Board of Building Standards

EDUCATION COMMITTEE MEETING
AGENDA

DATE: FEBRUARY 25, 2021
TIME: 10:00 AM
LOCATION: VIDEOCONFERENCE:
DIAL-IN 1 614-721-2972
CONFERENCE ID: 671 066 950#

Staff and Guest 'Check-in'

Call to Order

Roll Call

Course Applications

ER-1 Complying with Fire Protection and Building Codes in Ohio (HalfMoon Education)
BO, MPE, MechPE, BI, FPI, RBO, RPE, ESI (7 hours)
Staff Notes: Tabled at January meeting for review of materials, now attached. NFPA 101 is not generally applicable in Ohio, and NFPA 1 is never applicable in Ohio: references should be to Ohio Fire Code
ESIAC Recommendation:
Committee Recommendation:

ER-2 2021 ICC EduCode Online Symposium
77 courses, mostly 4 or 8 hours, in a 5 day program: see brochure.
Staff Notes: Recommend approval for most courses on a request basis rather than creating 77 new courses in BBS database, except 12, 22, 61 and 63, which are not recommended for approval. ESI courses have been submitted to ESIAC for review.
Committee Recommendation:

ER-3 What's New for the 2020 NEC? Virtual Seminar (ICC)
ESI, EPE, 8 hours
Staff Notes: ICC is offering a week of virtual learning, focused on the 2020 NEC and exam preparation. Certified personnel have asked BBS to offer BBS credit for these online courses, as the pandemic has made continuing education opportunities more difficult to come by. Recommend approval, add BO, MPE, RBO, RPE
ESIAC Recommendations: Recommend approval
Committee Recommendation:

ER-4 Electrical Safety and NFPA 70E 2021 Virtual Seminar (ICC)
ESI, EPE (8 hours)

Staff Notes: Part of ICC 2021 EduCode program. Not recommended for approval, NFPA 70E not applicable in Ohio
ESIAC Recommendations: Not recommended for approval
Committee Recommendation:

ER-5 Electrical Exam Preparation for Inspectors, Journeyman and Master's Virtual Seminar (ICC)
ESI, EPE (8 hours)
Staff Notes: Part of 2021 ICC EduCode Virtual Education Program
ESIAC Recommendations: Recommend approval
Committee Recommendation:

ER-6 Solar/PV Inspections, What are we missing? Virtual Seminar (ICC)
ESI, EPE (4 hours)
Staff Notes: Part of the 2021 ICC EduCode program. Recommend approval, add BO, MPE, RBO, RPE.
ESIAC Recommendations: Recommend approval
Committee Recommendation:

ER-7 Healthcare Electrical Systems – Hospitals, Clinics and Care Facilities Virtual Seminar (ICC)
ESI, EPE (4 hours)
Staff Notes: Part of 2021 ICC EduCode program. Recommend approval, add BO, MPE.
ESIAC Recommendations: Recommend approval
Committee Recommendation:

ER-8 Grounding and Bonding, What is What? Virtual Seminar (ICC)
ESI, EPE (8 hours)
Staff Notes: Part of 2021 ICC EduCode program. Recommend approval, add BO, MPE, RBO, RPE
ESIAC Recommendations: Recommend approval
Committee Recommendation:

ER-9 Hospital Isolated Power Systems 2020 NEC Article 517, Part VII (Independent Electrical Contractors)
ESI, EPE (2 hours)
Staff Notes: Handouts only, no slides. Recommend approval, add BO, MPE.
ESIAC Recommendation: Recommend approval
Committee Recommendation:

ER-10 Installing Services (2020 NEC) (Jade Learning)
ESI (4 hours)
Staff Notes: This course is pages 1-5 of the attachment. Recommend approval, add BO, MPE, EPE, RBO, RPE.
ESIAC Recommendation: Recommend approval
Committee Recommendation:

ER-11 Most Unanswered NEC Code Questions (IAEI)
ESI, BO, BPE, MPE, EPE, BI, RBO, RPE (12 hours in 6 sessions)

Staff Notes: The slides are the questions. To allow for plenty of interaction, there is no quota of slides/questions to cover in a given session. Recommend approval.
ESIAC Recommendation: Recommend approval
Committee Recommendation:

ER-12 Motor Circuits 2020 NEC Article 430 (Independent Electrical Contractors)
ESI, EPE (2 hours)
Staff Notes: Handouts only, no slides. Recommend approval, add BO, MPE, RBO, RPE.
ESIAC Recommendation: Recommend approval
Committee Recommendation:

ER-13 NEC 2020 Commercial and Industrial Power Systems (Electrical League of Ohio)
ESI, BO, MPE, BPE, EPE, BI, RBO, RPE (4 hours)
Staff Notes: Recommend approval.
ESIAC Recommendation: Recommend approval
Committee Recommendation:

ER-14 NEC 2020 Electrical Systems for Health Care (Electrical League of Ohio)
ESI, BO, MPE, BPE, EPE, BI, RBO, RBI (4 hours)
Staff Notes: Recommend approval, add RPE.
ESIAC Recommendation: Recommend approval
Committee Recommendation:

ER-15 Pools, Fountains, Natural and Artificial Bodies of Water: 2020 NEC Articles 680 and 682 (Independent Electrical Contractors)
ESI, EPE (2 hours)
Staff Notes: This course does have slides (attached). Recommend approval, add BO, MPE, RBO, RPE.
ESIAC Recommendation: Recommend approval
Committee Recommendation:

ER-16 Significant Changes to the 2020 NEC, Part A (Electrical Trades Center)
ESI, BI (10 hours in 3 sessions)
Staff Notes: Recommend approval, add BO, MPE, EPE, RBO, RPE
ESIAC Recommendation: Recommend approval
Committee Recommendation:

ER-17 Significant Changes to the 2020 NEC, Part B (Electrical Trades Center)
ESI, BI (10 hours in 3 sessions)
Staff Notes: Recommend approval, add BO, MPE, EPE, RBO, RPE
ESIAC Recommendation: Recommend approval
Committee Recommendation:

Old Business

New Business

Adjourn

EDUCATION COMMITTEE MEETING
CONSENT AGENDA

Course Applications

File Attachments for Item:

ER-1 Complying with Fire Protection and Building Codes in Ohio (HalfMoon Education)

BO, MPE, MechPE, BI, FPI, RBO, RPE, ESI (7 hours)

Staff Notes: Tabled at January meeting for review of materials, now attached.

ESIAC Recommendation:

Committee Recommendation:

HalfMoon Education Inc.
WWW.HALFMOONSEMINARS.ORG

January 19, 2021

Ohio Board of Building Standards
PO Box 4009
Reynoldsburg, OH 43068-9009

Re: CONTINUING EDUCATION COURSE APPLICATION
Complying with Fire Protection and Building Codes in Ohio
March 19, 2021 – Live, Interactive Webinar

Dear OBBS:

Please accept the enclosed Application for Continuing Education Course Approval, the course agenda, the instructor's biography, and the course materials that will be distributed to course participants.

As standard practice for a live, interactive webinars, HalfMoon Education monitors attendance electronically, maintains attention with the use of prompts, and administers a knowledge retention test following the presentation. Learners must score 80% on the test to receive a completion certificate (multiple attempts are allowed).Interactivity includes learners being able to ask the instructor questions in real time and with chat rooms for questions and comments.

If you have any questions or need more information, please contact me.

Thank you,

Doug Chapman
CE Coordinator
HalfMoon Education Inc.
doug@halfmoonseminars.org

[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: Doug Chapman
(Contact Name)
Organization: HalfMoon Education Inc.
(Organization/Company)
Address: PO Box 278
(Include Room Number, Suite, etc.)
City: Altoona State: WI Zip: 54720
E-Mail: doug@halfmoonseminars.org
Telephone: 715-835-5900 Fax: 715-835-6066
Course Sponsor: HalfMoon Education Inc.

COURSE INFORMATION:

Course Title: Complying with Fire Protection and Building Codes in Ohio

New Course Submittal: [x] Update Course: [ ] Prior Approval Number:

Purpose and Objective: Learners will be able to reference and understand compliance standards for fire protection and life safety codes, occupancy classifications, high piles storage and H Occupancies OFC Chapter 32, andFire Protection Features and Equipment OFC Chapter 9 MBC Chapter 9. Learners will also be able to discuss the differences between fire protection codes and construction codes.

Number of Instructional Contact Hours that can be obtained upon completion: 7.0

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

Program Applicable for the Following Participants:

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

Res Building Official [x] Res Plans Examiner [x] Res Building Inspector [ ] Res Mechanical Inspector [ ] Res IU Inspector [ ]

Electrical Safety Inspectors [ ]
Location of ESI Course: Online Date(s) of ESI Course(s): March 19, 2021

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:		

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

Complying with Fire Protection and Building Codes in Ohio

Webinar – Friday, March 19, 2021

8:30-10:00 **Fire Protection and Life Safety Design**

- Applicable codes, difference between a fire prevention code and construction codes
- Fire Code Chapter 1, 9, 32, 50
- Ohio Building Codes Chapter 1, 3, 307, 9, 414, 415
- National Fire Protection Association (NFPA standards) OFC 102.8
- Local ordinances
- Scope and purpose of codes and ordinances OFC 101.2, 101.3
- Understanding shared jurisdiction/authority: Special occupancies
- OFC 104.7.2 and OBC 414.1.3 – Report overview

10:00-10:15 **Break**

10:15-11:45 **Occupancy Classifications**

- OBC Chapter 3 General requirements and MAQ's,
- OBC Chapter 3 / is it H or F
- H Occupancies OFC Chapter 50 and OBC Chapter 3 and 4
- Change of use and /or change of occupancy OFC 102.3
- Occupancy/Hazard classifications tables 5003.1.1 (1) and (2)
- How the hazardous materials opinion & report assist the designer and code official as well as the building owner/operator, OFC 104.7.2 and OBC 414.1.3
- Life Safety issues / Hazards
- Design solutions and scenarios
- Control Areas Definitions / Technical Requirements, Limitations
- Evaluation and documentation OFC E-103

11:45-12:45 **Lunch**

12:45-2:00 **High Pile Storage and H Occupancies OFC Chapter 32**

- When is it applicable? OFC 3206.3
- What fire protection regulations are applicable? OFC 3206.2
- How to use the OFC Table OFC 3206.2
- Differences between NFPA 13 and OFC 32 on High pile storage
- Technical Requirements / Submittals OFC 3201.3

2:00-2:15 **Break**

2:15- 3:45 **Fire Protection Features and Equipment OFC Chapter 9 MBC Chapter 9**

- Submittals
- Walls, Ratings, signage OFC 5003.5
- Fire detection and communication systems Chapter 9 OFC and MBC
- Sprinkler systems OFC 903
- Emergency alarm systems as one type of Fire Protection OFC 908

3:45 – 4:30 **Occupancy Exercises**

- Case studies:
- New construction OFC OBC
- Changing occupancy of existing buildings OFC OBC

Instructor Biography

Kendall Nightlinger – *Senior Code Specialist at Ino-Tek*

Kendall Nightlinger is a nationally-recognized expert in the application of building and fire codes to the safe design and operation of commercial and industrial facilities. He possesses over 40 years of mechanical trade experience and has been a fire protection, mechanical plans examiner/inspector since 1992. Mr. Nightlinger has been a code instructor since 1994 and is designated as a lifetime state of Michigan code instructor (#1952). He participates in the International Code Council Action Committees (FCAC, BCAC) and work groups regarding hazardous material, fire protection and life safety issues. Mr. Nightlinger speaks regularly to architects and engineers about code compliance and life safety design issues. He also speaks before building, mechanical and fire inspector associations promoting a higher level of understanding about the challenges of safety around hazardous materials. Mr. Nightlinger's passion for his trade and professionalism engages his audience, empowering many of them as ambassadors for code compliance. He joined Ino-Tek in 2018 as a senior code specialist and consultant for hazardous materials.

Complying with Fire Protection and Building Codes

Kendall Nightlinger

HalfMoon Education Inc.
Altoona, Wisconsin
www.halfmoonseminars.org

HalfMoon Education Inc.
P.O. Box 278
Altoona, WI 54720-0278
(715) 835-5900

This manual is designed to provide general information regarding the subject matter covered. The reader understands that the publisher is not engaged in the practice of rendering legal, accounting, medical or other professional services. This manual **should not** be used as a substitute for obtaining advice and counsel from a qualified professional of your choice.

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AIA Provider No. J885

Complying with Fire Protection and Building Codes

Instructor:

Kendall Nightlinger

HalfMoon Education Inc.
PO Box 278
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AIA Provider No. J885

AIA CES Provider Statement

HalfMoon Education Inc. is a registered provider of AIA-approved continuing education under Provider Number J885. All registered AIA/CES providers must comply with the AIA Standards for Continuing Education Programs. Any questions or concerns about this provider or this learning program may be sent to AIA/CES (cessupport@aia.org or (800) AIA 3837, Option 3).

This learning program is registered with the AIA/CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing or dealing in any material or product.

AIA continuing education credit has been reviewed and approved by AIA/CES. Learners must complete the entire learning program to received continuing education credit. AIA continuing education Learning Units earned upon completion of this course will be reported to AIA/CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

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AIA Provider No. J885

Complying with Fire Protection and Building Codes

Course Description:

This 6.5 hour live lecture presentation examines provisions of the International Fire Code, Ohio Building Codes, the National Fire Protection Association, and local codes addressing occupancy classifications, high pile storage and H occupancies (IFC), fire protection features and equipment.

HalfMoon Education Inc.
PO Box 278
Altoona, WI 54720
(715) 835-5900

AIA Provider No. J885

Complying with Fire Protection and Building Codes

Learning Objectives:

Learners will be able to identify life safety and building codes which mandate fire protection and fire resistance features, including the International Fire Code, state building codes and National Fire Protection Association (NFPA) Codes, and learners will apply the proper codes to specific projects.

Learners will be able to define building occupancies and identify how changes of use and occupancy affect fire protection requirements.

Learners will be able to comply with requirements for fire protection features and equipment, including fire-resistant building materials, fire and smoke protection features, fire detection and alarm systems and sprinkler systems.

Learners will be able to participate in code compliance exercises, applying fire protection code requirements to new construction and to buildings undergoing changes in occupancy.

Materials Provided By

Kendall Nightlinger
Senior Code Specialist at Ino-Tek

Mr. Nightlinger is a nationally-recognized expert in the application of building and fire codes to the safe design and operation of commercial and industrial facilities. He possesses over 40 years of mechanical trade experience and has been a fire protection, mechanical plans examiner/inspector since 1992. Mr. Nightlinger has been a code instructor since 1994 and is designated as a lifetime state of Michigan code instructor (#1952). He participates in the International Code Council Action Committees (FCAC, BCAC) and work groups regarding hazardous material, fire protection and life safety issues. Mr. Nightlinger speaks regularly to architects and engineers about code compliance and life safety design issues. He also speaks before building, mechanical and fire inspector associations promoting a higher level of understanding about the challenges of safety around hazardous materials. Mr. Nightlinger's passion for his trade, and his professionalism, engages his audience, empowering many of them as ambassadors for code compliance. He joined Ino-Tek in 2018 as a senior code specialist and consultant for hazardous materials.

Complying with Fire Protection and Building Codes

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By Kendall Nightlinger

Fire Protection and Life Safety Design

Kendall Nightlinger

COMPLYING WITH FIRE PROTECTION

AND BUILDING CODES

Ohio Building Code 2017 w 2018 errata
Ohio Fire Code 2017 w 2019 errata
And applicable NFPA standards

Making Communities Safer Every Day

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Kendall Nightlinger
Fire Protection/Mechanical Inspector 27 Years

President of the ICC Chapter;
Metropolitan Mechanical Inspectors Association
AIA Course Instructor

Fire Protection / Mechanical / Plans Examiner / Inspector Since 1992
Been in the Mechanical Trades Since 1978

I'm just here to share my experiences and interpretations

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About us…

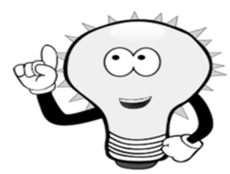
Founded in 1996, Ino-Tek is the Leader for the Design, Installation and Service of Turn-Key, Code-Compliant Life Safety / Hazardous Material Emergency Alarm Systems and Gas Detection. Our customers include leading manufacturers, universities, research institutions, hospitals, municipalities, the United States Environmental Protection Agency and now - with changes in State law legalizing marijuana for recreational use - grow, extraction and processing facilities across the state.

Ino-Tek has installed over **2200 Life Safety Systems** that keep over **100,000 employees** and visitors safe from exposure to toxic and flammable hazards. Keeping people and facilities safe around hazardous materials is our mission… and we do it better than anyone. Across the United States, Canada and Mexico, Ino-Tek is the supplier of choice when it comes to keeping people and facilities safe around hazardous materials!

Our comprehensive, Proactive Compliance approach incorporates Hazard Reviews, Code-Compliance Assessments and cutting-edge Engineering to ensure that our systems set the standard for worker safety in Hazardous Material environments. To ensure continued safety in the workplace, we provide ongoing Calibration, Certification, Maintenance and 24/7 support to our customers through our in-house team of service professionals.

www.ino-tek.com
586-336-0856

Enthusiasm/Passion



- Please excuse me if it sounds like I am preaching today…
- It's just that I am passionate about the subject matter
- and the day the light bulb came on in my mind of **our true mandate**

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QUOTE by Theodore Hesburgh
Former President of the University of Notre Dame

"My basic principle is that you don't make decisions because they are easy;
you don't make them because they are cheap;
you don't make them because they're popular;
you make them because they're right."

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TODAYS FORMAT

You will find my format and approach a little different than some…

- I have taught Code Officials for over 17 years
- College Courses,
- Contractor's Preparation Courses,
- Code Update courses,
- Key Note Speaker at Trade Expo's

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LEARNING OBJECTIVES contd.

- How to Correctly Deal With **MAQ's**
- What is the Purpose of **THE REPORT** (OBC 414.1.3)
- What is the Difference between OFC Chapter 32 and NFPA-13 on **High Piled Storage**

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Understanding the **Difference**

Between **Fire Prevention** Codes

and **Construction** Codes in Ohio

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How these two agencies / codes work together

- **Coordination at the time of review**

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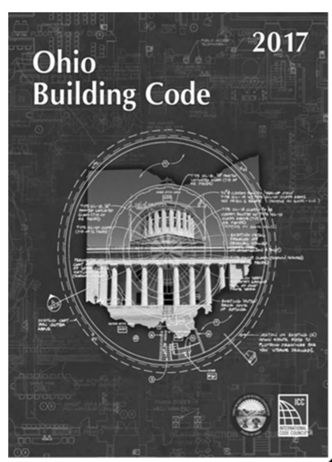
CONSTRUCTION CODES



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FIRE PREVENTION CODE

OHIO FIRE CODE
OHIO ADMINISTRATIVE CODE 1301:7-7-01
UPDATED JANUARY 2019

The most recent amendments to the 2017 *Ohio Fire Code* resulting from the:

- adoption of changes made by the Board of Building Standards
- Follow Steps 1 through 36

OFC (A) SECTION 101
SCOPE AND GENERAL REQUIREMENTS

- **(1) 101.1 Title.** *The rules of the **state fire marshal** as set forth in Chapter 1301:7-7- of the Administrative Code shall be known as the "**Ohio Fire Code**" abbreviated "**OFC**", and hereinafter in such rule may also be referred to as the "state fire code" or "this code."*

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OFC (2) 101.2 Scope. This code establishes ***state fire marshal rules***

- *for the administration and enforcement of **authorities granted to the fire marshal and fire code officials** in Chapters 3701., 3731., 3737., 3741., 3743., 3781., 3791. and 5104. of the Revised Code including, but not limited to,* regulations affecting or relating to structures, processes, premises and safeguards regarding all of the following:

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1. The hazard of fire and explosion arising from the storage, **handling or use** of structures, **materials** or **devices;**
2. Con**ditions hazardous** to life, **property** or **public welfare** in the occupancy of structures **or premises**;
3. Fire hazards in the structure or on the premises from occupancy **or operation**;
4. Matters related to the construction, extension, repair, alteration or removal of fire *protection* systems; and
5. Conditions affecting the **safety** of **fire fighters** and **emergency responders** during emergency operations.

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OFC (b) *101.2.2 Activities, locations and persons subject to the Ohio Fire Code.*

- ***Unless specifically exempted*** *or as limited by federal or state law or this code, the provisions of this code are intended to safeguard* ***life and property*** *from fire and explosion and shall apply to all aspects of fire safety at any structures, building, premises, vehicles or other locations within the territorial jurisdiction of the State of Ohio.*

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DEFINITIONS and ADMINISTRATION Sections
Are our most powerful TOOLS

OFC (3) 101.3 Intent. The purpose of this code is to establish the minimum requirements consistent with **nationally recognized good practice** for providing a reasonable level of;

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IMPORTANT TOOLS Continued;

life safety and property protection from the hazards of fire, explosion or dangerous conditions in **new and existing** buildings, structures and premises, and to provide a;

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IMPORTANT TOOLS… Continued

reasonable level of safety to **fire fighters** and **emergency responders** during emergency operations.

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OFC (4) 102.4 Application of building code.

- *The planning, design and construction of new buildings and structures to provide the necessary egress facilities, fire protection, and built-in fire protection equipment shall be controlled by the building code of the jurisdiction;*
- *and any alterations, additions or changes of occupancy in buildings required by the provisions of this code which are within the scope of the building code shall be made in accordance therewith.*

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OFC (1) 103.1 Fire code(s) within a political subdivision.

- *Consistent with this paragraph, a political subdivision **may, but is not required to**, adopt and enforce a local fire code in accordance with the provisions of Ohio law.*
- *If a political subdivision adopts a local fire code, that local fire code constitutes an **additional set** of fire safety regulations in the applicable jurisdiction.*

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OFC (1) 103.1 Continued

A local fire code shall not and does not modify,

repeal, invalidate or otherwise nullify any provisions of this code or any authorities reserved for the state fire marshal under this code. Such local fire codes shall not be called the "Ohio Fire Code" even if such codes contain the same or similar substantive rules as this code.

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OFC (1) 103.1 continued

- *Regardless of whether a political subdivision adopts a local fire code, this code remains in effect and is enforceable at all locations in the state in accordance with the applicable provisions of the Revised Code and this code.*

OFC (2) *103.2 The state fire code is a minimum statewide standard.*

- *This code shall constitute the **minimum** standards for safeguarding life and property from fire and explosion in this state.*
- ***No** political subdivision with the statutory authority to promulgate a local fire code may enact a local fire code, or parts thereof, or authorize a **variance or waiver** to such local fire code by any means, that provide a lower threshold of such safeguards or violate accepted engineering practice involving public safety.*

OFC (D) SECTION 104 GENERAL AUTHORITY AND RESPONSIBILITIES (1) 104.1 General.

- The fire code official is hereby authorized to enforce the provisions of this code and *to the extent the state fire marshal has not rendered an interpretation or issued a "Technical Bulletin" regarding a particular topic,*
- *the fire code official* shall have the authority **to render interpretations** of this code, and to **adopt policies, procedures, rules and regulations in order to clarify** the application of its provisions.
- Such interpretations, policies, procedures, rules and regulations shall be in compliance with the intent and purpose of this code and shall not have the effect of waiving requirements specifically provided for in this code.

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OFC "Technical Bulletin"

- *To the extent the state fire marshal has rendered an interpretation or issued a "**Technical Bulletin**" regarding the provisions of this code, such interpretation shall be **definitive throughout the state** and in the discretion of the state fire marshal shall **supersede all prior interpretations** that may have been r**endered by any** other fire code official.*

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OFC (2) 104.2 Applications and permits

- **.** The fire code official is authorized to receive applications, **review construction documents** and **issue permits for construction** regulated by this code,
- issue permits for operations regulated by this code, inspect the premises for which such permits have been issued and enforce compliance with the provisions of this code.

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OFC (a) *104.2.1 Plan review for fire protection systems*

- ***in structures regulated by the building code as listed in rule 1301:7-7-80 of the Administrative Code.***
- *For the purposes of this paragraph, a fire code official is authorized to **conduct plan review of fire protection systems** in structures regulated by the building code as listed in rule 1301:7-7-80 of the Administrative Code in accordance with Section 106.1.2 of that code and the provisions of this paragraph.*

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OFC The fire code official is authorized to:

- **(i)** ***104.2.1.1.*** *Receive and review fire protection system and associated fire safety feature related construction documents* ***when notice is provided*** *to the building code official in accordance with* ***Section 106.1.2 of the building code*** *as listed in rule 1301:7-7-80 of the Administrative Code*

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OFC (ii) *104.2.1.2. Provide to the building official written findings*

- *of the reviewed construction documents for compliance with the provisions of this code. For each element of the reviewed construction document that does not meet the requirements of this code,*
- *the fire code official shall, in that official's written findings,* ***provide a specific reference*** *to the relevant sections of this code that have not been fully satisfied.*

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OBC 102.3 Other rules. *As provided in division (B) of Section 3781.11 of the Revised Code,*

- *the rules of the **board of building standards** shall supersede and govern any order, standard, or rule of the divisions of the fire marshal*
- *or industrial compliance in the department of commerce,*
- *and the department of health and of counties and townships, in all cases where such orders, standards or rules are in conflict with the rules of the board of building standards,*
- *except that rules adopted and orders issued by the fire marshal pursuant to Chapter 3743. of the Revised Code prevail in the event of a conflict.*

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OBC Other rules continued;

- *There may be other requirements owners may be required to meet as set forth by other licensing agencies such as;*
- *The Ohio State Fire Marshal,*
- *Ohio Department of Health,*
- *The Ohio Department of Jobs and Family Services,*
- *Ohio Department of Mental Health and Addiction Services,*
- *Ohio Department of Developmental Disabilities,*
- *Federal agencies,*
- *Or other licensing authorities.*
- *Owners and designers should investigate these additional licensing agency requirements to ensure they are incorporated into the building design before submitting to the certified building department for plan approval.*

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OBC 102.11 Building department jurisdictional limitations.

- *A municipal, township, or county building department that has been certified by the board of building standards, pursuant to Section 103.2, shall enforce provisions of the rules of the board and of Chapters 3781. and 3791. of the Revised Code,*
- *relating to construction, arrangement, and the erection of buildings or parts thereof as defined in the rules of the board in accordance with the certification* ***except as follows:***

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OBC Fire. *The state fire marshal or fire chief*

- *of municipal corporations or townships, having fire departments, shall enforce all provisions of the rules of the board relating to* ***fire prevention.***

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SECTION 106 CONSTRUCTION DOCUMENTS
106.1 Submittal documents.

