3R
Operating Humidity	Up to 95% non-condensing
Operating Temperature	-30 degree C to +50 degree C ambient
Other Specs	
Surge Protection	6kV@3,000A
EMI Compliance	FCC Part 15 Class A
Dimensions	18" H x 7.5" W x 7.5" D
Approximate Shipping Weights	Head Unit and Cable - 28 lbs.
	Pedestal Mount - 11 lbs.
	Wall Mount - 10 lbs.
Installation	Indoor / Outdoor
Wall and Cober Mount	Integrated

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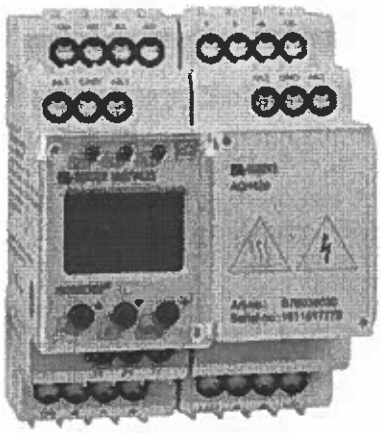
EV CHARGING STATIONS



Manufactured Charging Stations

Inherent (Built-In) GFCI protection

20mA CCID "Type C" Protection

CCID = Charge Current Interrupting Device

2020

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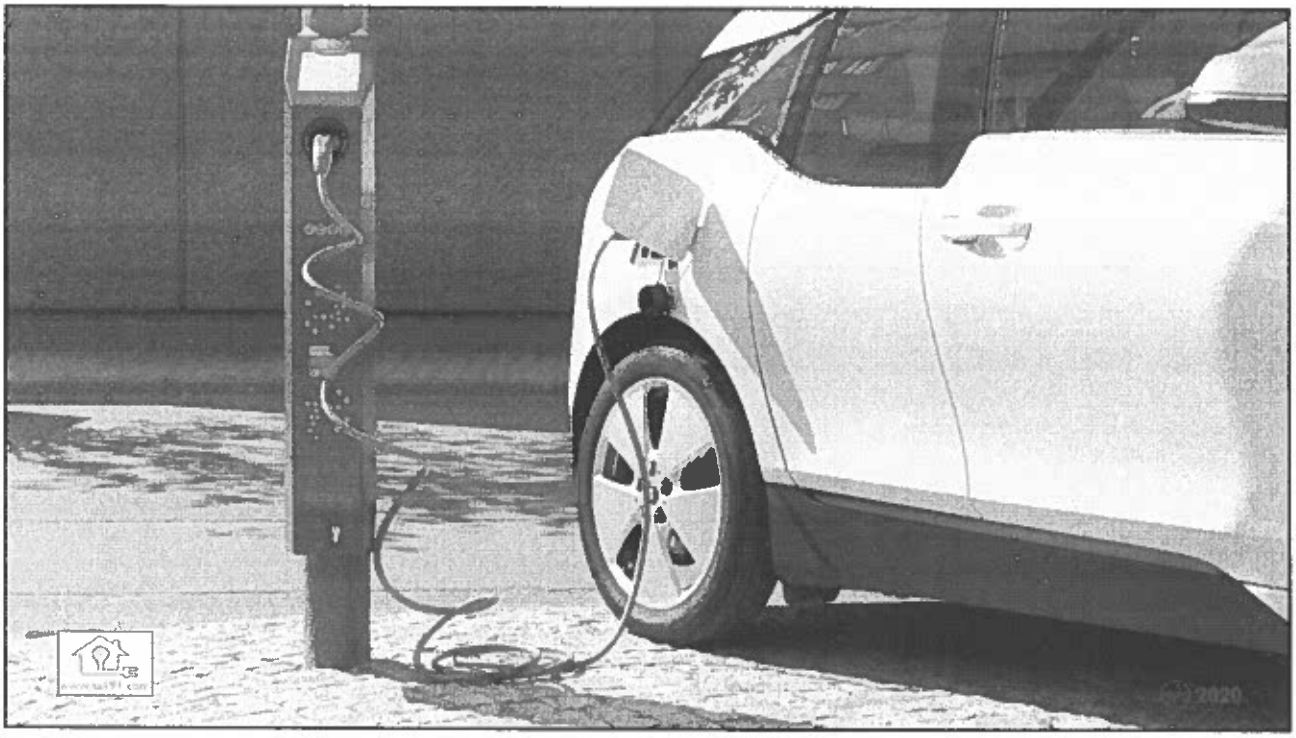
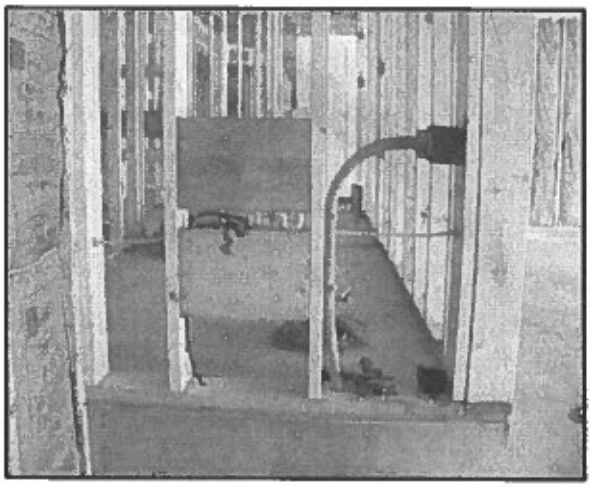
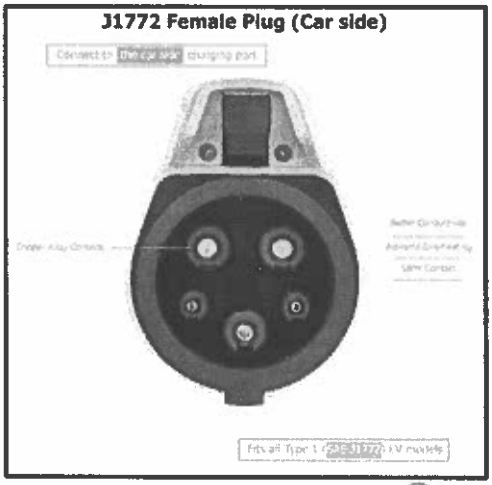


194

ELECTRIC VEHICLE RECEPTACLE ROUGH-IN





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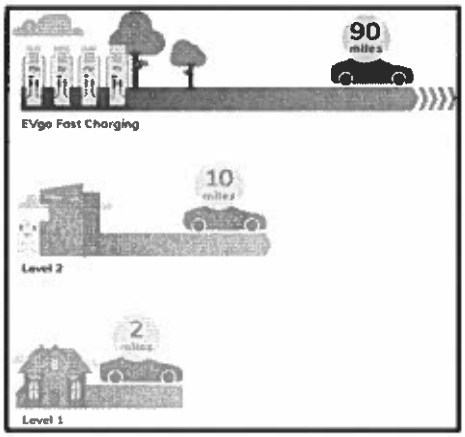
ARTICLE 625 ELECTRIC VEHICLE POWER TRANSFER SYSTEM

30 Minute Charge



Estimated Charging Cost:

Charging Station Fees

- Fast Charge $1.50 minute
- Approximately .30 minute for Level 1 or Level 2
- Typically, a Tesla vehicle will require a separate adapter or specific Tesla charging station

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PUBLIC EVSE STATIONS / PORTS BY STATE (DOE)
US / LEVEL 1 – 1,331 / LEVEL 2 – 86,095 / DC FAST 18,895

- Ohio – 770 / 1,680
- West Virginia – 88 / 254
- Virginia – 898 / 2,471
- Pennsylvania – 1,008 / 2,377
- Kentucky – 163 / 388
- Indiana – 294 /810
- Illinois – 875 / 2,192
- North Carolina – 918 / 2,158
- Tennessee – 584 / 1,334

- California – 13,088 / 33,461
- New York – 2,563 / 6,235
- Florida – 2,256 / 5,529
- Texas – 2,077 / 4,849
- Massachusetts – 1,771 / 3,916
- Washington – 1,518 / 3,716
- Georgia – 1,483 / 3,669
- Colorado – 1,363 / 3,208
- Entire US – 43,413 / 106,321

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TOTAL STATION LOCATIONS COUNTS IN US

Alternative Fuel Types:

- **Biodiesel** – 313
- **CNG** – 851
- **E85** – 3,905
- **Electric** – 43,413 / 106,321
- **Hydrogen** – 49
- **LNG** – 55
- **Propane** – 1,233 Primary / 1,243 Secondary / Total 2,576

Total 114,070

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N 625.60 AC RECEPTACLE OUTLETS USED FOR EVPE

EVPE = Electric Vehicle Power Export Equipment

AC receptacles installed in electric vehicles and intended to allow for connection of off-board utilization equipment shall comply with 625.60 (A) – (D).

(A) Type. The receptacle shall be listed
(B) Rating. Outlet shall be rated 250-v max, 1ø, 50a max
(C) Overcurrent Protection. Integral to power export system
(D) GFCI Protection for Personnel. All receptacles shall be GFCI protected, indication and reset shall be accessible

Not Current Code in Ohio

2020

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2022 FORD F-150 LIGHTNING PICK-UP

All-Electric. All F-150

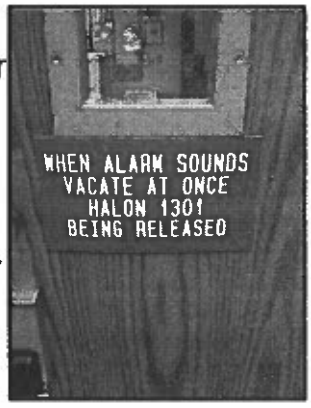
Available features include Backup Power that can provide full-home power for up to 3 days, on a fully charge battery and 80-amp Ford Charge station Pro. *When home is properly equipped & home transfer switch disconnects home from the grid*. Based on 30 kWh used per day. Turn your truck into a generator. Pro Power Onboard offers an available 9.6kw max power provided through 11 outlets. (4) 120v outlets in front trunk, (2) in the cab (4) in the bed, and (1) 240-v outlet for tougher tasks.

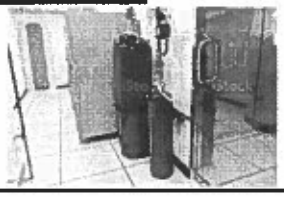
200

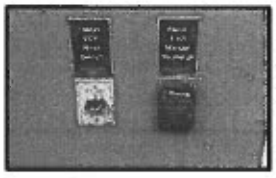
ARTICLE 645
INFORMATION TECHNOLOGY EQUIPMENT

645.5 Supply Circuits and Interconnecting Cables

Δ **645.5 (E) Under Raised Floors.** Where the area under the floor is accessible and openings minimize the entrance of debris beneath the floor, power cables, ***communications cables,*** connection cables, interconnecting cables, cord-and-plug connections and receptacles with the IT equipment. ***Typically protected with a Halon (clean agent) fire suppression system or Fm200 system.***







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THERE ARE "8" PARTS TO ARTICLE 680

Part 1 **General** (Page 564)

Part 2 **Permanently Installed Pools** (Page 567)

Part 3 **Storable Pools, Spas, Hot Tubs** (Page 573)

Part 4 **Spas, Hot Tubs & Immersion Pools** (Page 574)

Part 5 **Fountains** (Page 576)

Part 6 **Pools and Tubs for Therapeutic Use** (Page 578)

Part 7 **Hydromassage Bathtubs** (Page 578)

Part 8 **Electrically Powered Pool Lifts** (Page 579)

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680.2 NEW DEFINITIONS

N Corrosive Environment. ***Areas where pool sanitation chemicals are stored, handled, or dispensed, and confined areas under decks adjacent to such areas, as well as areas with circulation pumps, automatic chlorinators, filters, open areas under decks adjacent to or abutting the pool structure, and similar locations. (Refer to 680.14)***

N Immersion Pool. **A pool for ceremonial or ritual immersion of users, which is designed and intended to have its contents drained or discharged.**

N Splash Pad. ***A fountain with a pool depth of 1" or less, intended for recreational use by pedestrians. This definition does not include showers intended for hygienic rinsing prior to use of a pool, spa, or other water feature.***

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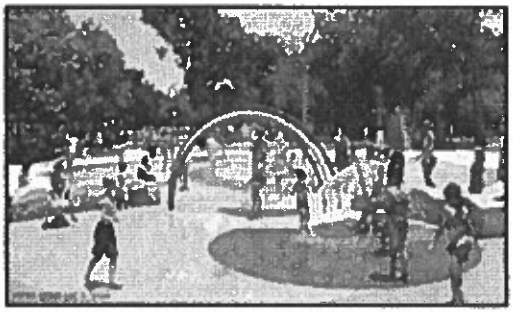
680.2 / 680.50 SPLASH PAD

NEW Definition / Requirements

Definition: A fountain with a pool depth of 1" or less, intended for recreational use by pedestrians.

Requirements of splash pads will need to comply with Parts I (***general***), II (***permanently installed pools***), and V (***fountains***) of Article 680



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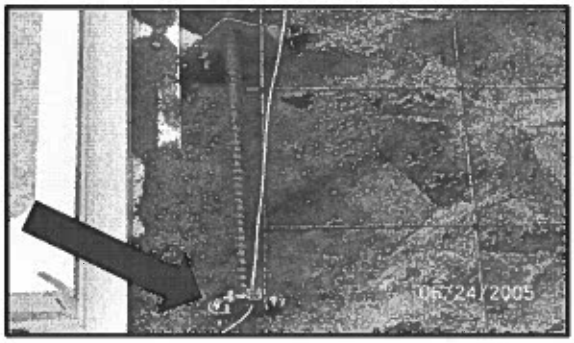
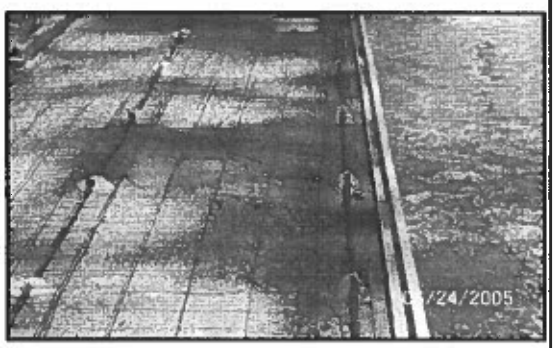
N 680.4 INSPECTION AFTER INSTALLATION

N Section

The authority having jurisdiction shall be permitted to require periodic inspection and testing.





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680.21 MOTORS

Δ **680.21 Wiring Methods.** The wiring to a pool motor shall comply with 680.21(A)(1) unless modified for specific circumstances to (A)(2) or (A)(3).

Δ **680.21 (A)(1) General.**
Wiring methods installed in a corrosive environment shall comply with **(680.14)** or shall be Type MC cable listed for the location, wiring methods in these locations shall include an insulated equipment grounding conductor, sized per Table (250.122), but not smaller than 12 AWG.

Where installed in noncorrosive environments, the wiring methods of branch circuits shall comply with the general requirements of Chapter 3.

2017 NEC Removed Interior of 1-Family

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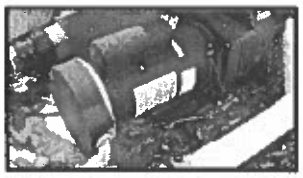
ARTICLE 680.21(C) – PART II.

PERMANENTLY INSTALLED POOLS

Expanded GFCI Protection of Pool Motors



Outlets supplying ***all*** pool ***motors on branch circuits rated 150-v or less to ground and 60 amperes or less, single or 3-phase shall be provided with Class "A"*** ground-fault circuit-interrupter protection.

Was 120-v through 240-v motors / + added 3-phase Motors

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ARTICLE 680.22
RECEPTACLE OUTLET LOCATIONS

2020 NEC; 15 and 20- ampere 125-v Outlets

680.22 (A)(1) – Required Outlet; (1) <6' – >20'

680.22 (A)(2) – Circulation pump; <6'

680.22 (A)(3) – Other Receptacles; – <6'

680.22 (A)(4) – GFCI Protection; – All 15 & 20a; within 20'

N **680.22(A)(5) – Pool Equipment Room; (1) GFCI outlet**

680.34 – Storable pool, Spa, & Hot Tub outlets; – 6 '

680.43 (A) – Indoor Spa & Hot Tub outlets; <6' – >10'

680.62 (E) – Therapeutic Tubs and pools – 6'

680.71 – Hydromassage Bathtubs – 30a or less; 6'

Type "A" GFCI Protection Required

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680.23(F) UNDERWATER LUMINAIRES

Branch Circuit Wiring for Underwater Luminaires

Branch circuits supplying underwater luminaires (Refer to 680.2) ***shall*** *include an insulated equipment grounding conductor, minimum size #12 CU. (Only permitted wiring methods are RMC, IMC, PVC and RTRC. (Refer to 680.14)*

Relaxing the requirements; Only the portion of the branch circuit in the "corrosive environment" requires an insulated equipment grounding conductor.

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680.26 EQUIPOTENTIAL BONDING (B)(2) PERIMETER SURFACES.

Copper Ring. Was alternative means.

(1) Minimum #8 bare solid CU conductor.
(2) Follow contour of pool perimeter surface
(3) Listed ***splicing devices or exothermic welding***
(4) 18" – 24" from the inside wall of the pool
(5) Secured under 4" – 6" below the subgrade

(C) Copper Grid.

(1) #8 bare solid CU conductor
(2) Follow contour of pool; 3' horizontally beyond pool
(3) Only listed splicing devices or exothermic welding
(4) Secured under 4" to 6" below the subgrade

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"VOLTAGE GRADIENTS"

- Corrected the wording regarding the performance and design of the Equipotential Bonding Grid.
- Replaced the word ***eliminate*** (which may be impossible to achieve) to the realistic term of ***"reduce"*** voltage gradients.
- ***The goal would be to keep the pool and all surrounding areas at or near the same potential.***

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680.31 / 32 STORABLE POOLS

Manufacturer Requirement

*Cord-connected pool filter pumps **"shall"** be provided with a ground-fault circuit interrupter that is an integral part of the attachment plug or located in the power supply cord within 12" of the attachment plug.*

Contractors Note: You are responsible to provide GFCI protection for the filter pump as well, if you add a new circuit, or replace a device on an existing circuit! Homeowners can and will plug the filter pump into a non-GFCI protected outlet.

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680.35 STORABLE & PORTABLE IMMERSION POOLS

N **New Section / Requirements**

(A) Cord Connection
(B) Pumps
(C) Heaters
(D) Audio Equipment
(E) Luminaires, Lighting Outlets & Fans
(F) Switches
(G) Receptacles

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680.45 IMMERSION POOLS

N **New Section / Requirements**

(A) Cord and Plug Connections

(B) Pumps

(C) Heaters

(D) Audio Equipment

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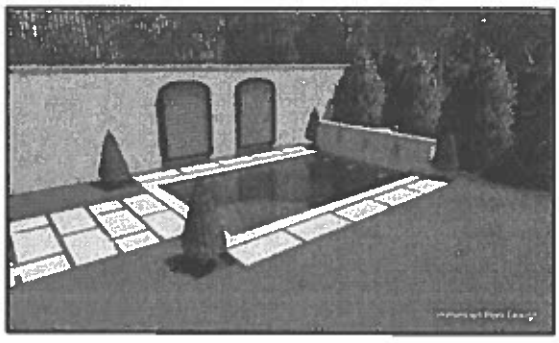
680.35 / 680.45 IMMERSION POOLS

NEW / & Clarification Info

680.35 Storable / portable immersion pools.

680.45 Permanently installed immersion pools

Addressing both custom built (on-site) and pre-packaged units.



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680.59 GFCI PROTECTION FOR PERMANENTLY INSTALLED NON-SUBMERSIBLE PUMPS

Re: Fountains / New Section

Outlets supplying all permanently installed non-submersible pump motors rated 250-v or less and 60a or less, 1ø or 3ø, shall be provided with ground-fault circuit interrupter protection.

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680.74(A) BONDING

Re: Hydromassage Bathtubs

(3) Added metal raceways within 5'

(5) Non-current-carrying metal parts of electrical devices and controls that are not associated with the hydromassage tubs within 5'.

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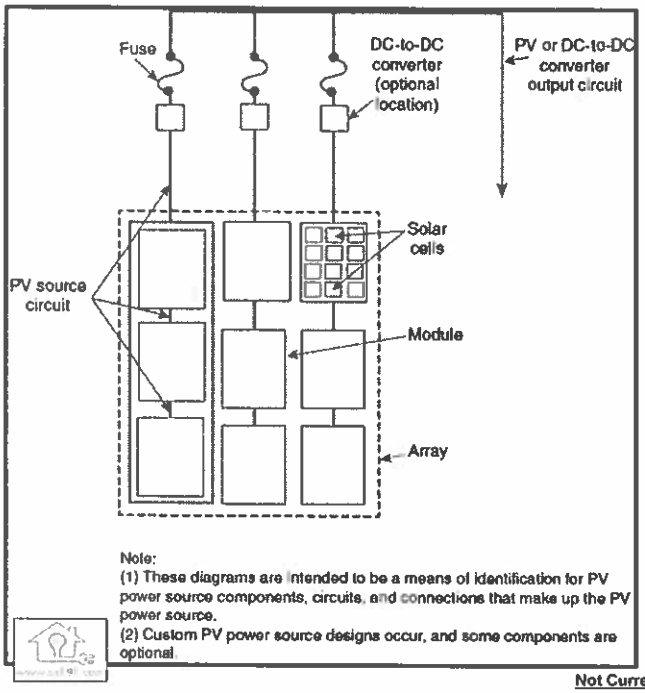

SOLAR PHOTOVOLTAIC (PV) SYSTEMS

690.1 Scope

This article applies to solar PV systems, other than those covered by Article 691, including the array circuit(s), inverter(s), & controller(s) for such systems. The systems covered by this article ***include those*** interactive with ***electric*** power production sources or stand-alone, ***or both.*** These PV systems may have ac or dc output for utilization.

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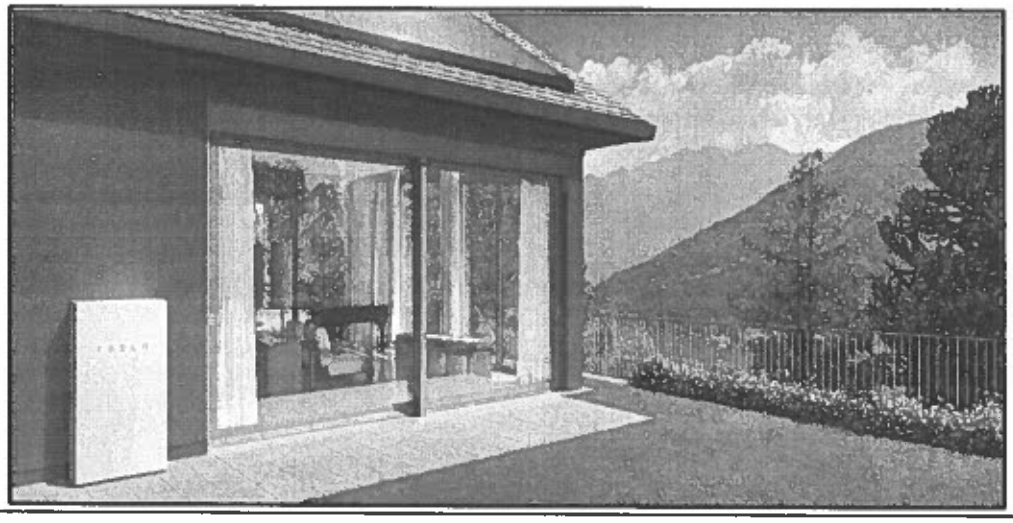
TESLA POWERWALL HOME BATTERY SYSTEM



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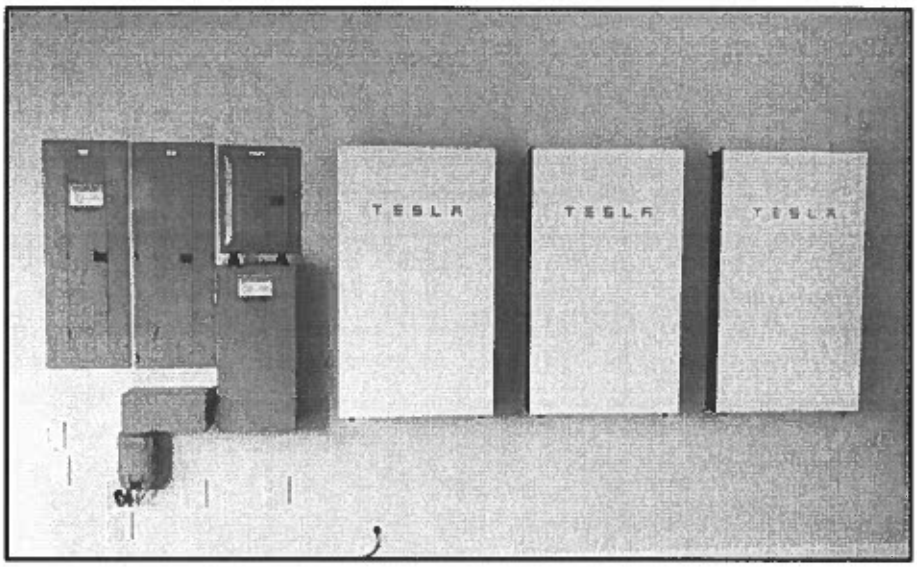
TESLA POWER WALL



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690.8 CIRCUIT SIZING AND CURRENT

N 690.8(A)(2)
Circuits Connected to the Input of Electronic Power Converters

Where a circuit is protected with an overcurrent device not exceeding the conductor ampacity, the maximum current shall be permitted to be the rated input current of the electronic power converter input to which it is connected. ***(Significant change for commercial installations)***

8.62 x 125% = 10.775a x (6) = 64.65a
****#4 CU 2017 NEC****

(6) 250-watt modules = (the string)

Input 33a x 125% = 41.25a

24 kW Inverter 75°C terminals *#8 CU* / 50a ocd 41.25amps = Continuous duty

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ARTICLE 690
SOLAR PHOTOVOLTAIC (PV) SYSTEMS

This Article has been extensively revised and updated

690.13(A) – The PV system disconnecting means shall be located in a readily accessible location. ***Where disconnecting means of systems above 30-v are readily accessible to "unqualified" persons, any enclosure door or hinged cover that exposes live parts when open shall be "locked" or require a tool to open.***

Limit unintentional contact

690.15(A) Reads the same for Isolating PV Equipment

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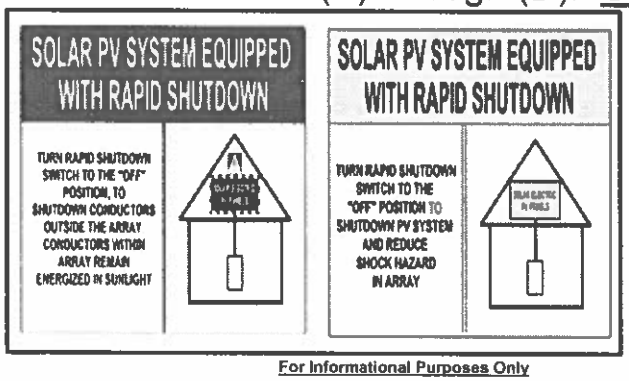
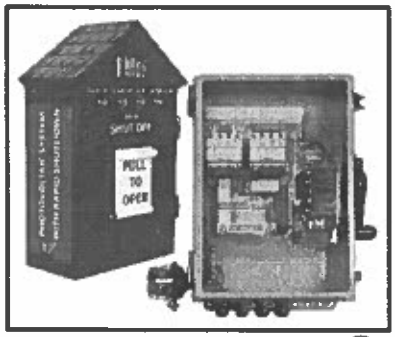
690.12 RAPID SHUTDOWN OF PV SYSTEMS ON BUILDINGS

PV system circuits ***installed on or in buildings*** shall include a rapid shutdown ***function to reduce shock hazard for firefighters*** in accordance with 690.12(A) through (D). **UL3741**





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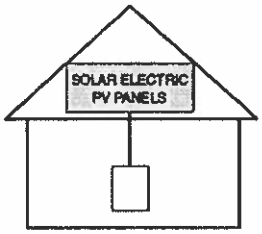
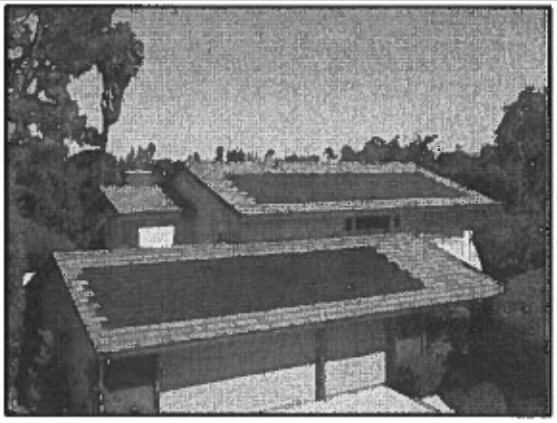
690.12(B)(1)(2) RAPID SHUTDOWN FOR PV SYSTEMS *ON OR IN* BUILDINGS FOR FIREFIGHTERS

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY.





Outside the boundary = >3' from the array, from point of entry, requires rapid shutdown.
Inside the boundary = <1 from array, requires rapid shutdown.
PV Hazard Control System / <80v in 30seconds / or integrated roof shingles / UL 3741 Standard

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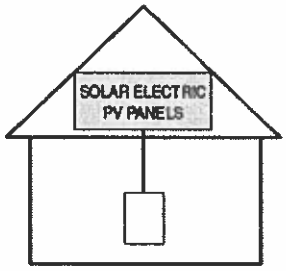
LABEL FOR ROOF MOUNTED PV SYSTEMS WITH RAPID SHUTDOWN

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY.



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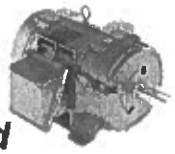
FIRE PUMPS
695.3(C)(2) SELECTIVE COORDINATION

Expanded Requirement (Revised)

Overcurrent protective device(s) shall be selectively coordinated with ***all*** supply-side overcurrent protective devices(s).



Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, maintain, and operate the system.

Similar to 700.32 Emergency Systems

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CHAPTER 7

Special Conditions

Article 700 – Emergency Systems

Article 725 – Class 1, 2, & 3 Power Limiting Cables

Article – 760 Fire Alarm Systems

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700.2 EMERGENCY SYSTEMS

N **Emergency Systems.** ***This definition shall apply within this article and throughout the Code.***

Informational Note: Emergency systems are generally installed in places of assembly where artificial illumination is required for safe exiting and for panic control in buildings subject to occupancy by large numbers of persons, such as hotels theaters, sports arenas, healthcare facilities, and similar installations. Emergency systems may also provide power for such functions as ventilation where essential to maintain life, fire detection and ***alarm systems***, elevators, fire pumps, public safety communications systems, industrial processes where current interruption would produce serious life-safety or health hazards, and similar functions.

Definition Modified / Clarified!

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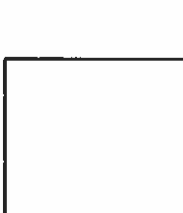
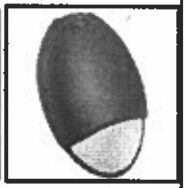


ARTICLE 700 – PART 4 EMERGENCY SYSTEM CIRCUITS FOR LIGHTING AND POWER



700.16 Emergency Illumination – Rewritten (Clarification)

N **(B)** ***System Reliability*****. Emergency lighting systems shall be designed and installed *so that the failure of any illumination source* cannot leave in total darkness any space that requires emergency illumination. Control devices in the emergency lighting system shall be listed for use in emergency system. Listed unit equipment in accordance with 700.12(F) shall be considered as meeting the provisions of this section.**

Removed reference to burning out of a lamp
(due to the use of LED's luminaires)

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N 700.32 SELECTIVE COORDINATION *INFORMATIONAL NOTE*

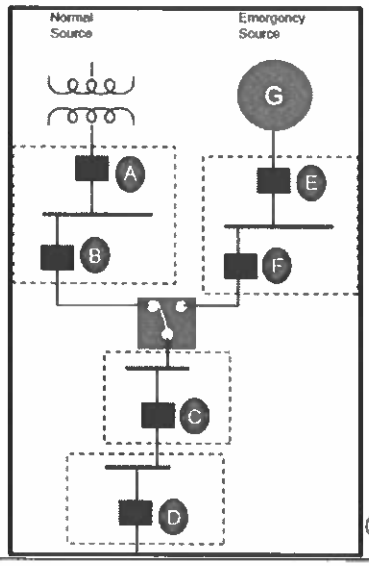
Informational Note: See Informational Note Figure Note 701.32 for an example of how legally required standby system overcurrent protective devices (OCPDs) selectively coordinate with all supply-side OCPDs.

OCPD "D" selectively coordinates with **OCPD's C, F, E, B, and A**.

OCPD "C" selectively coordinates with **OCPD's F, E, B, and A**.

OCPD "F" selectively coordinates with **OCPD E**.

OCPD "B" is not required to selectively coordinate with OCPD A because OCPD B is not a legally required standby system OCPD.



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ARTICLE 720 – CIRCUITS & EQUIPMENT OPERATING AT LESS THAN 50 VOLTS

720.1 Scope. This article covers installations operating at less than 50 volts, direct current or alternating current.

720.2 Other Articles. Direct current or alternating-current installations operating at less than 50 volts, as covered in Articles 411, 517, 551, 552, 650, 669, 690 and 760.... "Parts I, ***II***, and III of Article 725, ***shall not be required to comply with this article***".

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ARTICLE 725 CLASS 1, 2, & 3 REMOTE CONTROL, SIGNALING & POWER LIMITED CIRCUITS

There are two types of Class 1 circuits:

1. **Power-limited**; supplied by a transformer, limited to 30v and 1000VA, have a current limiter (OCPD) that limits the amount of supply current on the circuit, due to an overload, short-circuit or ground-fault.
2. **Remote-control & signaling;** maximum voltage is 600 and limited on the power output of the source.

Note: Class 1 circuits are permitted to occupy the same cable, raceway or enclosure of power and lighting circuits (whether A/C or D/C), when installed in associated equipment, and conductors are properly insulated. (watch de-rating).

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CLASS 2 & 3 CIRCUITS

Both Class 2 & 3 circuits have power limitations as identified in Chapter 9 of the 2020 National Electrical Code;

Table 11(a) Alternating Current Limitations

Table 11(b) Direct Current Limitations

Class 2 Note: Typical operating voltage is 48v, not exceeding 100VA, with a listed power supply. (limited in length due to voltage drop)

Class 3 Note: Have higher current thresholds than Class 2 circuits, therefore have additional requirements. (can run longer lengths than Class 2 circuits)

2020

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725.144 TRANSMISSION OF POWER & DATA

New in 2017 NEC

Typically, referred as Power over Ethernet **(PoE)**. A common use is for video cameras, that have a class 2 power supply, that will also utilize conductors within the same cable for video transmission (network cable).

Ampacity ratings of these cables are based on 86°F. As current flow in these bundled or bunched cables can increase the temperature and therefore can degrade the insulation of the cables (overheating).

Generally operating @ 48v / connectors rated @ 1.3 amperes maximum

2020

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POE TERMINOLOGY

- **IEEE 802.3 PoE Standard; *(48v and up to 15.4W)***

Typically, Cat 5 Cable contains 8 wires; as 4 twisted pairs of conductors 2 pairs are used for data (data pairs), 1 pair can be used for power 48v DC

PSE = Power Sourcing Equipment; Equipment that provides power to the cable. (WAP); Wired Access Points (IP); Security Cameras

PD = Powered Device; Device that receives power from the cable

PSE = Power Sourcing Equipment; Devices that send power and data over ethernet cable to a connected PD. (midpoint, endpoint or span); no additional power source required.

VOIP = Voice over internet phone; PoE is needed to power the phone, via the network.

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POWER OVER ETHERNET (POE) NEW IN THE 2017 NEC

Applies to both Class 2 & Class 3 Circuits

IN #1 – Applies to *CCTV cameras*

IN #2 – Used in Powered *Communication systems*

IN #3 – 4 Pair copper balanced twisted conductors

IN #4 – Guidelines for supporting power delivery over balanced twisted conductors

IN #5 – Minimum Requirements for *PoE lighting systems*

IN #6 – Rated current for power sources; designed to deliver

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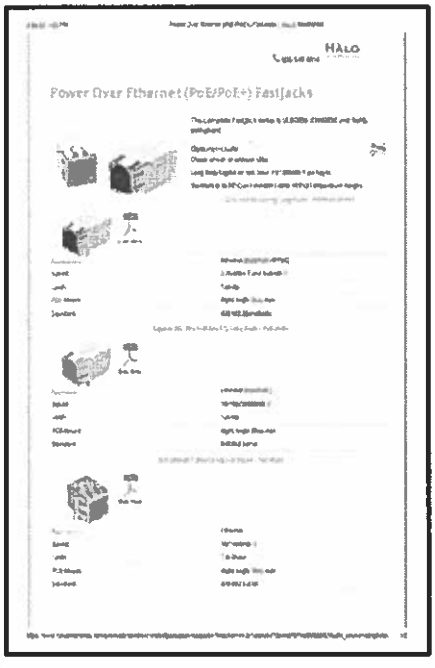

725.144 TRANSMISSION OF POWER & DATA

Power over Ethernet (PoE)

Section 725.144(A) & (B) shall apply to Class 2 & Class 3 circuits that transmit power and data to a powered device. Section 300.11 and Parts I and III of Article 725 shall apply to Class 2 & Class 3 circuits that transmit power and data. Conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

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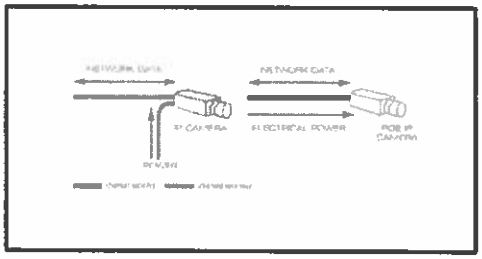
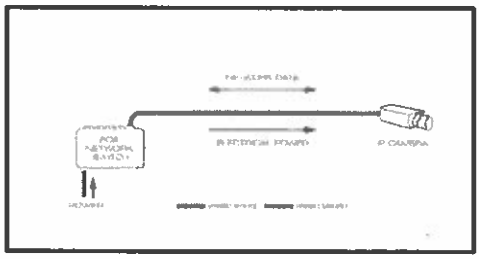
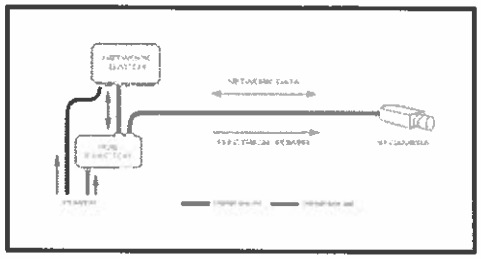
NETWORK CABLES THAT CARRY ELECTRIC POWER







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PoE [power over ethernet] USE CASES

PoE facilitates the deployment of powered devices in several scenarios. The following are just a few sample use-cases for PoE

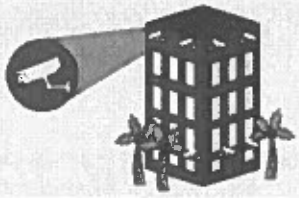
PoE Deployment Locations:
- Throughout Building
- Campuses
- Others

VoIP in an Office Environment

Businesses seeking to save on wired telephone services switch to VoIP phone systems.

IP Surveillance in an Enterprise Building

Outdoor IP cameras give system integrators the ability to deploy cameras around a multi-story enterprise building where electrical circuitry may be absent.



Access Points in a Campus

PoE-capable wireless access points make it simple to disregard the placement of electrical circuitry, and place wireless access points anywhere on a campus.

2020

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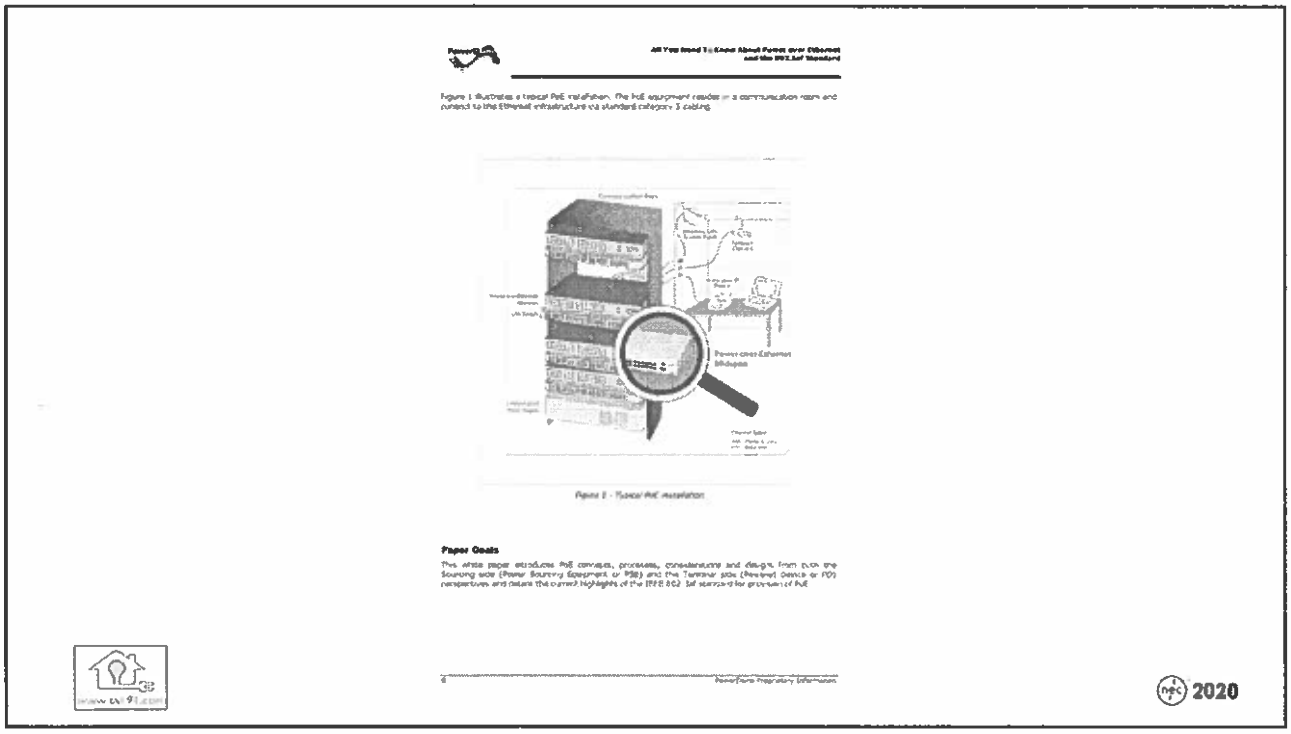

All You Need To Know About Power over Ethernet and the IEEE 802.3af Standard

Figure 1 illustrates a typical PoE installation. The PoE equipment resides in a communication room and connects to the Ethernet infrastructure via standard category 5 cabling.