- *Construction documents, statement of special inspections required and other data shall be submitted in two or more sets with each application for an approval.*
- *Construction documents, adequate for the scope of the project, shall include information necessary to determine compliance with the building, mechanical, plumbing, fire, electrical, energy, and fuel gas codes such as:*

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106.1.1 Information on construction documents. Index

- *An index of drawings located on the first sheet which shall also include all occupancy classification(s), type(s) of construction, the area in gross square feet for each level, the maximum design occupant load, the structural design loads, and the seismic design category and site class;*

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2. Site plan.
2.2 Site accessibility plan.
3. Floor plans.
4. Demolition.
5. Roof plan.
6. Exterior elevations.
7. Building sections.
8. Exterior building envelope.
9. Wall sections.
10. Interior elevations.

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11. Schedules.
12. Structure.
13. Fire suppression system.
14. Fire-resistance ratings.
15. System descriptions.
16. Operations.
17. Additional information.

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Notes

Occupancy Classifications

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OBC SECTION 302
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.

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OCCUPANCY CLASSIFICATIONS

- 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.

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HAZARDOUS MATERIALS

- The **functions** of what is happening inside the building determine the **fire protection** and **life safety** features required.
- ALL uses involving hazardous materials require some form of protection

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WHAT IS HAPPENING INSIDE?

- If we do not ask the owner what is happening inside **we will not know**!
- **Best practice** is to obtain this in **writing**
- We know they never change their operations once we design the building, RIGHT?

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HOW DO YOU KNOW IF ITS AN F OR H?

If you don't ask for the **report**
- **OBC 401.1.3** and;
- **OFC (b) 104.7.2 Technical assistance.**

you **don't KNOW**!!!!

Many occupancies are routinely **over MAQ**

- Dangerous Buildings!!
- CSB REPORTS as case studies
- NIOSH REPORTS as case studies
- NIST reports as case studies

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1. Assembly (see Section **303**): Groups A-1, A-2, A-3, A-4 and A-5.
2. Business (see Section **304**): Group B.
3. Educational (see Section **305**): Group E.
4. **Factory and Industrial (see Section 306): Groups F-1 and F-2.**
5. **High Hazard (see Section 307): Groups H-1, H-2, H-3, H-4 and H-5.**
6. Institutional (see Section **308**): Groups I-1, I-2, I-3 and I-4.
7. Mercantile (see Section **309**): Group M.
8. Residential (see Section **310**): Groups R-1, R-2, R-3 and R-4.
9. Storage (see Section **311**): Groups S-1 and S-2.
10. Utility and Miscellaneous (see Section **312**): Group U.

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OBC 307.1.2 HAZARDOUS MATERIALS

- **307.1.2** HAZARDOUS MATERIALS regardless of quantity shall comply with 414 the Ohio Fire Code (OFC)
- **Which means:** Chapters 50 through 67 and many other miscellaneous sections

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DOCUMENTATION IS KEY

- The statements of the **design limitations** should be on the drawings to protect all parties from the owners changing things later on.
- Otherwise its their word against yours.
- Emails are not adequate when deaths or serious injury are involved
- Even notarized statements are questioned. Their claim is: **"hey I misunderstood"**

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Notes

High Pile Storage and H Occupancies, OFC Chapter 32

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OFC 32 HIGH PILED STORAGE

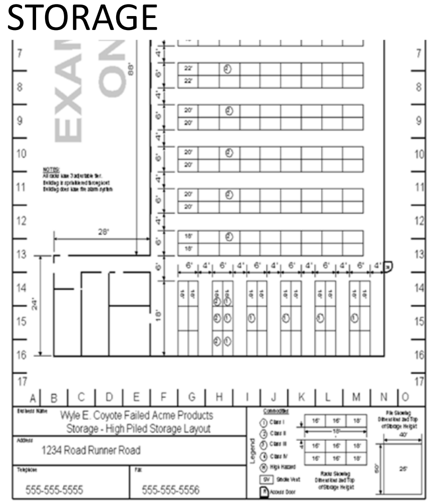
- THIS IS IMPORTANT – Items **REQUIRED** on the Construction Documents

- THERES AN **ENTIRE CHAPTER** ON THIS!!!!

- PROCEED WITH CAUTION!!
  - **9** pages
  - **14 +** Items
  - **1** Figure, and
  - **2** Tables per **OFC 3201.3**

OBC 413.1 GENERAL. HIGH PILE STORAGE

- COMBUSTIBLE STORAGE
- High-piled stock or rack storage in any occupancy group shall comply with the **Ohio Fire Code.**



OFC CHAPTER 32
HIGH-PILED COMBUSTIBLE STORAGE

- **OFC 3201.3 Construction documents.**
- At the **time of building permit application** for new structures designed to accommodate high-piled storage
- or for requesting a **change of occupancy/use,**
- and at the time of **application for a storage permit**,
- plans and specifications shall be submitted for review and approval. **NOT OPTIONAL!!!**

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OFC 3201.3 CONSTRUCTION DOCUMENTS. continued

- In addition to the information required by the Ohio Building Code,
- the storage permit submittal shall include the information specified in this section.
- Following approval of the plans, a **copy** of the approved plans **shall be maintained** on the **premises** in an **approved location**.

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THE PLANS SHALL INCLUDE ALL OF THE FOLLOWING:

- Items 1 through 14. There are actually **28**
- These are very detailed requirements
- **These should be left to specialists**
- These have very specific fire protection features to be designed into the building and are OFTEN NEGLECTED!!
- **THIS IS NOT OPTIONAL!!**

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OFC SECTION 3206 GENERAL FIRE PROTECTION AND LIFE SAFETY FEATURES

- OFC 3206.1 General.
- **Fire protection** and **life safety** features for high-piled storage areas shall be in accordance with Sections 3206.2
- through 3206.10.
- **THERE ARE 8 SUBSECTIONS AND A TABLE THAT YOU NEED TO KNOW HOW TO APPLY**

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HIGH-PILED COMBUSTIBLE STORAGE CONTINUED

- OFC 3206.3.1 **Separation** from other uses. Mixed occupancies shall be separated in accordance with the Ohio Building Code.

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307.1.2 HAZARDOUS MATERIALS

- Refers to **any OFC** references to hazardous materials!!!
- More on this later!!!
- Unfortunately this is **often overlooked** by **all** parties

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In this presentation we will discuss more simple hazards for clarity of the process

We realize not everyone will be dealing with these exact hazards, you will see.

Our intent is to start with the more simple hazards as the majority of hazards are dealt with in a similar manner.

Use and Occupancy

Companies are continually **changing**

the way they use **buildings**

and the way they use **chemicals** and **materials**

Use and Occupancy… one example of change

The tap room concept has become a fast growing concept in bars.

What we see…

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And what we don't…

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IF WE DON'T KNOW WHAT MAQ IS

- How can we apply the various Building and Mechanical Code Requirements?
- **OBC 307**
- many aspects of OBC **chapter 4 on Special Detailed Requirements**
- **OMC chapter 5 on Exhaust**

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307.1.2 HAZARDOUS MATERIALS

- 307.1.2 Hazardous materials. **Hazardous materials in ANY** quantity shall conform to the requirements of this code, including **Section 414,** and the **Ohio Fire Code**.

- **This is OFC Chapter 50 through 67!!!!! Plus the other applicable sections!!!!**

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Originally listed as a Possible CO_2 Death RECORDABLE WORKPLACE DEATH,

NOW RULED CARDIAC ARREST

10/20/2014 "A 48 year old bartender went into the basement after closing the bar in Northville Township, where she was **allegedly** overcome by leaking carbon dioxide. She was found unresponsive at 7:00 am. EMS was called and she was taken to the hospital where she died on October 20th."

See Phoenix Fire Department reenactment video
https://www.youtube.com/watch?v=fJ5FtMkUYHw

Update: The Official Cause of Death was determined not by CO_2
But CO_2 death does mimic a heart attack!!!

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MOST IMPORTANT DEFINITION OF ALL TIME

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APPROVED!

- This word was added to specific CODE sections because it is impossible to prescribe a recipe for all situations
- This word requires **PERSONAL judgment**
- This word leaves the **responsibility** upon the **Code Official** to determine what they will accept

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APPROVED!

We **all** must run our decisions through the **INTENT** test,

- to determine if our decisions meet the **intent** of the code
- and have a **SOUND BASIS**
- for the decisions/
- interpretations made.
- Where is the science?

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APPROVED!

How do we determine what is Acceptable?/**Approved?**

We ask a series of questions

- What are the **intended function**(s) of the item we are talking about?
- What must be in place in order for this intended function(s) to happen?
- What standards, NFPA or Industry are available to compare to so that we can use a
- **logical/non-arbitrary approach?**

WHAT ARE THEY WILLING TO APPROVE?

Serious Consequences for our Actions/Inactions

Ammonia Deaths, see the gas cloud low, even though it has a specific gravity of .6.

Do YOU know where sensors should be placed?

OFC Technical Assistance and OBC Hazardous Materials Opinion and Report Required

- OFC 104.7.2 Technical **assistance**
- OBC 414.1.3 Information **required**

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OFC TECHNICAL ASSISTANCE CONTINUED

- To determine the acceptability of technologies, processes, products, facilities, materials and uses attending the design, **operation or use** of a building or premises subject to inspection by the Fire Code Official,
- The Fire Code Official is authorized to require the owner or owner's authorized agent to provide, without charge to the jurisdiction, a **technical opinion and report.**

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OFC TECHNICAL ASSISTANCE CONTINUED

- The **opinion** and **report** shall be prepared by a **qualified** engineer, specialist, laboratory or fire safety specialty organization **acceptable to the fire code official**
- and shall **analyze** the **fire safety properties** of the design, operation or **use** of the building or premises and the facilities and **appurtenances** situated thereon, to **recommend necessary changes**
- The fire code official is authorized to require design submittals to be prepared by, and bear the stamp of, a registered design professional.

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LET'S TALK SOME MORE ABOUT CO_2 MOST GASSES ARE THE INVISIBLE HAZARDS

- Odorless gas
- Tasteless
- Invisible
- Acidic
- Relative density is **1.6**
- Expansion ratio is **535:1**
- Means it takes very little liquid to fill a building with a gas concentrated enough to **KILL**

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CO_2 PROPERTIES CONTINUED

- Even in the presence of normal concentrations of oxygen, death will occur at exposures of **7%** CO_2 in **only 5 minutes**
- Concentrations of 30% CO_2, even with 70% oxygen, leads to **unconsciousness in 30 seconds**

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CO_2 GAS CARRIES A 704 HEALTH RANKING OF 3

- This means the use of CO_2 gas in buildings has been regulated for many years, due the pressure being over **15 psi** per **OFC 5003.2.2 Piping, tubing, valves and fittings.**
- 2015 Codes have specific language for beverage dispensing
- **More on this later…**

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Another Emerging CO_2 Threat

Conversion of Fast-food beverage dispensing from gas cylinders (they looked like gas cylinders anyways, but really contained liquid all along) to Liquid CO_2 cryogenic cylinders (often called dewars)

Did they come back for additional design work?

Was the AHJ consulted when these locations converted to the high capacity storage containers?

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OFC 5003.2.2 PIPING, TUBING, VALVES AND FITTINGS.
OFC 5003.2.2.1 #6.

- Where gases or liquids having a hazard ranking of:
- **Health Class 3 or 4**
- Flammability Class 4
- Instability Class 3 or 4
- in accordance with NFPA 704 are carried in pressurized piping above **15 pounds** per square inch
- an **APPROVED means of leak detection** and **emergency shutoff** or excess flow control shall be provided.

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CODES NOW HAVE SPECIFIC LANGUAGE FOR BEVERAGE DISPENSING OFC OFC SECTION 5307

- Carbon dioxide **(CO_2)** systems used in beverage dispensing applications
- Applies to installations over 2-50# tanks
- OFC 5307.3 **NFPA 55**, Chapter 13.
- OFC 5307.5.1 Ventilation OR
- OFC 5307.5.2 **Emergency Alarm System** alarming at 5,000 PPM

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TAP ROOM CRAZE 50 to over 100 on tap

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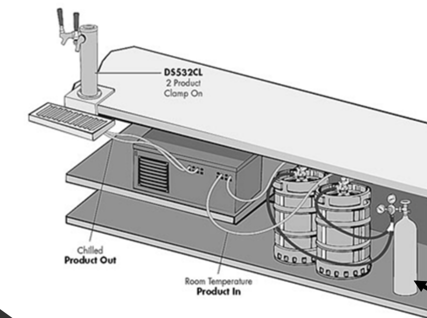
TAP ROOM COOLERS, the new hazard

Old beer delivery was limited to a **few taps** with **reach-in** coolers **directly** behind the server.



20 # CO_2 Cylinder

Now there are huge coolers with over 100 kegs tapped with pressurized CO_2 and nitrogen, **Thousands of feet of vinyl tubing**

ARE THESE EXAMPLES "H" AREAS?

Probably not

Would you want to walk in?

Probably not…

At least not without a
6-Gas Personal Protection Monitor,
as this is a **CONFINED SPACE**

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WHAT LEAKS? WHERE? WHEN? WHY?

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MORE ABOUT OFC 5003…

OFC 5003.2.2.1 Additional regulations for supply piping for health-hazard materials...items

#1shall be designed and fabricated from materials that are compatible with the material to be contained

#2 Piping and tubing shall be **identified** in accordance with **ASME A13.1**

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MORE ABOUT OFC 5003…

- OFC 5003.2.5 Empty containers and tanks.

Empty containers and tanks previously used for the storage of hazardous materials shall be free from residual material and vapor as defined by DOTn

- **EMPTY containers count as full** except those meeting standards above

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OBC EMERGENCY ALARM PRESCRIPTIVE LOCATIONS

OBC 908.1 Group H Occupancies

OBC 908.2 Group H-5 occupancy

OBC 908.3 Highly Toxic and Toxic Materials

OBC 908.4 Ozone Gas-Generator Rooms

OBC 908.5 Repair Garages

OBC 908.6 Refrigerant Detector

OBC 908.7 Carbon Monoxide Alarms

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OTHER LOCATIONS OF HAZARDS

- CO_2 Refrigeration
- CO_2 suppression systems NFPA-12
- MRI machines
- Swimming pool water treatment
- Laundromat water treatment
- Brewhouses
- Distilleries
- Ice Cream Making in a Retail Setting

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OTHER LOCATIONS

- On-location ice cream station with liquid Nitrogen in small tenant spaces!!
- Expansion ratio of **694:1**

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Is Ice Cream making mentioned **specifically** in the codes?
NO!!

It **doesn't't have to be** specifically mentioned!

Do they need some form of protection?

Absolutely!

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WHY??

Because they are hazards!!!

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OBC 908.1 GROUP "H"

A Group "**H**" occupancy is typically triggered by a quantities of hazardous materials in **excess of the MAQ** (Maximum Allowable Quantity).

Additionally, the codes identify a number of **specific applications** that require classification of an area as **"H"**

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REQUIRED FOR GROUP “H” OCCUPANCIES…

Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided in accordance with Section OBC 414.7

Section OBC 414.7 says:

Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided as set forth herein.

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BLAST PROTECTION NFPA 68

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OBC 414.7.1 STORAGE (GROUP H) SAYS…

An ***"approved"*** manual emergency alarm system shall be provided in buildings, rooms or areas used for storage of hazardous materials.

Emergency **alarm-initiating devices** shall be installed outside of each **interior exit** or **exit access** door of storage buildings, rooms or **areas**.

Activation of an emergency alarm-initiating device shall sound a local alarm

OBC 414.7.2 DISPENSING, USE AND HANDLING (GROUP H) SAYS…

Where hazardous materials having a hazard **ranking of 3 or 4** in accordance with **NFPA 704** a local manual alarm station or an **approved** alarm-initiating device at not more than **150-foot** intervals and at **each exit** and exit access doorway throughout the transport route.

OBC 415.5.3 SUPERVISION

Emergency alarm systems **shall be supervised by an approved:**

- central,
- proprietary or
- remote station service or
- shall initiate an audible and visual signal at a constantly attended on-site location.

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EMERGENCY POWER

- **OBC 415.5.4** Emergency alarm systems. Emergency alarm systems shall be provided with **emergency power** in accordance with Section 2702.

EMERGENCY POWER SYSTEM. A source of automatic electric power of a required capacity and duration to operate required;

- life safety,
- fire alarm,
- detection and
- ventilation systems in the event of a failure of the primary power.
- Emergency power systems are required for electrical loads where interruption of the primary power **could Result** in loss of human life or serious injuries.

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OBC 415.6 FIRE SEPARATION DISTANCE

- Group H occupancies shall be located on property in accordance with the other provisions provisions of this chapter.

- In Groups **H-2 and H-3**, not less than **25 percent** of the perimeter wall of the occupancy **shall be an exterior wall .**

OBC 908.2 GROUP H-5 OCCUPANCY. RARE

HPM areas, Hazardous Production Materials, used in semiconductor industry,

Also other uses that use **similar materials** with **similar hazards**.

OBC 908.3 HIGHLY TOXIC MATERIALS

What is a "**Highly Toxic** Material"?

A material which produces a lethal dose or lethal concentration which falls within **any** of the following categories:

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1. A chemical that has a median lethal dose (LD50) of 50 mg. or less per kg. of body weight when administered **orally** to albino rats weighing between 200 and 300 gr. each.

2. A chemical that has a median lethal dose (LD50) of 200 mg. or less per kg**.** of body weight when administered by **continuous contact** for 24 hours (or less if death occurs within 24 hours) with the **bare skin** of albino rabbits weighing between 2 and 3 kilograms each.

3. PART #1: A chemical that has a median lethal concentration (LC50) in air of **200 PPM** by volume or less **of gas or vapor,** or

PART #2: 2 mg. per liter or less of **mist, fume or dust**, when administered by **continuous inhalation** for one hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

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OBC 908.4 OZONE GAS-GENERATOR ROOMS.

Laundromats

Commercial Swimming Pools (Schools, Hotels, Clubs, YMCA)

Equipment staged for Installation into usually a closed space

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OTHER BUILDINGS

- Landscaping contractors
- Home oxygen supply companies
- Dry cleaners
- Distilleries
- Breweries
- Light manufacturing
- Any bulk gas quantities

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OBC 908.5 REPAIR GARAGES

Traditionally CO and NO_2

See
Emerging Hazards…
Non-odorized alternative fuel types such as:

- Compressed Natural Gas
- Liquefied Natural Gas
- Hydrogen Gas

What do you ask for on the plans, the plans should state: "This building is NOT equipped nor designed for alternative fueled vehicles!!!!

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OBC 908.6 REFRIGERANT DETECTOR

- When Required by the Ohio Mechanical Code **Chapter 11**
- Based upon type of system, type of refrigerant, volume of refrigerant compared to room volume
- **"I"** (Institutional) uses are **50%** of all others
- **RCL**= Refrigerant Concentration Limits

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OFC 606 MACHINERY ROOMS

Two different levels of Machinery Rooms

Or as I say, **“two different animals”**

OMC SECTION 1105 MACHINERY ROOM,

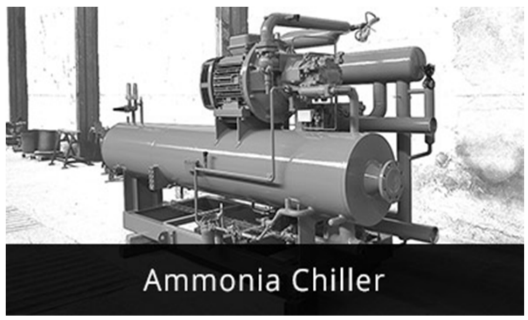
GENERAL REQUIREMENTS refers to 606.8 of the OFC

OMC SECTION 1106 MACHINERY ROOM,

SPECIAL REQUIREMENTS

OMC 1106.4 Flammable Toxic refrigerants

HAZARDOUS REFRIGERANT CLASSIFICATIONS
Require an
EMERGENCY ALARM SYSTEM



Common in supermarket refrigeration systems for coolers freezers, “**REFRIGERATED WORKSPACES”**. **REQUIRE APPROVED DETECTION SYSTEMS!!!**

Multi-zone detection requires **detailed engineering and detailed submittals & REPORT**

908.7 CARBON MONOXIDE ALARMS

- Where required by the Building Code
- When the designer chooses to use the intermittent option for parking garage and other motor vehicle areas (LPGAS and Gasoline/Diesel forklifts, Zambonis, floor cleaners).

CO AND NOX TECHNICAL REQUIREMENTS

Both NOX and CO detection, alarm and ventilation activation required, 30-minute post-operation time-delay off requirement frequently missed.

This **is not** a code requirement, but prevents short cycling the equipment.

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CHECKLIST

- Only beverage dispensing?
- Beverage dispensing and walk-in cooler with gas piped in?
- Hazardous materials opinion and report?
- Emergency Alarm System Approved by the AHJ?
- Emergency Plan?

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STRATEGY

- Identify the hazard
- Quantify the hazard
- Identify acceptable mitigation strategies
- Implement the above strategies

- ABOVE ALL ELSE, **STOP AND ASK QUESTIONS, RESEARCH, ASK YOUR PEERS.**

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ADDITIONAL RESOURCES

- In all cases we **need the report**
- We are required to ask for **the report**
- OFC **Appendix E**
- Especially **OFC E-103** provides the methodology

- Remember you do not have to be an expert, just seek them out for assistance

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Notes

Fire Protection Features and Equipment, OFC Chapter 9, MBC Chapter 9

Kendall Nightlinger

NOT WALLS!!! SECTION 707 FIRE BARRIERS

- 707.1 **General.** Fire barriers installed as required elsewhere in this code or the Ohio Fire Code shall comply with this section.
- 707.2 **Materials**. Fire barriers shall be of materials permitted by the building type of construction.
- 707.3 **Fire-resistance rating**. The fire-resistance rating of fire barriers shall comply with this section.

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FIRE BARRIER

- **IS MENTIONED**
- **ONE HUNDRED AND TWENTY TWO TIMES!!!**
- **IS IT IMPORTANT???**
- **It is to important to compartmentalization**

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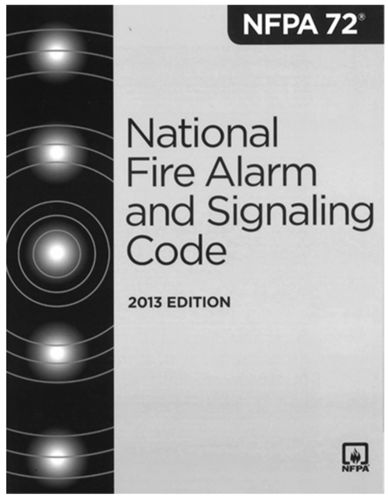
FIRE DETECTION, ALARM AND COMMUNICATION SYSTEMS



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FIRE PROTECTION / SPRINKLER SYSTEMS

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EMERGENCY ALARM SYSTEMS

- There Is No Stand Alone Standard
- Nfpa-72 Speaks About It Briefly
- It Is A Fire Protection System
- It Is In Chapter 9 Of The OBC
- It Is A Life Safety System
- It Should Be Treated As Such
- **Deferred Submittals Required**
- Same Level Of Performance, Reliability, Detail And Scrutiny

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STANDARD OF CARE

- You can meet the code minimum and still find yourself explaining for not providing standard of care.

- Industry standard
- Due diligence
- Documentation

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Ohio | Department of Commerce
Division of Industrial Compliance

PLAN SUBMITTAL CHECKLIST
FIRE ALARM SYSTEMS

1. If this fire alarm submittal is a part of a building permit submission, please indicate the building permit number **(CPA number)** in your submittal document.
2. Identify the proper **building use group** and **construction type** classifications in accordance with Chapter 3 and Chapter 6 of Ohio Building Code.
3. Identify applicable scope of work as follows:

   _____ New Alarm System Installation ______ Existing System Replacement
   _____ Existing System Alteration
4. Submit a scaled floor plan indicating the following:
   - Room names or use purposes
   - Alarm device location and output capacity (candela and decibels)
   - Ceiling height and device mounting height
   - Compliance with accessibility requirements in Chapter 11 OBC and ICC A117.1.
   - If alteration, indicate all existing devices and output capacities
5. Submit manufacturer's specifications and details for all alarm devices and panels. Panels and devices must show their listing for proper uses.
6. Submit a battery calculation and a voltage drop calculation.
7. Submit an electrical floor plan and wiring diagram indicating the following:
   - Control panel
   - Zones
   - System Riser and wiring schematic including conductor types and sizes
   - Method of fire alarm system supervision
   - Auxiliary devices such as door holders, sprinkler flow switches, elevator recall, exhaust hood systems, etc.
8. If an elevator exists, coordinate with the following:
   - Ohio Elevator Code
   - NFPA 72
   - ICC A117.1
9. Provide certified fire alarm designer's certification number and signature,
10. Provide fire alarm system installer's certification number
11. Submit fees for fire alarm plan review and process.

Revised 04/02/2019

Bureau of Building Code Compliance
6606 Tussing Road
Reynoldsburg, OH 43068-9009

614-644-2622
Fax 614 -644-3145
TTY/TDD 800-750-0750
com.ohio.gov

Notes

Occupancy Exercises

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OCCUPANCY EXERCISES

- What information is necessary to determine the Occupancy Classification?

- Why is it important to properly classify an occupancy?