Figure 1 - Typical PoE installation

Paper Goals

This white paper introduces PoE concepts, processes, considerations and design from both the Sourcing side (Power Sourcing Equipment or PSE) and the Terminal side (Powered Device or PD) perspectives and details the current highlights of the IEEE 802.3af standard for provision of PoE

2020

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ADDITIONAL USES

Integrating Building Systems

Heating, Ventilation & A/C Systems (VAV Boxes)

Lighting System Sensors

Security Camera Systems

Automation, Control Systems & Energy Savings

Refer to Chapter 9 Tables 11(a) & (b)

2020

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CLASS 2 & CLASS 3 NETWORK CABLING

Data and Power Circuits

1. Cable Listing & Compliance
2. Structured Cabling
3. Data Centers
4. Power over Ethernet (PoE)
5. Uses Cat 5 or Cat 6 Cable

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2020

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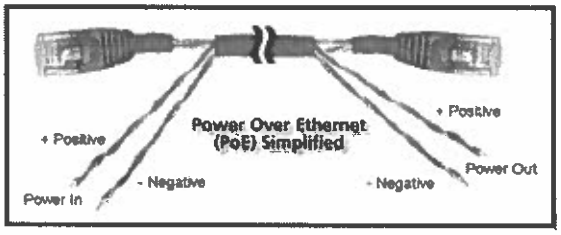
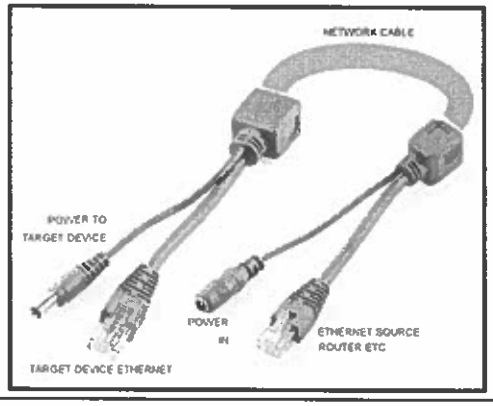
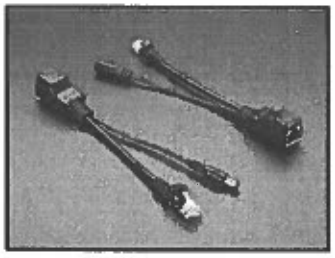
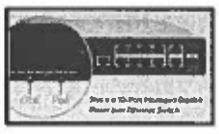
EXAMPLES OF CAT 5 / 6 CABLES / USES









2020

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CHAPTER 8

Communications Systems

N Article 805 – Communication Circuits

2020

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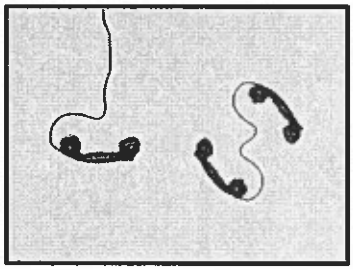
ARTICLE 805 (NEW) GENERAL REQUIREMENTS FOR COMMUNICATION SYSTEMS

General info for Articles;

800, 820, 830 and 840 combined in one location.

800 – Communication Circuits
820 – CATV & Radio Dist. Systems
830 – Network Powered Broadband Comm. Systems
840 – Premises-Powered Broadband Comm. Systems



Not Current Code in Ohio

2020

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CHAPTER 9

Tables

Table 1 – Conduit Fill

Informative Annex I – Recommended Tightening Torque Tables from UL Standard 486A – 486B

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2020

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CHAPTER 9 – TABLES

Table 1

Conduit Fill / Cross Sectional Area (%)

1 Conductor = 53% Cross Sectional Fill
2 Conductors = 31% Cross Sectional Fill
Over 2 Conductors = 40% Cross Sectional Fill

Notes to Tables:

(3) EGC's / bonding conductors ***to be included*** in calculating conduit fill

(4) Where conduit or tubing nipples having a maximum length not to exceed ***24"*** are installed between boxes, cabinets, and similar enclosures, the nipples shall be permitted to be filled to ***60%*** of their cross-sectional area, and 310.15(C)(1) adjustment factors need not apply to this condition. ***(no de-rating required)***

2020

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2020 NEC COMMERCIAL OVERVIEW

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

Not Current Code in Ohio

2020

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2020 NEC RESIDENTIAL OVERVIEW

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

For Informational Purposes Only

2020

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2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Labriola Training Agency #191
www.ta191.com

John M. Labriola
Principal

150 Maplecrest Street SW
North Canton, Ohio 44720

330.497.6309 Phone
330.606.8098 Cell
john@ta191.com

www.ta191.com

Thank You!

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File Attachments for Item:

EC-12 2020 NEC Changes and Updates Chapters 6, 7, and 8 (Labriola)

All certifications except plumbing (4 hours)

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax. (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: John M. Labriola (Contact Name)
Organization: Training Agency #191 (Organization/Company)
Address: 150 Maplecrest St. SW (Include Room Number, Suite, etc.)
City: North Canton State: Ohio Zip: 44720
E-Mail: john@ta191.com
Telephone: 330.497.6309 Fax:
Course Sponsor: None

COURSE INFORMATION:

Course Title: 2020 National Electrical Code Changes & Updates - Chapters 6, 7 & 8

New Course Submittal: ■ Update Course: ☐ Prior Approval Number:

Purpose and Objective:
To provide BBS certified personnel a better understanding of the changes & Updates to the 2020 National electrical Code.
by utilizing a power-point presentation and real-life examples, for no charge to attendees.

Number of Instructional Contact Hours that can be obtained upon completion: 4 Hours

If Multi-Session, Number of Instructional Contact Hours Per Session:

Program Applicable for the Following Participants:

Building Official ■	Master Plans Examiner ■	Building Inspector ■	Fire Protection Inspector ■	Mechanical Inspector ■
	Plumbing Plans Exam. ☐			Plumbing Inspector ☐
	Electrical Plans Exam. ■			Non-Res IU Inspector ■
	Mechanical Plans Exam. ■			

Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ■ Res IU Inspector ■

Electrical Safety Inspectors [x]
Location of ESI Course: Various locations Date(s) of ESI Course(s): TBD

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline: list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	
Completed Application:		

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

RECEIVED
MAY 04 2022
BOARD OF BUILDING STANDARDS

October 16, 2020

John M. Labriola
150 Maplecrest St. SW
North Canton, Ohio 44720

330.497.6309 Home 330.606.8098 Cell

Professional Bio'

Education

2012- 1984	Akron University, Stark State College: Continuing Education
1975	St. Thomas Aquinas High School; Louisville, Ohio
1971	Fairmount Elementary; Canton, Ohio

Building Department Experience

2017 – 2009	Summit County, Ohio; Chief Building Official (retired)
2009 – 2006	City of Canton, Ohio; Chief Building Official
2008 – 1997	City of Alliance, Ohio; Back-up Building and Electrical Inspector
2006 – 1997	City of North Canton, Ohio; Building and Electrical Inspector
1997 – 1986	Stark County, Ohio; Chief Electrical Inspector
1988 – 1984	City of Louisville, Ohio; Part-time Electrical Inspector

Current Certifications Held

International Code Council (ICC)

Accessibility Inspector/ Plans Examiner, Building Inspector, Building Plans Examiner, Certified Building Code Official, Certified Building Official, Certified Electrical Code Official, Certified Mechanical Code Official, Commercial Electrical Inspector, Commercial Mechanical Inspector, Commercial Plumbing Inspector, Electrical Inspector, Electrical Plans Examiner, Fire Plans Examiner, Master Code Professional, Mechanical Inspector, Mechanical Plans Examiner, Property Maintenance and Housing Inspector, Residential Electrical Inspector, Residential Energy Inspector / Plans Examiner, Residential Mechanical Inspector and Residential Plumbing Inspector.

State of Ohio:

Building Inspector, Building Official, Building Plans Examiner, Electrical Plans Examiner, Electrical Safety Inspector, Fire Protection Plans Examiner, Mechanical Plans Examiner and Residential Building Official.

Construction Experience

2007 – 1986	President; Electrical Design and Construction Co.
2004 – Present	State of South Carolina; Licensed Commercial Contractor
1992 – Present	State of Ohio; Licensed Electrical Contractor
1986 – 1981	Owner; Labriola Electric
1981 – 1975	Pedersen Electric; Helper / Apprentice / Journeyman Electrician
1980 – Present	Journeyman Electrician; City of Canton, Ohio

Professional Organization Memberships

2010 – 2017	American Institute of Architects - Akron Chapter (AIA-Akron)
2009 – 2017	Building Officials Code Officials of Northeast Ohio (BOCONEO)
2009 – 2017	National Fire Protection Association (NFPA)
1997 – 2017	Five County Building Officials Association (FBOA)
1997 – 2017	Ohio Building Officials Association (OBOA)
1986 – Present	International Association of Electrical Inspectors (IAEI)

Appointments (Director Positions)

2011 – 2017	Air-Conditioning Contractors Association of Akron / Canton
2011 – 2017	Home Builders Association of Summit and Portage Counties

Teaching Experience

2012 – 2017	Instructor; Home Builders Association of Greater Cleveland
2012 – 2017	Instructor; Home Builders Association of Summit and Portage Counties
2012 – Present	Instructor; National Electrical Contractors Association (NECA); Greater Cleveland, Ohio Division
2011 – Present	Instructor; Northeast Ohio Electrical Contractors Association (NOECA)
2005	Instructor; Clemson University; Clemson, South Carolina
2004 – Present	Instructor; Electrical League of Ohio; Cleveland, Ohio
2000 – 2016	Instructor; Stark State College of Technology: North Canton, Ohio
1999 – Present	Instructor; National Electrical Contractors Association (NECA); Akron, Ohio Division
1991 – 2009	OCILB Approved Contractor Training Agency
1990 – Present	State of Ohio; Approved Electrical Safety Inspector, Instructor

Respectfully,
John M. Labriola
John M. Labriola
OBBS ID #815
john@ta191.com

www.ta191.com

May 02, 2022

Labriola Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720

Ohio Board of Building Standards
6606 Tussing Road – PO Box 4009
Reynoldsburg, Ohio 43068 – 9009

Course Submittal #6 – 4 Hours

Chapters 6 / 7 & 8

Elevator Sump Pump Pit Locations

Electric Vehicle Charging Stations

Ford Lighting Vehicle

Swimming Pool Motors

Storable / Immersion Pools

Solar Photovoltaic (PV) Systems

Emergency Systems

Remote-Control Signaling & Power Limited Circuits

Transmission of Power and Data

Power over Ethernet (PoE)

Communication Systems

2 ☐ **CURRENT ADOPTED CODES**

3 ☐ **2019 RESIDENTIAL CODE OF OHIO**

4 ☐

5 ☐

THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).

THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.

PRESENTED FOR INFORMATIONAL PURPOSES ONLY.

OHIO BOARD OF BUILDING STANDARDS

6 ☐ **"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)**

Subject to the local or State adoption authority

180 ☐ **CHAPTER 6**
Special Equipment

Article 620 – Elevators, Dumbwaiters, Escalators....

Article 625 – Electric Vehicle Power Transfer System

Article 645 – Information Technology Equipment

Article 680 – Swimming Pools, Fountains, & Similar Installations

Article 690 – Solar Photovoltaic (PV) Systems

Article 695 – Fire Pumps

181 ☐ ***N* 620.6 GFCI PROTECTION FOR PERSONNEL**
New Section

Ground- Fault Circuit- Interrupter Protection for Personnel

Each 125-v, 1ø, 15 and 20-ampere receptacle installed in pits, in hoistways, on the cars of

elevators and dumbwaiters, ... shall be of the GFCI type. Re: 620.85
2017 NEC

Added *machinery spaces* / to have GFCI protection of 125-v receptacles

A permanently installed sump pump *shall* be permanently wired or shall be supplied by a single receptacle that is GFCI protected.

Hardwired sump pumps; GFCI protection not required!

182 ☐ ***N* 620.65 SELECTIVE COORDINATION "SIGNAGE"**

Equipment enclosures containing selectively coordinated overcurrent devices shall be legibly marked in the field to indicate that the overcurrent devices are selectively coordinated. The marking shall meet the requirements of 110.21(B), shall be readily visible, and shall state the following:

"CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED"

Applies to where more than one driving machine disconnect is supplied by the same source!

183 ☐ **08.05.2021 PRESIDENT JOE BIDEN SIGNS EXECUTIVE ORDER**

-
-
-
-
- August 05, 2021

President Biden signs executive order (goal), that 50% of vehicles sold in the US to be EV's by 2030. Intended to cut carbon emissions.
Currently 2%

184 ☐ **NEW - EV CHARGING STATIONS**

Federal Government Initiative – Infrastructure Plan

Construct 500,000 new charging stations throughout the USA

DOE Goal: 40 Level 2 charging ports / 1000 EVs
3.4 DC fast charging ports / 1000 EVs

5 Billion Dollars / 10,000 For each State
5,000,000,000 / 500,000 = 10,000 each
By the year 2030 number of EVs expected to be 35 million

185 ☐ **ARTICLE 625 – ELECTRIC VEHICLE POWER TRANSFER EQUIPMENT**

N 625.2 Definitions

Electric Vehicle Connector. – A device that, when electrically coupled (conductive or inductive) to an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of power transfer and informational exchange.

Electric Vehicle Power Export Equipment (EVPE). – The equipment, including the outlet on the vehicle, that is used to provide electrical power at voltages greater than or equal to 30Vac or 60Vdc to loads external to the vehicle, using the vehicle as the source of supply.

186 ☐ ***Δ* 625.54 GFCI PROTECTION FOR PERSONNEL**

In addition to the requirements in 210.8, all receptacles installed for the connection of electric vehicle charging shall have ground-fault circuit-interrupter protection for personnel. (Type A)

187 ☐ **P&S LEGRAND EV CHARGING STATION**

188 ☐ **GE CHARGING STATION DETAILS**

189 ☐ **GE EV WIRING DIAGRAM**

190 ☐ **CHARGING STATION 1-LINE DRAWING**

191 ☐

192 ☐

193 ☐ **EV CHARGING STATIONS**

Manufactured Charging Stations

Inherent (Built-In) GFCI protection
20mA CCID "Type C" Protection

CCID = Charge Current Interrupting Device

194 ☐

195 ☐ **ELECTRIC VEHICLE RECEPTACLE ROUGH-IN**

196 ☐ **ARTICLE 625 ELECTRIC VEHICLE POWER TRANSFER SYSTEM**

1 30 Minute Charge
2 Estimated Charging Cost:

3 Charging Station Fees

- Fast Charge $1.50 minute

- Approximately .30 minute for Level 1 or Level 2
-
- Typically, a Tesla vehicle will require a separate adapter or specific Tesla charging station

197 **PUBLIC EVSE STATIONS / PORTS BY STATE (DOE)**
US / LEVEL 1 – 1,331 / LEVEL 2 – 86,095 / DC FAST 18,895

1 •
- Ohio – 770 / 1,680
- West Virginia – 88 / 254
- Virginia – 898 / 2,471
- Pennsylvania – 1,008 / 2,377
- Kentucky – 163 / 388
- Indiana – 294 /810
- Illinois – 875 / 2,192
- North Carolina – 918 / 2,158
- Tennessee – 584 / 1,334

2 •
- California – 13,088 / 33,461
- New York – 2,563 / 6,235
- Florida – 2,256 / 5,529
- Texas – 2,077 / 4,849
- Massachusetts – 1,771 / 3,916
- Washington – 1,518 / 3,716
- Georgia – 1,483 / 3,669
- Colorado – 1,363 / 3,208
- Entire US – 43,413 / 106,321

198 **TOTAL STATION LOCATIONS COUNTS IN US**

Alternative Fuel Types:
- Biodiesel – 313
- CNG – 851
- E85 – 3,905
- Electric – 43,413 / 106,321
- Hydrogen – 49
- LNG – 55
- Propane – 1,233 Primary / 1,243 Secondary / Total 2,576

Total 114,070

199 ***N* 625.60 AC RECEPTACLE OUTLETS USED FOR EVPE**

EVPE = Electric Vehicle Power Export Equipment

AC receptacles installed in electric vehicles and intended to allow for connection of off-board utilization equipment shall comply with 625.60 (A) – (D).

(A) Type. The receptacle shall be listed
(B) Rating. Outlet shall be rated 250-v max, 1ø, 50a max
(C) Overcurrent Protection. Integral to power export system
(D) GFCI Protection for Personnel. All receptacles shall be GFCI protected, indication and reset shall be accessible

200 ☐ **2022 FORD F-150 LIGHTNING PICK-UP**

All-Electric. All F-150

Available features include Backup Power that can provide full-home power for up to 3 days, on a fully charge battery and 80-amp Ford Charge station Pro. *When home is properly equipped & home transfer switch disconnects home from the grid*. Based on 30 kWh used per day. Turn your truck into a generator. Pro Power Onboard offers an available 9.6kw max power provided through 11 outlets. (4) 120v outlets in front trunk, (2) in the cab (4) in the bed, and (1) 240-v outlet for tougher tasks.

201 ☐ **ARTICLE 645**
INFORMATION TECHNOLOGY EQUIPMENT

645.5 Supply Circuits and Interconnecting Cables

Δ 645.5 (E) Under Raised Floors. Where the area under the floor is accessible and openings minimize the entrance of debris beneath the floor, power cables, *communications cables,* connection cables, interconnecting cables, cord-and-plug connections and receptacles with the IT equipment. *Typically protected with a Halon (clean agent) fire suppression system or Fm200 system.*

202 ☐ **THERE ARE "8" PARTS TO**
ARTICLE 680

Part 1 General (Page 564)
Part 2 Permanently Installed Pools (Page 567)
Part 3 Storable Pools, Spas, Hot Tubs (Page 573)
Part 4 Spas, Hot Tubs & Immersion Pools (Page 574)
Part 5 Fountains (Page 576)
Part 6 Pools and Tubs for Therapeutic Use (Page 578)
Part 7 Hydromassage Bathtubs (Page 578)
Part 8 Electrically Powered Pool Lifts (Page 579)

203 ☐ **680.2 NEW DEFINITIONS**

N Corrosive Environment. Areas where pool sanitation chemicals are stored, handled, or dispensed, and confined areas under decks adjacent to such areas, as well as areas with circulation pumps, automatic chlorinators, filters, open areas under decks adjacent to or abutting the pool structure, and similar locations. (Refer to 680.14)

N Immersion Pool. A pool for ceremonial or ritual immersion of users, which is designed and intended to have its contents drained or discharged.

N Splash Pad. A fountain with a pool depth of 1" or less, intended for recreational use by pedestrians. This definition does not include showers intended for hygienic rinsing prior to use of a pool, spa, or other water feature.

204 ☐ **680.2 / 680.50 SPLASH PAD**

NEW Definition / Requirements

Definition: A fountain with a pool depth of 1" or less, intended for recreational use by pedestrians.

Requirements of splash pads will need to comply with Parts I (*general*), II (*permanently installed pools*), and V (*fountains*) of Article 680

205 ☐ ***N* 680.4 INSPECTION AFTER INSTALLATION**

N Section

The authority having jurisdiction shall be permitted to require periodic inspection and testing.

206 ☐ **680.21 MOTORS**

Δ 680.21 Wiring Methods. The wiring to a pool motor shall comply with 680.21(A)(1) unless modified for specific circumstances to (A)(2) or (A)(3).

Δ 680.21 (A)(1) General.
Wiring methods installed in a corrosive environment shall comply with (680.14) or shall be Type MC cable listed for the location, wiring methods in these locations shall include an insulated equipment grounding conductor, sized per Table (250.122), but not smaller than 12 AWG.

Where installed in noncorrosive environments, the wiring methods of branch circuits shall comply with the general requirements of Chapter 3.

2017 NEC Removed Interior of 1-Family

207 ☐ **ARTICLE 680.21(C) – PART II.**

PERMANENTLY INSTALLED POOLS

Expanded GFCI Protection of Pool Motors

Outlets supplying *all* pool *motors on branch circuits rated 150-v or less to ground and 60 amperes or less, single or 3-phase shall be provided with Class "A"* ground-fault circuit-

interrupter protection.

Was 120-v through 240-v motors / + added 3-phase Motors

208 ☐ **ARTICLE 680.22**
RECEPTACLE OUTLET LOCATIONS

2020 NEC; 15 and 20- ampere 125-v Outlets

680.22 (A)(1) – Required Outlet; (1) <6' – >20'
680.22 (A)(2) – Circulation pump; <6'
680.22 (A)(3) – Other Receptacles; – <6'
680.22 (A)(4) – GFCI Protection; – All 15 & 20a; within 20'
N 680.22(A)(5) – Pool Equipment Room; (1) GFCI outlet
680.34 – Storable pool, Spa, & Hot Tub outlets; – 6 '
680.43 (A) – Indoor Spa & Hot Tub outlets; <6' – >10'
680.62 (E) – Therapeutic Tubs and pools – 6'
680.71 – Hydromassage Bathtubs – 30a or less; 6'

Type "A" GFCI Protection Required

209 ☐ **680.23(F) UNDERWATER LUMINAIRES**

Branch Circuit Wiring for Underwater Luminaires

Branch circuits supplying underwater luminaires (Refer to 680.2) *shall include an insulated equipment grounding conductor, minimum size #12 CU. (Only permitted wiring methods are RMC, IMC, PVC and RTRC. (Refer to 680.14)*

Relaxing the requirements; Only the portion of the branch circuit in the "corrosive environment" requires an insulated equipment grounding conductor.

210 ☐ **680.26 EQUIPOTENTIAL BONDING**
(B)(2) PERIMETER SURFACES.

Copper Ring. Was alternative means.

(1) Minimum #8 bare solid CU conductor.
(2) Follow contour of pool perimeter surface
(3) Listed *splicing devices or exothermic welding*
(4) 18" – 24" from the inside wall of the pool
(5) Secured under 4" – 6" below the subgrade

(C) Copper Grid.

(1) #8 bare solid CU conductor
(2) Follow contour of pool; 3' horizontally beyond pool
(3) Only listed splicing devices or exothermic welding
(4) Secured under 4" to 6" below the subgrade

211 ☐ **"VOLTAGE GRADIENTS"**

- Corrected the wording regarding the performance and design of the Equipotential Bonding Grid.
- Replaced the word *eliminate* (which may be impossible to achieve) to the realistic term of *"reduce"* voltage gradients.
- *The goal would be to keep the pool and all surrounding areas at or near the same potential.*

212 ☐ **680.31 / 32 STORABLE POOLS**

Manufacturer Requirement

Cord-connected pool filter pumps "shall" be provided with a ground-fault circuit interrupter that is an integral part of the attachment plug or located in the power supply cord within 12" of the attachment plug.

Contractors Note: You are responsible to provide GFCI protection for the filter pump as well, if you add a new circuit, or replace a device on an existing circuit! Homeowners can and will plug the filter pump into a non-GFCI protected outlet.

213 ☐ **680.35 STORABLE & PORTABLE IMMERSION POOLS**

N New Section / Requirements

(A) Cord Connection
(B) Pumps
(C) Heaters
(D) Audio Equipment
(E) Luminaires, Lighting Outlets & Fans
(F) Switches
(G) Receptacles

214 ☐ **680.45 IMMERSION POOLS**

N New Section / Requirements

(A) Cord and Plug Connections

(B) Pumps
(C) Heaters
(D) Audio Equipment

215 ☐ **680.35 / 680.45**
IMMERSION POOLS
NEW / & Clarification Info

680.35 Storable / portable immersion pools.

680.45 Permanently installed immersion pools

Addressing both custom built (on-site) and pre-packaged units.

216 ☐ **680.59 GFCI PROTECTION FOR PERMANENTLY INSTALLED NON-SUBMERSIBLE PUMPS**

Re: Fountains / New Section

Outlets supplying all permanently installed non-submersible pump motors rated 250-v or less and 60a or less, 1ø or 3ø, shall be provided with ground-fault circuit interrupter protection.

217 ☐ **680.74(A) BONDING**

Re: Hydromassage Bathtubs

(3) Added metal raceways within 5'
(3)
(5) Non-current-carrying metal parts of electrical devices and controls that are not associated with the hydromassage tubs within 5'.

218 ☐ **SOLAR PHOTOVOLTAIC (PV) SYSTEMS**
690.1 Scope
This article applies to solar PV systems, other than those covered by Article 691, including the array circuit(s), inverter(s), & controller(s) for such systems. The systems covered by this article *include those* interactive with *electric* power production sources or stand-alone, *or both.* These PV systems may have ac or dc output for utilization.

221 ☐ **690.8 CIRCUIT SIZING AND CURRENT**
N 690.8(A)(2)
Circuits Connected to the Input of Electronic Power Converters

Where a circuit is protected with an overcurrent device not exceeding the conductor ampacity,

the maximum current shall be permitted to be the rated input current of the electronic power converter input to which it is connected. *(Significant change for commercial installations)*

8.62 x 125% = 10.775a x (6) = 64.65a
#4 CU 2017 NEC

Input 33a x 125% = 41.25a

(6) 250-watt modules = (the string)

24 kW Inverter
75°C terminals
#8 CU / 50a ocd
41.25amps =
Continuous duty

222 ☐ **ARTICLE 690**
SOLAR PHOTOVOLTAIC (PV) SYSTEMS
This Article has been extensively revised and updated

690.13(A) – The PV system disconnecting means shall be located in a readily accessible location. *Where disconnecting means of systems above 30-v are readily accessible to "unqualified" persons, any enclosure door or hinged cover that exposes live parts when open shall be "locked" or require a tool to open.*

Limit unintentional contact

690.15(A) Reads the same for Isolating PV Equipment

219 ☐ **TESLA POWERWALL HOME BATTERY SYSTEM**

220 ☐ **TESLA POWER WALL**

223 ☐ **690.12 RAPID SHUTDOWN OF PV SYSTEMS ON BUILDINGS**
PV system circuits *installed on or in buildings* shall include a rapid shutdown *function to reduce shock hazard for firefighters* in accordance with 690.12(A) through (D). UL3741

224 ☐ **690.12(B)(1)(2) RAPID SHUTDOWN FOR PV SYSTEMS *ON OR IN* BUILDINGS FOR FIREFIGHTERS**
Outside the boundary = >3' from the array, from point of entry, requires rapid shutdown.
Inside the boundary = <1 from array, requires rapid shutdown.
PV Hazard Control System / <80v in 30seconds / or integrated roof shingles / UL 3741 Standard

225 ☐ **LABEL FOR ROOF MOUNTED PV SYSTEMS WITH RAPID SHUTDOWN**

226 ☐ **FIRE PUMPS**
695.3(C)(2) SELECTIVE COORDINATION
Expanded Requirement (Revised)

Overcurrent protective device(s) shall be selectively coordinated with *all* supply-side

overcurrent protective devices(s).

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, maintain, and operate the system.

Similar to 700.32 Emergency Systems

227 ☐ **CHAPTER 7**

Special Conditions

Article 700 – Emergency Systems

Article 725 – Class 1, 2, & 3 Power Limiting Cables

Article – 760 Fire Alarm Systems

228 ☐ **700.2 EMERGENCY SYSTEMS**

N Emergency Systems. *This definition shall apply within this article and throughout the Code.*

Informational Note: Emergency systems are generally installed in places of assembly where artificial illumination is required for safe exiting and for panic control in buildings subject to occupancy by large numbers of persons, such as hotels theaters, sports arenas, healthcare facilities, and similar installations. Emergency systems may also provide power for such functions as ventilation where essential to maintain life, fire detection and *alarm systems*, elevators, fire pumps, public safety communications systems, industrial processes where current interruption would produce serious life-safety or health hazards, and similar functions.

Definition Modified / Clarified!

229 ☐ **ARTICLE 700 – PART 4**
EMERGENCY SYSTEM CIRCUITS
FOR LIGHTING AND POWER

700.16 Emergency Illumination – Rewritten (Clarification)

N (B) *System Reliability*. Emergency lighting systems shall be designed and installed *so that the failure of any illumination source* cannot leave in total darkness any space that requires emergency illumination. Control devices in the emergency lighting system shall be listed for use in emergency system. Listed unit equipment in accordance with 700.12(F) shall be

considered as meeting the provisions of this section.

Removed reference to burning out of a lamp
(due to the use of LED's luminaires)

230 ☐ ***N* 700.32 SELECTIVE COORDINATION**
INFORMATIONAL NOTE

Informational Note: See Informational Note Figure Note 701.32 for an example of how legally required standby system overcurrent protective devices (OCPDs) selectively coordinate with all supply-side OCPDs.

OCPD "D" selectively coordinates with OCPD's C, F, E, B, and A.

OCPD "C" selectively coordinates with OCPD's F, E, B, and A.

OCPD "F" selectively coordinates with OCPD E.

OCPD "B" is not required to selectively coordinate with OCPD A because OCPD B is not a legally required standby system OCPD.

231 ☐ **ARTICLE 720 – CIRCUITS & EQUIPMENT OPERATING AT LESS THAN 50 VOLTS**

720.1 Scope. This article covers installations operating at less than 50 volts, direct current or alternating current.

720.2 Other Articles. Direct current or alternating-current installations operating at less than 50 volts, as covered in Articles 411, 517, 551, 552, 650, 669, 690 and 760.... "Parts I, II, and III of Article 725, *shall not be required to comply with this article*".

232 ☐ **ARTICLE 725 CLASS 1, 2, & 3 REMOTE CONTROL, SIGNALING & POWER LIMITED CIRCUITS**

There are two types of Class 1 circuits:

1. Power-limited; supplied by a transformer, limited to 30v and 1000VA, have a current limiter (OCPD) that limits the amount of supply current on the circuit, due to an overload, short-circuit or ground-fault.

2. Remote-control & signaling; maximum voltage is 600 and limited on the power output of the source.

Note: Class 1 circuits are permitted to occupy the same cable, raceway or enclosure of power and lighting circuits (whether A/C or D/C), when installed in associated equipment, and conductors are properly insulated. (watch de-rating).

233 ☐ **CLASS 2 & 3 CIRCUITS**

Both Class 2 & 3 circuits have power limitations as identified in Chapter 9 of the 2020 National Electrical Code;

Table 11(a) Alternating Current Limitations

Table 11(b) Direct Current Limitations

Class 2 Note: Typical operating voltage is 48v, not exceeding 100VA, with a listed power supply. (limited in length due to voltage drop)

Class 3 Note: Have higher current thresholds than Class 2 circuits, therefore have additional requirements. (can run longer lengths than Class 2 circuits)

234 ☐ **725.144 TRANSMISSION OF POWER & DATA**

New in 2017 NEC

Typically, referred as Power over Ethernet (PoE). A common use is for video cameras, that have a class 2 power supply, that will also utilize conductors within the same cable for video transmission (network cable).

Ampacity ratings of these cables are based on 86°F. As current flow in these bundled or bunched cables can increase the temperature and therefore can degrade the insulation of the cables (overheating).

Generally operating @ 48v / connectors rated @ 1.3 amperes maximum

235 ☐ **POE TERMINOLOGY**

- IEEE 802.3 PoE Standard; *(48v and up to 15.4W)*

Typically, Cat 5 Cable contains 8 wires; as 4 twisted pairs of conductors 2 pairs are used for data (data pairs), 1 pair can be used for power 48v DC

PSE = Power Sourcing Equipment; Equipment that provides power to the cable. (WAP); Wired Access Points (IP); Security Cameras

PD = Powered Device; Device that receives power from the cable

PSE = Power Sourcing Equipment; Devices that send power and data over ethernet cable to a connected PD. (midpoint, endpoint or span); no additional power source required.

VOIP = Voice over internet phone; PoE is needed to power the phone, via the network.

236 ☐ **POWER OVER ETHERNET (POE) NEW IN THE 2017 NEC**

Applies to both Class 2 & Class 3 Circuits

IN #1 – Applies to *CCTV cameras*

IN #2 – Used in Powered *Communication systems*
IN #3 – 4 Pair copper balanced twisted conductors
IN #4 – Guidelines for supporting power delivery over balanced twisted conductors
IN #5 – Minimum Requirements for *PoE lighting systems*
IN #6 – Rated current for power sources; designed to deliver

237 ☐ **725.144 TRANSMISSION OF POWER & DATA**

Power over Ethernet (PoE)

Section 725.144(A) & (B) shall apply to Class 2 & Class 3 circuits that transmit power and data to a powered device. Section 300.11 and Parts I and III of Article 725 shall apply to Class 2 & Class 3 circuits that transmit power and data. Conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

238 ☐ **NETWORK CABLES THAT CARRY ELECTRIC POWER**

239 ☐

240 ☐

241 ☐ **ADDITIONAL USES**

Integrating Building Systems

Heating, Ventilation & A/C Systems (VAV Boxes)
Lighting System Sensors
Security Camera Systems
Automation, Control Systems & Energy Savings
Refer to Chapter 9 Tables 11(a) & (b)

242 ☐ **CLASS 2 & CLASS 3 NETWORK CABLING**

Data and Power Circuits

1.Cable Listing & Compliance
2. Structured Cabling
3. Data Centers
4. Power over Ethernet (PoE)
5. Uses Cat 5 or Cat 6 Cable

243 ☐ **EXAMPLES OF CAT 5 / 6 CABLES / USES**

244 ☐ **CHAPTER 8**

Communications Systems

N Article 805 – Communication Circuits

245 ☐ **ARTICLE 805 (NEW)**
GENERAL REQUIREMENTS FOR COMMUNICATION SYSTEMS
General info for Articles;

800, 820, 830 and 840 combined in one location.

800 – Communication Circuits
820 – CATV & Radio Dist. Systems
830 – Network Powered Broadband Comm. Systems
840 – Premises-Powered Broadband Comm. Systems

246 ☐ **CHAPTER 9**
Tables

Table 1 – Conduit Fill

Informative Annex I – Recommended Tightening Torque Tables from UL Standard 486A – 486B

247 ☐ **CHAPTER 9 – TABLES**
Table 1

Conduit Fill / Cross Sectional Area (%)

1 Conductor = 53% Cross Sectional Fill
2 Conductors = 31% Cross Sectional Fill
Over 2 Conductors = 40% Cross Sectional Fill

Notes to Tables:

(3) EGC's / bonding conductors *to be included* in calculating conduit fill

(4) Where conduit or tubing nipples having a maximum length not to exceed *24"* are installed between boxes, cabinets, and similar enclosures, the nipples shall be permitted to be filled to *60%* of their cross-sectional area, and 310.15(C)(1) adjustment factors need not apply to this condition. *(no de-rating required)*

248 ☐ **2020 NEC COMMERCIAL OVERVIEW**

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)

- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

249 ☐ **2020 NEC RESIDENTIAL OVERVIEW**

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

250 ☐ **2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES**

Thank You!

CURRENT ADOPTED CODES

July 01, 2019

Current Adopted Codes in Ohio – (2017)

Non-Residential Construction (4- Family and Above)

2017 Ohio Building Code (Based on the 2015 International Building Code)
2017 Ohio Mechanical Code (Based on the 2015 International Mechanical Code)
2017 Ohio Plumbing Code (Based on the 2015 International Plumbing Code)
2017 Ohio Fire Code (Based on the 2015 International Fire Code)
2017 NFPA 70 – National Electrical Code (Effective 11 01 2017)
2016 NFPA 13 – Standard for Installation of Sprinkler Systems
2016 NFPA 72 – National Fire Alarm and Signaling Code
2015 International Fuel Gas Code
2012 International Energy Conservation Code / ASHRAE 90.1 2010
ICC / ANSI A117.1 2009 Accessible & Usable Buildings and Facilities

Residential Construction (1, 2 and 3- Family Dwellings)

2019 Residential Code of Ohio (Based on the 2018 International Residential Code)
2017 Ohio Plumbing Code
2017 NFPA 70 – National Electrical Code w/ amendments (07.01.2017)
2018 International Energy Conservation Code

March 24, 2020

Current Adopted Building Codes in West Virginia

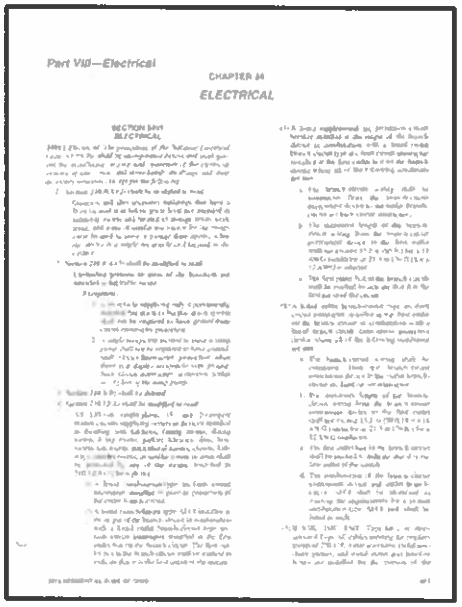
The State of West Virginia Fire Commission has adopted statewide the 2015 ICC (International Code Council), family of Codes for any jurisdiction that chooses to enforce building codes. Check locally for enforcement information / details.

2015 International Building Code (IBC)
2009 International Energy Conservation Code (IECC)
2015 International Existing Building Code (IEBC)
2015 International Fuel Gas Code (IFGC)
2015 International Mechanical Code (IMC)
2015 International Plumbing Code (IPC)
2012 International Property Maintenance Code (IPMC)
2015 International Residential Code (1- & 2- Family) (IRC)
2015 International Swimming Pool & Spa Code (ISPSC)

2015 NFPA 1 – Fire Code (Effective 07.01.2019)
2015 NFPA 101 – Life Safety Code (Effective 07.01.2016)
2017 NFPA 70 – National Electrical Code (Effective 03.24.2020)

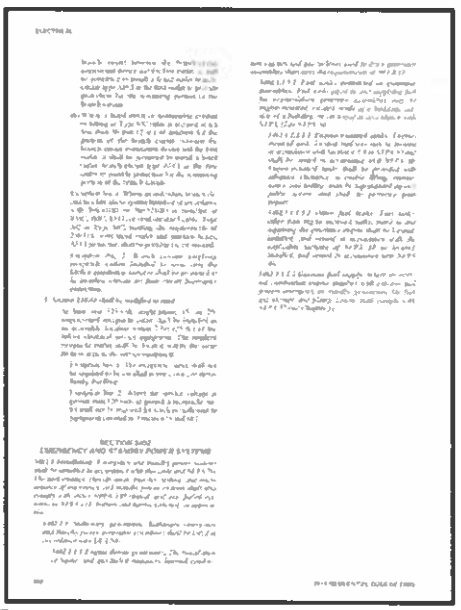
2

2019 RESIDENTIAL CODE OF OHIO


Part VIII—Electrical

CHAPTER 34

ELECTRICAL



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www.ta191.com
2020 "Proposed" National Electrical Code (NEC) Changes & Updates
Training Agency #191
150 Maplecrest Street SW
North Canton, Ohio 44720
330.497.6309 Phone
John M. Labriola
www.ta191.com
2020

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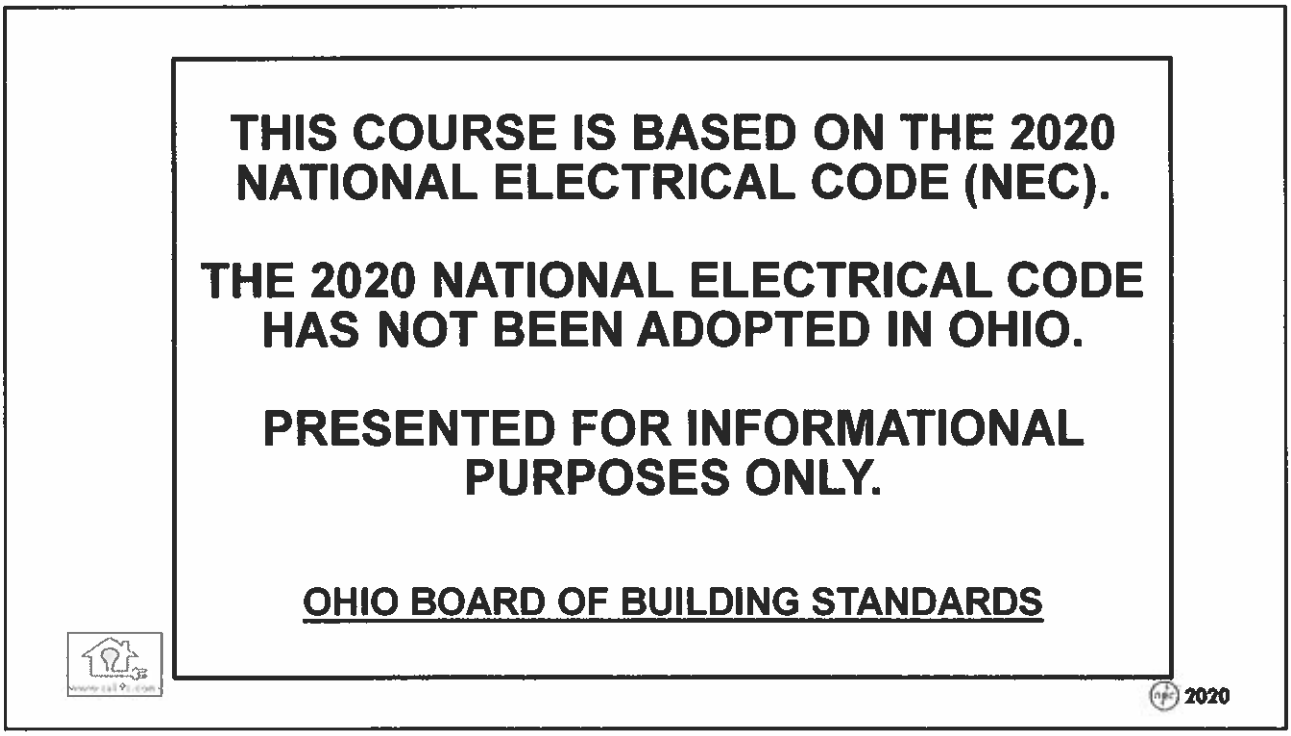
THIS COURSE IS BASED ON THE 2020 NATIONAL ELECTRICAL CODE (NEC).
THE 2020 NATIONAL ELECTRICAL CODE HAS NOT BEEN ADOPTED IN OHIO.
PRESENTED FOR INFORMATIONAL PURPOSES ONLY.
OHIO BOARD OF BUILDING STANDARDS
2020

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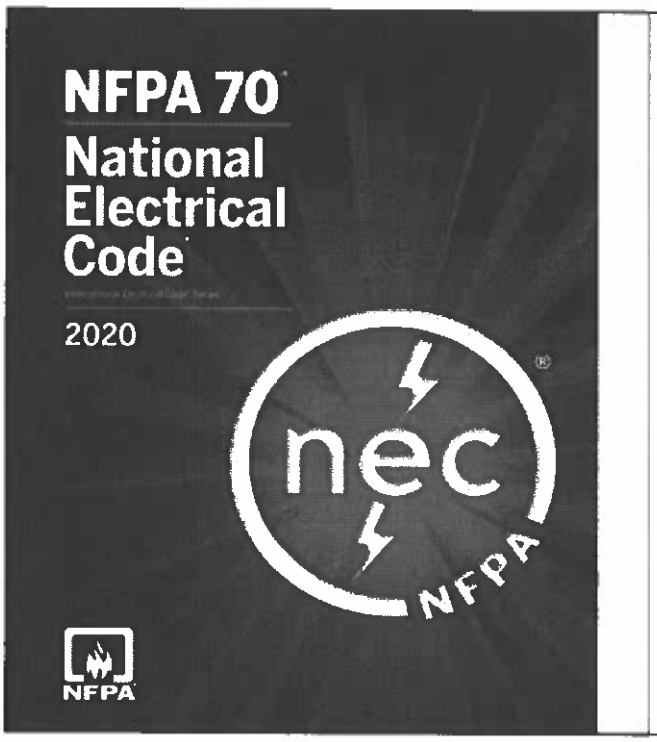

"PROPOSED" CHANGES & UPDATES TO THE 2020 NATIONAL ELECTRICAL CODE (NEC)

Subject to the local or State adoption authority

2020

6

CHAPTER 6

Special Equipment

Article 620 – Elevators, Dumbwaiters, Escalators....

Article 625 – Electric Vehicle Power Transfer System

Article 645 – Information Technology Equipment

Article 680 – Swimming Pools, Fountains, & Similar Installations

Article 690 – Solar Photovoltaic (PV) Systems

Article 695 – Fire Pumps

For Informational Purposes Only

2020

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N 620.6 GFCI PROTECTION FOR PERSONNEL

New Section

Ground- Fault Circuit- Interrupter Protection for Personnel

Each 125-v, 1ø, 15 and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters, ... shall be of the GFCI type.
Re: 620.85 2017 NEC

Added ***machinery spaces*** / to have GFCI protection of 125-v receptacles

A permanently installed sump pump ***shall*** be permanently wired or **shall be supplied by a single receptacle that is GFCI protected.**

Hardwired sump pumps; GFCI protection not required!

Not Current Code in Ohio

2020

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N 620.65 SELECTIVE COORDINATION "SIGNAGE"

Equipment enclosures containing selectively coordinated overcurrent devices shall be legibly marked in the field to indicate that the overcurrent devices are selectively coordinated. The marking shall meet the requirements of 110.21(B), shall be readily visible, and shall state the following:

"CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED"

Applies to where more than one driving machine disconnect is supplied by the same source!

For Informational Purposes Only

2020

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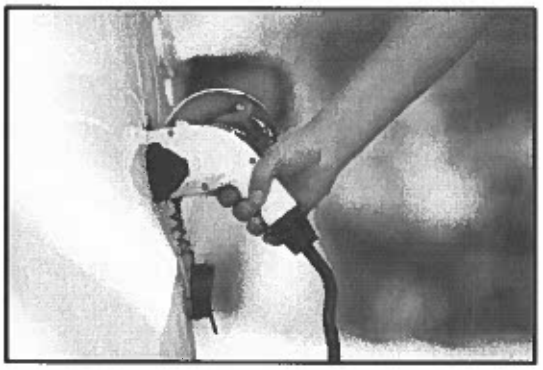
08.05.2021 PRESIDENT JOE BIDEN SIGNS EXECUTIVE ORDER



President Biden signs executive order (goal), that 50% of vehicles sold in the US to be EV's by 2030. Intended to cut carbon emissions.