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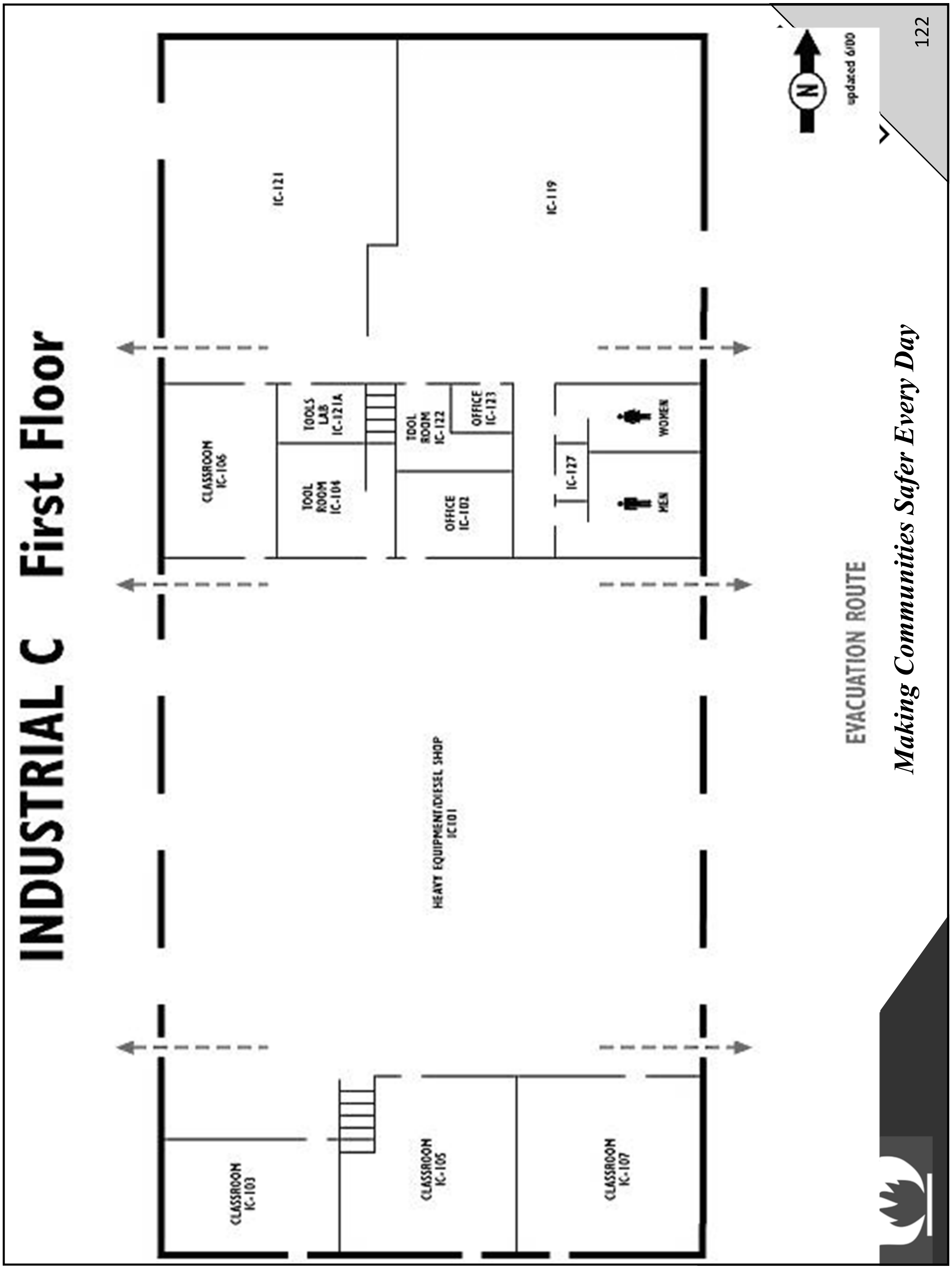
INDUSTRIAL C First Floor
CLASSROOM IC-106
TOOLS LAB IC-121A
TOOL ROOM IC-104
TOOL ROOM IC-122
OFFICE IC-123
OFFICE IC-102
IC-127
WOMEN
MEN
IC-121
IC-119
HEAVY EQUIPMENT/DIESEL SHOP IC101
CLASSROOM K-103
CLASSROOM IC-105
CLASSROOM K-107
N
updated 6/00
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EVACUATION ROUTE
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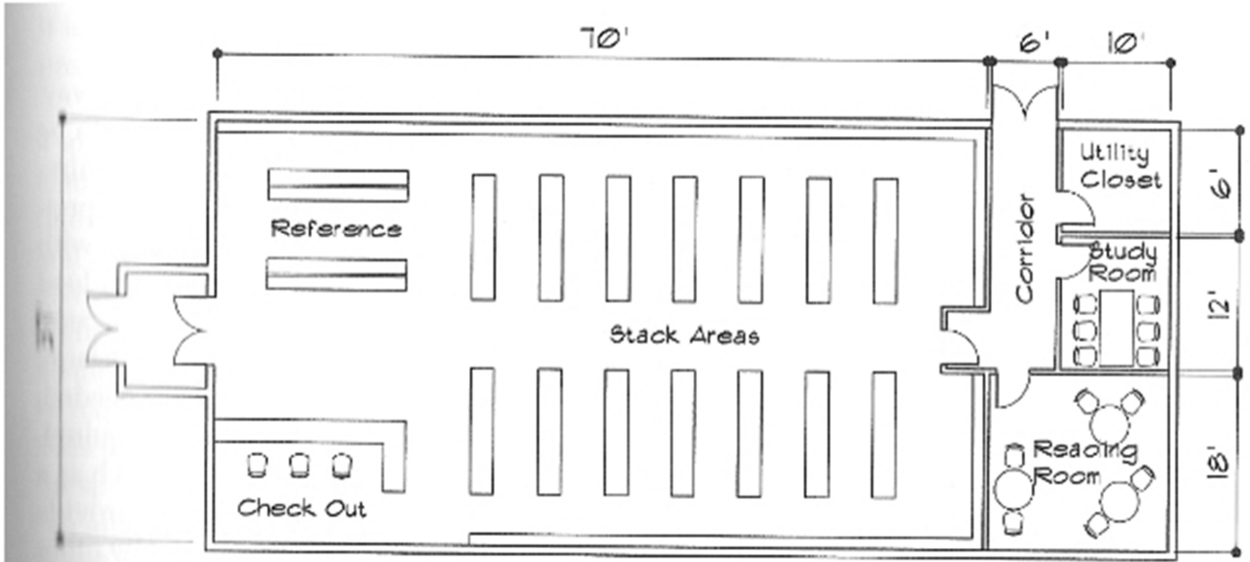
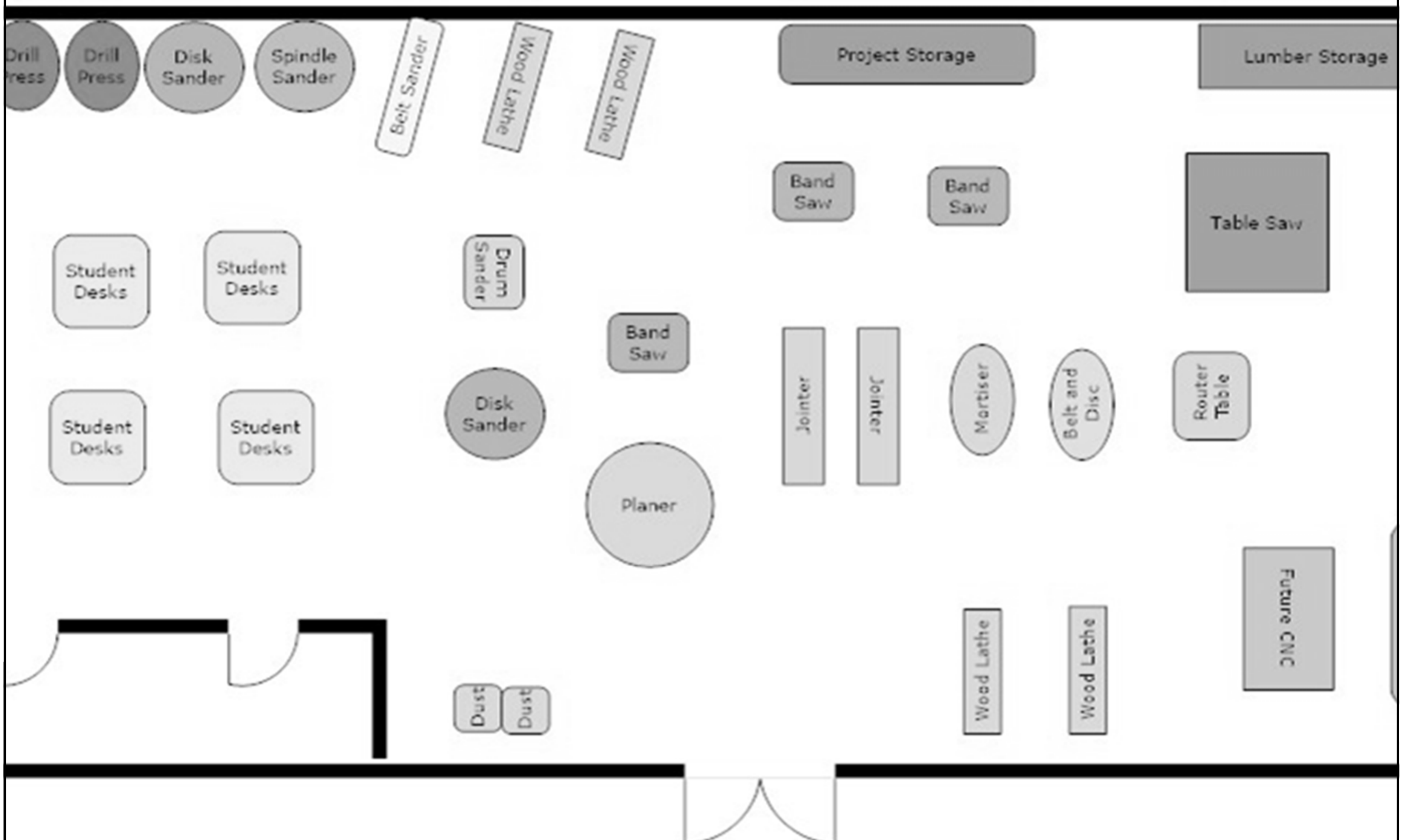
Occupancy Load = Floor Area (sq. ft) / Occupant Factor



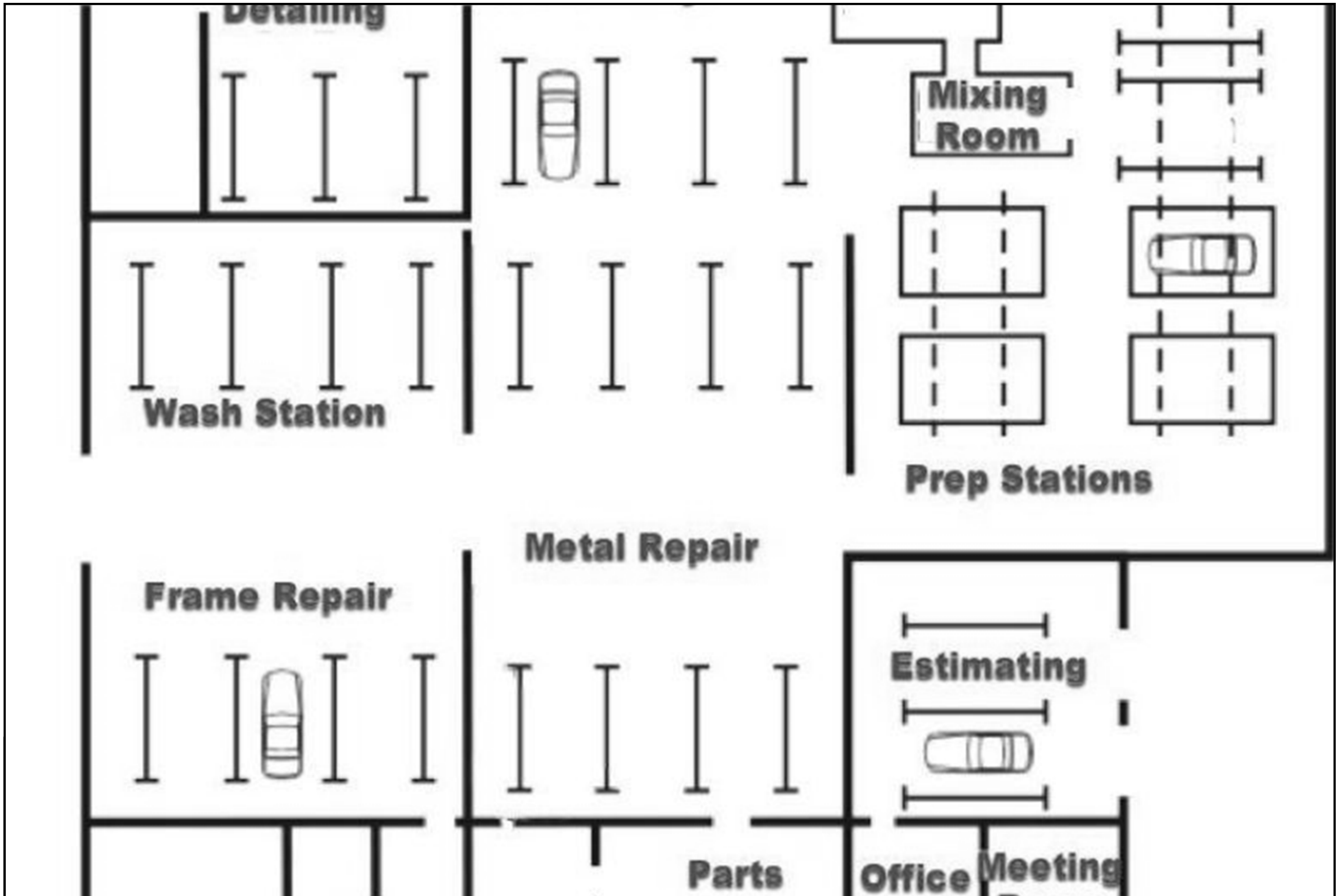
ROOM	LOAD FACTOR	SIZE OF SPACE	FLOOR AREA	OCCUPANCY LOAD
Stack Area	100 gross	70 x 37	2590 SF	2590 ÷ 100 = 25.9
Reading Room	50 net	16 x 18	288 SF	288 ÷ 50 = 5.8
Study Room	15 net	10 x 12	120 SF	120 ÷ 15 = 8
		Total Number of Occupants = 39.7 = 40		

Library table 1004.1.2 for occupant load and section 303 is this an A or B?

SHOP WITH OFFICE

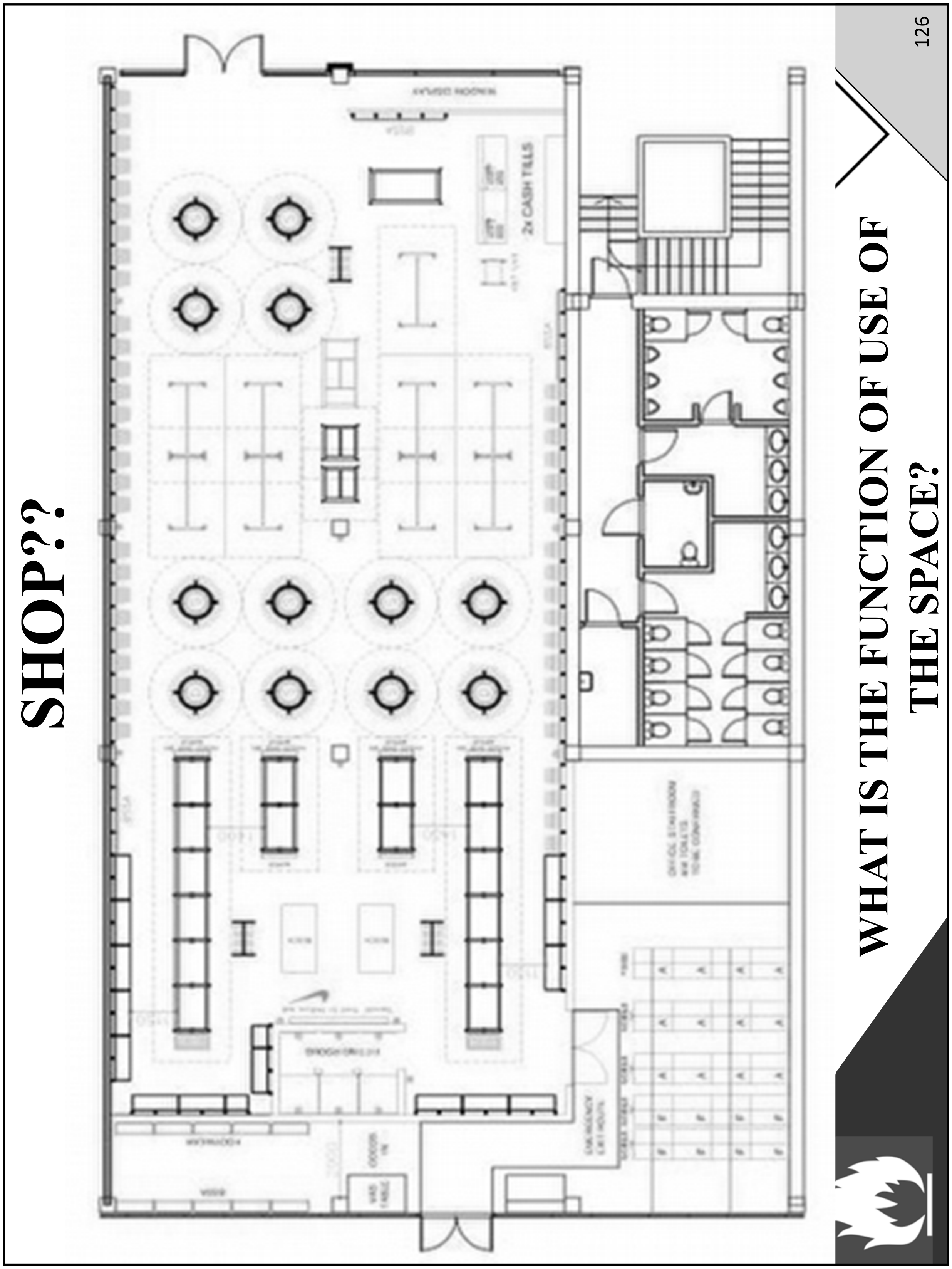


Making Communities Safer Every Day

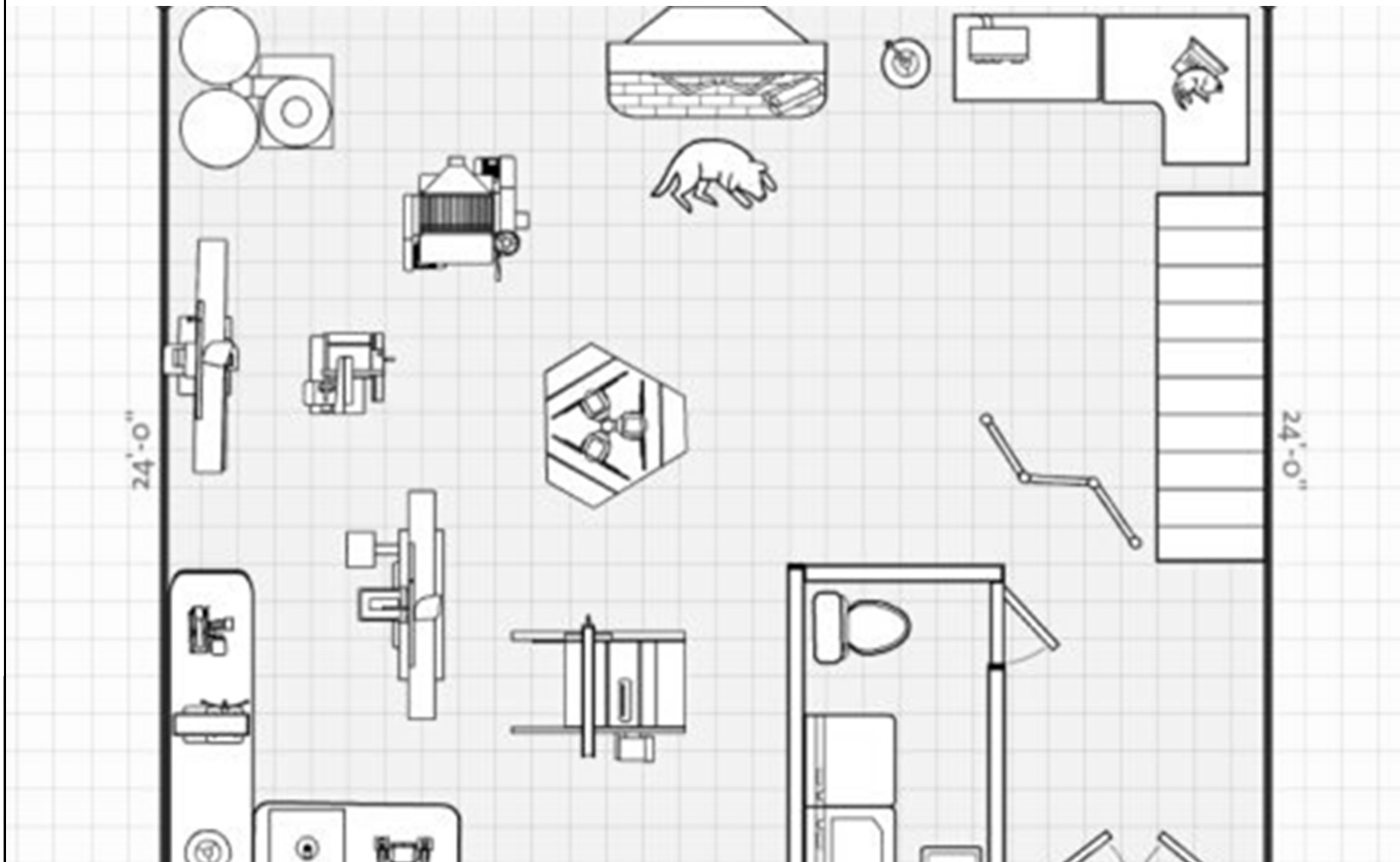


AUTO SERVICE SHOP

125


126
WHAT IS THE FUNCTION OF USE OF THE SPACE?
SHOP??
2x CASH TILLS

WOOD SHOP



Making Communities Safer Every Day

We live and die by the code!!

https://www.youtube.com/watch?v=vB77ZqdDSZ4

Making Communities Safer Every Day 128

Making Communities Safer Every Day 129

Proactive Compliance saves your clients Time and Money

The Ino-Tek approach is to provide customers with cost-effective code-compliant systems and all documentation needed to gain rapid acceptance from both Building and Fire officials. For Ino-tek customers, our deferred submittals are readily accepted by municipal Building Departments and upon commissioning, approval by the Fire Official is virtually guaranteed. These quick approvals save your clients time and money by avoiding costly delays.

Code-Compliance is at the core of Ino-Tek's mission. Understanding the complex interplay between the various code sources is incredibly difficult – but Ino-Tek leads the way! With over 20 years of Code Research, and close interaction with the International Code Council, we are a respected and sought-after choice for sharing our expertise and perspectives to the Code Enforcement community, Architects and Engineers plus End-Users. Each year, we share our knowledge through dozens of seminars, trade show presentations and state-approved classes.

Interested in a Lunch and Learn for your team? Call us today!

www.ino-tek.com
586-336-0856

Thank You

Making Communities Safer Every Day 131

Notes

This concludes The American Institute of Architects Continuing Education Systems Course

Complying with Fire Protection and Building Codes

HalfMoon Education, Inc.

Douglas E. Chapman

doug@halfmoonseminars.org

File Attachments for Item:

ER-2 2021 ICC EduCode Online Symposium

77 courses, mostly 4 or 8 hours, in a 5 day program: see brochure.

Staff Notes: Recommend approval for all courses on a request basis rather than creating 77 new courses in BBS database. ESI courses have been submitted to ESIAC for review.

ESIAC Recommendations: Recommend approval for ESI courses.

Committee Recommendation:

Classes being offered **virtually!**

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Twenty-Four Years of Building Code Education

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#EduCode2021

March 1–5, 2021

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#EduCode2021

Welcome to EduCode 2021!

EduCode 2021 is our 24th year of providing outstanding education for Inspectors, Plans Examiners, Permit Technicians, Code Enforcement Officers, Building Officials, Architects, Engineers, Managers, Leaders, Directors, and all others working or interested in a safe built community. The last several months have been quite taxing on everyone in the building, fire and safety environment, but overall by the quality of the trained professionals in our industry we have proven to overcome any hurdles put in place.

EduCode is here to help strengthen this professionalism by providing industry renowned education, training, networking, and experiences for everyone who attends. Due to restrictions put in place throughout the country, this year EduCode is proud to offer a virtual platform that will maintain our level of excellence and interesting events. This is a first for EduCode, but we listened to our partners, sponsors, and attendees to ensure that we always provide what is needed and best suits you, our customer.

EduCode 2021, while only virtual this year, still provides you with a full week of training where you will receive up to 4.0 CEU's of ICC Preferred Provider credit. Whether you attend for one day or the full week, your experience will be rewarding! While attending, make sure you visit all our exhibitor and sponsors for updates on new innovations, techniques, career potentials, and other valuable information.

I am looking forward to seeing everyone online and will continue to make your EduCode experience the best it can be!

Sincerely,

Alan Ellis
EduCode Director

2018 IRC Essentials

SESSION 1

CEU: 0.8
Instructor: Cash Olszowy
Class Format: Virtual

This seminar examines basic concepts of the 2018 International Residential Code (IRC). These concepts provide a basis for the correct utilization of the code. A clear understanding of the identified requirements allows the code user to apply the IRC in specific situations and helps to build an understanding of the intent of the code when asked to make a judgment on code compliance. This course will also help the code user to correctly locate code requirements. It will also provide a basis for the correct use and application of the code as well as to begin to develop a procedure for applying them.

2018 IBC Use of Fire and Smoke Separations

SESSION 2

CEU: 0.4
Instructor: George Mann
Class Format: Virtual

This seminar identifies the many and varied conditions identified in the IBC where fire and/or smoke separations are required. The discussion will focus on those required locations where fire-resistance-rated wall and horizontal assemblies, as well as smoke-resistive wall and horizontal assemblies, are either required by the IBC or utilized by design professionals as alternative approaches to code compliance. Such locations include the selective or mandated use of fire walls, fire barriers, fire partitions, smoke barriers, horizontal assemblies and other separation elements.

2018 IBC Allowable Height and Area

SESSION 3

CEU: 0.4
Instructor: George Mann
Class Format: Virtual

Based on the provisions of IBC Chapter 5, this seminar focuses on how a building's occupancy classification and type of construction relate to the maximum building size permitted by the IBC. The approach to determining a building's maximum allowable height and area is explained, including use of Table 503 and all related permitted increases due to sprinkler protection and frontage open space. Detailed provisions related to mezzanines and unlimited area buildings are also addressed.

What's New for the 2020 NEC?

SESSION 4

CEU: 0.8
Instructors: Christel & Randy Hunter
Class Format: Virtual

This is a fast-paced seminar that will cover major changes in the 2020 National Electrical Code®. Photos and illustrations will be used to show how the NEC® is changing and how those changes will affect electrical installations. A few of the changes include: GFCI protection expansion, emergency disconnects for dwellings, changes to lighting load calculations, new articles, and the extensive reorganization of Article 310. Attendees should bring a 2020 NEC.