Currently 2%

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NEW - EV CHARGING STATIONS

Federal Government Initiative – Infrastructure Plan

Construct 500,000 new charging stations throughout the USA

DOE Goal: 40 Level 2 charging ports / 1000 EVs

3.4 DC fast charging ports / 1000 EVs

5 Billion Dollars / 10,000 For each State

5,000,000,000 / 500,000 = 10,000 each

By the year 2030 number of EVs expected to be 35 million

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ARTICLE 625 – ELECTRIC VEHICLE POWER TRANSFER EQUIPMENT

N 625.2 Definitions

Electric Vehicle Connector. – A device that, when electrically coupled (conductive or inductive) to an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of power transfer and informational exchange.

Electric Vehicle Power Export Equipment (EVPE). – The equipment, including the outlet on the vehicle, that is used to provide electrical power at voltages greater than or equal to 30Vac or 60Vdc to loads external to the vehicle, using the vehicle as the source of supply.

Not Current Code in Ohio

2020

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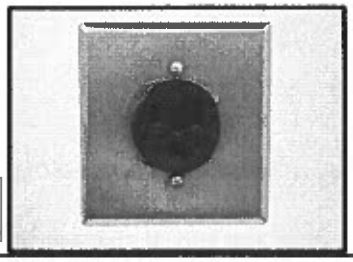
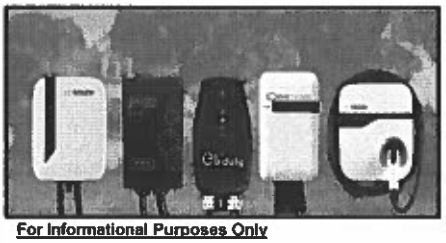
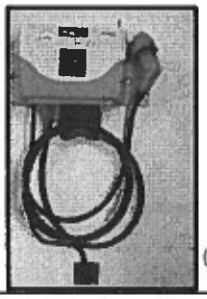
Δ 625.54 GFCI PROTECTION FOR PERSONNEL

In addition to the requirements in 210.8, all **receptacles installed for the connection of electric vehicle charging shall have ground-fault circuit-interrupter protection for personnel. (Type A)**







For Informational Purposes Only

2020

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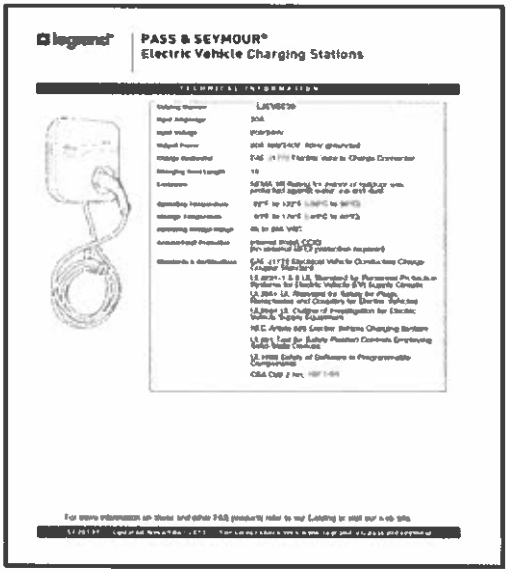
P&S LEGRAND EV CHARGING STATION



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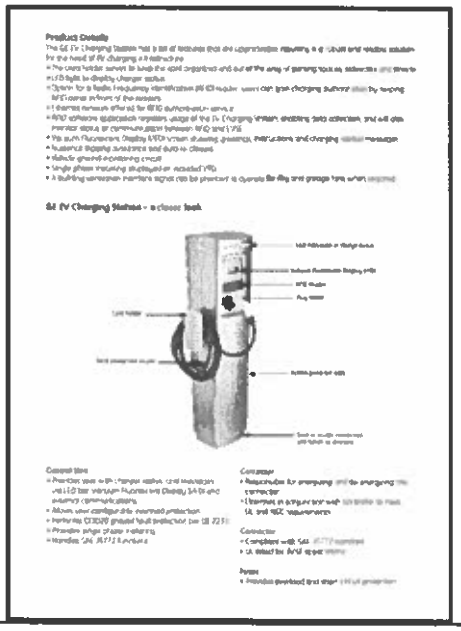
GE CHARGING STATION DETAILS



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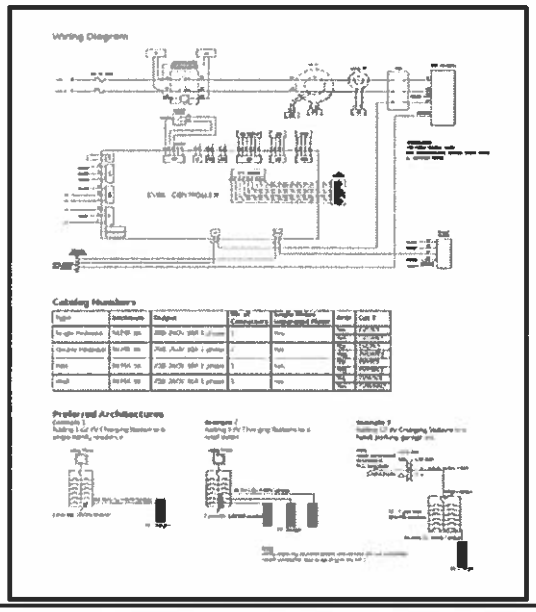
GE EV WIRING DIAGRAM



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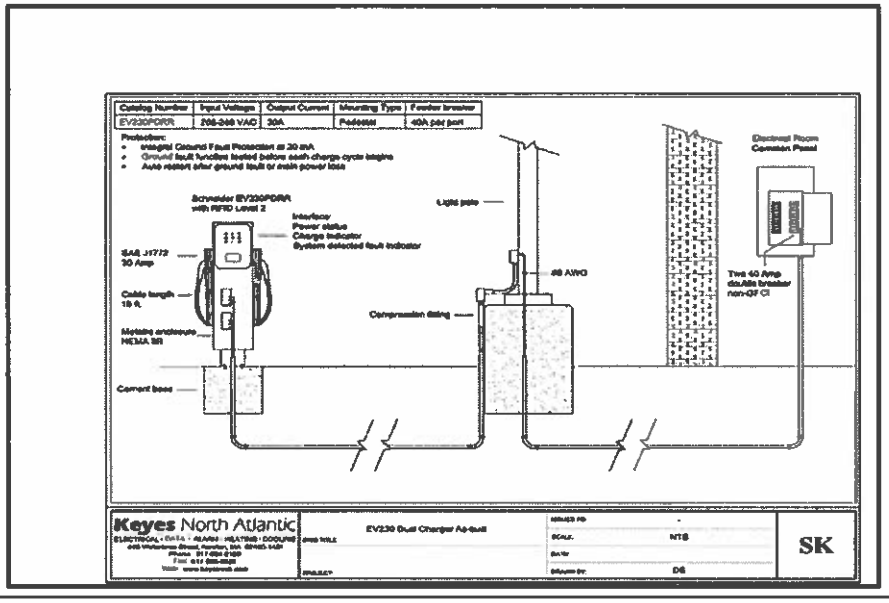
CHARGING STATION 1-LINE DRAWING



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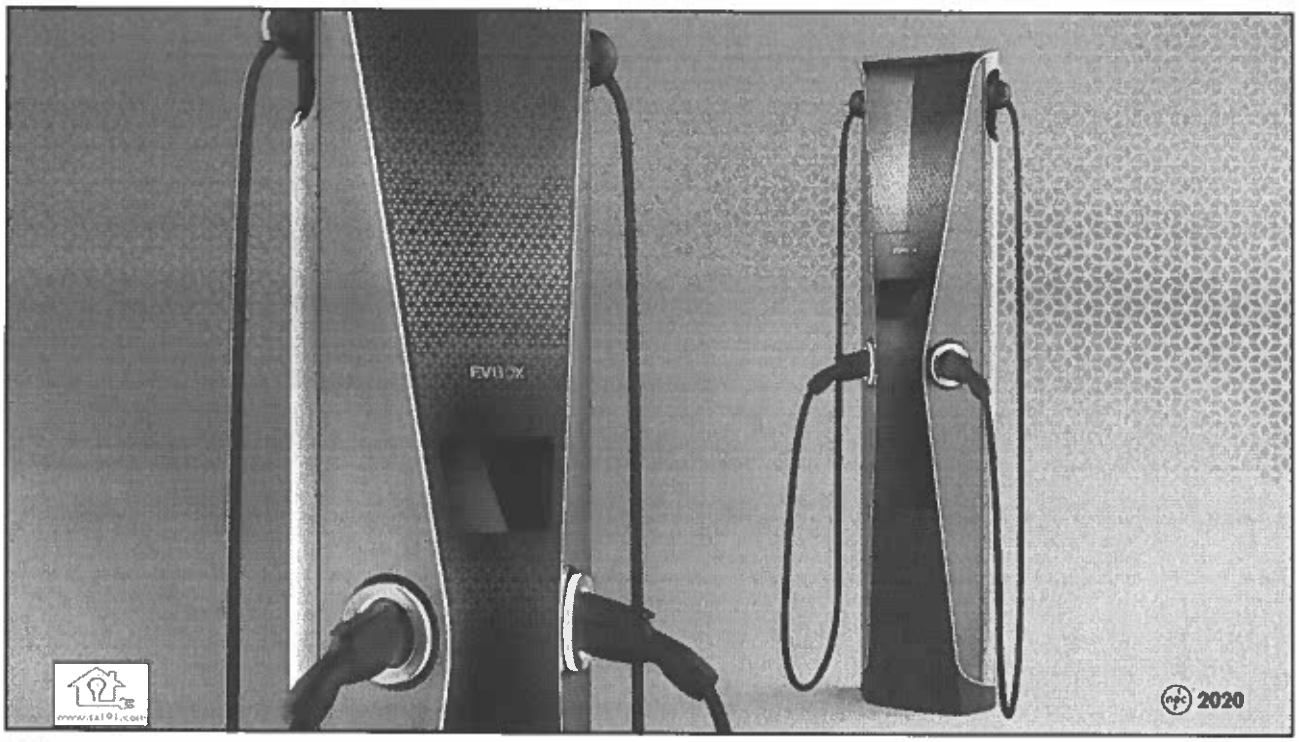

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SemaConnect

Series 8 EV Charging Station
Technical Specification

Power Specs	
AC Power Output, maximum (per port)	Level II: 7.2kW (240 VAC@30A)
AC Power Input (per port)	Level II: 3Ø4, Line 1, Line 2 and GND (no neutral)
Ports Per Charging Station	Two
Vehicle to Charger Connection (per port)	SAE J1772 EV Connector, 18ft Cable
Energy Metering Accuracy	+/- 1%
Standby Power	6.5 W typical
Service Panel Breaker (per port)	Dual-pole trip 40A breaker, dedicated circuit
Safety Specs	
Safety, Ground Fault Circuit Interrupt	20mA CCID with auto retry (every 15 seconds)
Automatic Plug Out Detection	Pen terminated per SAE J1772 spec; SAE/small
General Safety Compliance	UL 2231-1, 2231-2, UL 2594 and NEC Article 625
Network Specs	
Data Communication Cellular	Cellular 4G LTE
Network Communication Protocol	OCPP
Network Security	HTTPS; WSS; 128 bit AES Encryption
Communication Device Specs	
LED Array	High visibility, multi-color visual status indicator
Display	Color LCD, 480 x 272
Operating Temperature	-30 degree C to +50 degree C ambient
Environmental Specs	
Outdoor Rated	NEMA 3R
Operating Humidity	Up to 95% non-condensing
Operating Temperature	-30 degree C to +50 degree C ambient
Other Specs	
Surge Protection	6kV@3 000A
EMI Compliance	FCC Part 15 Class A
Dimensions	11" H x 23" W x 7.5" D
Approximate Shipping Weights	Head Unit and Cable – 28 lbs Pedestal Mount – 8 lbs Wall Mount – 10 lbs
Installation	Indoor / Outdoor
Wall and Cable Mount	Integrated

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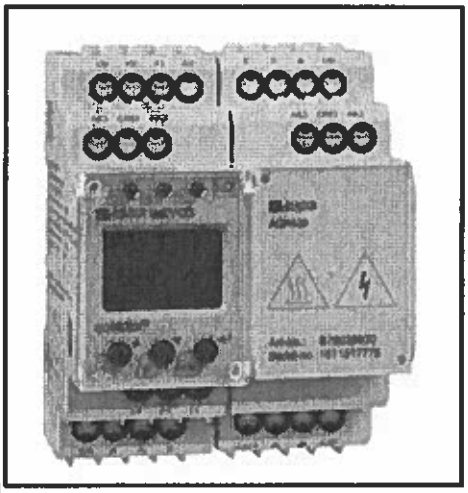
EV CHARGING STATIONS



Manufactured Charging Stations

Inherent (Built-in) GFCI protection

20mA CCID "Type C" Protection

CCID = Charge Current Interrupting Device

2020

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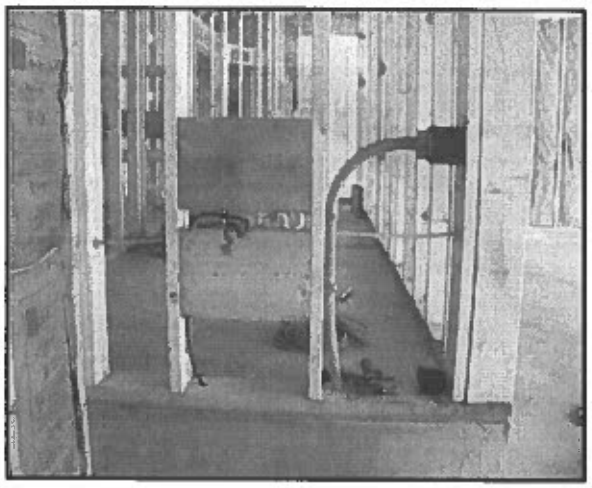
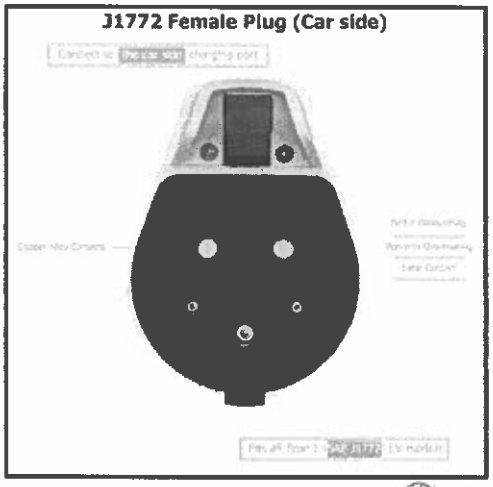
ELECTRIC VEHICLE RECEPTACLE ROUGH-IN





2020

Not Current Code in Ohio

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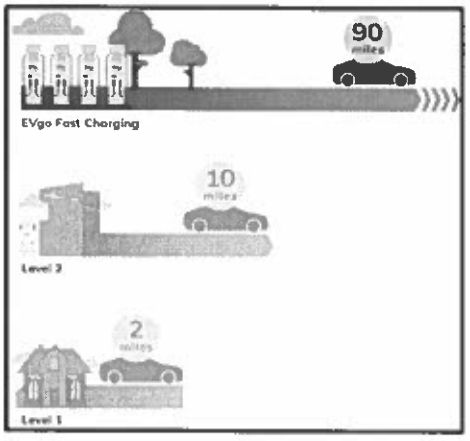
ARTICLE 625 ELECTRIC VEHICLE POWER TRANSFER SYSTEM

30 Minute Charge



Estimated Charging Cost:

Charging Station Fees

- **Fast Charge $1.50 minute**
- **Approximately .30 minute for Level 1 or Level 2**
- **Typically, a Tesla vehicle will require a separate adapter or specific Tesla charging station**

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PUBLIC EVSE STATIONS / PORTS BY STATE (DOE)
US / LEVEL 1 – 1,331 / LEVEL 2 – 86,095 / DC FAST 18,895

- Ohio – 770 / 1,680
- West Virginia – 88 / 254
- Virginia – 898 / 2,471
- Pennsylvania – 1,008 / 2,377
- Kentucky – 163 / 388
- Indiana – 294 /810
- Illinois – 875 / 2,192
- North Carolina – 918 / 2,158
- Tennessee – 584 / 1,334

- California – 13,088 / 33,461
- New York – 2,563 / 6,235
- Florida – 2,256 / 5,529
- Texas – 2,077 / 4,849
- Massachusetts – 1,771 / 3,916
- Washington – 1,518 / 3,716
- Georgia – 1,483 / 3,669
- Colorado – 1,363 / 3,208
- Entire US – 43,413 / 106,321

197

TOTAL STATION LOCATIONS COUNTS IN US

Alternative Fuel Types:

- Biodiesel – 313
- CNG – 851
- E85 – 3,905
- Electric – 43,413 / 106,321
- Hydrogen – 49
- LNG – 55
- Propane – 1,233 Primary / 1,243 Secondary / Total 2,576

Total 114,070

198

N 625.60 AC RECEPTACLE OUTLETS USED FOR EVPE

EVPE = Electric Vehicle Power Export Equipment

AC receptacles installed in electric vehicles and intended to allow for connection of off-board utilization equipment shall comply with 625.60 (A) – (D).

- **(A) Type. The receptacle shall be listed**
- **(B) Rating. Outlet shall be rated 250-v max, 1ø, 50a max**
- **(C) Overcurrent Protection. Integral to power export system**
- **(D) GFCI Protection for Personnel. All receptacles shall be GFCI protected, indication and reset shall be accessible**

Not Current Code in Ohio

2020

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2022 FORD F-150 LIGHTNING PICK-UP

All-Electric. All F-150

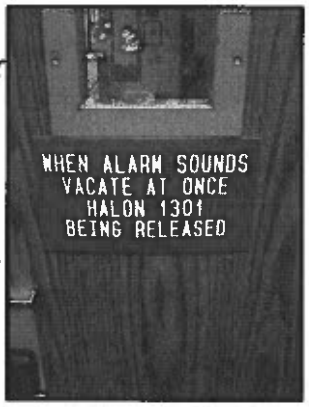
Available features include Backup Power that can provide full-home power for up to 3 days, on a fully charge battery and 80-amp Ford Charge station Pro. *When home is properly equipped & home transfer switch disconnects home from the grid*. Based on 30 kWh used per day. Turn your truck into a generator. Pro Power Onboard offers an available 9.6kw max power provided through 11 outlets. (4) 120v outlets in front trunk, (2) in the cab (4) in the bed, and (1) 240-v outlet for tougher tasks.

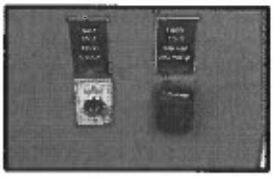
200

ARTICLE 645
INFORMATION TECHNOLOGY EQUIPMENT

645.5 Supply Circuits and Interconnecting Cables

Δ **645.5 (E) Under Raised Floors.** Where the area under the floor is accessible and openings minimize the entrance of debris beneath the floor, power cables, ***communications cables,*** connection cables, interconnecting cables, cord-and-plug connections and receptacles with the IT equipment. ***Typically protected with a Halon (clean agent) fire suppression system or Fm200 system.***





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THERE ARE "8" PARTS TO ARTICLE 680

Part 1 **General** (Page 564)

Part 2 **Permanently Installed Pools** (Page 567)

Part 3 **Storable Pools, Spas, Hot Tubs** (Page 573)

Part 4 **Spas, Hot Tubs & Immersion Pools** (Page 574)

Part 5 **Fountains** (Page 576)

Part 6 **Pools and Tubs for Therapeutic Use** (Page 578)

Part 7 **Hydromassage Bathtubs** (Page 578)

Part 8 **Electrically Powered Pool Lifts** (Page 579)

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680.2 NEW DEFINITIONS

N Corrosive Environment. ***Areas where pool sanitation chemicals are stored, handled, or dispensed, and confined areas under decks adjacent to such areas, as well as areas with circulation pumps, automatic chlorinators, filters, open areas under decks adjacent to or abutting the pool structure, and similar locations. (Refer to 680.14)***

N Immersion Pool. **A pool for ceremonial or ritual immersion of users, which is designed and intended to have its contents drained or discharged.**

N Splash Pad. ***A fountain with a pool depth of 1" or less, intended for recreational use by pedestrians. This definition does not include showers intended for hygienic rinsing prior to use of a pool, spa, or other water feature.***

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680.2 / 680.50 SPLASH PAD

NEW Definition / Requirements

Definition: A fountain with a pool depth of 1" or less, intended for recreational use by pedestrians.

Requirements of splash pads will need to comply with Parts I (***general***), II (***permanently installed pools***), and V (***fountains***) of Article 680

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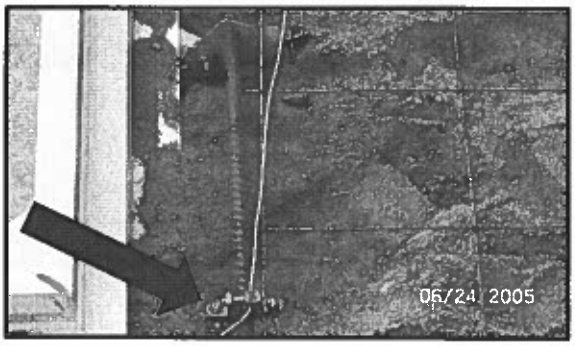
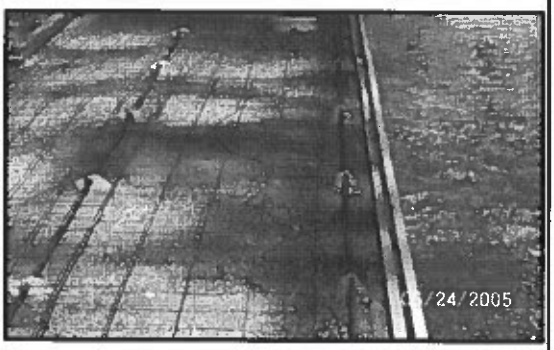
N 680.4 INSPECTION AFTER INSTALLATION

N Section

The authority having jurisdiction shall be permitted to require periodic inspection and testing.





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680.21 MOTORS

Δ **680.21 Wiring Methods.** The wiring to a pool motor shall comply with 680.21(A)(1) unless modified for specific circumstances to (A)(2) or (A)(3).

Δ **680.21 (A)(1) General.**
Wiring methods installed in a corrosive environment shall comply with **(680.14)** or shall be Type MC cable listed for the location, wiring methods in these locations shall include an insulated equipment grounding conductor, sized per Table (250.122), but not smaller than 12 AWG.

Where installed in noncorrosive environments, the wiring methods of branch circuits shall comply with the general requirements of Chapter 3.

2017 NEC Removed Interior of 1-Family

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2020

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ARTICLE 680.21(C) – PART II.

PERMANENTLY INSTALLED POOLS

Expanded GFCI Protection of Pool Motors

Outlets supplying ***all*** pool ***motors on branch circuits rated 150-v or less to ground and 60 amperes or less, single or 3-phase shall be provided with Class "A"*** ground-fault circuit-interrupter protection.

Was 120-v through 240-v motors / + added 3-phase Motors

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ARTICLE 680.22
RECEPTACLE OUTLET LOCATIONS

2020 NEC; 15 and 20- ampere 125-v Outlets

680.22 (A)(1) – Required Outlet; (1) <6' – >20'

680.22 (A)(2) – Circulation pump; <6'

680.22 (A)(3) – Other Receptacles; – <6'

680.22 (A)(4) – GFCI Protection; – All 15 & 20a; within 20'

N **680.22(A)(5) – Pool Equipment Room; (1) GFCI outlet**

680.34 – Storable pool, Spa, & Hot Tub outlets; – 6 '

680.43 (A) – Indoor Spa & Hot Tub outlets; <6' – >10'

680.62 (E) – Therapeutic Tubs and pools – 6'

680.71 – Hydromassage Bathtubs – 30a or less; 6'

Type "A" GFCI Protection Required

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680.23(F) UNDERWATER LUMINAIRES

Branch Circuit Wiring for Underwater Luminaires

Branch circuits supplying underwater luminaires (Refer to 680.2) ***shall*** *include an insulated equipment grounding conductor, minimum size #12 CU. (Only permitted wiring methods are RMC, IMC, PVC and RTRC. (Refer to 680.14)*

Relaxing the requirements; Only the portion of the branch circuit in the "corrosive environment" requires an insulated equipment grounding conductor.

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2020

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680.26 EQUIPOTENTIAL BONDING (B)(2) PERIMETER SURFACES.

Copper Ring. Was alternative means.

(1) Minimum #8 bare solid CU conductor.
(2) Follow contour of pool perimeter surface
(3) Listed ***splicing devices or exothermic welding***
(4) 18" – 24" from the inside wall of the pool
(5) Secured under 4" – 6" below the subgrade

(C) Copper Grid.

(1) #8 bare solid CU conductor
(2) Follow contour of pool; 3' horizontally beyond pool
(3) Only listed splicing devices or exothermic welding
(4) Secured under 4" to 6" below the subgrade

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"VOLTAGE GRADIENTS"

- Corrected the wording regarding the performance and design of the Equipotential Bonding Grid.
- Replaced the word ***eliminate*** (which may be impossible to achieve) to the realistic term of ***"reduce"*** voltage gradients.
- ***The goal would be to keep the pool and all surrounding areas at or near the same potential.***

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680.31 / 32 STORABLE POOLS

Manufacturer Requirement

*Cord-connected pool filter pumps **"shall"** be provided with a ground-fault circuit interrupter that is an integral part of the attachment plug or located in the power supply cord within 12" of the attachment plug.*

Contractors Note: You are responsible to provide GFCI protection for the filter pump as well, if you add a new circuit, or replace a device on an existing circuit! Homeowners can and will plug the filter pump into a non-GFCI protected outlet.

Not Current Code in Ohio

2020

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680.35 STORABLE & PORTABLE IMMERSION POOLS

N **New Section / Requirements**

(A) Cord Connection
(B) Pumps
(C) Heaters
(D) Audio Equipment
(E) Luminaires, Lighting Outlets & Fans
(F) Switches
(G) Receptacles

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680.45 IMMERSION POOLS

N **New Section / Requirements**

(A) Cord and Plug Connections
(B) Pumps
(C) Heaters
(D) Audio Equipment

Not Current Code in Ohio

2020

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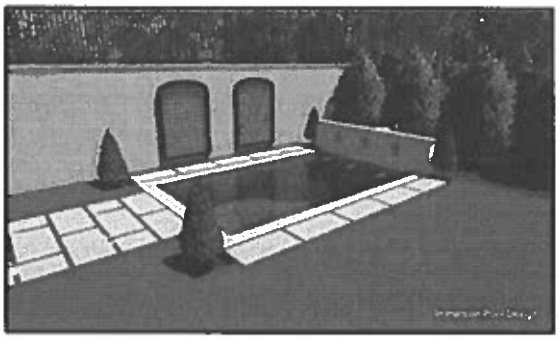
680.35 / 680.45 IMMERSION POOLS

NEW / & Clarification Info

680.35 Storable / portable immersion pools.

680.45 Permanently installed immersion pools

Addressing both custom built (on-site) and pre-packaged units.



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680.59 GFCI PROTECTION FOR PERMANENTLY INSTALLED NON-SUBMERSIBLE PUMPS

Re: Fountains / New Section

Outlets supplying all permanently installed non-submersible pump motors rated 250-v or less and 60a or less, 1ø or 3ø, shall be provided with ground-fault circuit interrupter protection.

Not Current Code in Ohio

2020

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680.74(A) BONDING

Re: Hydromassage Bathtubs

(3) Added metal raceways within 5'

(5) Non-current-carrying metal parts of electrical devices and controls that are not associated with the hydromassage tubs within 5'.

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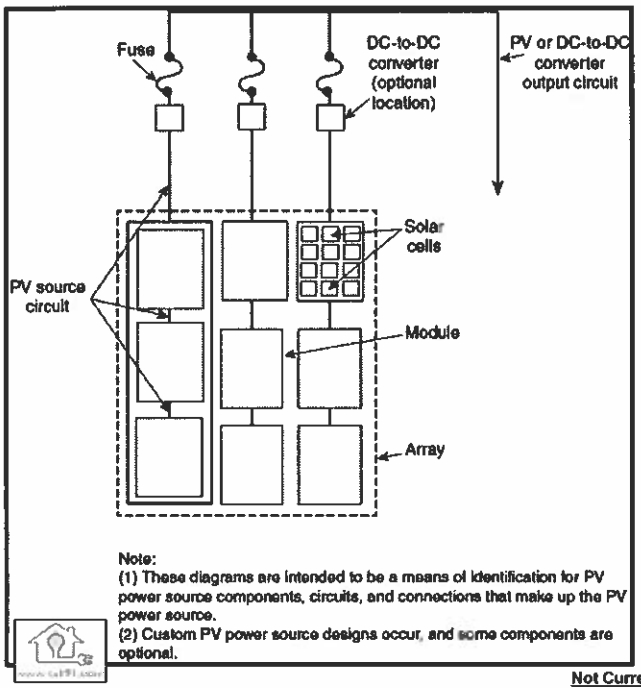

SOLAR PHOTOVOLTAIC (PV) SYSTEMS

690.1 Scope

This article applies to solar PV systems, other than those covered by Article 691, including the array circuit(s), inverter(s), & controller(s) for such systems. The systems covered by this article ***include those*** interactive with ***electric*** power production sources or stand-alone, ***or both.*** These PV systems may have ac or dc output for utilization.

2020

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690.8 CIRCUIT SIZING AND CURRENT

N 690.8(A)(2)
Circuits Connected to the Input of Electronic Power Converters

Where a circuit is protected with an overcurrent device not exceeding the conductor ampacity, the maximum current shall be permitted to be the rated input current of the electronic power converter input to which it is connected. *(Significant change for commercial installations)*

8.62 x 125% = 10.775a x (6) = 64.65a
#4 CU 2017 NEC

Input 33a x 125% = 41.25a

(6) 250-watt modules = (the string)

24 kW Inverter
75°C terminals
#8 CU / 50a ocd
41.25amps =
Continuous duty

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2020

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ARTICLE 690
SOLAR PHOTOVOLTAIC (PV) SYSTEMS

This Article has been extensively revised and updated

690.13(A) – The PV system disconnecting means shall be located in a readily accessible location. ***Where disconnecting means of systems above 30-v are readily accessible to "unqualified" persons, any enclosure door or hinged cover that exposes live parts when open shall be "locked" or require a tool to open.***

Limit unintentional contact

690.15(A) Reads the same for Isolating PV Equipment

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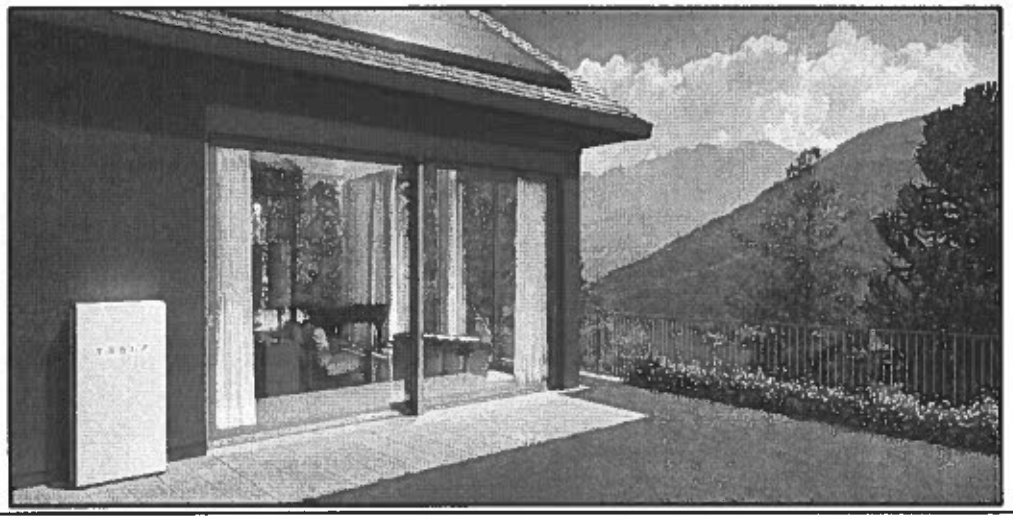
TESLA POWERWALL HOME BATTERY SYSTEM



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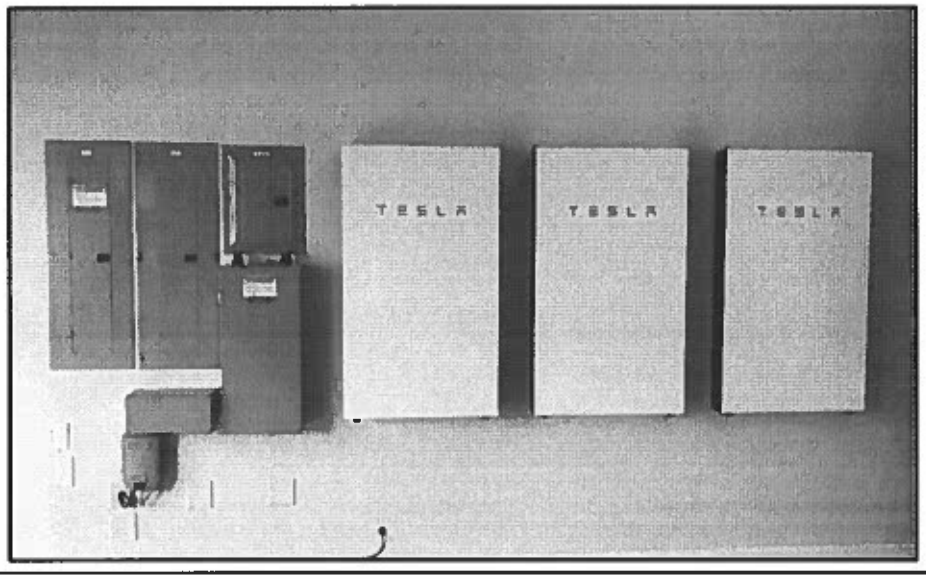
TESLA POWER WALL



2020

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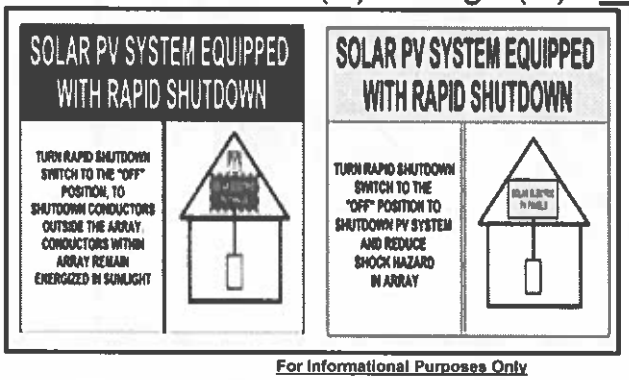
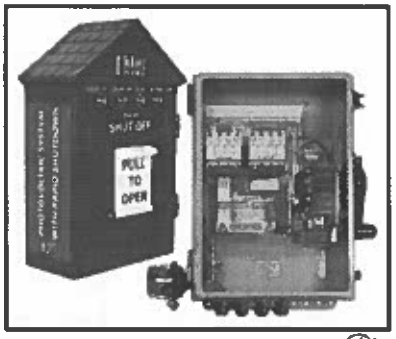
690.12 RAPID SHUTDOWN OF PV SYSTEMS ON BUILDINGS

PV system circuits ***installed <u>on</u> or <u>in</u> buildings*** shall include a rapid shutdown ***function to reduce shock hazard for firefighters*** in accordance with 690.12(A) through (D). **<u>UL3741</u>**





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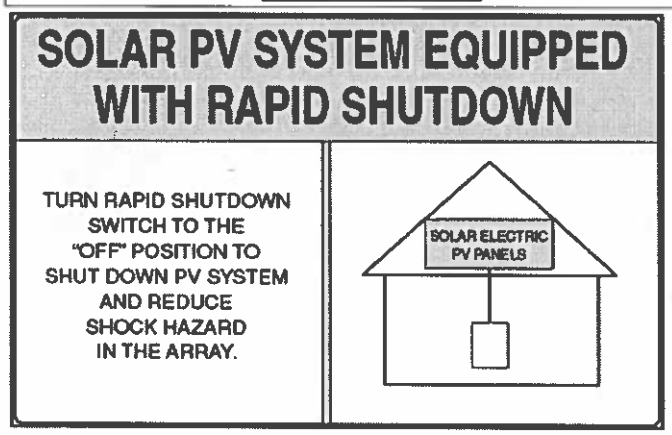
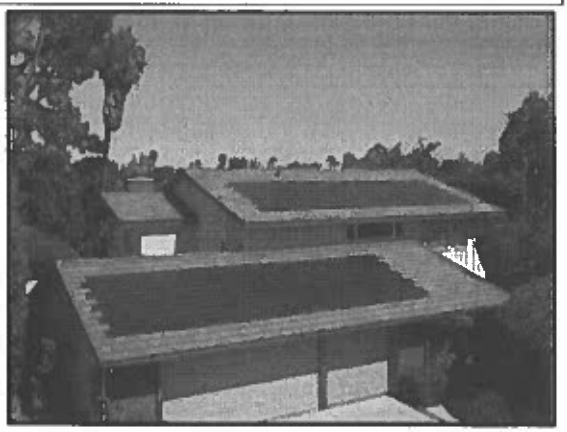
690.12(B)(1)(2) RAPID SHUTDOWN FOR PV SYSTEMS *<u>ON OR IN</u>* BUILDINGS FOR FIREFIGHTERS





Outside the boundary = >3' from the array, from point of entry, requires rapid shutdown.
Inside the boundary = <1 from array, requires rapid shutdown.
<u>PV Hazard Control System / <80v in 30seconds / or integrated roof shingles / UL 3741 Standard</u>

<u>Not Current Code in Ohio</u>

2020

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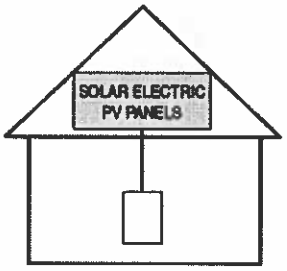
LABEL FOR ROOF MOUNTED PV SYSTEMS WITH RAPID SHUTDOWN

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY.



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FIRE PUMPS 695.3(C)(2) SELECTIVE COORDINATION

Expanded Requirement (Revised)

Overcurrent protective device(s) shall be selectively coordinated with ***all*** supply-side overcurrent protective devices(s).

Selective coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems. The selection shall be documented and made available to those authorized to design, install, maintain, and operate the system.

Similar to 700.32 Emergency Systems

Not Current Code in Ohio

2020

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CHAPTER 7

Special Conditions

Article 700 – Emergency Systems

Article 725 – Class 1, 2, & 3 Power Limiting Cables

Article – 760 Fire Alarm Systems

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700.2 EMERGENCY SYSTEMS

N **Emergency Systems.** ***This definition shall apply within this article and throughout the Code.***

Informational Note: Emergency systems are generally installed in places of assembly where artificial illumination is required for safe exiting and for panic control in buildings subject to occupancy by large numbers of persons, such as hotels theaters, sports arenas, healthcare facilities, and similar installations. Emergency systems may also provide power for such functions as ventilation where essential to maintain life, fire detection and ***alarm systems***, elevators, fire pumps, public safety communications systems, industrial processes where current interruption would produce serious life-safety or health hazards, and similar functions.

Definition Modified / Clarified!

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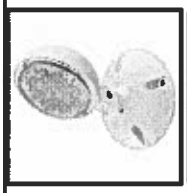
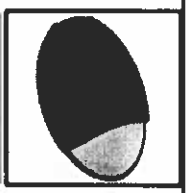


ARTICLE 700 – PART 4 EMERGENCY SYSTEM CIRCUITS FOR LIGHTING AND POWER



700.16 Emergency Illumination – Rewritten (Clarification)

N **(B)** ***System Reliability*****. Emergency lighting systems shall be designed and installed** ***so that the failure of any illumination source*** **cannot leave in total darkness any space that requires emergency illumination. Control devices in the emergency lighting system shall be listed for use in emergency system. Listed unit equipment in accordance with 700.12(F) shall be considered as meeting the provisions of this section.**

Removed reference to burning out of a lamp
(due to the use of LED's luminaires)

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N 700.32 SELECTIVE COORDINATION *INFORMATIONAL NOTE*

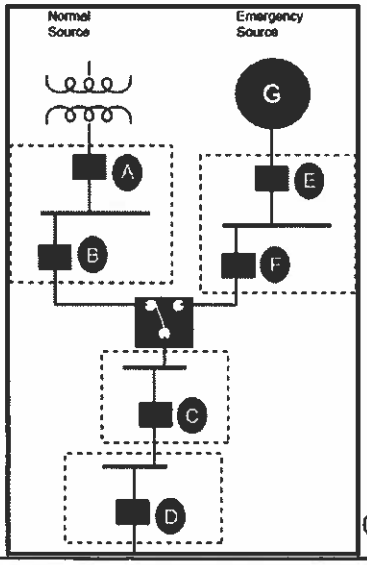
Informational Note: See Informational Note Figure Note 701.32 for an example of how legally required standby system overcurrent protective devices (OCPDs) selectively coordinate with all supply-side OCPDs.

OCPD "D" selectively coordinates with **OCPD's C, F, E, B, and A**.

OCPD "C" selectively coordinates with **OCPD's F, E, B, and A**.

OCPD "F" selectively coordinates with **OCPD E**.

OCPD "B" is not required to selectively coordinate with OCPD A because OCPD B is not a legally required standby system OCPD.



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ARTICLE 720 – CIRCUITS & EQUIPMENT OPERATING AT LESS THAN 50 VOLTS

720.1 Scope. This article covers installations operating at less than 50 volts, direct current or alternating current.

720.2 Other Articles. Direct current or alternating-current installations operating at less than 50 volts, as covered in Articles 411, 517, 551, 552, 650, 669, 690 and 760.... "Parts I, ***II***, and III of Article 725, ***shall not be required to comply with this article***".

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2020

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ARTICLE 725 CLASS 1, 2, & 3 REMOTE CONTROL, SIGNALING & POWER LIMITED CIRCUITS

There are two types of Class 1 circuits:

1. **Power-limited**; supplied by a transformer, limited to 30v and 1000VA, have a current limiter (OCPD) that limits the amount of supply current on the circuit, due to an overload, short-circuit or ground-fault.
2. **Remote-control & signaling;** maximum voltage is 600 and limited on the power output of the source.

Note: Class 1 circuits are permitted to occupy the same cable, raceway or enclosure of power and lighting circuits (whether A/C or D/C), when installed in associated equipment, and conductors are properly insulated. (watch de-rating).

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CLASS 2 & 3 CIRCUITS

Both Class 2 & 3 circuits have power limitations as identified in Chapter 9 of the 2020 National Electrical Code;

Table 11(a) Alternating Current Limitations

Table 11(b) Direct Current Limitations

Class 2 Note: Typical operating voltage is 48v, not exceeding 100VA, with a listed power supply. (limited in length due to voltage drop)

Class 3 Note: Have higher current thresholds than Class 2 circuits, therefore have additional requirements. (can run longer lengths than Class 2 circuits)

2020

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725.144 TRANSMISSION OF POWER & DATA

New in 2017 NEC

Typically, referred as Power over Ethernet **(PoE)**. A common use is for video cameras, that have a class 2 power supply, that will also utilize conductors within the same cable for video transmission (network cable).

Ampacity ratings of these cables are based on 86°F. As current flow in these bundled or bunched cables can increase the temperature and therefore can degrade the insulation of the cables (overheating).

Generally operating @ 48v / connectors rated @ 1.3 amperes maximum

2020

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POE TERMINOLOGY

- IEEE 802.3 PoE Standard; *(48v and up to 15.4W)*

Typically, Cat 5 Cable contains 8 wires; as 4 twisted pairs of conductors 2 pairs are used for data (data pairs), 1 pair can be used for power 48v DC

PSE = Power Sourcing Equipment; Equipment that provides power to the cable. (WAP); Wired Access Points (IP); Security Cameras

PD = Powered Device; Device that receives power from the cable

PSE = Power Sourcing Equipment; Devices that send power and data over ethernet cable to a connected PD. (midpoint, endpoint or span); no additional power source required.

VOIP = Voice over internet phone; PoE is needed to power the phone, via the network.