2018 IFC Performing Commercial Fire Inspections

SESSION 5

CEU: 0.8
Instructor: Scott Adams
Class Format: Virtual

This seminar presents the process of conducting commercial fire inspections, following the provisions and requirements of the 2018 International Fire Code®. Specifically, the seminar provides participants with checklists that enable those performing commercial fire inspections to determine whether the materials, design, construction, installation and location of building components comply with the code.

2018 IBC Use of Fire Sprinklers and Alarms

SESSION 6

CEU: 0.4
Instructor: Terrell Stripling
Class Format: Virtual

This seminar identifies those conditions under which automatic sprinkler protection and/or fire alarm systems are required. The application of the fire area concept will be discussed, along with the varying extent of sprinkler protection required based upon specific situations. In addition, the discussion will address many of the key code conditions under which the presence of an automatic sprinkler system can be used to modify other requirements.

2018 IBC Exit Systems

SESSION 7

CEU: 0.4
Instructor: Terrell Stripling
Class Format: Virtual

This seminar focuses on IBC Chapter 10 means of egress components that are defined and regulated as exits. These components, defined in Chapter 2, are considered as high-level elements that provide a considerable degree of occupant protection within the means of egress system. The exit discharge provisions will also be discussed.

IRC Plan Review

SESSION 8

CEU: 0.8
Instructor: Gil Rossmiller
Class Format: Virtual

This seminar is designed to provide a broad overview of the process for residential plan review, this course will provide the basic steps involved to complete a comprehensive review of a residence. The class will discuss the tools and process for conducting a residential plan review. It will also increase your awareness of the necessary items required to ensure code compliance of the homes built in your jurisdiction.

2018/2021 UMC/IMC Code Changes

SESSION 9

CEU: 0.4
Instructor: Tim Collings
Class Format: Virtual

Keep up-to-date on the Uniform Mechanical Code® (UMC®)/ International Mechanical Code® (IMC®) by learning about the changes from 2018 to the 2021 edition. Each notable change to the code will be discussed in depth so attendees see exactly how the code changed, why the code changed, and what impact it will have on the code enforcement and installer communities.

2018/2021 UPC/IPC Code Changes

SESSION 10

CEU: 0.4
Instructor: Tim Collings
Class Format: Virtual

Keep up-to-date on the Uniform Plumbing Code® (UPC®)/ International Plumbing Code® (IPC®) by learning about the changes from 2018 to the 2021 edition. Each notable change to the code will be discussed in depth so attendees see exactly how the code changed, why the code changed, and what impact it will have on the code enforcement and installer communities.

Leadership IMPACT – Communications

SESSION 11

CEU: 0.8
Instructor: Tim Schneider
Class Format: Virtual

The ability to communicate effectively and at the right frequency is the core of success in leadership, business and life. Those that are able to relay instructions, vision and more, can connect with others, enhance personal productivity and avoid unneeded conflicts.

This seminar will enhance the ability to listen, communicate clearly, manage communication tone, match communication style, and control non-verbal tone. Additionally, communication boundaries, frequency and the incredibly important skill of communication richness will be presented. Leadership IMPACT-Communications introduces participants to the powerful DiSC assessment as a highly accurate predictor of communication style and other key tendencies.

Morning sessions start at 7:30 a.m. PT | Afternoon sessions start at 1:00 p.m

2018 IPMC Crash Course

SESSION 12

CEU: 0.4
Instructor: Tana Bryant
Class Format: Virtual

Learn to navigate the International Property Maintenance Code in a fun filled manner. Easy study tips to help prepare for the IPMC certification exam.

Communications – Verbal, Written and Physical

SESSION 13

CEU: 0.4
Instructor: Barbara Burlingame
Class Format: Virtual

What you say and how you say it, whether in writing, face to face or by body language can determined how your interaction with the public will be. Tips for success in dealing with the public, co-workers or city officials for use in day to day settings.

2018 IBC Fire and Life Safety Principles

SESSION 14

CEU: 0.8
Instructor: Jay Woodward
Class Format: Virtual

This seminar addresses the critical concepts of the 2018 IBC regarding fire and life safety issues. These concepts provide a basis for the correct use of the code in building planning, classification of buildings and occupancies, fire-resistance-rated construction, fire protection systems and means of egress. The content addresses issues that are necessary for many designs and plan review decisions. During this training, participants will be listening to lecture and viewing examples, as well as discussing sections of the IBC that pertain to fire and life safety principles in building design and regulation.

2021 IBC Update

SESSION 15

CEU: 0.4
Instructor: Sandra Hyde
Class Format: Virtual

This seminar addresses important changes that occurred between the 2018 to the 2021 edition of the International Building Code (IBC). Although most of the presentation focuses on revisions to the IBC fire- and life-safety provisions, additional areas of discussion include accessibility, structural elements and systems, construction materials and building services. The seminar assists building officials, fire officials, plans examiners, inspectors and design professionals in identifying the specific code changes that have occurred and understanding the reasoning behind the changes. This seminar is a shortened version of the seminars 2021 IBC Nonstructural Changes and 2021 IBC Structural Changes and covers only a portion of the topics addressed in those programs.

2021 IRC Update

SESSION 16

CEU: 0.4
Instructor: Sandra Hyde
Class Format: Virtual

This seminar addresses important changes that occurred between the 2018 to the 2021 edition of the International Residential Code (IRC). Although the focus of the presentation is on revisions to the IRC building planning, foundation and framing provisions, additional topics of discussion include energy, plumbing, mechanical and electrical. The seminar assists building officials, fire officials, plans examiners, inspectors and design professionals in identifying the specific code changes that have occurred and understanding the reasoning behind the changes. The seminar is a shortened version of the seminar 2021 IRC Significant Changes.

DESCRIPTIONS – MONDAY, MARCH 1

Building Plans Examiner Test Academy – Day 1

SESSION 17

CEU: 2.4
Instructor: Jerry Flanik
Class Format: Virtual

The 2018 Building Plans Examiner Certification Test Academy features expert instruction and includes interactive review exercises, practice exams and individual and group-based activities to help you get better prepared to take the exam. Throughout the academy you will be given an opportunity to answer questions that reference the exam resources. Main Topics include: General Administration, Building Planning, Footings and Special Foundations, Floor Construction, Wall Construction and Coverings, Roof/Ceiling Construction and Public Safety and Special Construction. The goal of the test academy is to familiarize you with the building plans examiner certification exam content.

Required Materials: For this academy, you will need the 2018 International Building Code (IBC) and either the ACI 318 OR Concrete Manual (any edition).

NOTE: Exam not included but can be purchased separately.

DESCRIPTIONS – TUESDAY, MARCH 2

2021 IRC Significant Changes

SESSION 19

CEU: 0.8
Instructor: Cash Olszowy
Class Format: Virtual

This seminar reviews and analyzes selected significant changes from the 2018 to the 2021 edition of the International Residential Code (IRC). Although the focus of the presentation is on revisions to the IRC building planning, foundation and framing provisions, additional topics of discussion include energy, plumbing, mechanical and electrical. The seminar assists building officials, fire officials, plans examiners, inspectors and design professionals in identifying the specific code changes that have occurred and understanding the reasoning behind the changes. The program is based on the ICC publication Significant Changes to the International Residential Code, 2021 Edition.

2018 IBC Special Building Types, Features and Hazards

SESSION 20

CEU: 0.4
Instructor: Terrell Stripling
Class Format: Virtual

Based on selected provisions from Chapter 4, this seminar focuses on several special building types, features and hazards. High-rise buildings, underground buildings, parking garages are specialized buildings that have their own unique considerations. Atriums, stages and platforms are building features that are evaluated in a special manner due to the hazards involved. Combustible storage, use and storage of hazardous materials, spray application of flammable finishes, medical gas storage rooms, control areas and laboratory suites are also addressed. The special detailed requirements and allowances set forth throughout Chapter 4 address a variety of uses and occupancies.

Application and Administration of the I-Codes

SESSION 21

CEU: 0.4
Instructor: Tim Ryan
Class Format: Virtual

Chapter 1 of each of the I-Codes is arguably the most important chapter in each of those publications. Although many jurisdictions modify the chapter to some degree, the fundamental concepts and principles typically remain to guide users in the code's proper application and administration. The seminar will focus on two primary areas of emphasis: 1) application of the provisions based on the concepts of minimum standard, AHJ interpretative authority, alternate methods of materials and coordination of potential conflicting provisions, and 2) administrative functions including code official, plan review and inspector responsibilities.

Electrical Safety and NFPA 70E 2021

SESSION 22

CEU: 0.8
Instructor: Howard Herndon
Class Format: Virtual

This is an extensive and popular program analyzing the major points to enable attendees to further their knowledge on safe practices related to electrical safety based on the new 2021 edition of NFPA 70E. Extremely detailed instructions and demonstrations are presented related to personal protective equipment (PPE). The demonstrations of PPE allow each participant to learn the proper practices to follow and prevent loss of life during the hazards involved in such work environments. The NFPA 70E 2021 is the recommended text for this class and each attendee bring their own copy. Copies will also be available for purchase at EduCode.

2018 IFC Essentials

SESSION 23

CEU: 0.8
Instructor: Scott Adams
Class Format: Virtual

This seminar will introduce the application of the IFC administrative requirements, occupancy classification, general precautions against fire, emergency planning and preparedness, fire service features, interior finish, decorative materials and furnishings, fire protection systems, means of egress, and provide an introduction to hazardous materials. Activities and discussions will further enhance participant learning. This seminar is designed to familiarize and assist code officials in locating, describing and applying applicable code requirements of the IFC to determine compliance or noncompliance.

Commercial Accessibility

SESSION 24

CEU: 0.8
Instructor: Kim Paarlberg
Class Format: Virtual

This seminar focuses on the minimum requirements for new or existing construction of accessible commercial buildings for compliance with the International Building Code® (IBC®) and ICC A117.1 Accessible and Usable Buildings and Facilities. It addresses the design, plan review and inspection of facilities to ensure that people with physical impairments, visual impairments and hearing impairments can use the facilities. Attendees will participate in activities that involve questions and answers, discussion and case study, performing parts of individually and in groups.

Residential Inspections

SESSION 25

CEU: 0.8
Instructor: Gil Rossmiller
Class Format: Virtual

This seminar provides new residential inspectors with basic techniques and an understanding of conducting inspections of one & two dwelling and townhouse buildings. The discussion will include preparation, presentation and inspections of the building, plumbing, mechanical and electrical portions of a building.

2018/2021 UPC/IPC Workshop

SESSION 26

CEU: 0.4
Instructor: Tim Collings
Class Format: Virtual

Apply your code knowledge and expertise in this dynamic, hands-on workshop. Attendees will examine drawings of plumbing systems and installations for code violations in a cooperative and collaborative environment with their peers. Each drawing is designed to challenge attendees on parts of the code that are frequently misunderstood or in frequent violation. Attendees will work in groups during the workshop exercise and their findings, as well as those presented by the instructor, will be shared with the rest of the attendees for a robust learning experience.

2018/2021 UMC/IMC Workshop

SESSION 27

CEU: 0.4
Instructor: Tim Collings
Class Format: Virtual

Apply your code knowledge and expertise in this dynamic, hands-on workshop. Attendees will examine drawings of mechanical systems and installations for code violations in a cooperative and collaborative environment with their peers. Each drawing is designed to challenge attendees on parts of the code that are frequently misunderstood or in frequent violation. Attendees will work in groups during the workshop exercise and their findings, as well as those presented by the instructor, will be shared with the rest of the attendees for a robust learning experience.

Leadership IMPACT – Team Member

SESSION 28

CEU: 0.4
Instructor: Tim Schneider
Class Format: Virtual

Unlock half of your influence with team members with this learning program. Team members that are engaged will have more loyalty, work harder, produce higher quality and deliver outstanding customer service. Leaders with engaged teams and healthy work cultures experience much greater results and have better levels of personal job satisfaction.

The return on investment for team member engagement is achieved by using the strategies of relationship building and depth, managing leadership tone and understanding team member motivating factors. Creating a healthy working culture and connecting team members to the purpose of the organization are provided as extra resources in this program.

Engagement Leadership IMPACT – Coaching

SESSION 29

CEU: 0.4
Instructor: Tim Schneider
Class Format: Virtual

At the heart of great leaders is a great coach. A person that can provide positive feedback easily, corrective feedback without alienating a team member and someone who uses coaching to release the rest of their influence with team members. Coaching, when done correctively and well, will dramatically improve workplace performance, team member engagement and unlock the potential of all team members. In addition to positive feedback and corrective feedback, this program presents skills associated with selecting team members, releasing team members when needed and providing teaching-type coaching.

Code Compliance Ideas & Challenges for Small Towns

SESSION 30

CEU: 0.4
Instructor: Kelvin Beene
Class Format: Virtual

This course delves into the varying issues that come with code enforcement in smaller municipalities. It compares and contrasts the many problems that are shared between the two entities and offers solutions and suggestions to making enforcement easier for the officers.

Why Are We Essential?

SESSION 31

CEU: 0.4
Instructor: Kelvin Beene
Class Format: Virtual

This course details why code enforcement is essential to the health, safety and economic development of cities. It also details the necessity to show yourself with city governance.

2018 IBC Exterior Wall and Opening Protection

SESSION 32

CEU: 0.4
Instructor: George Mann
Class Format: Virtual

This seminar addresses the various provisions in the IBC dealing with exterior wall design and construction. Although such walls are primarily regulated due to their location on the lot, many other additional requirements are set forth in the code. Exterior bearing walls are regulated by Table 601, while the use of exterior exit stairways, exit courts and exterior areas of assisted rescue will also typically mandate some degree of fire-resistance.

2018 Types of Construction Classification and Application

SESSION 33

CEU: 0.4
Instructor: George Mann
Class Format: Virtual

Together with occupancy classification, one of the most critical steps in analyzing a building for code compliance is classifying it for type of construction purposes. This seminar will address the two distinct aspects of construction type: 1) determination of the appropriate types of construction based on building occupancy, height and area, and 2) identification of the construction and fire-resistance-rated features associated with the nine individual construction types. The permissible use of combustible materials in Type I and II noncombustible buildings will also be addressed.

Building Plans Examiner Test Academy – Day 2

SESSION 17

CEU: 2.4
Instructor: Jerry Flanik
Class Format: Virtual

The 2018 Building Plans Examiner Certification Test Academy features expert instruction and includes interactive review exercises, practice exams and individual and group-based activities to help you get better prepared to take the exam. Throughout the academy you will be given an opportunity to answer questions that reference the exam resources. Main Topics include: General Administration, Building Planning, Footings and Special Foundations, Floor Construction, Wall Construction and Coverings, Roof/Ceiling Construction and Public Safety and Special Construction. The goal of the test academy is to familiarize you with the building plans examiner certification exam content.

Required Materials: For this academy, you will need the 2018 International Building Code (IBC) and either the ACI 318 OR Concrete Manual (any edition).

NOTE: Exam not included but can be purchased separately.

Building Science Meets the IECC

SESSION 79

CEU: 0.8
Instructor Les Lazareck and Robby Schwarz
Class Format: Virtual

Enforcement of the 2021 IECC has moved from prescriptive requirements to an understanding of the intent of the code. Therefore, we need to better understand Building Science, so we realize the connections between efficiency, durability, safety, and comfort. This course will walk you through the 2021 IECC, the basic building science incorporated in its compliance path and the connection between energy and specific sections of the IRC.

2018 IBC Essentials

SESSION 35

INTERNATIONAL CODE COUNCIL®

CEU: 0.8
Instructor: Jay Woodward
Class Format: Virtual

This seminar focuses on the basic concepts of the 2018 International Building Code (IBC). These concepts provide a basis for the correct utilization of the code. A clear understanding of the identified requirements allows the code user to apply the IBC in specific situations and helps to build an understanding of the intent of the code when asked to make a judgment on code compliance. This course will also help the code user to correctly locate code requirements. It will also provide a basis for the correct use and application of the code as well as to begin to develop a procedure for applying them. It will address the organization of the code and how it relates to the IBC family of International Codes.

Type A and B Units in Multi-family Dwellings

SESSION 36

INTERNATIONAL CODE COUNCIL®

CEU: 0.4
Instructor: George Mann
Class Format: Virtual

In Group R-2 apartment buildings, if is often necessary to provide both Type A and Type B dwelling units. This seminar will identify under what conditions Type A and B units are required, as well as the technical requirements for these specific types of dwelling units. The discussion will focus on both the scoping provisions in 2018 IBC Chapter 11, as well as the technical criteria set forth in ICC A117.1-2009. The scoping requirements for public and common-use areas associated with apartment buildings, including parking and recreational facilities, will also be addressed.

2018 IBC Mixed Occupancies

SESSION 37

INTERNATIONAL CODE COUNCIL®

CEU: 0.4
Instructor: Roger Axel
Class Format: Virtual

Based on the provisions of IBC Section 508, this seminar addresses those special requirements applicable to buildings containing two or more occupancy classifications. The three mixed-occupancy options are presented along with examples and exercises that illustrate the proper application of the provisions.

Electrical Exam Preparation for the Inspector, Journeyman and Master Electrician

SESSION 38

CEU: 0.8
Instructor: Randy & Christel Hunter
Class Format: Virtual

This seminar is designed to provide a strong foundation of electrical knowledge for electricians and inspectors who wish to take the electrical license and certification exams. Topics that will be covered are NEC structure, using the National Electrical Code® (NEC®) to locate requirements and tables for electrical systems. Topics will also include using the NEC for calculations, ampacities, box sizing, feeder sizing and more. Attendees should bring a 2017 or 2020 NEC.

2021 IFC Significant Changes

SESSION 39

INTERNATIONAL CODE COUNCIL®

CEU: 0.8
Instructor: Scott Adams
Class Format: Virtual

The goal of this seminar is to familiarize building officials, fire officials, plans examiners, inspectors, design professionals, contractors, and others in the construction industry with many of the important changes in the 2021 International Fire Code® (IFC®). The major changes from the 2018 IFC to the 2021 IFC will be presented. Participants will discuss the changes, reasons for the changes, and take part in knowledge review activities. Information presented will allow participants to apply these new code requirements to design, plan review, and/or inspection. The seminar uses the publication, Significant Changes to the International Fire Code, 2021 Edition.

2018 IEBC Essentials

SESSION 40

CEU: 0.8
Instructor: Tim Ryan
Class Format: Virtual

This seminar will introduce critical concepts of the 2018 International Existing Building Code® (IEBC®). It will provide a basis for the correct use and application of the code. It will build an understanding of the intent of the code through detailing basic tables, categorizations and a case study.

IBC Plan Review

SESSION 41

CEU: 0.8
Instructor: Gil Rossmiller
Class Format: Virtual

This seminar explains the process of conducting a plan review for small/medium-sized commercial projects. It will cover the building, plumbing, mechanical and electrical requirements for commercial projects. The class will provide students with formats, process and understanding of how to conduct a commercial plan review.

2018/2021 UPC/IPC, UMC/IMC Combination Inspections

SESSION 42

CEU: 0.8
Instructor: Tim Collings
Class Format: Virtual

With the increasing budgetary and staffing restraints being experienced on code enforcement departments across the country, more and more jurisdictions are having to rely on performing combination inspections rather having dedicated inspectors for each trade. This seminar is designed to provide the inspection and code basics for combination inspectors who find themselves inspecting plumbing and mechanical systems but have a background in another trade. The basics of the UPC and UMC will be discussed and organized in a manner that assists combination inspectors in understanding and enforcing these codes.

Leadership IMPACT – Self-Mastery

SESSION 43

CEU: 0.8
Instructor: Tim Schneider
Class Format: Virtual

"No one is fit to command another that cannot command himself" said William Penn and he could not be more right. The ability to manage and master your own behaviors will have an enormous impact on your ability to lead and maintain credibility with your team. Team members look to their leaders for calm, controlled and hopeful responses, especially during tough times. This program will dive deeply in to self-awareness, understanding the real and authentic you, uncovering blind spots in your behavior, looking at reaction hot buttons and noting core emotional composition. From there, the power comes with enhanced confidence, optimism, resilience, self-control and the ability to encourage others. Leadership IMPACT-Self-Mastery utilizes the powerful DiSC assessment to assist in discovering blind spots and other behavioral traits.

What Is In Your Toolbox?

SESSION 44

CEU: 0.4
Instructor: Christylla Miles
Class Format: Virtual

How to be an effective code officer by increasing your knowledge of ordinances, local and state codes, best practices and the like. Knowledge is the key!

Live to See Another Day

SESSION 45

CEU: 0.4
Instructor: Christylla Miles
Class Format: Virtual

This course will cover officer safety in the field as well as in the office. How well do you know the ones you work with? This is a fun class that has an element of surprise.

TRACK	Monday March 1	Tuesday March 2	Wednesday March 3	Thursday March 4	Friday March 5
Track 1: I-Codes	**2018 IRC Essentials** Session 1 FULL DAY	**2021 IRC Significant Changes** Session 19 FULL DAY	**2018 IBC Essentials** Session 35 FULL DAY	**2021 IBC Significant Nonstructural Changes** Session 49 FULL DAY	**2018 IBC Fire and Smoke Protection Features** Session 65 FULL DAY
Track 2: I-Codes	**2018 IBC Use of Fire and Smoke Separations** AM Session 2 **2018 IBC Allowable Height and Area** PM Session 3	**2018 IBC Special Building Types, Features and Hazards** AM Session 20 **Application and Administration of the I-Codes** PM Session 21	**Type A and B Units in Multi-family Dwellings** AM Session 36 **2018 IBC Mixed Occupancies** PM Session 37	**2018 IRC Inspector Insights** AM Session 50 **2018 IRC Construction Concepts** PM Session 51	**2021 IBC Significant Structural Changes** AM Session 66 **Structural Loads and Load Paths** PM Session 67
Track 3: Electrical	**What's New for the 2020 NEC?** Session 4 FULL DAY	**Electrical Safety and NFPA 70E 2021** Session 22 FULL DAY	**Electrical Exam Preparation for Inspectors, Journeyman and Master's** Session 38 FULL DAY	**Solar/PV Inspections, What are we missing?** AM Session 52 **Healthcare Electrical Systems – Hospitals, Clinics and Care Facilities** PM Session 53	**Grounding and Bonding, What is What?** Session 68 FULL DAY
Track 4: Building & Fire Safety Protection & Principles	**2018 IFC Performing Commercial Fire Inspections** Session 5 FULL DAY	**2018 IFC Essentials** Session 23 FULL DAY	**2021 IFC Significant Changes** Session 39 FULL DAY	**2018 IFC & IBC Hazardous Materials** Session 54 FULL DAY	**2018 IBC & IFC Fire Protection Systems** Session 69 FULL DAY
Track 5: Building Plan Review and Inspections	**2018 IBC Use of Fire Sprinklers and Alarms** AM Session 6 **2018 IBC Exit Systems** PM Session 7	**Commercial Accessibility** Session 24 FULL DAY	**2018 IEBC Essentials** Session 40 FULL DAY	**2018 IBC Means of Egress** Session 55 FULL DAY	**2018 IBC Building Classification** Session 70 FULL DAY
Track 6: Building Plan Review & Inspections	**IRC Plan Review** Session 8 FULL DAY	**IRC Inspections** Session 25 FULL DAY	**IBC Plan Review** Session 41 FULL DAY	**Commercial Inspections** Session 56 FULL DAY	**Energy Code Compliance Documentation, Testing and More** Session 82 FULL DAY
Track 7: Plumbing & Mechanical	**2018/2021 UMC/IMC Code Changes** AM Session 9 **2018/2021 UPC/IPC Code Changes** PM Session 10	**2018/2021 UMC/IMC Workshop** AM Session 27 **2018/2021 UPC/IPC Workshop** PM Session 26	**2018/2021 UPC/IPC, UMC/IMC Combination Inspections** Session 42 FULL DAY	**Indoor Cannabis Cultivation Facilities** Session 57 FULL DAY	**Health Risk of Improper Plumbing** AM Session 72 **UPC Grease Interceptors, Emphasis on Hydro-mechanical Interceptors** PM Session 73

Morning sessions start at 7:30 a.m. PT | Afternoon sessions start at 1:00 p.m

TRACK	Monday March 1	Tuesday March 2	Wednesday March 3	Thursday March 4	Friday March 5
Track 8: Leadership, Management & Personal Development	**Leadership IMPACT – Communications** Session 11 FULL DAY	**Leadership IMPACT – Team Member** AM Session 28	**Leadership IMPACT – Self-Mastery** Session 43 FULL DAY	**Leadership SUCCESS – Decision Making and Ethics** AM Session 58	**Leadership TRANSFORMATION – Innovation and Change** AM Session 74
		Engagement Leadership IMPACT – Coaching PM Session 29		**Leadership SUCCESS – Personal Power and Relationships** PM Session 59	**Leadership TRANSFORMATION – Leading Through Challenging Times** PM Session 75
Track 9: Code Enforcement	**2018 IPMC Crash Course** AM Session 12	**Code Compliance Ideas & Challenges for Small Towns** AM Session 30	**What Is In Your Toolbox?** AM Session 44	**Legal, Ethical and Moral Code Enforcement** AM Session 60	**Recruiting Pool Talent/Photography for Code Enforcement** AM Session 83
	Communications – Verbal, Written and Physical PM Session 13	**Why are we Essential?** PM Session 31	**Live to See Another Day** PM Session 45	**Planning, Zoning and Land Use for Code Enforcement** PM Session 61	**Proper Code Inspections and Documentation** PM Session 84
Track 10: Building Specialties	**2018 IBC Fire & Life Safety Principles** Session 14 FULL DAY	**2018 IBC Exterior Wall and Opening Protection** AM Session 32	**A117.1-2017 Significant Changes** AM Session 46	**2018 IBC Apartment Buildings** Session 62 FULL DAY	**Fire Protection of Commercial Cooking Operations** Session 77 FULL DAY
		2018 Types of Construction Classification and Application PM Session 33	**2018 IBC Assembly Means of Egress** PM Session 47		
Track 11: Current Topics	**2021 IBC Update** AM Session 15	**Building Science Meets the IECC** Session 79 FULL DAY	**Fire Related Behavior of Materials** Session 48 FULL DAY	**The Complete Permit Technician** SESSION 63 TWO DAYS	
	2021 IRC Update PM Session 16				
Track 12: Certification Test Academy	**B3 – Building Plans Examiner Test Academy** Session 17 THREE DAYS			**Legal Aspects of Code Administration** Session 64 FULL DAY	**Inspector Skills** Session 78 FULL DAY
Track 13: Energy		**Building Science Meets the IECC** Session 79 FULL DAY	**Residential Compliance with the 2021 IECC – Real Life Examples** Session 80 FULL DAY	**2021 IECC Residential Real-World Applications** Session 81 FULL DAY	**Energy Code Compliance Documentation, Testing and More** Session 82 FULL DAY

REGISTER ONLINE at www.iccsafe.org/EduCode

Early bird pricing ends February 5, 2021

Form also available on page 22 for mail-in registration.