2020

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POWER OVER ETHERNET (POE) NEW IN THE 2017 NEC

Applies to both Class 2 & Class 3 Circuits

IN #1 – Applies to *CCTV cameras*

IN #2 – Used in Powered *Communication systems*

IN #3 – 4 Pair copper balanced twisted conductors

IN #4 – Guidelines for supporting power delivery over balanced twisted conductors

IN #5 – Minimum Requirements for *PoE lighting systems*

IN #6 – Rated current for power sources; designed to deliver

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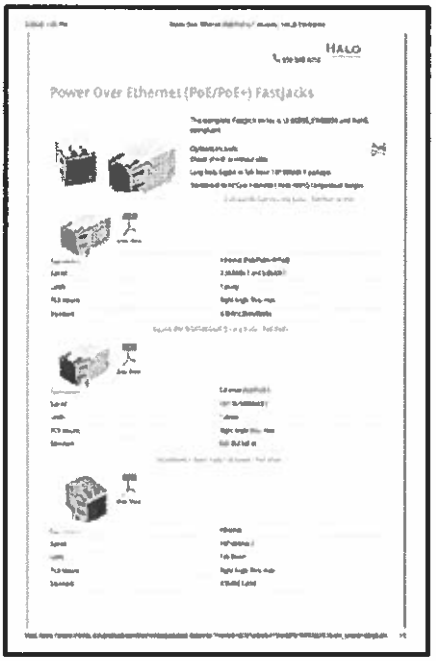

725.144 TRANSMISSION OF POWER & DATA

Power over Ethernet (PoE)

Section 725.144(A) & (B) shall apply to Class 2 & Class 3 circuits that transmit power and data to a powered device. Section 300.11 and Parts I and III of Article 725 shall apply to Class 2 & Class 3 circuits that transmit power and data. Conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

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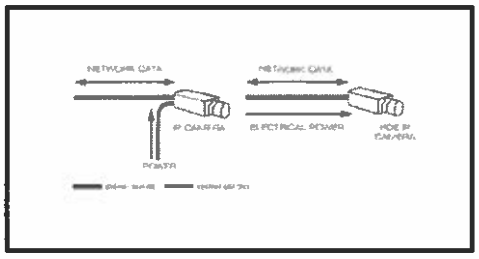
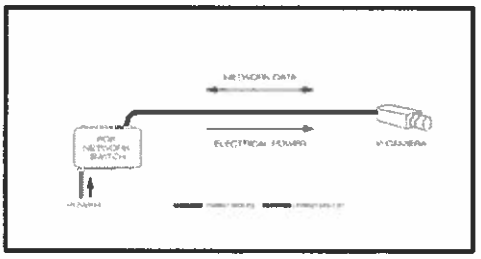
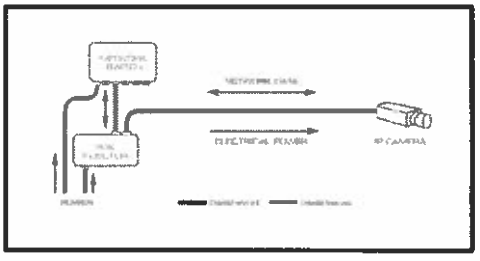
NETWORK CABLES THAT CARRY ELECTRIC POWER







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PoE [power over ethernet] USE CASES

PoE facilitates the deployment of powered devices in several scenarios. The following are just a few sample use-cases for PoE.

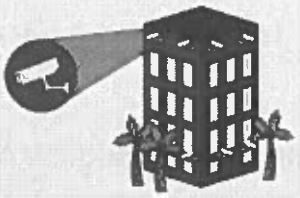
PoE Deployment Exceptions:
- Enterprise Business
- Campuses
- Offices
- Hotels

VoIP in an Office Environment

Businesses seeking to save on wired telephone services switch to VoIP phone systems.

IP Surveillance in an Enterprise Building

Outdoor IP cameras give system integrators the ability to deploy cameras around a multi-story enterprise building where electrical circuitry may be absent.



Access Points in a Campus

PoE-capable wireless access points make it simple to disregard the placement of electrical circuitry, and place wireless access points anywhere on a campus.

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Figure 1 illustrates a typical PoE installation. The PoE equipment resides on a communication room and connect to the Ethernet infrastructure via standard category 5 cabling.

Figure 1 - Typical PoE installation

Paper Goals

This white paper introduces PoE concepts, protocols, considerations and designs from both the sourcing side (Power Sourcing Equipment or PSE) and the Terminal side (Powered Device or PD) compliant here, and details the current highlights of the IEEE 802.3af standard for provision of PoE.

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ADDITIONAL USES

Integrating Building Systems

Heating, Ventilation & A/C Systems (VAV Boxes)

Lighting System Sensors

Security Camera Systems

Automation, Control Systems & Energy Savings

Refer to Chapter 9 Tables 11(a) & (b)

2020

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CLASS 2 & CLASS 3 NETWORK CABLING

Data and Power Circuits

1. Cable Listing & Compliance
2. Structured Cabling
3. Data Centers
4. Power over Ethernet (PoE)
5. Uses Cat 5 or Cat 6 Cable

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2020

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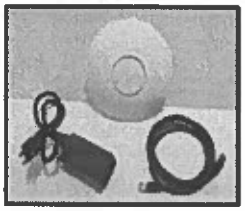
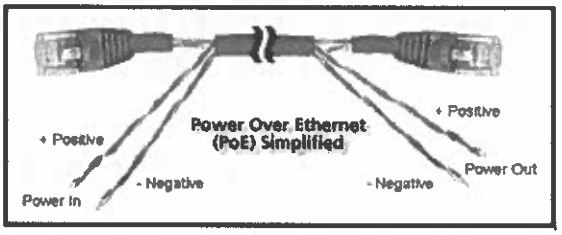
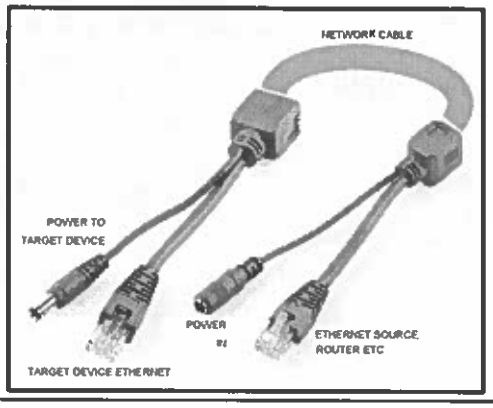
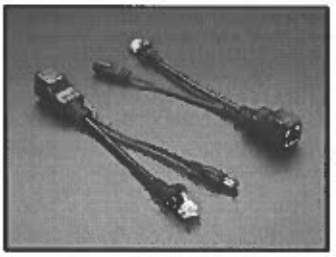
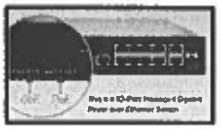
EXAMPLES OF CAT 5 / 6 CABLES / USES











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CHAPTER 8

Communications Systems

N Article 805 – Communication Circuits

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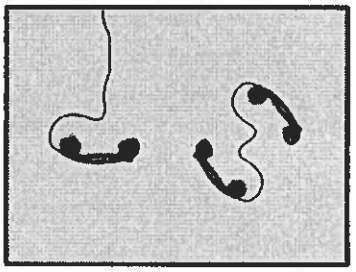
ARTICLE 805 (NEW) GENERAL REQUIREMENTS FOR COMMUNICATION SYSTEMS

General info for Articles;

800, 820, 830 and 840 combined in one location.



800 – Communication Circuits
820 – CATV & Radio Dist. Systems
830 – Network Powered Broadband Comm. Systems
840 – Premises-Powered Broadband Comm. Systems

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CHAPTER 9

Tables

Table 1 – Conduit Fill

Informative Annex I – Recommended Tightening Torque Tables from UL Standard 486A – 486B

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2020

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CHAPTER 9 – TABLES

Table 1

Conduit Fill / Cross Sectional Area (%)

1 Conductor = 53% Cross Sectional Fill
2 Conductors = 31% Cross Sectional Fill
Over 2 Conductors = 40% Cross Sectional Fill

Notes to Tables:

(3) EGC's / bonding conductors ***to be included*** in calculating conduit fill

(4) Where conduit or tubing nipples having a maximum length not to exceed ***24"*** are installed between boxes, cabinets, and similar enclosures, the nipples shall be permitted to be filled to ***60%*** of their cross-sectional area, and 310.15(C)(1) adjustment factors need not apply to this condition. ***(no de-rating required)***

2020

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2020 NEC COMMERCIAL OVERVIEW

- 110.22(A) Identification of Disconnecting Means (Source)
- 210.8(B) GFCI Protection (Food Prep Areas / Dishwasher)
- 220.12 General Lighting Loads (ASHRAE 90.1 – 2016)
- 230.71(B) MLO / Split-Bus Panels (No Longer Acceptable)
- 240.67 / 240.87 – Arc Energy Reduction Methods (Fuses & Breakers)
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's; NM, UF, A/C & M/C)
- 406.12 Tamper Resistant Receptacle Additional Locations
- 406.4 (D)(4) – Receptacle Replacements; (AFCI Locations)
- 408.6 SCCR Rating Identification (Boards and Gear Marking)
- 422.5(A) Appliances; GFCI Protection Requirements
- 625 Electric Vehicle Power Transfer System; Interactive Systems
- 690 Solar Photovoltaic (PV) Systems (Revised / Updated)
- 695.(C)(3) Fire Pumps- Selective Coordination
- 725.144 – Transmission of Power & Data (PoE; Power over Ethernet)

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2020 NEC RESIDENTIAL OVERVIEW

- 2019 Residential Code of Ohio Adoption (1, 2, & 3)
- 210.8(A) GFCI Protection (Ranges, Dryers, A/C Units?)
- 210.52(C)(2) Island / Peninsula Receptacle Outlets
- 210.52(E)(3) Deck Receptacle Outlets
- 230.67 Surge Protection Requirements (New / Existing)
- 230.85 Exterior Emergency Service Disconnects
- Table 310.12 Single-Phase Dwelling Services & Feeders
- 314.16(B)(5) Box Fill Calculations (more than 4-egc's)
- 406.4 (D)(4) Receptacle Replacements; (AFCI Locations)
- 406.12 Tamper Resistant Receptacle Locations
- 445.18(D) Generator Emergency Shutdown (1 & 2 Family Dwellings)
- 680.45 / 680.50 Added Immersion Pools and Splash Pads

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2020

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2020 NATIONAL ELECTRICAL CODE "PROPOSED" CHANGES & UPDATES

Labriola Training Agency #191
www.ta191.com

John M. Labriola
Principal

150 Maplecrest Street SW
North Canton, Ohio 44720

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john@ta191.com

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Thank You!

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File Attachments for Item:

EC-13 Analysis of Changes: 2020 NEC (International Code Council)

All certifications (8 hours)

Title of Course: IAEI Analysis of Changes – 2020 *NEC*

Course Syllabus: This is an extensive and popular program analyzing the major changes to the *NEC* for this code cycle. Members of the eighteen *NEC* code-making panels contributed to the development of this authoritative text. This seminar covers more than 275 of the most significant changes and includes interpretations by the group that enforces the *Code.* The four-color book is loaded with illustrations that clearly identify and explain the changes. Note: The 202 NEC has not been adopted in Ohio and this is for educational purposes only.

Topic Outline for IAEI Analysis of Changes-2020 *NEC* (8 hr)		
8:00 am – 10:00 am	Instruction:	2 hrs
	NEC Chapter 1 – General Requirements	
	NEC Chapter 2 – Wiring and Protection	
10:00 am – 10:15 am	Break	15 min
10:15 am – 12:00 noon	Instruction:	1 hr 45 min
	NEC Chapter 2 – Wiring and Protection (cont)	
	NEC Chapter 3 – Wiring Methods and Materials	
12:00 noon – 1:00 pm	Lunch	
1:00 pm – 3:00 pm	Instruction:	2 hrs
	NEC Chapter 3 – Wiring Methods and Materials (cont)	
	NEC Chapter 4 – Equipment for General Use	
3:00 pm – 3:15 pm	Break	15 min
3:15 pm – 5:00 pm	Instruction:	1 hr 45 min
	NEC Chapter 5 – Special Occupancies	
	NEC Chapter 6 – Special Equipment	
	NEC Chapter 7 – Special Conditions	
	NEC Chapter 8 – Communication Systems	
	NEC Chapter 9 – Tables	
	Total CE Hours	**8 hours**

Course Description: The IAEI staff and IAEI representatives on the NFPA *NEC* Code Making Panels have worked together to develop a quality seminar program that will provide information about code changes covering the safe installation and use of electrical products pertaining to the 2020 National Electrical Code.

Course Objectives: This course is designed to cover the major changes in the National Electrical Code for the 2020 *NEC* code cycle. There are new articles that will be discussed and well as numerous changes and some re-organization for this code cycle.

Method of Presentation: Microsoft PowerPoint® Presentations

JOSEPH WAGES, JR.

Joseph Wages, Jr., is the Digital Education Director at IAEI. Previously, he held the positions of Technical Advisor, Education, Codes and Standards and Seminar Coordinator at IAEI. He represents IAEI on NFPA's NEC CMP-2 for the 2020 and 2023 NEC code cycles. He previously represented IAEI on NFPA's NEC CMP-3 for the 2014 and 2017 NEC. He serves on the Underwriters Laboratories (UL) Electrical Council and several UL Technical Standard Panels.

APPLICATION

FOR

Continuing Education Course Approval

Continuing education programs approved for education credit by the Ohio Board of Building Standards may be used for compliance with certification requirements related to code enforcement, plan review, and inspection responsibilities. The credit is to be used to renew the certifications issued by the Ohio Board of Building Standards pursuant to section 3781.10(E) ORC.

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
(614) 644-2613 Fax: (614) 644-3147
dic.bbs@com.state.oh.us
www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: Laura Morris
(Contact Name)

Organization: International Code Council
(Organization/Company)

Address: 4051 Flossmoor Road
(Include Room Number, Suite, etc.)

City: Country Club Hills State: IL Zip: 60478

E-Mail: lmorris@iccsafe.org

Telephone: 888-422-7233 Ext: 4523 Fax:

Course Sponsor: International Code Council

COURSE INFORMATION:

Course Title: Analysis of Changes - 2020 NEC

New Course Submittal: ■ Update Course: ☐ Prior Approval Number:

Purpose and Objective: This is an extensive and popular program analyzing the major changes to the NEC for this code cycle. Members of the eighteen NEC code-making panels contributed to the development of this authoritative text. This seminar covers more than 275 of the most significant changes and includes interpretations by the group that enforces the Code. The four-color book is loaded with illustrations that clearly identify and explain the changes. Note: The 202 NEC has not been adopted in Ohio and this is for educational purposes only.

Number of Instructional Contact Hours that can be obtained upon completion: 8

If Multi-Session, Number of Instructional Contact Hours Per Session:

Program Applicable for the Following Participants:

Building Official ■ Master Plans Examiner ■ Plumbing Plans Exam. ■ Electrical Plans Exam. ■ Mechanical Plans Exam. ■

Building Inspector ■ Fire Protection Inspector ■ Mechanical Inspector ■ Plumbing Inspector ■ Non-Res IU Inspector ■

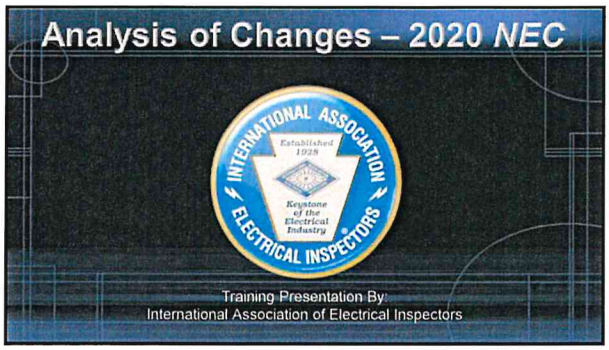
Res Building Official ■ Res Plans Examiner ■ Res Building Inspector ■ Res Mechanical Inspector ■ Res IU Inspector ☐

Electrical Safety Inspectors [X]

Location of ESI Course: Nappanee, IN Date(s) of ESI Course(s): 8/17/2022

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor:	Organization sponsoring or requesting the program (if any)	x
Course Title:	Name of course (related to content)	x
Purpose/Objective:	Describe purpose and how course will improve competency of certification(s) listed	x
Contact Hours:	Indicate instructional time and credit requested in hours (e.g.: 0.5 hr, 1 hr, 3.5 hrs)	x
Participants:	Check off each certification for which credit is requested (for which course relates to certification)	x
Content of Program:	Include collated agenda, time schedule, course outline; list specific sections of code, references, and topics covered	x
Course Materials:	Collated workbooks, handouts, hard copy or electronic versions of program is available	x
Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certifications	x
Test Materials:	Copy of quizzes or tests to be given	x
Completed Application:		x

NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.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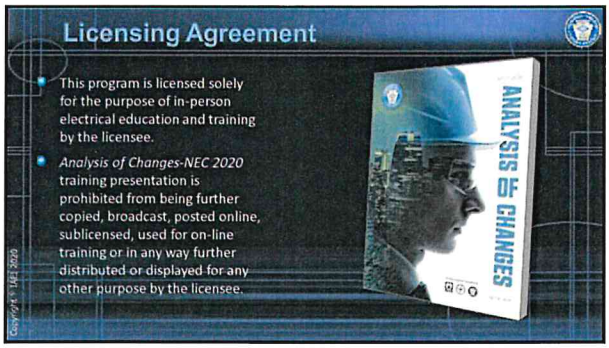
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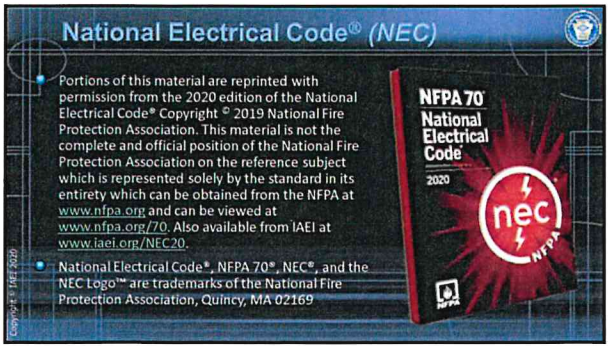
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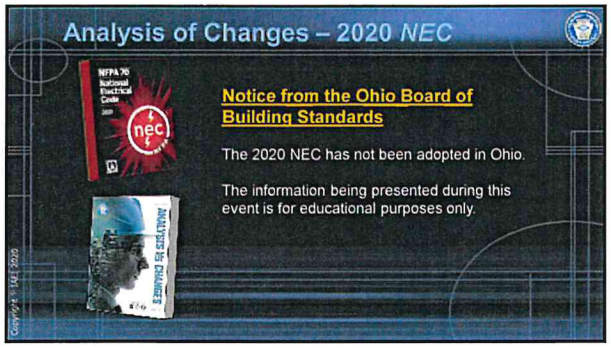
NFPA 70
National Electrical Code
2020
nec
NFPA
ANALYSIS OF CHANGES

4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Notice from the Ohio Board of Building Standards
The 2020 NEC has not been adopted in Ohio.
The information being presented during this event is for educational purposes only.

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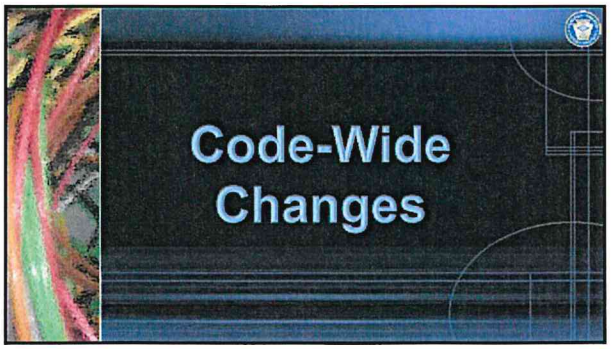
Code-Wide Changes

6

Code-Wide Changes

- There were a total of **3730** Public Inputs (PI) and **1930** Public Comments (PC) submitted from interested participants seeking changes to the 2020 *NEC*
- **Available Fault Current References.** Different terms like "available short-circuit current" and "short-circuit current" were previously used to describe large amounts of current capable of being delivered at a point on the system during a short-circuit condition. For the 2020 *NEC*, these large amounts of current descriptions were changed to "**available fault current**" throughout the *Code* for improved consistency
- **Reconditioned Equipment, Yes or No ?** Each Code Making Panel (CMP) was asked to review the equipment they have purview over and determine what equipment could be reconditioned and what equipment could not be reconditioned but rather replaced when necessary

7

Code-Wide Changes *(cont.)*

- **Definition Statements.** Two distinct statements added at XXX.2 sections of the *Code*
  - "*The definitions in this section shall apply only within this article.*"
  - "*The definitions in this section shall apply within this article and throughout the Code.*"
- **GFCI Requirements Alignment with 210.8.** Changes were proposed throughout the *Code* to align all GFCI requirements with the GFCI requirements of 210.8
- **"Allowable" Ampacity.** Several locations across the *NEC* where the term "allowable ampacity" was used and should have been simply stated as "**ampacity**" as it is the intent for those sections to determine the ampacity of a conductor based upon its conditions of use

8

Code-Wide Changes *(cont.)*

- **Grounding Conductor Changed to Equipment Grounding Conductor.** The term "grounding conductor" *(not a defined term)* was replaced with mainly the proper term "equipment grounding conductor," but in some instances with the terms "grounding electrode conductor" or one of the several types of "bonding jumpers"

9

Code-Wide Changes

Available Fault Current References

Reconditioned Equipment (Yes or No)

XXX.2 Definitions

"The definitions in this section shall apply only within this article."

"The definitions in this section shall apply within this article and throughout the *Code*"

Definition Statements


Alignment of GFCI Requirements


Allowable Ampacity vs Ampacity


Term "Grounding Conductor" Deleted

10

New Articles for the 2020 *NEC*

Article 242 Overvoltage Protection (CMP-10) This article provides the general requirements, installation requirements, and connection requirements for overvoltage protection and overvoltage protective devices. Part II covers surge-protective devices (SPDs) permanently installed on premises wiring systems of not more than 1000 volts, nominal, while Part III covers surge arresters permanently installed on premises wiring systems over 1000 volts, nominal.

Article 337 Type P Cable (CMP-6) This article covers the use, installation, and construction specifications for up through 2000 volt Type P cable (armored and unarmored). Type P cable is a factory assembly of one or more insulated flexible tinned copper conductors, with associated equipment grounding conductor(s), with or without a braided metallic armor and with an overall nonmetallic jacket.

Article 311 Medium Voltage Conductors and Cable (CMP-6) This article covers the use, installation, construction specifications, and ampacities for Type MV medium voltage conductors and cable. Type MV conductor and cable requirements that were previously found in Articles 310 (Conductors or General Use) and 328 (Medium Voltage Cable) were consolidated into one article.

Article 800 General Requirements for Communications Systems (CMP-16) This article covers general requirements for communications systems. These general requirements apply to communications circuits, community antenna television and radio distribution systems, network-powered broadband communications systems, and premises-powered broadband communications systems, unless modified by Articles 805, 820, 830, and or 840. **[Previous Article 800 (Communication Circuits) is now Article 805]*

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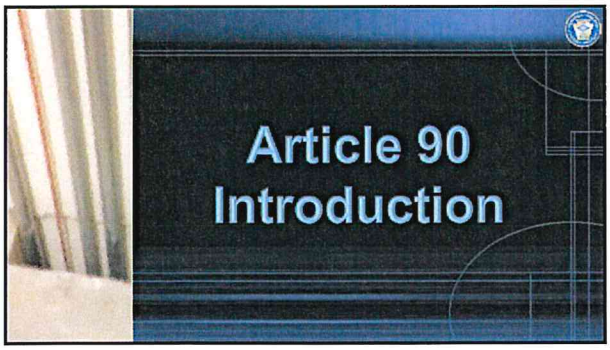

12

90.2(A) Scope

- Revision clarifies that the *NEC* covers installations **supplying shore power to** ships and watercraft, including monitoring of leakage current
- 90.2(B)(1) reveals that **installations in** ships and watercraft *(other than floating buildings)* are not covered by the *NEC*
  - This does not include electrical supply system **supplying shore power to** ships and watercraft
- Change intended for ships, boats, and other watercraft covered by **Article 555**
- New provision was necessary to address potential hazards created where shore power is supplied to ships and watercraft with a significant number of fatalities from **electric shock drowning (ESD)** associated with leakage of current from watercraft connected to shore power

13

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90.2(A) Scope

- A new (6) has been added to 90.2(A) to address installations used to **export power from electric vehicles to premises wiring**
- Bidirectional flow of power is typically accomplished using utility interactive inverters

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16

Chapter One
General

17

Article 100: Definitions - Scope

- Scope of Article 100 is modified to include **new Part III for Hazardous (Classified) Locations**
- During the 2017 *NEC* revision cycle, several definitions that applied to hazardous (classified) locations were relocated to Article 100 of the *NEC*
- Previously located at 500.2 *(2014 NEC)*
- Creating new Part III and the relocation of these definitions will add clarity and usability and help users of the *Code* understand that these definitions only apply to hazardous (classified) location articles located in Chapter 5

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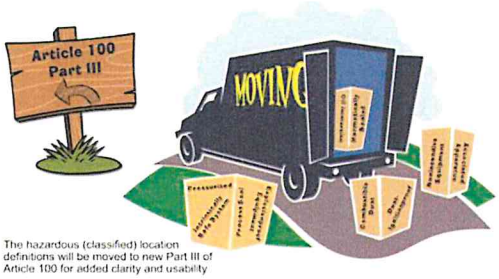
Article 100 Part III Hazardous (Classified) Locations (CMP-14)



The hazardous (classified) location definitions will be moved to new Part III of Article 100 for added clarity and usability

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Article 100: Definitions – Scope *(cont.)*

- New sentence added to Scope of Article 100 to indicate that definitions can also be found at "**XXX.2 of other articles**"
- Two distinct statements added at XXX.2 sections of the *Code*
  - *"The definitions in this section shall apply only within this article."*
  - *"The definitions in this section shall apply within this article and throughout the Code"*
- This was in conjunction with an effort this *Code* cycle to make a distinction to definitions found throughout the *Code*, particularly at XXX.2 of individual articles

20

Article 100: Definitions - Accessible

- **Accessible (as applied to equipment)**. Capable of being reached for operation, renewal, and inspection. (CMP-1)
- Definition revised for clarity and usability
- Previous definition seemed to contradict other sections of the *Code*
- By stating that equipment is not accessible, if "guarded by locked doors" was in contradiction with 110.26(F) *[electrical equipment rooms or enclosures housing electrical apparatus that are controlled by a lock(s) shall be considered accessible to qualified persons]*
- Former definition also stated that equipment could be considered not accessible by "elevation" while the *Code* demonstrates that equipment can still be considered accessible, despite being elevated *(above suspended ceiling)*

21

22

Article 100: Definitions - SSBJ

- **Bonding Jumper, Supply-Side.** 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)
- Definition of a **Supply-Side Bonding Jumper** was relocated from 250.2 to Article 100
- Prior to 2011 *NEC*, the term "equipment bonding jumper" used at most locations to described a fault carrying conductor for a separately derived system
- 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

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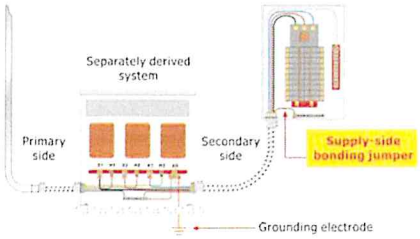
Article 100 - Supply-Side Bonding Jumper



Bonding Jumper, Supply Side - 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)

24

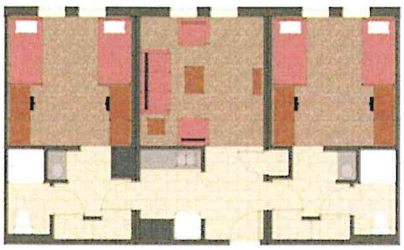
Article 100: Definitions – Dormitory Unit

- **Dormitory Unit.** 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. (CMP 2)
- New definition for a "Dormitory Unit" was introduced at Article 100
- Used in (4) different articles but was not defined in the *NEC*
- Without an *NEC* definition, installers and inspectors alike experience a **wide variety of interpretation** as to what constitutes a dormitory unit
- While a dormitory unit can certainly be found at a typical college campus, a dormitory unit is not limited to a learning institution

25

26

Article 100 Definitions: Dormitory Unit



Dormitory Unit. 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. (CMP 2)

27

Article 100: Definitions - Equipotential Plane

- **Equipotential Plane.** Accessible conductive parts bonded together to reduce voltage gradients in a designated area. (CMP-17)
- Definition for an "Equipotential Plane" *(previously defined in Article 682 Natural and Artificially Made Bodies of Water)* was modified, deleted from Article 682, and moved to Article 100 *(was also defined at 547.2)*
- Previous text concerning conductive elements in or under walking surfaces was a requirement located in a definition and was moved to 682.33(C) *(Equipotential Planes and Bonding of Equipotential Planes-Walking Surfaces)*
- Definition for **"Equipotential Plane (as applied to agricultural buildings)"** remains in Article 547 (Agricultural Buildings)

28

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Article 100: Fault Current and Fault Current, Available

- New definitions of the terms **"fault current"** and **"fault current, available"** have been added to Article 100
- A **new informational note** and associated figure have been added to enhance clarity and usability
- This revision aligns with similar recent revisions in other standards that use the terms, such as NFPA 70E
- Different terms were used to describe large amount of current capable of being delivered at a point on the system during a short-circuit condition:
  - Maximum available fault current and Maximum available short-circuit current, Short circuit, fault current, available fault current, short-circuit current rating, interrupting rating, available short-circuit current, short-circuit current, available fault current

30

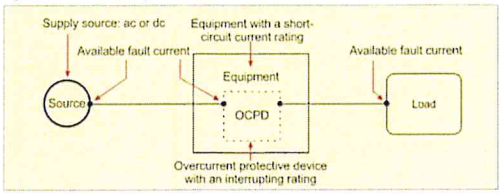
Article 100: Definitions

Fault Current. The current delivered at a point on the system during a short-circuit condition. (CMP-10)

Available Fault Current. The largest amount of current capable of being delivered at a point on the system during a short-circuit condition. (CMP-10)

Informational Note: A short-circuit can occur during abnormal conditions such as a fault between circuit conductors or a ground fault. See Informational Note Figure 100.1.

Figure Informational Note Figure 100.1 Available Fault Current.



31

Article 100: Definitions – Free Air

- **Free Air (as applied to conductors).** Open or ventilated environment that allows for heat dissipation and air flow around an installed conductor. (CMP-6)
- New definition for "Free Air (as applied to conductors)" added to Article 100
- The term "free air" is used throughout the *NEC*, yet to this point, this term has not been defined in the *NEC*
- Contact or close proximity with additional conductors or other materials that could impede the flow of heat away from the conductor would not allow the use of free air ampacity ratings of the conductor ampacity tables in Article 310

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Article 100 Definitions: Free Air (as Applied to Conductors)

Free Air (as applied to conductors). Open or ventilated environment that allows for heat dissipation and air flow around an installed conductor. (CMP-6)

New definition should clarify that contact or close proximity with additional conductors or other materials that could impede the flow of heat away from the conductor would not allow the use of free air ampacity ratings of the conductor ampacity tables in Article 310

33

Article 100: Definitions – Grounded Conductor, Informational Note

- A new Informational note was added to the definition of a "Grounded Conductor" to clarify that an **equipment grounding conductor** is **not subject to** the identification and connection rules of a grounded conductor
- I-Note states that although an equipment grounding conductor is grounded, it is **not considered a grounded conductor**
- Some would argue that an EGC is an "intentionally grounded" conductor while others would say an EGC is not by definition an "intentionally grounded" conductor as it is not a "system or circuit" conductor

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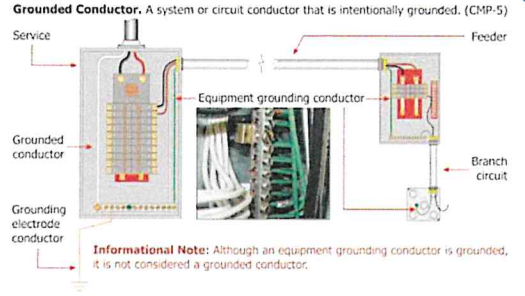
Article 100 Definitions: Grounded Conductor (I-Note)

Grounded Conductor. A system or circuit conductor that is intentionally grounded. (CMP-5)



Informational Note: Although an equipment grounding conductor is grounded, it is not considered a grounded conductor.

35

Article 100: Definitions – Habitable Room

- **Habitable Room.** A room in a building for living, sleeping, eating, or cooking, but excluding bathrooms, toilet rooms, closets, hallways, storage or utility spaces, and similar areas. (CMP-2)
- New definition for "Habitable Room" was added to Article 100
- Definition aligns with the same term that is used in *NFPA 5000, Building Construction and Safety Code* and promotes consistency of its use
- Adds clarity and usability to the *Code* for both the installer and AHJ in relation to sections of the *Code* that reference a "habitable room or area" *(such as 210.8 GFCI requirements for dwelling units)*

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Article 100: Definitions – Island Mode

- **Island Mode.** 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 or other primary power source. (CMP-4)
- **Informational Note:** Isolated microgrids are distinguished from interconnected microgrids, which are addressed in Article 705.
- New definition for "Island Mode" primarily related to microgrid systems and stand-alone systems was added to Article 100
- A stand-alone (or islanded mode) microgrid never connects to the utility grid but instead operate in an island mode at all times
- Using terms like "stand-alone mode" and "islanded mode" necessitated the need to define these terms as they are used often in in the Chapter 7 articles

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Article 100: Definitions – Island Mode *(cont.)*

- Name was changed to simply "Island Mode"
- Changes were made to the definition to better clarify the use of the term and how it applies to various applications that operate in island mode
- Name was changed from "Stand-Alone (Islanded) Mode" to "Island Mode" as the changes made to the definition of "Stand-Alone System" in Article 100 and the proposed definition of "Stand-Alone (Islanded) Mode" originally slated for 710.2 caused confusion with the definition of "Microgrid System" in Article 705
- Definitions consistent with IEEE 1547-2018 - IEEE *Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces*

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Article 100 Labeled

- New Informational Note added explaining that even though a section of the *NEC* may require a product to be labeled, it is common practice to have the label, symbol, or other identifying mark applied to the **smallest unit container** in which the product is packaged
- Several types of electrical equipment addressed in the *NEC* that are required to not only be "**Listed**," but also required to be "**Labeled**"
- A typical pressure wire connector (wire nut) for splicing conductors together is required to be listed and labeled, but it is one of those products that are too small to affix a label to each individual pressure wire connector

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Article 100: Definitions – Reconditioned

- 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**
- Several requirements added throughout the *Code* added to indicate if specific equipment **can or cannot be reconditioned** *(see receptacles, switches, panelboards, circuit breakers, etc.)*
- Definition based on a National Electrical Manufacturers Association (NEMA) document titled, "*NEMA Policy on Reconditioned Electrical Equipment*"
- Marking requirements for reconditioned, refurbished or remanufactured electrical equipment added to 110.21(A)(2) for 2017 *NEC*

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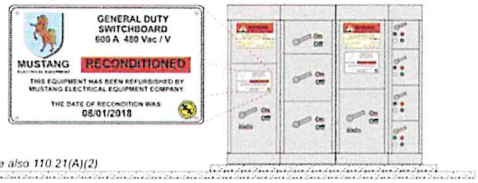
Article 100 Definitions: Reconditioned

Reconditioned. 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. (CMP-10)



*See also 110.21(A)(2)

Informational Note: The term reconditioned is frequently referred to as rebuilt, refurbished, or remanufactured.

44

110.3(B) Installation and Use of Listed Equipment

- Equipment that is listed, labeled, **or both** shall be installed and used in accordance with any instructions included in the listing or labeling
- Listing requirements were **modified** for clarity and usability to address equipment that is listed, labeled, **or both**
- The words "listed" and "labeled" are often looked upon as interchangeable by installers and inspectors alike even though both of these terms are defined in Article 100
- Electrical equipment can easily be both listed and labeled
- Marking on the product is the manufacturer's substantiation that the product is in compliance with the appropriate product standard
- Only true way AHJ can determine whether the inspected product is compliant with the applicable product standard is the third-party label on the product

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110.3(B) Installation and Use of Listed Equipment

Equipment that is listed, labeled, or both shall be installed and used in accordance with any instructions included in the listing or labeling

46

110.12(C) Cables and Conductors

- Redundant requirements for "**Mechanical Execution of Work**" for communication cables and conductors in Chapter 7 and 8 were relocated to Article 110
- A new subdivision (C) titled "**Cables and Conductors**" has been added to 110.12 which is titled "**Mechanical Execution of Work**"
- Includes relocated requirements from the **.24 sections** from the communications articles in Chapters 7 and 8
- Conductor and cable support and concerns about damage are addressed in both 110.12(C) and in 800.24

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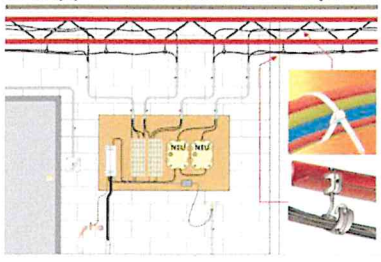
110.12(C) Mechanical Execution of Work (Cables and Conductors)



Exposed cables and conductors to be supported by building structure to prevent damaged by normal building use

Cables and conductors to be secured by hardware *(straps, staples, cable ties, hangers, etc.)* designed and installed to not damage the cable

Installation to comply with 300.4 and 300.11

Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in environmental air spaces (plenums) must be listed as having low smoke and heat release properties

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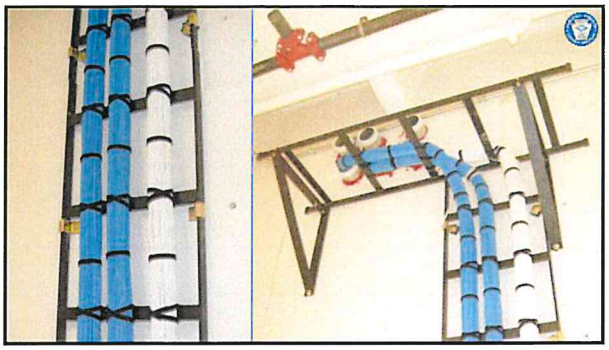

49

110.14(D) Terminal Connection Torque

- The title of subdivision (D) has been changed from "Installation" to "**Terminal Connection Torque**"
- The term "**calibrated**" has been deleted from this section *(replaced with "approved means shall be used to achieve the indicated torque value")*
- Three new informational notes provide practical guidance for installers and inspectors
- Proper emphasis needs to be on achieving the required torqueing values rather than the tool used to achieve such values

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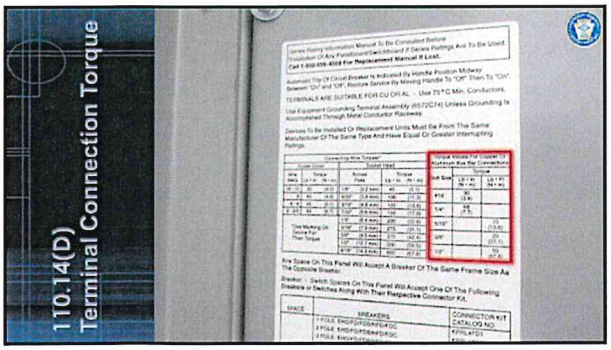

51

110.22(A) Identification of Disconnecting Means

- Disconnects are now required to **identify of the source** of the branch circuit or feeder for the disconnect at the disconnecting means enclosure *(other than one- or two-family dwellings)*
- Disconnecting means is required to be marked with a label to identify exactly what the disconnect is for
- Also required to provide identification of the circuit source that supplies the disconnecting means
- Same identification requirement for switchboards, switchgear, and panelboards *[see 408.4(B)]*
- Power supply identification practice will enhance the safety for the electrical personnel who service these disconnects

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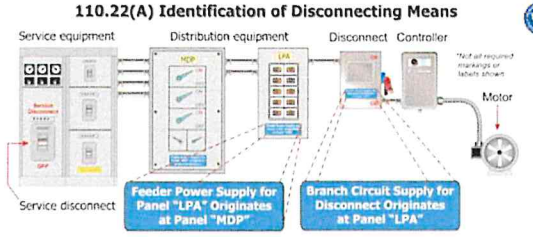
110.22(A) Identification of Disconnecting Means



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

53

110.26(C)(2) Large Equipment

- Revisions to "**Large Equipment**" working space to address the hazards presented by two or more service disconnects with combined ratings of **1200 amps or more**
- For service disconnecting means where **two or more service disconnect enclosures** are installed with combined ampere rating is 1200 amperes or more and over 1.8 m (6 ft) wide, the **"Large Equipment" rules will now apply**
- Requirements also added to prevent **open equipment doors** from impeding the entry to or egress from the working space of large equipment

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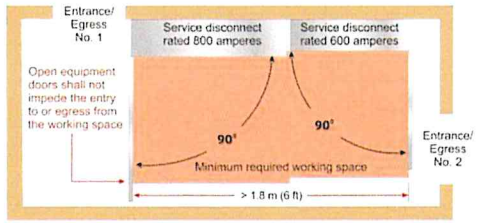
110.26(C)(2) Large Equipment



Large equipment is generally required to have an entrance/egress at each end of the working space for equipment rated 1200 amperes or more and over 1.8 m (6 ft) wide or for service disconnecting means installed in accordance with 230.71 where the combined ampere rating is 1200 amperes or more and over 1.8 m (6 ft) wide

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110.26(C)(3) Personnel Doors

- Revision added to clarity appropriate hardware *(equipped with listed panic hardware* ***or listed fire exit hardware****)* for personnel doors within 7.6 m (25 ft) from working space around electrical equipment rated 800 amperes or more
- The words **"or listed fire exit hardware"** have been added to 110.26(C)(3)
- An informational note has been added that references two UL standards that apply to the door hardware referred to in this rule
- Both panic hardware and fire exit hardware are listed to **UL 305** *(Standard for Safety for Panic Hardware)*, while fire exit hardware is tested to **UL 10C** *(Standard for Safety for Positive Pressure Fire Tests of Door Assemblies)*
- The revision differentiates **listed panic hardware** from **listed fire exit hardware**

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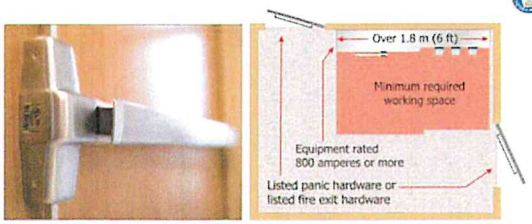
110.26(C)(3) Personnel Doors



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.

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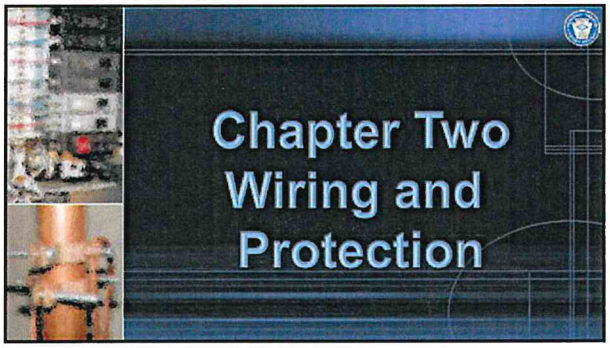
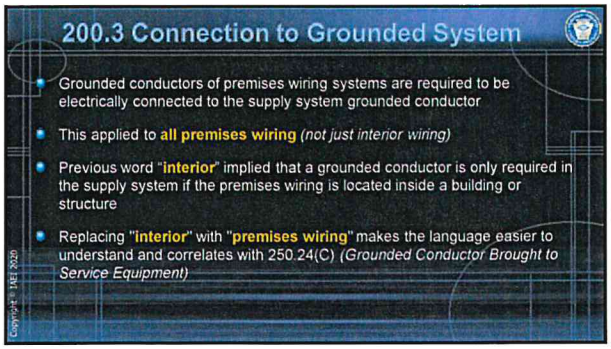

Chapter Two
Wiring and
Protection

59


200.3 Connection to Grounded System
Grounded conductors of premises wiring systems are required to be electrically connected to the supply system grounded conductor
This applied to all premises wiring (not just interior wiring)
Previous word "interior" implied that a grounded conductor is only required in the supply system if the premises wiring is located inside a building or structure
Replacing "interior" with "premises wiring" makes the language easier to understand and correlates with 250.24(C) (Grounded Conductor Brought to Service Equipment)
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