Morning sessions start at 7:30 a.m. PT | Afternoon sessions start at 1:00 p.m. PT

A117.1 – 2017 Significant Changes

SESSION 46

CEU: 0.4
Instructor: Kim Paarlberg
Class Format: Virtual

This course offers an overview and in-depth coverage of the the changes from the 2009 to the 2017 A117.1 Accessibility Standard. It identifies important changes in organization, accessibility standard requirements and the applicability of these requirements to design, plan review and inspection.

2018 IBC Assembly Means of Egress

SESSION 47

CEU: 0.4
Instructor: Kim Paarlberg
Class Format: Virtual

Focusing on Section 2029 of the 2018 IBC, this seminar identifies those provisions specific to assembly buildings and assembly spaces. The hazards associated with large numbers of occupants in concentrated areas are specifically addressed through the special requirements of Section 2029. The seminar also includes a discussion of ICC 300, Standard for Bleachers, Folding and Telescoping Seating, and Grandstands.

Fire Related Behavior of Materials

SESSION 48

CEU: 0.8
Instructor: Ed Kaminski
Class Format: Virtual

Understand the origins, nature and application of codes, test standards and research reports. How common building materials are evaluated for fire safety. This course will cover common materials and how their properties are tested and then applied to requirements of the International Building Code and International Fire Code.

Building Plans Examiner Test Academy – Day 3

SESSION 17

CEU: 2.4
Instructor: Jerry Flanik
Class Format: Virtual

The 2018 Building Plans Examiner Certification Test Academy features expert instruction and includes interactive review exercises, practice exams and individual and group-based activities to help you get better prepared to take the exam. Throughout the academy you will be given an opportunity to answer questions that reference the exam resources. Main Topics include: General Administration, Building Planning, Footings and Special Foundations, Floor Construction, Wall Construction and Coverings, Roof/Ceiling Construction and Public Safety and Special Construction. The goal of the test academy is to familiarize you with the building plans examiner certification exam content.

Required Materials: For this academy, you will need the 2018 International Building Code (IBC) and either the ACI 318 OR Concrete Manual (any edition).

NOTE: Exam not included but can be purchased separately.

Residential Compliance with the 2021 IECC – Real Life Examples

SESSION 80

CEU: 0.4
Instructor: Les Lazareck and Robby Schwarz
Class Format: Virtual

This day long class will break down the residential provisions of the 2021 IECC to reveal what is new, what is the same, and what is aspirational. The 2021 IECC focused less on changing compliance pathways and more on performance metrics, mandatory and prescriptive measures, and an appendix that offers a potential trail to the future of zero energy homes if a jurisdiction is looking in that direction.

2021 IBC Significant Nonstructural Changes

SESSION 49

CEU: 0.8
Instructor: Kim Paarlberg
Class Format: Virtual

This seminar reviews and analyzes selected significant changes from the 2018 to the 2021 edition of the International Building Code (IBC). Although the focus of the presentation is on revisions to the IBC fire- and life-safety provisions, additional areas of discussion include accessibility, construction materials and building services. The seminar assists building officials, fire officials, plans examiners, inspectors and design professionals in identifying the specific code changes that have occurred and understanding the reasoning behind the changes. The program is based on the ICC publication Significant Changes to the International Building Code, 2021 Edition.

2018 IRC Inspector Insights

SESSION 50

CEU: 0.4
Instructor: Sandra Hyde
Class Format: Virtual

Mid-career residential inspectors and plans examiners will find this seminar insightful as will designers looking for a review of common construction issues. With a focus on wood construction, the course addresses floor, wall and roof assemblies, common footing and foundation issues, and how to recognize alternate acceptable methods versus problems requiring modification in residential construction. This seminar is based on the concepts and provisions of the International Residential Code.

2018 IRC Construction Concepts

SESSION 51

CEU: 0.4
Instructor: Sandra Hyde
Class Format: Virtual

Mid-career residential plans examiners and inspectors will find this seminar insightful as will designers looking for a review of IRC structural options. With a focus on wood construction, the course addresses component and cladding wind loads and the affects changes to the loads have on wall and roof cladding. Selection of floor, roof and wall members are also considered for a two-story residential structure. This seminar is based on the concepts and provisions of the International Residential Code.

Solar/PV Inspections, What are we missing?

SESSION 52

CEU: 0.4
Instructor: Jon Lee
Class Format: Virtual

This seminar is focused on the inspections of Solar/PV systems. This critical system is often misunderstood by inspectors and those new to the industry. Whether you are inspecting via video, virtually or in person this seminar will provide you with key pointers on critical safety guidelines of the National Electrical Code® (NEC®) on the mounting, anchoring, disconnects, signage, grounding and bonding of PV systems. Attendees should bring a 2017 or 2020 NEC.

Healthcare Electrical Systems – Hospitals, Clinics and Care

SESSION 53

CEU: 0.4
Instructor: Mark Ode
Class Format: Virtual

Requirements for electrical installations in health care facilities: hospitals, clinics, dental offices and care facilities are covered in this seminar. This is primarily focused on the equipotential area surrounding patient care areas in hospitals, clinics, dental offices, limited care, and nursing care facilities based on the provisions set forth in the National Electrical Code® (NEC®) (2017-2020). This presentation will establish a thorough understanding of the code requirements contained in NEC Article 517 and the most missed and overlooked items in construction and inspections. Introductory information is provided about the basic requirements and structure of NFPA 99, Standard for Health Care Facilities and how it applies. Attendees should bring a 2017 or 2020 NEC.

2018 IFC & IBC Hazardous Materials

SESSION 54

CEU: 0.8
Instructor: Terrell Stripling
Class Format: Virtual

This seminar addresses requirements for buildings utilizing hazardous materials and requiring coordination between the fire and building codes. It reviews the requirements found in Chapters 50 through 67 of the International Fire Code® (IFC®), as well as Chapter 3, and Sections 414 and 415 of the International Building Code® (IBC®).

2018 IBC Means of Egress

SESSION 55

CEU: 0.8
Instructor: George Mann
Class Format: Virtual

This seminar addresses numerous provisions in the 2018 International Building Code® (IBC®) where the code contains requirements pertaining to establishing a means of egress in buildings. The course is intended to help designers, plan reviewers and building officials responsible for plan review identify those areas where plan review will include compliance with the IBC. During this training, participants will listen to lecture and view examples, as well as discuss sections of the IBC that pertain to means of egress. They will participate in activities that involve a set of plans.

Commercial Inspections

SESSION 56

CEU: 0.8
Instructor: Gil Rossmiller
Class Format: Virtual

This seminar provides new commercial inspectors with basic techniques and an understanding of conducting inspections of small commercial buildings. The discussion will include preparation, presentation and inspections of the building, plumbing, mechanical and electrical portions of a building.

Indoor Cannabis Cultivation Facilities

SESSION 57

CEU: 0.8
Instructor: Jeff Hutcher
Class Format: Virtual

This full day seminar covers plumbing, mechanical, building, fire, energy, state regulations, and limited electrical codes. The class also covers the growing process, from propagation to flowering and will help cultivators, regulators, architects, designers and engineers make sense of the myriad of regulations and special processes used in cultivation. We'll also cover new technologies for cultivation. Many mistakes are made from design deficiencies that may be code compliant but make cultivation difficult. We'll cover how to avoid the mistakes that currently plague the industry.

Leadership SUCCESS – Decision Making and Ethics

SESSION 58

CEU: 0.4
Instructor: Tim Schneider
Class Format: Virtual

A leader's decisions become a lasting part of his or her legacy. Making the right decision, in the right time frame, with the correct information and involving the right people is one key focus of this program. The delicate balance between rash or too quick decisions and overly deliberative decisions is the starting point followed by examining decision making levels and who should be making those decisions. Understanding unintended consequences and applying some basic critical thinking will improve decision quality tremendously. As important as decisions are, making sure those decisions and other choices maintain ethical congruence is equally important. This program will provide participants with the tools to keep integrity always, refer to an organization's ethical values and avoid pitfalls associated with personal morality and beliefs. When ethical values are strong, a leader maintains the highest credibility with her or his team and can continue to successfully lead.

Leadership SUCCESS- Personal Power and Relationships

SESSION 59

CEU: 0.4
Instructor: Tim Schneider
Class Format: Virtual

Although the word power has certain stigma attached, leaders need power to operate and to lead. This program will provide the skills to manage the types of leadership power and create an effective balance between the five power types for a more successful connection with team member and more sustained organizational results. Relationship power is the most critical of the power types and building networks of influence using relationship techniques will be provided. Additional tools for Leadership Success-Personal Power and Relationships include seeing the big picture or global perspective, appreciation of workplace diversity and creating some charismatic charm for your role as a leader. Because this leadership competency is about the outward you, key skills related to teamwork, empathy and dealing successfully with conflict will also be presented.

Legal, Ethical and Moral Code Enforcement

SESSION 60

CEU: 0.4
Instructor: Marcus Kellum
Class Format: Virtual

Ethics and morals relate to "right" and "wrong" conduct. While they are sometimes used interchangeably, they are different, especially as they relate to code enforcement, building inspection and all other forms of regulatory enforcement. How many code officials are required to enforce rules and regulations that they do not fundamentally agree with? Instead of considering the needs of the resident, interjecting common sense into the matter, taking on a bit of personal risk on behalf of an individual and making a simple accommodation; should you just stick to the code?

Planning, Zoning and Land Use for Code Enforcement

SESSION 61

CEU: 0.4
Instructor: Marcus Kellum
Class Format: Virtual

This presentation was developed to provide code officials with the general processes and procedures that guide the issuance of permits and business licenses within a municipality and familiarize attendees with zoning concepts.

2018 IBC Apartment Buildings

SESSION 62

CEU: 0.8
Instructor: Jay Woodward
Class Format: Virtual

The design and construction of apartment buildings requires the application of both fundamental and unique IBC requirements. This seminar focuses on those provisions that are commonly encountered in these types of residential buildings. Provisions specific to residential building classification, fire-resistance, fire protection, means of egress and accessibility will be addressed. In addition, detailed provisions discussed will include podium buildings, occupied roofs, incidental uses and dwelling unit separations.

The Complete Permit Technician – Day 1 SESSION 63

CEU: 1.6
Instructor: Steve Burger
Class Format: Virtual

This 2-day course is intended to provide essential information in the areas of code administration and history, legal aspects, customer service, basic plan review, inspection process, zoning requirements, permit fee calculations, basic occupancy and construction types, basic means of egress and dealing with difficult customers. The course is also beneficial for preparing for the Permit Technician Certification Exam.

Required Materials: Calculator, 2015 or 2018 International Building Code®, 2015 or 2018 International Zoning Code®, Legal Aspects of Code Administration

Recommended Materials: Basic Code Enforcement

Legal Aspects of Code Administration SESSION 64

ICC INTERNATIONAL CODE COUNCIL®

CEU: 0.8
Instructor: Bob Church
Class Format: Virtual

Provides code officials with guidelines for administering the legal aspects of codes with regard to enforcement, prosecution and maintenance. In this course participants will discuss historical consequences of ignoring the regulation of building construction and materials, and learn how to interpret and applying local government, state and federal legislative laws, pertaining to the administration and enforcement of a building code. Participants will also be able to define and apply concepts which are legally important to the administration and enforcement of a building code and establish or document rules of procedure used before a board of building code appeals. By using the guidelines presented in the course, participants will learn how to effectively testify in a court of law.

2021 IECC Residential Real-World Applications SESSION 81

CEU: 0.8
Instructor: Les Lazareck and Robby Schwarz
Class Format: Virtual

This seminar will address applying the 2021 IECC requirements for residential buildings in the real world. Through pictures and examples of real applications, we will see why the residential requirements got into the code and the intent behind the provisions. This will also provide examples of frequently missed items.

2018 IBC Fire and Smoke Protection Features

SESSION 65

INTERNATIONAL CODE COUNCIL®

CEU: 0.8
Instructor: George Mann
Class Format: Virtual

This seminar addresses the critical concepts of the 2018 International Building Code® (IBC®) regarding Chapter 7, Fire and Smoke Protection Features. These concepts provide a basis for the analysis and identification of which components require fire-resistance ratings; where the fire-resistance-rated construction is required in building construction; where smoke-resistant construction is mandated; and the use of fire door assemblies, fire window assemblies, penetration firestopping systems, fire dampers and smoke dampers.

2021 IBC Significant Structural Changes

SESSION 66

INTERNATIONAL CODE COUNCIL®

CEU: 0.4
Instructor: Sandra Hyde
Class Format: Virtual

This seminar reviews and analyzes selected significant changes from the 2018 to the 2021 edition of the International Building Code (IBC). This presentation examines revisions to the IBC structural provisions, including loads, material requirements, special inspection and deep foundation design. The seminar assists building officials, plans examiners, inspectors and engineers in identifying specific code changes and understanding the reasoning behind the changes. The program is based on the ICC publication Significant Changes to the International Building Code, 2021 Edition.

Structural Loads and Load Paths

SESSION 67

INTERNATIONAL CODE COUNCIL®

CEU: 0.4
Instructor: Sandra Hyde
Class Format: Virtual

Mid-career residential and commercial inspectors and plan examiners will find this seminar useful as well as architects and engineers looking for a review of structural loads and their load paths. With a focus on connections, the course considers moment frame, braced frame and shear wall load paths in selecting a particular structural frame for a single story, low-rise or mid-rise building.

Grounding and Bonding – What is What?

SESSION 68

CEU: 0.8
Instructor: Mark Ode
Class Format: Virtual

This seminar is a must for anyone looking to broaden their understanding of where we ground and where we bond and the effects on the electrical system. We will start with the fundamentals and practice of grounding and bonding in easily understood language. We will look at the tables, references and practices for each. Attendees should bring a 2017 or 2020 NEC.

2018 IBC & IFC Fire Protection Systems

SESSION 69

INTERNATIONAL CODE COUNCIL®

CEU: 0.8
Instructor: Terrell Stripling
Class Format: Virtual

This seminar is designed to guide participants through the 2018 IBC and IFC requirements related to fire protection systems (Chapter 9). These requirements include suppression systems, standpipe systems, automatic fire alarm systems, automatic detection systems and additional fire protection assemblies. Because the 2018 IFC and Chapter 9 of the 2018 IBC have such broad scopes, the focus of this seminar is to review design, construction, inspection and testing requirements for fire sprinkler systems, fire-extinguishing systems, standpipe systems, fire alarm and detection systems, smoke control systems and smoke removal systems.

2018 IBC Building Classification

SESSION 70

CEU: 0.8
Instructor: Roger Axel
Class Format: Virtual

This seminar addresses the key issues of the 2018 International Building Code® (IBC®) regarding the proper classification of buildings. The process for correctly evaluating a building for code compliance relies on a systematic approach to the determination of occupancy classification and construction type. Everything starts with the correct building classification! A clear understanding of the classification process provides the groundwork for the proper application of many other important code provisions.

Health Risk of Improper Plumbing

SESSION 72

CEU: 0.8
Instructor: Jeff Hutcher
Class Format: Virtual

This presentation discusses the potential health and safety risks associate with improper plumbing installation, fixtures, and maintenance. Specifically covered in this program are the potential hazards of scalding as well as the major health concerns regarding the proliferation and spreading of SARS and Legionella.

UPC Grease Interceptors, Emphasis on Hydro-mechanical Interceptors

SESSION 73

CEU: 0.8
Instructor: Jeff Hutcher
Class Format: Virtual

This class will focus more on Hydro-mechanical Grease Interceptor installation and sizing per Section 1014, 2018/2021 UPC. This is a great class for Contractors, Engineers, Plans Examiners and Inspectors who will install, design, review and inspect hydro-mechanical grease interceptors.

Leadership TRANSFORMATION – Innovation and Change

SESSION 74

CEU: 0.4
Instructor: Tim Schneider
Class Format: Virtual

We have more memory and storage in our phones compared to the first computers we owned. Drones deliver packages to our doorstep. Human organs are being grown in a laboratory and you can't give away CD's, DVD's or VHS tapes at a garage sale. Change and innovation are everywhere and successful leaders both embrace change and stimulate innovation; both personally and with their team. This program provides the powerful tools to reduce the loss of productivity associated with any change event, build partnerships with those affected by change and work to condition their team and selves to embrace change. Leadership TRANSFORMATION – Innovation and Change also presents the skills needed to become more innovative, creative and produced sustained and impacting change in the working environment.

Leadership TRANSFORMATION – Leading Through Challenging Times

SESSION 75

CEU: 0.4
Instructor: Tim Schneider
Class Format: Virtual

Great leadership is forged in difficult times. Leaders need to make some pivots and changes to ensure their team moves through difficult times successfully and is prepared to move forward after the difficulty ends. The keys to working through, and not getting stuck in, difficult and challenging times is to communicate frequently, rally the team and connect downward in the organizational structure. Leaders also discover during challenging periods to rely on their resilience and confidence to pull their organizations through tough times. The discovery of flexibility, new technologies and improved processes also help the successful leader.

How to recognize Talent in the Recruiting Pool/Photography for Successful Code Enforcement

SESSION 83

CEU: 0.4
Class Format: Virtual

If you've ever hired someone and six months later found yourself wondering why the employee now is so different from the candidate you interviewed, this presentation is for you. We'll take and in-depth look at how to recognize the candidates that have real workplace potential versus the ones that just tell a good story during the interview.

Observations and notes are a good start, but photos really cement your case…or do they? This course briefly touches on the technical aspects of photography, but really focuses on how to highlight your observations and make sure the viewer sees and feels the way you did when you were at the property. We'll also touch on how to organize and present your photographs for judicial proceedings or administrative hearings.

Proper Code Inspections and Documentation

SESSION 84

CEU: 0.4
Class Format: Virtual

To raise awareness of the importance of soft skills, provide guidance on recognizing and improving skills, while reinforce positive behaviors and explain the importance of documentation. Identifying pitfalls and enhancing social behaviors to increase their job performance and the role it plays with enforcement.

Fire Protection of Commercial Cooking Operations

SESSION 77

CEU: 0.8
Instructor: Ed Kaminski
Class Format: Virtual

This is a comprehensive seminar in the hazards associated with commercial cooking and code compliance. Fuels used for cooking, the mechanisms of extinguishment, extinguishing systems, ventilation and applications are covered. Applications include the various appliances, self-contained units, high-production cooking and mobile food preparation vehicles. Attendees will be able to conduct plan reviews and apply the 2018 IFC, the Standard for Wet Chemical Extinguishing Systems NFPA 17A, the Standard for Hand Portable Extinguishers NFPA 10, Standard for Ventilation Control and Fire Protection NFPA 96 and the 2018 IMC. Commissioning and routine inspection methods also examined.

The Complete Permit Technician – Day 2

SESSION 63

CEU: 1.6
Instructor: Steve Burger
Class Format: Virtual

This 2-day course is intended to provide essential information in the areas of code administration and history, legal aspects, customer service, basic plan review, inspection process, zoning requirements, permit fee calculations, basic occupancy and construction types, basic means of egress and dealing with difficult customers. The course is also beneficial for preparing for the Permit Technician Certification Exam.

Required Materials: Calculator, 2015 or 2018 International Building Code®, 2015 or 2018 International Zoning Code®, Legal Aspects of Code Administration

Recommended Materials: Basic Code Enforcement

Inspector Skills

SESSION 78

CEU: 0.8
Instructor: Tim Ryan
Class Format: Virtual

This seminar addresses the necessary soft skills for success as an inspector—those non-technical traits and behaviors that enhance an inspector's ability to interact with others and to successfully carry out their job duties. These include people skills such as effective communication, diplomacy and customer service, but also include skills for problem solving, professionalism, integrity, and time management. In addition to a solid understanding of the technical provisions of the codes, developing appropriate soft skills are essential in pursuing the goal of safe, healthy and durable buildings for the community. Developed specifically for construction inspectors in all disciplines, the topics covered are equally important to all employees of public service agencies including permit technicians, plan reviewers, managers, building officials and fire code officials. The information is also beneficial for developing policies and procedures to promote consistent and fair inspection practices while improving communications and public relations.

Energy Code Compliance Documentation, Testing and More

SESSION 82

CEU: 0.8
Instructor: Les Lazareck and Robby Schwarz
Class Format: Virtual

In this class we will briefly discuss how embedded building science is in the code and then quickly move on to understanding how to read residential IECC compliance reports that are generated from different software. We will discuss the difference between the RESNET HERS ERI vs IECC ERI scores and how blower door and duct leakage testing is performed and what the IECC requires. Lastly, we will cover indoor air quality and other health and safety issues that are entwined within the IECC.

Please use this form if you are submitting your registration by Mail and paying by check, purchase order or are an ICC Member who wants to be billed. To pay by credit card, purchase order or to be billed, Register online at www.iccsafe.org/educode.

ICC Membership Number:			
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- $90 – Per Day
- $360 – Full Five-Day Week

MAIL TO:
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Central Regional Office
4051 Flossmoor Road
Country Club Hills, Illinois 60478

CONTACT THE CODE COUNCIL AT:
1-888-422-7233, ext. 4333 or jfranklin@iccsafe.org

SEMINAR REGISTRATION

LIST SEMINAR SESSION NUMBER

	Monday	Tuesday	Wednesday	Thursday	Friday
AM or All Day					
PM					

TOTAL REGISTRATION FEES

I am attending VIRTUALLY	☐ $360 – all 5 days	☐ $90 per day	
PAYMENT OPTIONS (Bill Me or Check)		**TOTAL**	
☐ Bill Me (Code Council Members only) Member #:	☐ Payment Enclosed (Checks payable to: International Code Council)		

REGISTRATION INFORMATION

Registration fees include: instruction, reference materials or books (when applicable and unless otherwise noted). Codes and other reference books are NOT provided and are the responsibility of the student. For your convenience, code books and other reference materials may be purchased from the International Code Council (ICC). Please review the session descriptions for required reference materials or supplies.

Attendees who have signed up for the virtual classes will receive an email with class log in information before the seminar.

REGISTRATION COSTS

VIRTUAL REGISTRATION
$360 – Full Five-Day Week per Registrant
$90 – Per Day or Session

REGISTRATION METHODS

1. REGISTER ONLINE
   The Code Council's secure website:
   www.iccsafe.org/educode.
   Follow the easy online directions.

2. REGISTER BY MAIL
   Complete the registration form on the previous page and mail to:

   EduCODE Registrar
   International Code Council
   Central Regional Office
   4051 Flossmoor Road
   Country Club Hills, Illinois 60478

3. EduCODE HELP LINE
   Contact the Code Council at 1-888-422-7233, ext. 4333 or jfranklin@iccsafe.org

CONFIRMATION

Registration confirmation will be sent by EduCODE prior to the seminar.

CANCELLATION POLICY

If you need to cancel, EduCODE must receive notification in writing by February 5, 2021 to receive a full refund. All refund requests after this date will be credited toward a future EduCODE conference attendance only.

Should circumstances beyond the control of the Southern Nevada Chapter of the International Code Council (SNICC) arise; such as acts of God, war, acts of terrorism, civil unrest, government regulations or mandates, disaster, strikes or curtailment of transportation facilities – to the extent that such circumstances make it impossible or illegal for SNICC to provide Educode, SNICC it's officers, members, employees and contractors shall not be held liable or responsible beyond providing a refund for the seminar.

SUBSTITUTIONS

Whenever a registrant is unable to attend a paid seminar session, a request for substitution may be made by contacting ICC at 1-888-422-7233, ext. 4333. *Please note that each registration may only be substituted with one person.*

CONTINUING EDUCATION INFORMATION

ICC PREFERRED EDUCATION PROVIDER

All EduCODE sessions are recognized by ICC's Preferred Provider Program for CEUs toward maintenance of your ICC certifications. Please check the website for updated AIA approvals at www.iccsafe.org/educode. Check with your local licensing board for additional CEU requirements.

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REGISTRATION CHECKLIST

Contact the International Code Council
at 1-888-422-7233, extension 4333
or online at **www.iccsafe.org/EduCode**

- Best Value $$ – Full week Registration

▶ Pre-Registered?

- Virtual: A link will be emailed prior to the seminar with login instructions

▶ Full-Day Class Schedule (0.8 CEU)

- Classes start: 7:30 AM PT
- Lunch Break 1½-hour break
- Classes End 5:00 PM PT

▶ Half-Day Class Schedule (0.4 CEU)

- A.M. Classes 7:30 AM – 11:30 AM PT
- Lunch Break 1½-hour break
- P.M. Classes 1:00 PM – 5:00 PM PT

EduCODE Expo Raffle Prizes at 12:35 PM each day!

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File Attachments for Item:

ER-3 What's New for the 2020 NEC? Virtual Seminar (ICC)

ESI, EPE, 8 hours

Staff Notes: ICC is offering a week of virtual learning, focused on the 2020 NEC and exam preparation. Certified personnel have asked BBS to offer BBS credit for these online courses, as the pandemic has made continuing education opportunities more difficult to come by. Recommend approval, add BO, MPE, RBO, RPE

ESIAC Recommendations: Recommend approval

Committee Recommendation:

Classes being offered **virtually!**

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March 1–5, 2021

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Welcome to EduCode 2021!

EduCode 2021 is our 24th year of providing outstanding education for Inspectors, Plans Examiners, Permit Technicians, Code Enforcement Officers, Building Officials, Architects, Engineers, Managers, Leaders, Directors, and all others working or interested in a safe built community. The last several months have been quite taxing on everyone in the building, fire and safety environment, but overall by the quality of the trained professionals in our industry we have proven to overcome any hurdles put in place.

EduCode is here to help strengthen this professionalism by providing industry renowned education, training, networking, and experiences for everyone who attends. Due to restrictions put in place throughout the country, this year EduCode is proud to offer a virtual platform that will maintain our level of excellence and interesting events. This is a first for EduCode, but we listened to our partners, sponsors, and attendees to ensure that we always provide what is needed and best suits you, our customer.

EduCode 2021, while only virtual this year, still provides you with a full week of training where you will receive up to 4.0 CEU's of ICC Preferred Provider credit. Whether you attend for one day or the full week, your experience will be rewarding! While attending, make sure you visit all our exhibitor and sponsors for updates on new innovations, techniques, career potentials, and other valuable information.

I am looking forward to seeing everyone online and will continue to make your EduCode experience the best it can be!

Sincerely,

Alan Ellis
EduCode Director

SESSION DESCRIPTIONS – MONDAY, MARCH 1

2018 IRC Essentials

SESSION 1

CEU: 0.8
Instructor: Cash Olszowy
Class Format: Virtual

This seminar examines basic concepts of the 2018 International Residential Code (IRC). These concepts provide a basis for the correct utilization of the code. A clear understanding of the identified requirements allows the code user to apply the IRC in specific situations and helps to build an understanding of the intent of the code when asked to make a judgment on code compliance. This course will also help the code user to correctly locate code requirements. It will also provide a basis for the correct use and application of the code as well as to begin to develop a procedure for applying them.

2018 IBC Use of Fire and Smoke Separations

SESSION 2

CEU: 0.4
Instructor: George Mann
Class Format: Virtual

This seminar identifies the many and varied conditions identified in the IBC where fire and/or smoke separations are required. The discussion will focus on those required locations where fire-resistance-rated wall and horizontal assemblies, as well as smoke-resistive wall and horizontal assemblies, are either required by the IBC or utilized by design professionals as alternative approaches to code compliance. Such locations include the selective or mandated use of fire walls, fire barriers, fire partitions, smoke barriers, horizontal assemblies and other separation elements.

2018 IBC Allowable Height and Area

SESSION 3

CEU: 0.4
Instructor: George Mann
Class Format: Virtual

Based on the provisions of IBC Chapter 5, this seminar focuses on how a building's occupancy classification and type of construction relate to the maximum building size permitted by the IBC. The approach to determining a building's maximum allowable height and area is explained, including use of Table 503 and all related permitted increases due to sprinkler protection and frontage open space. Detailed provisions related to mezzanines and unlimited area buildings are also addressed.

What's New for the 2020 NEC?

SESSION 4

CEU: 0.8
Instructors: Christel & Randy Hunter
Class Format: Virtual

This is a fast-paced seminar that will cover major changes in the 2020 National Electrical Code®. Photos and illustrations will be used to show how the NEC® is changing and how those changes will affect electrical installations. A few of the changes include: GFCI protection expansion, emergency disconnects for dwellings, changes to lighting load calculations, new articles, and the extensive reorganization of Article 310. Attendees should bring a 2020 NEC.

2018 IFC Performing Commercial Fire Inspections

SESSION 5

CEU: 0.8
Instructor: Scott Adams
Class Format: Virtual

This seminar presents the process of conducting commercial fire inspections, following the provisions and requirements of the 2018 International Fire Code®. Specifically, the seminar provides participants with checklists that enable those performing commercial fire inspections to determine whether the materials, design, construction, installation and location of building components comply with the code.

2018 IBC Use of Fire Sprinklers and Alarms

SESSION 6

INTERNATIONAL CODE COUNCIL®

CEU: 0.4
Instructor: Terrell Stripling
Class Format: Virtual

This seminar identifies those conditions under which automatic sprinkler protection and/or fire alarm systems are required. The application of the fire area concept will be discussed, along with the varying extent of sprinkler protection required based upon specific situations. In addition, the discussion will address many of the key code conditions under which the presence of an automatic sprinkler system can be used to modify other requirements.

2018 IBC Exit Systems

SESSION 7

INTERNATIONAL CODE COUNCIL®

CEU: 0.4
Instructor: Terrell Stripling
Class Format: Virtual

This seminar focuses on IBC Chapter 10 means of egress components that are defined and regulated as exits. These components, defined in Chapter 2, are considered as high-level elements that provide a considerable degree of occupant protection within the means of egress system. The exit discharge provisions will also be discussed.

IRC Plan Review

SESSION 8

CEU: 0.8
Instructor: Gil Rossmiller
Class Format: Virtual

This seminar is designed to provide a broad overview of the process for residential plan review, this course will provide the basic steps involved to complete a comprehensive review of a residence. The class will discuss the tools and process for conducting a residential plan review. It will also increase your awareness of the necessary items required to ensure code compliance of the homes built in your jurisdiction.

2018/2021 UMC/IMC Code Changes

SESSION 9

CEU: 0.4
Instructor: Tim Collings
Class Format: Virtual

Keep up-to-date on the Uniform Mechanical Code® (UMC®)/ International Mechanical Code® (IMC®) by learning about the changes from 2018 to the 2021 edition. Each notable change to the code will be discussed in depth so attendees see exactly how the code changed, why the code changed, and what impact it will have on the code enforcement and installer communities.

2018/2021 UPC/IPC Code Changes

SESSION 10

CEU: 0.4
Instructor: Tim Collings
Class Format: Virtual

Keep up-to-date on the Uniform Plumbing Code® (UPC®)/ International Plumbing Code® (IPC®) by learning about the changes from 2018 to the 2021 edition. Each notable change to the code will be discussed in depth so attendees see exactly how the code changed, why the code changed, and what impact it will have on the code enforcement and installer communities.

Leadership IMPACT – Communications

SESSION 11

CEU: 0.8
Instructor: Tim Schneider
Class Format: Virtual

The ability to communicate effectively and at the right frequency is the core of success in leadership, business and life. Those that are able to relay instructions, vision and more, can connect with others, enhance personal productivity and avoid unneeded conflicts.

This seminar will enhance the ability to listen, communicate clearly, manage communication tone, match communication style, and control non-verbal tone. Additionally, communication boundaries, frequency and the incredibly important skill of communication richness will be presented. Leadership IMPACT-Communications introduces participants to the powerful DiSC assessment as a highly accurate predictor of communication style and other key tendencies.

2018 IPMC Crash Course

SESSION 12

CEU: 0.4
Instructor: Tana Bryant
Class Format: Virtual

Learn to navigate the International Property Maintenance Code in a fun filled manner. Easy study tips to help prepare for the IPMC certification exam.

Communications – Verbal, Written and Physical

SESSION 13

CEU: 0.4
Instructor: Barbara Burlingame
Class Format: Virtual

What you say and how you say it, whether in writing, face to face or by body language can determined how your interaction with the public will be. Tips for success in dealing with the public, co-workers or city officials for use in day to day settings.

2018 IBC Fire and Life Safety Principles

SESSION 14

CEU: 0.8
Instructor: Jay Woodward
Class Format: Virtual

This seminar addresses the critical concepts of the 2018 IBC regarding fire and life safety issues. These concepts provide a basis for the correct use of the code in building planning, classification of buildings and occupancies, fire-resistance-rated construction, fire protection systems and means of egress. The content addresses issues that are necessary for many designs and plan review decisions. During this training, participants will be listening to lecture and viewing examples, as well as discussing sections of the IBC that pertain to fire and life safety principles in building design and regulation.

2021 IBC Update

SESSION 15

CEU: 0.4
Instructor: Sandra Hyde
Class Format: Virtual

This seminar addresses important changes that occurred between the 2018 to the 2021 edition of the International Building Code (IBC). Although most of the presentation focuses on revisions to the IBC fire- and life-safety provisions, additional areas of discussion include accessibility, structural elements and systems, construction materials and building services. The seminar assists building officials, fire officials, plans examiners, inspectors and design professionals in identifying the specific code changes that have occurred and understanding the reasoning behind the changes. This seminar is a shortened version of the seminars 2021 IBC Nonstructural Changes and 2021 IBC Structural Changes and covers only a portion of the topics addressed in those programs.

2021 IRC Update

SESSION 16

CEU: 0.4
Instructor: Sandra Hyde
Class Format: Virtual

This seminar addresses important changes that occurred between the 2018 to the 2021 edition of the International Residential Code (IRC). Although the focus of the presentation is on revisions to the IRC building planning, foundation and framing provisions, additional topics of discussion include energy, plumbing, mechanical and electrical. The seminar assists building officials, fire officials, plans examiners, inspectors and design professionals in identifying the specific code changes that have occurred and understanding the reasoning behind the changes. The seminar is a shortened version of the seminar 2021 IRC Significant Changes.

DESCRIPTIONS – MONDAY, MARCH 1

Building Plans Examiner Test Academy – Day 1

SESSION 17

CEU: 2.4
Instructor: Jerry Flanik
Class Format: Virtual

The 2018 Building Plans Examiner Certification Test Academy features expert instruction and includes interactive review exercises, practice exams and individual and group-based activities to help you get better prepared to take the exam. Throughout the academy you will be given an opportunity to answer questions that reference the exam resources. Main Topics include: General Administration, Building Planning, Footings and Special Foundations, Floor Construction, Wall Construction and Coverings, Roof/Ceiling Construction and Public Safety and Special Construction. The goal of the test academy is to familiarize you with the building plans examiner certification exam content.

Required Materials: For this academy, you will need the 2018 International Building Code (IBC) and either the ACI 318 OR Concrete Manual (any edition).

NOTE: Exam not included but can be purchased separately.

DESCRIPTIONS – TUESDAY, MARCH 2

2021 IRC Significant Changes

SESSION 19

CEU: 0.8
Instructor: Cash Olszowy
Class Format: Virtual

This seminar reviews and analyzes selected significant changes from the 2018 to the 2021 edition of the International Residential Code (IRC). Although the focus of the presentation is on revisions to the IRC building planning, foundation and framing provisions, additional topics of discussion include energy, plumbing, mechanical and electrical. The seminar assists building officials, fire officials, plans examiners, inspectors and design professionals in identifying the specific code changes that have occurred and understanding the reasoning behind the changes. The program is based on the ICC publication Significant Changes to the International Residential Code, 2021 Edition.

2018 IBC Special Building Types, Features and Hazards

SESSION 20

CEU: 0.4
Instructor: Terrell Stripling
Class Format: Virtual

Based on selected provisions from Chapter 4, this seminar focuses on several special building types, features and hazards. High-rise buildings, underground buildings, parking garages are specialized buildings that have their own unique considerations. Atriums, stages and platforms are building features that are evaluated in a special manner due to the hazards involved. Combustible storage, use and storage of hazardous materials, spray application of flammable finishes, medical gas storage rooms, control areas and laboratory suites are also addressed. The special detailed requirements and allowances set forth throughout Chapter 4 address a variety of uses and occupancies.

Application and Administration of the I-Codes

SESSION 21

CEU: 0.4
Instructor: Tim Ryan
Class Format: Virtual

Chapter 1 of each of the I-Codes is arguably the most important chapter in each of those publications. Although many jurisdictions modify the chapter to some degree, the fundamental concepts and principles typically remain to guide users in the code's proper application and administration. The seminar will focus on two primary areas of emphasis: 1) application of the provisions based on the concepts of minimum standard, AHJ interpretative authority, alternate methods of materials and coordination of potential conflicting provisions, and 2) administrative functions including code official, plan review and inspector responsibilities.

Electrical Safety and NFPA 70E 2021

SESSION 22

CEU: 0.8
Instructor: Howard Herndon
Class Format: Virtual

This is an extensive and popular program analyzing the major points to enable attendees to further their knowledge on safe practices related to electrical safety based on the new 2021 edition of NFPA 70E. Extremely detailed instructions and demonstrations are presented related to personal protective equipment (PPE). The demonstrations of PPE allow each participant to learn the proper practices to follow and prevent loss of life during the hazards involved in such work environments. The NFPA 70E 2021 is the recommended text for this class and each attendee bring their own copy. Copies will also be available for purchase at EduCode.

2018 IFC Essentials

SESSION 23

CEU: 0.8
Instructor: Scott Adams
Class Format: Virtual

This seminar will introduce the application of the IFC administrative requirements, occupancy classification, general precautions against fire, emergency planning and preparedness, fire service features, interior finish, decorative materials and furnishings, fire protection systems, means of egress, and provide an introduction to hazardous materials. Activities and discussions will further enhance participant learning. This seminar is designed to familiarize and assist code officials in locating, describing and applying applicable code requirements of the IFC to determine compliance or noncompliance.

Commercial Accessibility

SESSION 24

CEU: 0.8
Instructor: Kim Paarlberg
Class Format: Virtual

This seminar focuses on the minimum requirements for new or existing construction of accessible commercial buildings for compliance with the International Building Code® (IBC®) and ICC A117.1 Accessible and Usable Buildings and Facilities. It addresses the design, plan review and inspection of facilities to ensure that people with physical impairments, visual impairments and hearing impairments can use the facilities. Attendees will participate in activities that involve questions and answers, discussion and case study, performing parts of individually and in groups.

Residential Inspections

SESSION 25

CEU: 0.8
Instructor: Gil Rossmiller
Class Format: Virtual

This seminar provides new residential inspectors with basic techniques and an understanding of conducting inspections of one & two dwelling and townhouse buildings. The discussion will include preparation, presentation and inspections of the building, plumbing, mechanical and electrical portions of a building.

2018/2021 UPC/IPC Workshop

SESSION 26

CEU: 0.4
Instructor: Tim Collings
Class Format: Virtual

Apply your code knowledge and expertise in this dynamic, hands-on workshop. Attendees will examine drawings of plumbing systems and installations for code violations in a cooperative and collaborative environment with their peers. Each drawing is designed to challenge attendees on parts of the code that are frequently misunderstood or in frequent violation. Attendees will work in groups during the workshop exercise and their findings, as well as those presented by the instructor, will be shared with the rest of the attendees for a robust learning experience.

2018/2021 UMC/IMC Workshop

SESSION 27

CEU: 0.4
Instructor: Tim Collings
Class Format: Virtual

Apply your code knowledge and expertise in this dynamic, hands-on workshop. Attendees will examine drawings of mechanical systems and installations for code violations in a cooperative and collaborative environment with their peers. Each drawing is designed to challenge attendees on parts of the code that are frequently misunderstood or in frequent violation. Attendees will work in groups during the workshop exercise and their findings, as well as those presented by the instructor, will be shared with the rest of the attendees for a robust learning experience.

Leadership IMPACT – Team Member

SESSION 28

CEU: 0.4
Instructor: Tim Schneider
Class Format: Virtual

Unlock half of your influence with team members with this learning program. Team members that are engaged will have more loyalty, work harder, produce higher quality and deliver outstanding customer service. Leaders with engaged teams and healthy work cultures experience much greater results and have better levels of personal job satisfaction.

The return on investment for team member engagement is achieved by using the strategies of relationship building and depth, managing leadership tone and understanding team member motivating factors. Creating a healthy working culture and connecting team members to the purpose of the organization are provided as extra resources in this program.

Engagement Leadership IMPACT – Coaching

SESSION 29

CEU: 0.4
Instructor: Tim Schneider
Class Format: Virtual

At the heart of great leaders is a great coach. A person that can provide positive feedback easily, corrective feedback without alienating a team member and someone who uses coaching to release the rest of their influence with team members. Coaching, when done correctively and well, will dramatically improve workplace performance, team member engagement and unlock the potential of all team members. In addition to positive feedback and corrective feedback, this program presents skills associated with selecting team members, releasing team members when needed and providing teaching-type coaching.

Code Compliance Ideas & Challenges for Small Towns

SESSION 30

CEU: 0.4
Instructor: Kelvin Beene
Class Format: Virtual

This course delves into the varying issues that come with code enforcement in smaller municipalities. It compares and contrasts the many problems that are shared between the two entities and offers solutions and suggestions to making enforcement easier for the officers.

Why Are We Essential?

SESSION 31

CEU: 0.4
Instructor: Kelvin Beene
Class Format: Virtual

This course details why code enforcement is essential to the health, safety and economic development of cities. It also details the necessity to show yourself with city governance.

2018 IBC Exterior Wall and Opening Protection

SESSION 32

CEU: 0.4
Instructor: George Mann
Class Format: Virtual

This seminar addresses the various provisions in the IBC dealing with exterior wall design and construction. Although such walls are primarily regulated due to their location on the lot, many other additional requirements are set forth in the code. Exterior bearing walls are regulated by Table 601, while the use of exterior exit stairways, exit courts and exterior areas of assisted rescue will also typically mandate some degree of fire-resistance.

2018 Types of Construction Classification and Application

SESSION 33

CEU: 0.4
Instructor: George Mann
Class Format: Virtual

Together with occupancy classification, one of the most critical steps in analyzing a building for code compliance is classifying it for type of construction purposes. This seminar will address the two distinct aspects of construction type: 1) determination of the appropriate types of construction based on building occupancy, height and area, and 2) identification of the construction and fire-resistance-rated features associated with the nine individual construction types. The permissible use of combustible materials in Type I and II noncombustible buildings will also be addressed.

Building Plans Examiner Test Academy – Day 2

SESSION 17

CEU: 2.4
Instructor: Jerry Flanik
Class Format: Virtual

The 2018 Building Plans Examiner Certification Test Academy features expert instruction and includes interactive review exercises, practice exams and individual and group-based activities to help you get better prepared to take the exam. Throughout the academy you will be given an opportunity to answer questions that reference the exam resources. Main Topics include: General Administration, Building Planning, Footings and Special Foundations, Floor Construction, Wall Construction and Coverings, Roof/Ceiling Construction and Public Safety and Special Construction. The goal of the test academy is to familiarize you with the building plans examiner certification exam content.

Required Materials: For this academy, you will need the 2018 International Building Code (IBC) and either the ACI 318 OR Concrete Manual (any edition).

NOTE: Exam not included but can be purchased separately.

Building Science Meets the IECC

SESSION 79

CEU: 0.8
Instructor Les Lazareck and Robby Schwarz
Class Format: Virtual

Enforcement of the 2021 IECC has moved from prescriptive requirements to an understanding of the intent of the code. Therefore, we need to better understand Building Science, so we realize the connections between efficiency, durability, safety, and comfort. This course will walk you through the 2021 IECC, the basic building science incorporated in its compliance path and the connection between energy and specific sections of the IRC.

2018 IBC Essentials

SESSION 35

CEU: 0.8
Instructor: Jay Woodward
Class Format: Virtual

This seminar focuses on the basic concepts of the 2018 International Building Code (IBC). These concepts provide a basis for the correct utilization of the code. A clear understanding of the identified requirements allows the code user to apply the IBC in specific situations and helps to build an understanding of the intent of the code when asked to make a judgment on code compliance. This course will also help the code user to correctly locate code requirements. It will also provide a basis for the correct use and application of the code as well as to begin to develop a procedure for applying them. It will address the organization of the code and how it relates to the IBC family of International Codes.

Type A and B Units in Multi-family Dwellings

SESSION 36

CEU: 0.4
Instructor: George Mann
Class Format: Virtual

In Group R-2 apartment buildings, if is often necessary to provide both Type A and Type B dwelling units. This seminar will identify under what conditions Type A and B units are required, as well as the technical requirements for these specific types of dwelling units. The discussion will focus on both the scoping provisions in 2018 IBC Chapter 11, as well as the technical criteria set forth in ICC A117.1-2009. The scoping requirements for public and common-use areas associated with apartment buildings, including parking and recreational facilities, will also be addressed.

2018 IBC Mixed Occupancies

SESSION 37

CEU: 0.4
Instructor: Roger Axel
Class Format: Virtual

Based on the provisions of IBC Section 508, this seminar addresses those special requirements applicable to buildings containing two or more occupancy classifications. The three mixed-occupancy options are presented along with examples and exercises that illustrate the proper application of the provisions.

Electrical Exam Preparation for the Inspector, Journeyman and Master Electrician

SESSION 38

CEU: 0.8
Instructor: Randy & Christel Hunter
Class Format: Virtual

This seminar is designed to provide a strong foundation of electrical knowledge for electricians and inspectors who wish to take the electrical license and certification exams. Topics that will be covered are NEC structure, using the National Electrical Code® (NEC®) to locate requirements and tables for electrical systems. Topics will also include using the NEC for calculations, ampacities, box sizing, feeder sizing and more. Attendees should bring a 2017 or 2020 NEC.

2021 IFC Significant Changes

SESSION 39

CEU: 0.8
Instructor: Scott Adams
Class Format: Virtual

The goal of this seminar is to familiarize building officials, fire officials, plans examiners, inspectors, design professionals, contractors, and others in the construction industry with many of the important changes in the 2021 International Fire Code® (IFC®). The major changes from the 2018 IFC to the 2021 IFC will be presented. Participants will discuss the changes, reasons for the changes, and take part in knowledge review activities. Information presented will allow participants to apply these new code requirements to design, plan review, and/or inspection. The seminar uses the publication, Significant Changes to the International Fire Code, 2021 Edition.

2018 IEBC Essentials

SESSION 40

CEU: 0.8
Instructor: Tim Ryan
Class Format: Virtual

This seminar will introduce critical concepts of the 2018 International Existing Building Code® (IEBC®). It will provide a basis for the correct use and application of the code. It will build an understanding of the intent of the code through detailing basic tables, categorizations and a case study.

IBC Plan Review

SESSION 41

CEU: 0.8
Instructor: Gil Rossmiller
Class Format: Virtual

This seminar explains the process of conducting a plan review for small/medium-sized commercial projects. It will cover the building, plumbing, mechanical and electrical requirements for commercial projects. The class will provide students with formats, process and understanding of how to conduct a commercial plan review.

2018/2021 UPC/IPC, UMC/IMC Combination Inspections

SESSION 42

CEU: 0.8
Instructor: Tim Collings
Class Format: Virtual

With the increasing budgetary and staffing restraints being experienced on code enforcement departments across the country, more and more jurisdictions are having to rely on performing combination inspections rather having dedicated inspectors for each trade. This seminar is designed to provide the inspection and code basics for combination inspectors who find themselves inspecting plumbing and mechanical systems but have a background in another trade. The basics of the UPC and UMC will be discussed and organized in a manner that assists combination inspectors in understanding and enforcing these codes.

Leadership IMPACT – Self-Mastery

SESSION 43

CEU: 0.8
Instructor: Tim Schneider
Class Format: Virtual

"No one is fit to command another that cannot command himself" said William Penn and he could not be more right. The ability to manage and master your own behaviors will have an enormous impact on your ability to lead and maintain credibility with your team. Team members look to their leaders for calm, controlled and hopeful responses, especially during tough times. This program will dive deeply in to self-awareness, understanding the real and authentic you, uncovering blind spots in your behavior, looking at reaction hot buttons and noting core emotional composition. From there, the power comes with enhanced confidence, optimism, resilience, self-control and the ability to encourage others. Leadership IMPACT-Self-Mastery utilizes the powerful DiSC assessment to assist in discovering blind spots and other behavioral traits.

What Is In Your Toolbox?

SESSION 44

CEU: 0.4
Instructor: Christylla Miles
Class Format: Virtual

How to be an effective code officer by increasing your knowledge of ordinances, local and state codes, best practices and the like. Knowledge is the key!

Live to See Another Day

SESSION 45

CEU: 0.4
Instructor: Christylla Miles
Class Format: Virtual

This course will cover officer safety in the field as well as in the office. How well do you know the ones you work with? This is a fun class that has an element of surprise.

TRACK	Monday March 1	Tuesday March 2	Wednesday March 3	Thursday March 4	Friday March 5
Track 1: I-Codes	**2018 IRC Essentials** Session 1 FULL DAY	**2021 IRC Significant Changes** Session 19 FULL DAY	**2018 IBC Essentials** Session 35 FULL DAY	**2021 IBC Significant Nonstructural Changes** Session 49 FULL DAY	**2018 IBC Fire and Smoke Protection Features** Session 65 FULL DAY
Track 2: I-Codes	**2018 IBC Use of Fire and Smoke Separations** AM Session 2 **2018 IBC Allowable Height and Area** PM Session 3	**2018 IBC Special Building Types, Features and Hazards** AM Session 20 **Application and Administration of the I-Codes** PM Session 21	**Type A and B Units in Multi-family Dwellings** AM Session 36 **2018 IBC Mixed Occupancies** PM Session 37	**2018 IRC Inspector Insights** AM Session 50 **2018 IRC Construction Concepts** PM Session 51	**2021 IBC Significant Structural Changes** AM Session 66 **Structural Loads and Load Paths** PM Session 67
Track 3: Electrical	**What's New for the 2020 NEC?** Session 4 FULL DAY	**Electrical Safety and NFPA 70E 2021** Session 22 FULL DAY	**Electrical Exam Preparation for Inspectors, Journeyman and Master's** Session 38 FULL DAY	**Solar/PV Inspections, What are we missing?** AM Session 52 **Healthcare Electrical Systems – Hospitals, Clinics and Care Facilities** PM Session 53	**Grounding and Bonding, What is What?** Session 68 FULL DAY
Track 4: Building & Fire Safety Protection & Principles	**2018 IFC Performing Commercial Fire Inspections** Session 5 FULL DAY	**2018 IFC Essentials** Session 23 FULL DAY	**2021 IFC Significant Changes** Session 39 FULL DAY	**2018 IFC & IBC Hazardous Materials** Session 54 FULL DAY	**2018 IBC & IFC Fire Protection Systems** Session 69 FULL DAY
Track 5: Building Plan Review and Inspections	**2018 IBC Use of Fire Sprinklers and Alarms** AM Session 6 **2018 IBC Exit Systems** PM Session 7	**Commercial Accessibility** Session 24 FULL DAY	**2018 IEBC Essentials** Session 40 FULL DAY	**2018 IBC Means of Egress** Session 55 FULL DAY	**2018 IBC Building Classification** Session 70 FULL DAY
Track 6: Building Plan Review & Inspections	**IRC Plan Review** Session 8 FULL DAY	**IRC Inspections** Session 25 FULL DAY	**IBC Plan Review** Session 41 FULL DAY	**Commercial Inspections** Session 56 FULL DAY	**Energy Code Compliance Documentation, Testing and More** Session 82 FULL DAY
Track 7: Plumbing & Mechanical	**2018/2021 UMC/IMC Code Changes** AM Session 9 **2018/2021 UPC/IPC Code Changes** PM Session 10	**2018/2021 UMC/IMC Workshop** AM Session 27 **2018/2021 UPC/IPC Workshop** PM Session 26	**2018/2021 UPC/IPC, UMC/IMC Combination Inspections** Session 42 FULL DAY	**Indoor Cannabis Cultivation Facilities** Session 57 FULL DAY	**Health Risk of Improper Plumbing** AM Session 72 **UPC Grease Interceptors, Emphasis on Hydro-mechanical Interceptors** PM Session 73

TRACK	Monday March 1	Tuesday March 2	Wednesday March 3	Thursday March 4	Friday March 5
Track 8: Leadership, Management & Personal Development	**Leadership IMPACT – Communications** Session 11 FULL DAY	**Leadership IMPACT – Team Member** AM Session 28	**Leadership IMPACT – Self-Mastery** Session 43 FULL DAY	**Leadership SUCCESS – Decision Making and Ethics** AM Session 58	**Leadership TRANSFORMATION – Innovation and Change** AM Session 74
		Engagement Leadership IMPACT – Coaching PM Session 29		**Leadership SUCCESS – Personal Power and Relationships** PM Session 59	**Leadership TRANSFORMATION – Leading Through Challenging Times** PM Session 75
Track 9: Code Enforcement	**2018 IPMC Crash Course** AM Session 12	**Code Compliance Ideas & Challenges for Small Towns** AM Session 30	**What Is In Your Toolbox?** AM Session 44	**Legal, Ethical and Moral Code Enforcement** AM Session 60	**Recruiting Pool Talent/Photography for Code Enforcement** AM Session 83
	Communications – Verbal, Written and Physical PM Session 13	**Why are we Essential?** PM Session 31	**Live to See Another Day** PM Session 45	**Planning, Zoning and Land Use for Code Enforcement** PM Session 61	**Proper Code Inspections and Documentation** PM Session 84
Track 10: Building Specialties	**2018 IBC Fire & Life Safety Principles** Session 14 FULL DAY	**2018 IBC Exterior Wall and Opening Protection** AM Session 32	**A117.1-2017 Significant Changes** AM Session 46	**2018 IBC Apartment Buildings** Session 62 FULL DAY	**Fire Protection of Commercial Cooking Operations** Session 77 FULL DAY
		2018 Types of Construction Classification and Application PM Session 33	**2018 IBC Assembly Means of Egress** PM Session 47		
Track 11: Current Topics	**2021 IBC Update** AM Session 15	**Building Science Meets the IECC** Session 79 FULL DAY	**Fire Related Behavior of Materials** Session 48 FULL DAY	**The Complete Permit Technician** SESSION 63 TWO DAYS	
	2021 IRC Update PM Session 16				
Track 12: Certification Test Academy	**B3 – Building Plans Examiner Test Academy** Session 17 THREE DAYS			**Legal Aspects of Code Administration** Session 64 FULL DAY	**Inspector Skills** Session 78 FULL DAY
Track 13: Energy		**Building Science Meets the IECC** Session 79 FULL DAY	**Residential Compliance with the 2021 IECC – Real Life Examples** Session 80 FULL DAY	**2021 IECC Residential Real-World Applications** Session 81 FULL DAY	**Energy Code Compliance Documentation, Testing and More** Session 82 FULL DAY

REGISTER ONLINE at www.iccsafe.org/EduCode

Early bird pricing ends February 5, 2021

Form also available on page 22 for mail-in registration.

Morning sessions start at 7:30 a.m. PT | Afternoon sessions start at 1:00 p.m. PT

A117.1 – 2017 Significant Changes

SESSION 46

CEU: 0.4
Instructor: Kim Paarlberg
Class Format: Virtual

This course offers an overview and in-depth coverage of the the changes from the 2009 to the 2017 A117.1 Accessibility Standard. It identifies important changes in organization, accessibility standard requirements and the applicability of these requirements to design, plan review and inspection.

2018 IBC Assembly Means of Egress

SESSION 47

CEU: 0.4
Instructor: Kim Paarlberg
Class Format: Virtual

Focusing on Section 2029 of the 2018 IBC, this seminar identifies those provisions specific to assembly buildings and assembly spaces. The hazards associated with large numbers of occupants in concentrated areas are specifically addressed through the special requirements of Section 2029. The seminar also includes a discussion of ICC 300, Standard for Bleachers, Folding and Telescoping Seating, and Grandstands.

Fire Related Behavior of Materials

SESSION 48

CEU: 0.8
Instructor: Ed Kaminski
Class Format: Virtual

Understand the origins, nature and application of codes, test standards and research reports. How common building materials are evaluated for fire safety. This course will cover common materials and how their properties are tested and then applied to requirements of the International Building Code and International Fire Code.

Building Plans Examiner Test Academy – Day 3

SESSION 17

CEU: 2.4
Instructor: Jerry Flanik
Class Format: Virtual

The 2018 Building Plans Examiner Certification Test Academy features expert instruction and includes interactive review exercises, practice exams and individual and group-based activities to help you get better prepared to take the exam. Throughout the academy you will be given an opportunity to answer questions that reference the exam resources. Main Topics include: General Administration, Building Planning, Footings and Special Foundations, Floor Construction, Wall Construction and Coverings, Roof/Ceiling Construction and Public Safety and Special Construction. The goal of the test academy is to familiarize you with the building plans examiner certification exam content.

Required Materials: For this academy, you will need the 2018 International Building Code (IBC) and either the ACI 318 OR Concrete Manual (any edition).

NOTE: Exam not included but can be purchased separately.

Residential Compliance with the 2021 IECC – Real Life Examples

SESSION 80

CEU: 0.4
Instructor: Les Lazareck and Robby Schwarz
Class Format: Virtual

This day long class will break down the residential provisions of the 2021 IECC to reveal what is new, what is the same, and what is aspirational. The 2021 IECC focused less on changing compliance pathways and more on performance metrics, mandatory and prescriptive measures, and an appendix that offers a potential trail to the future of zero energy homes if a jurisdiction is looking in that direction.

2021 IBC Significant Nonstructural Changes

SESSION 49

CEU: 0.8
Instructor: Kim Paarlberg
Class Format: Virtual

This seminar reviews and analyzes selected significant changes from the 2018 to the 2021 edition of the International Building Code (IBC). Although the focus of the presentation is on revisions to the IBC fire- and life-safety provisions, additional areas of discussion include accessibility, construction materials and building services. The seminar assists building officials, fire officials, plans examiners, inspectors and design professionals in identifying the specific code changes that have occurred and understanding the reasoning behind the changes. The program is based on the ICC publication Significant Changes to the International Building Code, 2021 Edition.

2018 IRC Inspector Insights

SESSION 50

CEU: 0.4
Instructor: Sandra Hyde
Class Format: Virtual

Mid-career residential inspectors and plans examiners will find this seminar insightful as will designers looking for a review of common construction issues. With a focus on wood construction, the course addresses floor, wall and roof assemblies, common footing and foundation issues, and how to recognize alternate acceptable methods versus problems requiring modification in residential construction. This seminar is based on the concepts and provisions of the International Residential Code.

2018 IRC Construction Concepts

SESSION 51

CEU: 0.4
Instructor: Sandra Hyde
Class Format: Virtual

Mid-career residential plans examiners and inspectors will find this seminar insightful as will designers looking for a review of IRC structural options. With a focus on wood construction, the course addresses component and cladding wind loads and the affects changes to the loads have on wall and roof cladding. Selection of floor, roof and wall members are also considered for a two-story residential structure. This seminar is based on the concepts and provisions of the International Residential Code.

Solar/PV Inspections, What are we missing?

SESSION 52

CEU: 0.4
Instructor: Jon Lee
Class Format: Virtual

This seminar is focused on the inspections of Solar/PV systems. This critical system is often misunderstood by inspectors and those new to the industry. Whether you are inspecting via video, virtually or in person this seminar will provide you with key pointers on critical safety guidelines of the National Electrical Code® (NEC®) on the mounting, anchoring, disconnects, signage, grounding and bonding of PV systems. Attendees should bring a 2017 or 2020 NEC.

Healthcare Electrical Systems – Hospitals, Clinics and Care

SESSION 53

CEU: 0.4
Instructor: Mark Ode
Class Format: Virtual

Requirements for electrical installations in health care facilities: hospitals, clinics, dental offices and care facilities are covered in this seminar. This is primarily focused on the equipotential area surrounding patient care areas in hospitals, clinics, dental offices, limited care, and nursing care facilities based on the provisions set forth in the National Electrical Code® (NEC®) (2017-2020). This presentation will establish a thorough understanding of the code requirements contained in NEC Article 517 and the most missed and overlooked items in construction and inspections. Introductory information is provided about the basic requirements and structure of NFPA 99, Standard for Health Care Facilities and how it applies. Attendees should bring a 2017 or 2020 NEC.

2018 IFC & IBC Hazardous Materials

SESSION 54

CEU: 0.8
Instructor: Terrell Stripling
Class Format: Virtual

This seminar addresses requirements for buildings utilizing hazardous materials and requiring coordination between the fire and building codes. It reviews the requirements found in Chapters 50 through 67 of the International Fire Code® (IFC®), as well as Chapter 3, and Sections 414 and 415 of the International Building Code® (IBC®).

2018 IBC Means of Egress

SESSION 55

CEU: 0.8
Instructor: George Mann
Class Format: Virtual

This seminar addresses numerous provisions in the 2018 International Building Code® (IBC®) where the code contains requirements pertaining to establishing a means of egress in buildings. The course is intended to help designers, plan reviewers and building officials responsible for plan review identify those areas where plan review will include compliance with the IBC. During this training, participants will listen to lecture and view examples, as well as discuss sections of the IBC that pertain to means of egress. They will participate in activities that involve a set of plans.

Commercial Inspections

SESSION 56

CEU: 0.8
Instructor: Gil Rossmiller
Class Format: Virtual

This seminar provides new commercial inspectors with basic techniques and an understanding of conducting inspections of small commercial buildings. The discussion will include preparation, presentation and inspections of the building, plumbing, mechanical and electrical portions of a building.

Indoor Cannabis Cultivation Facilities

SESSION 57

CEU: 0.8
Instructor: Jeff Hutcher
Class Format: Virtual

This full day seminar covers plumbing, mechanical, building, fire, energy, state regulations, and limited electrical codes. The class also covers the growing process, from propagation to flowering and will help cultivators, regulators, architects, designers and engineers make sense of the myriad of regulations and special processes used in cultivation. We'll also cover new technologies for cultivation. Many mistakes are made from design deficiencies that may be code compliant but make cultivation difficult. We'll cover how to avoid the mistakes that currently plague the industry.

Leadership SUCCESS – Decision Making and Ethics

SESSION 58

CEU: 0.4
Instructor: Tim Schneider
Class Format: Virtual

A leader's decisions become a lasting part of his or her legacy. Making the right decision, in the right time frame, with the correct information and involving the right people is one key focus of this program. The delicate balance between rash or too quick decisions and overly deliberative decisions is the starting point followed by examining decision making levels and who should be making those decisions. Understanding unintended consequences and applying some basic critical thinking will improve decision quality tremendously. As important as decisions are, making sure those decisions and other choices maintain ethical congruence is equally important. This program will provide participants with the tools to keep integrity always, refer to an organization's ethical values and avoid pitfalls associated with personal morality and beliefs. When ethical values are strong, a leader maintains the highest credibility with her or his team and can continue to successfully lead.

Leadership SUCCESS- Personal Power and Relationships

SESSION 59

CEU: 0.4
Instructor: Tim Schneider
Class Format: Virtual

Although the word power has certain stigma attached, leaders need power to operate and to lead. This program will provide the skills to manage the types of leadership power and create an effective balance between the five power types for a more successful connection with team member and more sustained organizational results. Relationship power is the most critical of the power types and building networks of influence using relationship techniques will be provided. Additional tools for Leadership Success-Personal Power and Relationships include seeing the big picture or global perspective, appreciation of workplace diversity and creating some charismatic charm for your role as a leader. Because this leadership competency is about the outward you, key skills related to teamwork, empathy and dealing successfully with conflict will also be presented.

Legal, Ethical and Moral Code Enforcement

SESSION 60

CEU: 0.4
Instructor: Marcus Kellum
Class Format: Virtual

Ethics and morals relate to "right" and "wrong" conduct. While they are sometimes used interchangeably, they are different, especially as they relate to code enforcement, building inspection and all other forms of regulatory enforcement. How many code officials are required to enforce rules and regulations that they do not fundamentally agree with? Instead of considering the needs of the resident, interjecting common sense into the matter, taking on a bit of personal risk on behalf of an individual and making a simple accommodation; should you just stick to the code?

Planning, Zoning and Land Use for Code Enforcement

SESSION 61

CEU: 0.4
Instructor: Marcus Kellum
Class Format: Virtual

This presentation was developed to provide code officials with the general processes and procedures that guide the issuance of permits and business licenses within a municipality and familiarize attendees with zoning concepts.

2018 IBC Apartment Buildings

SESSION 62

CEU: 0.8
Instructor: Jay Woodward
Class Format: Virtual

The design and construction of apartment buildings requires the application of both fundamental and unique IBC requirements. This seminar focuses on those provisions that are commonly encountered in these types of residential buildings. Provisions specific to residential building classification, fire-resistance, fire protection, means of egress and accessibility will be addressed. In addition, detailed provisions discussed will include podium buildings, occupied roofs, incidental uses and dwelling unit separations.

The Complete Permit Technician – Day 1 SESSION 63

CEU: 1.6
Instructor: Steve Burger
Class Format: Virtual

This 2-day course is intended to provide essential information in the areas of code administration and history, legal aspects, customer service, basic plan review, inspection process, zoning requirements, permit fee calculations, basic occupancy and construction types, basic means of egress and dealing with difficult customers. The course is also beneficial for preparing for the Permit Technician Certification Exam.

Required Materials: Calculator, 2015 or 2018 International Building Code®, 2015 or 2018 International Zoning Code®, Legal Aspects of Code Administration

Recommended Materials: Basic Code Enforcement

Legal Aspects of Code Administration SESSION 64

CEU: 0.8
Instructor: Bob Church
Class Format: Virtual

Provides code officials with guidelines for administering the legal aspects of codes with regard to enforcement, prosecution and maintenance. In this course participants will discuss historical consequences of ignoring the regulation of building construction and materials, and learn how to interpret and applying local government, state and federal legislative laws, pertaining to the administration and enforcement of a building code. Participants will also be able to define and apply concepts which are legally important to the administration and enforcement of a building code and establish or document rules of procedure used before a board of building code appeals. By using the guidelines presented in the course, participants will learn how to effectively testify in a court of law.

2021 IECC Residential Real-World Applications SESSION 81

CEU: 0.8
Instructor: Les Lazareck and Robby Schwarz
Class Format: Virtual

This seminar will address applying the 2021 IECC requirements for residential buildings in the real world. Through pictures and examples of real applications, we will see why the residential requirements got into the code and the intent behind the provisions. This will also provide examples of frequently missed items.

2018 IBC Fire and Smoke Protection Features

SESSION 65

CEU: 0.8
Instructor: George Mann
Class Format: Virtual

This seminar addresses the critical concepts of the 2018 International Building Code® (IBC®) regarding Chapter 7, Fire and Smoke Protection Features. These concepts provide a basis for the analysis and identification of which components require fire-resistance ratings; where the fire-resistance-rated construction is required in building construction; where smoke-resistant construction is mandated; and the use of fire door assemblies, fire window assemblies, penetration firestopping systems, fire dampers and smoke dampers.

2021 IBC Significant Structural Changes

SESSION 66

CEU: 0.4
Instructor: Sandra Hyde
Class Format: Virtual

This seminar reviews and analyzes selected significant changes from the 2018 to the 2021 edition of the International Building Code (IBC). This presentation examines revisions to the IBC structural provisions, including loads, material requirements, special inspection and deep foundation design. The seminar assists building officials, plans examiners, inspectors and engineers in identifying specific code changes and understanding the reasoning behind the changes. The program is based on the ICC publication Significant Changes to the International Building Code, 2021 Edition.

Structural Loads and Load Paths

SESSION 67

CEU: 0.4
Instructor: Sandra Hyde
Class Format: Virtual

Mid-career residential and commercial inspectors and plan examiners will find this seminar useful as well as architects and engineers looking for a review of structural loads and their load paths. With a focus on connections, the course considers moment frame, braced frame and shear wall load paths in selecting a particular structural frame for a single story, low-rise or mid-rise building.

Grounding and Bonding – What is What?

SESSION 68

CEU: 0.8
Instructor: Mark Ode
Class Format: Virtual

This seminar is a must for anyone looking to broaden their understanding of where we ground and where we bond and the effects on the electrical system. We will start with the fundamentals and practice of grounding and bonding in easily understood language. We will look at the tables, references and practices for each. Attendees should bring a 2017 or 2020 NEC.

2018 IBC & IFC Fire Protection Systems

SESSION 69

CEU: 0.8
Instructor: Terrell Stripling
Class Format: Virtual

This seminar is designed to guide participants through the 2018 IBC and IFC requirements related to fire protection systems (Chapter 9). These requirements include suppression systems, standpipe systems, automatic fire alarm systems, automatic detection systems and additional fire protection assemblies. Because the 2018 IFC and Chapter 9 of the 2018 IBC have such broad scopes, the focus of this seminar is to review design, construction, inspection and testing requirements for fire sprinkler systems, fire-extinguishing systems, standpipe systems, fire alarm and detection systems, smoke control systems and smoke removal systems.

2018 IBC Building Classification

SESSION 70

CEU: 0.8
Instructor: Roger Axel
Class Format: Virtual

This seminar addresses the key issues of the 2018 International Building Code® (IBC®) regarding the proper classification of buildings. The process for correctly evaluating a building for code compliance relies on a systematic approach to the determination of occupancy classification and construction type. Everything starts with the correct building classification! A clear understanding of the classification process provides the groundwork for the proper application of many other important code provisions.

Health Risk of Improper Plumbing

SESSION 72

CEU: 0.8
Instructor: Jeff Hutcher
Class Format: Virtual

This presentation discusses the potential health and safety risks associate with improper plumbing installation, fixtures, and maintenance. Specifically covered in this program are the potential hazards of scalding as well as the major health concerns regarding the proliferation and spreading of SARS and Legionella.

UPC Grease Interceptors, Emphasis on Hydro-mechanical Interceptors

SESSION 73

CEU: 0.8
Instructor: Jeff Hutcher
Class Format: Virtual

This class will focus more on Hydro-mechanical Grease Interceptor installation and sizing per Section 1014, 2018/2021 UPC. This is a great class for Contractors, Engineers, Plans Examiners and Inspectors who will install, design, review and inspect hydro-mechanical grease interceptors.

Leadership TRANSFORMATION – Innovation and Change

SESSION 74

CEU: 0.4
Instructor: Tim Schneider
Class Format: Virtual

We have more memory and storage in our phones compared to the first computers we owned. Drones deliver packages to our doorstep. Human organs are being grown in a laboratory and you can't give away CD's, DVD's or VHS tapes at a garage sale. Change and innovation are everywhere and successful leaders both embrace change and stimulate innovation; both personally and with their team. This program provides the powerful tools to reduce the loss of productivity associated with any change event, build partnerships with those affected by change and work to condition their team and selves to embrace change. Leadership TRANSFORMATION – Innovation and Change also presents the skills needed to become more innovative, creative and produced sustained and impacting change in the working environment.

Leadership TRANSFORMATION – Leading Through Challenging Times

SESSION 75

CEU: 0.4
Instructor: Tim Schneider
Class Format: Virtual

Great leadership is forged in difficult times. Leaders need to make some pivots and changes to ensure their team moves through difficult times successfully and is prepared to move forward after the difficulty ends. The keys to working through, and not getting stuck in, difficult and challenging times is to communicate frequently, rally the team and connect downward in the organizational structure. Leaders also discover during challenging periods to rely on their resilience and confidence to pull their organizations through tough times. The discovery of flexibility, new technologies and improved processes also help the successful leader.

How to recognize Talent in the Recruiting Pool/Photography for Successful Code Enforcement

SESSION 83

CEU: 0.4
Class Format: Virtual

If you've ever hired someone and six months later found yourself wondering why the employee now is so different from the candidate you interviewed, this presentation is for you. We'll take and in-depth look at how to recognize the candidates that have real workplace potential versus the ones that just tell a good story during the interview.

Observations and notes are a good start, but photos really cement your case…or do they? This course briefly touches on the technical aspects of photography, but really focuses on how to highlight your observations and make sure the viewer sees and feels the way you did when you were at the property. We'll also touch on how to organize and present your photographs for judicial proceedings or administrative hearings.

Proper Code Inspections and Documentation

SESSION 84

CEU: 0.4
Class Format: Virtual

To raise awareness of the importance of soft skills, provide guidance on recognizing and improving skills, while reinforce positive behaviors and explain the importance of documentation. Identifying pitfalls and enhancing social behaviors to increase their job performance and the role it plays with enforcement.

Fire Protection of Commercial Cooking Operations

SESSION 77

CEU: 0.8
Instructor: Ed Kaminski
Class Format: Virtual

This is a comprehensive seminar in the hazards associated with commercial cooking and code compliance. Fuels used for cooking, the mechanisms of extinguishment, extinguishing systems, ventilation and applications are covered. Applications include the various appliances, self-contained units, high-production cooking and mobile food preparation vehicles. Attendees will be able to conduct plan reviews and apply the 2018 IFC, the Standard for Wet Chemical Extinguishing Systems NFPA 17A, the Standard for Hand Portable Extinguishers NFPA 10, Standard for Ventilation Control and Fire Protection NFPA 96 and the 2018 IMC. Commissioning and routine inspection methods also examined.

The Complete Permit Technician – Day 2

SESSION 63

CEU: 1.6
Instructor: Steve Burger
Class Format: Virtual

This 2-day course is intended to provide essential information in the areas of code administration and history, legal aspects, customer service, basic plan review, inspection process, zoning requirements, permit fee calculations, basic occupancy and construction types, basic means of egress and dealing with difficult customers. The course is also beneficial for preparing for the Permit Technician Certification Exam.

Required Materials: Calculator, 2015 or 2018 International Building Code®, 2015 or 2018 International Zoning Code®, Legal Aspects of Code Administration

Recommended Materials: Basic Code Enforcement

Inspector Skills

SESSION 78

INTERNATIONAL CODE COUNCIL®

CEU: 0.8
Instructor: Tim Ryan
Class Format: Virtual

This seminar addresses the necessary soft skills for success as an inspector—those non-technical traits and behaviors that enhance an inspector's ability to interact with others and to successfully carry out their job duties. These include people skills such as effective communication, diplomacy and customer service, but also include skills for problem solving, professionalism, integrity, and time management. In addition to a solid understanding of the technical provisions of the codes, developing appropriate soft skills are essential in pursuing the goal of safe, healthy and durable buildings for the community. Developed specifically for construction inspectors in all disciplines, the topics covered are equally important to all employees of public service agencies including permit technicians, plan reviewers, managers, building officials and fire code officials. The information is also beneficial for developing policies and procedures to promote consistent and fair inspection practices while improving communications and public relations.

Energy Code Compliance Documentation, Testing and More

SESSION 82

CEU: 0.8
Instructor: Les Lazareck and Robby Schwarz
Class Format: Virtual

In this class we will briefly discuss how embedded building science is in the code and then quickly move on to understanding how to read residential IECC compliance reports that are generated from different software. We will discuss the difference between the RESNET HERS ERI vs IECC ERI scores and how blower door and duct leakage testing is performed and what the IECC requires. Lastly, we will cover indoor air quality and other health and safety issues that are entwined within the IECC.

EduCODE 2021 international℠

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Twenty-Four Years of Building Code Education

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ICC INTERNATIONAL CODE COUNCIL®

Please use this form if you are submitting your registration by Mail and paying by check, purchase order or are an ICC Member who wants to be billed. To pay by credit card, purchase order or to be billed, Register online at www.iccsafe.org/educode.

ICC Membership Number:			
First Name:		Middle Initial	
Last Name:			
Job Title for Badge:			
Jurisdiction/Organization:			
Address:			
City:			
State/Province:			
Zip Code:			
Country:			
E-Mail:			
Day Telephone:		Extension	
Home Telephone:		Fax Number	

VIRTUAL REGISTRATION

- $90 – Per Day
- $360 – Full Five-Day Week

MAIL TO:

EduCODE Registrar, International Code Council
Central Regional Office
4051 Flossmoor Road
Country Club Hills, Illinois 60478

CONTACT THE CODE COUNCIL AT:

1-888-422-7233, ext. 4333 or jfranklin@iccsafe.org

SEMINAR REGISTRATION

LIST SEMINAR SESSION NUMBER

	Monday	Tuesday	Wednesday	Thursday	Friday
AM or All Day					
PM					

TOTAL REGISTRATION FEES

I am attending VIRTUALLY	☐ $360 – all 5 days	☐ $90 per day	
PAYMENT OPTIONS (Bill Me or Check)		**TOTAL**	
☐ Bill Me (Code Council Members only) Member #:	☐ Payment Enclosed (Checks payable to: International Code Council)		

Morning sessions start at 7:30 a.m. PT | Afternoon sessions start at 1:00 p.m. PT

REGISTRATION INFORMATION

Registration fees include: instruction, reference materials or books (when applicable and unless otherwise noted). Codes and other reference books are NOT provided and are the responsibility of the student. For your convenience, code books and other reference materials may be purchased from the International Code Council (ICC). Please review the session descriptions for required reference materials or supplies.

Attendees who have signed up for the virtual classes will receive an email with class log in information before the seminar.

REGISTRATION COSTS

VIRTUAL REGISTRATION
$360 – Full Five-Day Week per Registrant
$90 – Per Day or Session

REGISTRATION METHODS

1. REGISTER ONLINE
   The Code Council's secure website:
   www.iccsafe.org/educode.
   Follow the easy online directions.

2. REGISTER BY MAIL
   Complete the registration form on the previous page and mail to:

   EduCODE Registrar
   International Code Council
   Central Regional Office
   4051 Flossmoor Road
   Country Club Hills, Illinois 60478

3. EduCODE HELP LINE
   Contact the Code Council at 1-888-422-7233, ext. 4333 or jfranklin@iccsafe.org

CONFIRMATION

Registration confirmation will be sent by EduCODE prior to the seminar.

CANCELLATION POLICY

If you need to cancel, EduCODE must receive notification in writing by February 5, 2021 to receive a full refund. All refund requests after this date will be credited toward a future EduCODE conference attendance only.

Should circumstances beyond the control of the Southern Nevada Chapter of the International Code Council (SNICC) arise; such as acts of God, war, acts of terrorism, civil unrest, government regulations or mandates, disaster, strikes or curtailment of transportation facilities – to the extent that such circumstances make it impossible or illegal for SNICC to provide Educode, SNICC it's officers, members, employees and contractors shall not be held liable or responsible beyond providing a refund for the seminar.

SUBSTITUTIONS

Whenever a registrant is unable to attend a paid seminar session, a request for substitution may be made by contacting ICC at 1-888-422-7233, ext. 4333. *Please note that each registration may only be substituted with one person.*

CONTINUING EDUCATION INFORMATION

ICC PREFERRED EDUCATION PROVIDER

All EduCODE sessions are recognized by ICC's Preferred Provider Program for CEUs toward maintenance of your ICC certifications. Please check the website for updated AIA approvals at www.iccsafe.org/educode. Check with your local licensing board for additional CEU requirements.

EduCODE International Conference & EXPO 2021

www.iccsafe.org/EduCode

1-888-ICC-SAFE (422-7233), ext. 4333

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REGISTRATION CHECKLIST

Contact the International Code Council
at 1-888-422-7233, extension 4333
or online at **www.iccsafe.org/EduCode**

- Best Value $$ – Full week Registration

▶ Pre-Registered?

- Virtual: A link will be emailed prior to the seminar with login instructions

▶ Full-Day Class Schedule (0.8 CEU)

- Classes start: 7:30 AM PT
- Lunch Break 1½-hour break
- Classes End 5:00 PM PT

▶ Half-Day Class Schedule (0.4 CEU)

- A.M. Classes 7:30 AM – 11:30 AM PT
- Lunch Break 1½-hour break
- P.M. Classes 1:00 PM – 5:00 PM PT

EduCODE Expo Raffle Prizes at 12:35 PM each day!

International Code Council
Training & Education Department
4051 Flossmoor Road
Country Club Hills, IL 60478

PREFERRED EDUCATION PROVIDER

www.snicc.org

www.educode.us

File Attachments for Item:

ER-9 Hospital Isolated Power Systems 2020 NEC Article 517, Part VII (Independent Electrical Contractors)

ESI, EPE (2 hours)

Staff Notes: Handouts only, no slides. Recommend approval, add BO, MPE.

ESIAC Recommendation: Recommend approval

Committee Recommendation:

[redacted]

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: Barbara A. Tipton (Contact Name)

Organization: IEC Central Ohio - AEC-IEC (Organization/Company)

Address: 3128-H East 17th Ave. (Include Room Number, Suite, etc.)

City: Columbus State: OH Zip: 43219

E-Mail: btipton@ieccentraloh.org

Telephone: 614-473-1050 Fax: 614-473-1359

Course Sponsor: IEC Central Ohio-AEC-IEC

COURSE INFORMATION:

Course Title: Hospital Isolated Power Systems - NEC Article 517-VII

New Course Submittal: [X] Update Course: [ ] Prior Approval Number: ______

Purpose and Objective: Course will have special focus on the ungrounded systems in Hospital environments to reduce the risk of shock to personnell and patients

Objective: Review various components of an IP System

Number of Instructional Contact Hours that can be obtained upon completion: 2.0 hours

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. [X]
- 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 [X]

Location of ESI Course: IEC Central Ohio-AEC-IEC Date(s) of ESI Course(s): March 16, 2021 - 5-7pm

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:		NA
Completed Application:		✓

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

Form: 1526 BBS 81028110

IEC Central Ohio
Independent Electrical Contractors

INSTRUCTOR BIO

Clay Carroll
614-557-1147

Clay has been in the electrical field for over 45 years serving in many capacities including apprentice, journeyman, service tech, estimator, business owner, even Safety Director.

He has held a state of Ohio Contractors Certification since its inception as well as a Master Electricians certification in 12 other states and a General Contractors Certification for the State of Florida
State of Ohio Fire Alarm Installers Certificate.

Credentials:
Conducted Continuing Education Classes on the NEC since 1988
Has taught apprenticeship classes for the past 16 years
Is a certified trainer of OSHA 10 and 30
Certified First Aid/ CPR/ AED instructor
Mobile Elevated Work Platform Operator Instructor
Forklift Operator Instructor

Beyond the Electrical Industry Clay has served his local community in the following capacities:

Mayor of the Village of Buckeye Lake
Village Council member
Planning and Zoning Commission
Tree and Landscape Commission
Member of the Masonic Lodge

OCILB License # 12911

COURSE OUTLINE:

Hospital Isolated Power Systems NEC Art. 517 part VII

Scope:

This course will have special focus on the **Ungrounded** systems required in Hospital environments to reduce the risk of shock to personnel and patients.

- Definitions
- Wiring Methods
- Grounding and bonding or lack thereof.

Course will review the various components of an IP System and how they differ from virtually every other power system that we install.

Hospital Isolated Power Systems

Catalog
4800CT9801R4/08

08

Class 4800

CONTENTS

Description . . . . Page

a brand of Schneider Electric

SQUARE D

Overview

This catalog has three purposes:

- To demonstrate to hospitals the need for isolated systems
- To guide the engineer in the application of hospital ungrounded systems
- To describe in detail the Square D® brand equipment used to design effective and economical isolated ungrounded systems

Schneider Electric has been building isolating transformers for hospital use since the first equipment standards appeared in 1944. We have built an enviable reputation for reliability, low sound levels, and minimum inherent leakage.

Proof of the engineered superiority of Square D brand products is found throughout the country in numerous installations, many dating to the earliest applications of isolating transformers.

This bulletin is not intended as a "do it yourself" manual for installation of hospital isolated systems. The information contained here regarding codes and standards is current as of this writing. However, these codes and standards are continually changing and are also subject to local changes and interpretations.

Any hospital considering design changes to electrical systems in critical care patient areas should obtain the services of an electrical consulting engineer. The technical complexities of today's hospitals require all involved parties to have a thorough understanding of the hospital's objectives. This is the only way to avoid purchasing unnecessary equipment.

Time spent planning the changes will result in large dividends, provided the following parties are involved:

- Consulting engineer
- Hospital administrator
- Hospital engineer
- Chief of surgery
- Chief of anesthesiology
- Cardiologist
- Manufacturer's representative

History

During the 1920s and '30s, the number of fires and explosions in operating rooms grew at an alarming rate. Authorities determined the major causes of these accidents fell into two categories:

- Man-made electricity
- Static electricity (75% of recorded incidents)

In 1939, experts began studying these conditions in an attempt to produce a safety standard. The advent of World War II delayed the study's results until 1944, when the National Fire Protection Agency (NFPA) published "Safe Practices in Hospital Operating Rooms."

The early standards were not generally adopted in new hospital construction until 1947. It soon became apparent these initial standards fell short of providing the necessary guidelines for construction of rooms in which combustible agents would be used.

NFPA appointed a committee to revise the 1944 standards. In 1949, this committee published a new standard, NFPA No. 56, the basis for our current standards.

The National Electrical Code (NEC) of 1959 firmly established the need for ungrounded isolated distribution systems in areas where combustible gases are used.

In the same year, the NEC incorporated the NFPA standards into the code. The NFPA No. 56A–Standard for the Use of Inhalation Anesthetics, received major revisions in 1970, 1971, 1973, and 1978.

In 1982, NFPA No. 56A was incorporated into a new standard, NFPA No. 99—Health Care Facilities. The new document includes the text of several other documents, such as:

- NFPA-3M
- 56K
- 76A
- 76B
- 76
- 56HM
- 56B
- 56C
- 56D
- 56G

The material originally covered by NFPA 56A is now located in Chapter 3 of NFPA No. 99, which was updated in 1984, 1987, 1990, 1993, 1996, and 1999, and in Chapter 4, which was updated in 2002.

The increased use of electronic diagnostic and treatment equipment, and the corresponding increase in electrical hazards, has resulted in the use of isolated ungrounded systems in new areas of the hospital since 1971. These new hazards were first recognized in NFPA bulletin No. 76BM, published in 1971. Isolating systems are now commonly used for protection against electrical shock in many areas, among them:

- Intensive care units (ICUs)
- Coronary care units (CCUs)
- Emergency departments
- Special procedure rooms
- Cardiovascular laboratories
- Dialysis units
- Various wet locations

Electrical Hazards In Hospitals

The major contributors to hospital electrical accidents are faulty equipment and wiring. Electrical accidents fall into three categories:

- Fires
- Burns
- Shock

This section covers the subject of electrical shock.

Electrical shock is produced by current, not voltage. It is not the amount of voltage a person is exposed to, but rather the amount of current transmitted through the person's body that determines the intensity of a shock. The human body acts as a large resistor to current flow. The average adult exhibits a resistance between 100,000 ohms (Ω) and 1,000,000 Ω, measured hand to hand. The resistance depends on the body mass and moisture content.

The threshold of perception for an average adult is 1 milliampere (mA). This amount of current will produce a slight tingling feeling through the fingertips.

Between 10 and 20 mA, the person experiences muscle contractions and finds it more difficult to release his or her hand from an electrode.

An externally applied current of 50 mA causes pain, possibly fainting, and exhaustion.

An increase to 100 mA will cause ventricular fibrillation.

The hazardous levels of current for many patients are amazingly smaller. The most susceptible patient is the one exposed to externalized conductors, diagnostic catheters, or other electric contact to or near the heart.

Surgical techniques bypass the patient's body resistance and expose the patient to electrical current from surrounding equipment. The highest risk is to patients undergoing surgery within the thoracic cavity. Increased use of such equipment as heart monitors, dye injectors, and cardiac catheters increases the threat of electrocution when used within the circulatory system.

Other factors contributing to electrical susceptibility are patients with hypokalemia, acidosis, elevated catecholamine levels, hypoxemia, and the presence of digitalis. Adult patients with cardiac arrhythmias can be electrocuted through the misuse of pacemakers connected directly to the myocardium.

Infants are more susceptible to electric shock because of their smaller mass, and thus lower body resistance. Much has been written about current levels considered lethal for catheterized and surgical patients. Considerable controversy exists about the actual danger level for a patient who has a direct electrical connection to his or her heart. The minimum claimed hazard level seems to be 10 microamperes (μA) with a maximum level given at 180 μA. Whatever the correct level, between 10 and 180 μA, it is still only a fraction of the level hazardous to medical attendants serving the patient.

It is believed that approximately 1,000 Ω of resistance lies between the patient's heart and external body parts.

All of this information leads us to the conclusion that the patient environment is a prime target for electrical accidents. Nowhere else can one find these elements: lowered body resistance, more electrical equipment, and conductors such as blood, urine, saline, and water. The combination of these elements presents a challenge to increase electrical safety.

Leakage Currents

Electric equipment operating in the patient vicinity, even though operating perfectly, may still be hazardous to the patient. This is because every piece of electrical equipment produces a leakage current. The leakage consists of any current, including capacitively coupled current, not intended to be applied to a patient, but which may pass from exposed metal parts of an appliance to ground or to other accessible parts of an appliance.

Normally, this current is shunted around the patient via the ground conductor in the power cord. However, as this current increases, it can become a hazard to the patient.

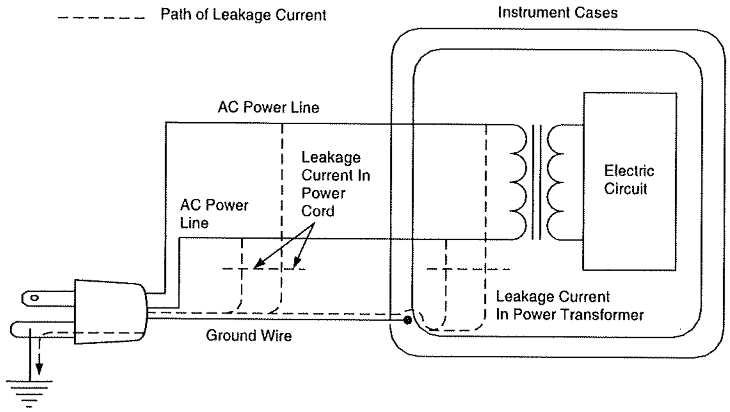
Isolated systems are now commonly used to protect against electrical shock in many areas, among them:

- Intensive care units (ICUs)
- Coronary care units (CCUs)
- Emergency departments
- Special procedure rooms
- Cardiovascular laboratories
- Dialysis units
- Various wet locations

Without proper use of grounding, leakage currents could reach values of 1,000 μA before the problem is perceived. On the other hand, a leakage current of 10 to 180 μA can injure the patient. Ventricular fibrillation can occur from exposure to this leakage current.

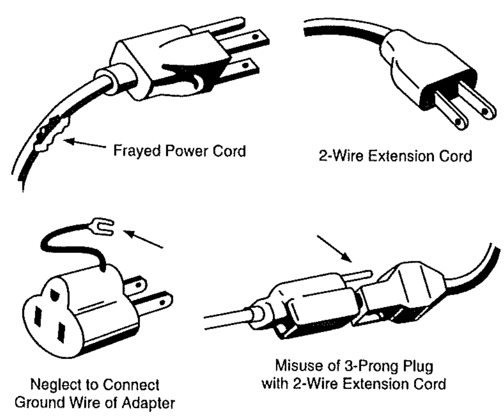
The following figure illustrates the origin and path of leakage current.

Origin of Leakage Current



Failure to use the grounding conductor in power cords causes a dangerous electrical hazard. This commonly results from using two-prong plugs and receptacles, improper use of adapters, use of two-wire extension cords, and the use of damaged electrical cords or plugs. The following figure illustrates these hazards.

Electrical Hazards



Answers

There are no perfect electrical systems or infallible equipment to eliminate hospital electrical accidents. However, careful planning on the part of the consulting engineer, architect, contractor, and hospital personnel can reduce electrical hazards to nearly zero. Hospital electrical equipment receives much physical abuse; therefore, it must be properly maintained to provide electrical safety for patients and staff.

Procedures for electrical safety should include the following:

- Check all wall power receptacles and their polarities regularly.
- Routinely verify that conductive surfaces are grounded in all patient areas.
- Request that patient electrical devices such as toothbrushes and shavers be battery powered.
- Use completely sealed and insulated remote controls for use in patient beds.
- Use bedrails made of plastic or covered in insulating material.

Codes and Standards

It would not be practical to attempt to reproduce the codes and standards that affect the application of isolated distribution systems in hospitals. As was previously mentioned, codes are continually refined and updated, with frequent amendments between major publications. All hospitals should have copies of the current standards for reference; the design engineer **must** have this information available. Obtain copies of all standards referenced in this bulletin from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

This chapter briefly covers the sections of codes and standards that apply to hospital isolated ungrounded distribution systems. This chapter only covers a few of the important points within these standards. A thorough study of applicable codes and standards is required to effectively design a project.

NFPA No. 99

History

Published by the NFPA, this code is included as a reference in the NEC Article 517.

NFPA No. 99 addresses fire, explosion, and electrical safety in hospitals. It consolidates 12 individual NFPA documents or standards into one document.

Many hospitals and consulting engineers are unaware of this document and its requirements. Square D recommends all consulting engineers who design hospitals have the hardcover "handbook" version of this document available.

Anesthetizing Location Classifications

The first type of location is one which is flammable because explosive anesthesia is used. This location must be designed to comply with NEC Article 501.

There are many other requirements for the flammable anesthetizing locations; these requirements are discussed in NFPA No. 99. Explosive anesthesia is now virtually non-existent in the United States. Therefore, this handbook does not cover the flammable location in any detail.

Non-flammable anesthetizing location requirements are also covered in NFPA No. 99. A permanent sign must be displayed at the entrance to all flammable locations. It must state that only non-flammable anesthetics can be used in the room.

Non-flammable anesthetizing locations can be further divided into locations that are subject to becoming wet and those that are not. A wet location requires special protection against electrical shock. The allowable protection is as follows:

- Ground-fault circuit interrupter if first-fault conditions are to be allowed to interrupt power
- Isolated power system if first-fault conditions are not to be allowed to interrupt power

The governing body of the hospital will make the determination of a "wet location," using the following definition:

> A patient care area that is normally subject to wet conditions while patients are present. This includes standing fluids on the floor or drenching of the work area, either of which condition is intimate to the patient or staff. Routine housekeeping procedures and incidental spillage of liquids do not define a wet location.

NFPA No. 99 defines the items in an anesthetizing location, which must be powered from the isolated ungrounded system. Because this section is subject to individual interpretation by local Code authorities, work closely with these authorities before selecting the equipment to be powered from standard grounded systems. This is especially important when ordering permanently installed equipment, such as X-ray apparatus. NFPA No. 99 and the NEC Article 517 allow the grounded circuit providing power to an isolated system to enter the non-hazardous area of an anesthetizing location. However, ungrounded wiring and grounded service wiring cannot occupy the same conduit or raceway.

The primary and secondary of the isolation transformer cannot exceed 600 volts in any isolation system supplying power to an anesthetizing area or other critical care patient area. The secondary circuit conductors must be provided with an approved overcurrent protective device in both conductors of each branch circuit.

NFPA No. 99 sets the limits of impedance to ground of the isolated system and the instructions for testing to determine compliance with the standards. The size of the isolation transformer should be limited to 10 kVA or less.

Even in the most sophisticated operating rooms, the equipment load rarely exceeds 5 kVA. When writing specifications, we suggest choosing an isolated transformer rated at 5 kVA, having a continuous overload capability of 25 to 50%. The transformer will thus be designed to operate at a relatively cool normal temperature, but will still be able to handle future demands which exceed today's norm.

Conductors for the isolated ungrounded system must be color-coded:

- Orange for conductor #1
- Brown for conductor #2
- Green for the grounding conductor
- Where three-phase isolated systems are used, yellow for conductor #3

NFPA No. 99 describes the line isolation monitor (ground detector) required to monitor the isolated system. The limitation for total system hazard is set at 5 mA.

NFPA No. 99 specifies the "Grounding System." This subject is also discussed in detail in "grounding" on page 16 of this handbook.

Article 517, National Electrical Code—NFPA No. 70

Article 517-3 specifies the legal minimum requirements in most states. It is the document used by most inspectors. When designing the system, use it in conjunction with NFPA No. 99, which is included as a reference in Article 517. Other NFPA standards are also referenced in Article 517, such as NFPA-101 and NFPA-20.

Patient Care Areas

Article 517 defines three types of patient care areas:

- **General Care Areas:** patient bedrooms, examining rooms, treatment rooms, clinics, and similar areas. In these areas, the patient may come in contact with ordinary appliances, such as nurse call systems, electrical beds, examining lamps, telephones, and entertainment devices. Patients may also be connected to electro-medical devices, such as heating pads, EKGs, drainage pumps, monitors, otoscopes, ophthalmoscopes, and IV lines.
- **Critical Care Areas:** special care units, intensive care units, coronary care units, angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, and similar areas. In these areas, patients are subjected to invasive procedures and connected to line-operated, electro-medical devices.
- **Wet Locations:** patient care areas normally subject to wet conditions while patients are present. This includes standing fluids on the floor or drenching of the work area, either of which condition is intimate to the patient or staff. Routine housekeeping procedures and incidental spillage of liquids do not define a wet location. Critical care and general care areas can also be considered wet areas. The governing body of the hospital determines whether a location is to be considered "wet."

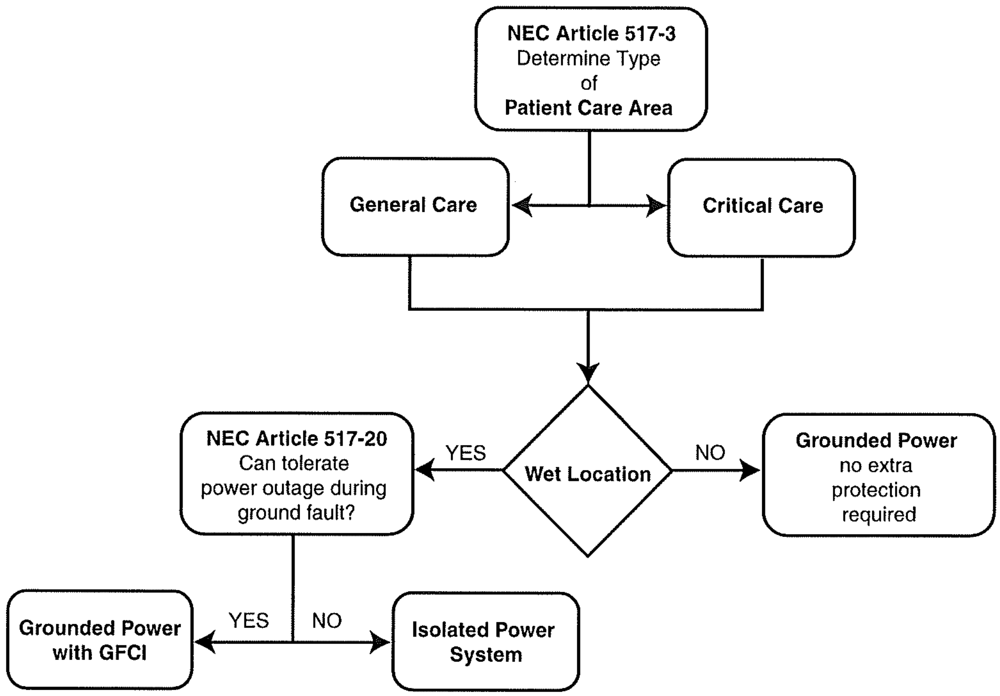
Anesthetizing Location Classifications

As with NFPA No. 99, anesthetizing locations are classified as:

- Hazardous locations which use flammable anesthetics. These locations must meet class I division requirements and must have isolated power systems.
- Other-than-hazardous locations, allowing the use of grounded power systems.

Both types of anesthetizing locations must be further classified as "wet" or "not wet" areas. If designated as a wet location, extra electrical protection is required. The acceptable protection is the same as that defined for NFPA No. 99.

The designation of all of the above-mentioned areas in the health care facility is the responsibility of the facility's governing body. Before a designer can choose the proper electrical distribution system for a hospital, the governing body of the hospital must inform the designer about the location's use. This requires close coordination with the medical staff of the facility, to ensure the designer understands current medical procedures as well as possible future procedures.



The NEC recognizes that hospital patients are more susceptible to electrical shock than are normally healthy individuals. Consequently, patients must be protected through use of special procedures. The special procedures and equipment required become more complicated with the degree of electrical susceptibility of the patient.

The hospital administration and designer are responsible for determining the degree of patient susceptibility and selecting the correct equipment. This selection process requires close communication between the hospital administration, medical staff, and the consulting electrical engineer.

It is generally accepted that any time the normal body resistance of a patient is bypassed, the body becomes electrically susceptible. Degree of susceptibility varies from having an electrical probe or catheter connected to the heart muscle, to having electrodes attached to the outer skin after conductive paste is applied. Patients who are anesthetized, or are demobilized through illness, restraints, or drug therapy, also have a higher degree of electrical susceptibility than normal individuals. Such patients cannot avoid or disconnect themselves from an electrical hazard that would be relatively harmless to a normal person.

For example, a patient who has impaired nerve sensitivity cannot detect heat. A cup of very hot coffee would not be a hazard for a normal person; however, it is a potential disaster for the nerve-impaired individual.

Certain medical conditions may render a patient particularly vulnerable to electrical shock. These patients may require special protection even though their normal body resistance has not been intentionally bypassed.

Give special consideration to the following potential electrically susceptible patient areas:

- Acute care beds
- Angiographic labs
- Cardiac catheterization labs
- Coronary care units
- Delivery rooms
- Dialysis units
- Emergency room treatment areas
- Human physiology labs
- Intensive care units
- Operating rooms
- Post-operative recovery rooms

UL 2601-1

This is the UL Standard against which all medical and dental equipment is tested by the Underwriters' Laboratories. UL derives its standards for performance requirements from the applicable NFPA standards and the NEC. Demand that any appliance purchased for use in patient care areas be labeled under this UL Standard for use in the specific area designated.

UL 1022

Line isolation monitors are measured against this UL Standard. Insist that any line isolation monitor installed in the facility have a UL component recognition under this standard.

UL 1047

This is the UL Standard for hospital isolating equipment. Do not accept any hospital isolation equipment unless it is listed and labeled as a complete system under this standard. This assures the hospital and consulting engineer that the equipment meets all existing codes and standards.

Isolated Systems

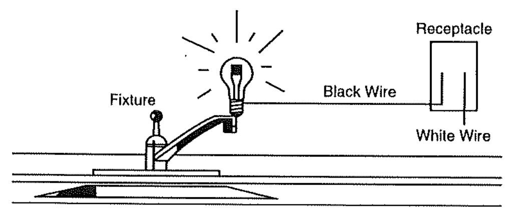
The term "isolated system" can apply to many systems in a hospital, such as the management of patients having a communicable disease. However, it is unlikely that any of the other systems is as widely used, yet as poorly understood, as the system discussed in this catalog.

The isolating system covered in this manual is really an "isolated ungrounded electrical distribution system." Although these isolated systems are very important to hospital operations, many hospital staff lack even a basic understanding of how isolating systems work. This includes the technicians responsible for maintaining the systems.

Consulting engineers and plant operating engineers who specify and apply these isolating systems usually understand them; but they have difficulty passing this knowledge to laymen. Hopefully, this section will help them fill this communication gap. The following simple analogy should help the layman understand isolated systems.

In this example, consider an electrical receptacle in the counter area of a household kitchen. The ground in this case is the kitchen plumbing fixture. The following figure illustrates this example.

Kitchen Plumbing as a Ground



Electrical current comes to the receptacle via two insulated conductors. One of them is usually black, the other white. Many people feel they can safely touch either one of these conductors, but this oversimplification could result in a dangerous shock.

When the two conductors touch each other, a violent arc results, part of the conductor melts, and the fuse opens or the circuit breaker trips. This demonstrates the energy used when any household appliance is run. Because the household appliance does not open a fuse or trip a circuit breaker the appliance places resistance between the two conductors. In placing resistance, the appliance limits the amount of current that can flow. However, the amount of current that can flow must always be less than the current rating of the fuse or circuit breaker.

When a light bulb touches both wires, it illuminates. If one of its terminals touches the white conductor in the receptacle, nothing happens. If the other terminal of the light bulb touches the kitchen plumbing, nothing happens. If the white wire touches the plumbing, nothing happens. The conclusion must be that the white wire is safe to handle as long as the black conductor is not handled at the same time.

Using the example as above, but with the black wire, the connections cause different results. When one terminal of the light bulb touches the black conductor, nothing happens. However, when the other terminal of the light bulb touches the kitchen plumbing, the bulb illuminates as it did when it touched both wires. When the black wire touches the kitchen plumbing, there is a violent arc, much as if both conductors had touched each other.

The conclusion from the above paragraph is that it is safe to handle the black conductor only if you do not simultaneously touch the white conductor, kitchen plumbing, or any other grounded item.

Obviously, the white conductor and the kitchen plumbing have something in common. That is that they are *grounded.* A wire becomes grounded when it is attached to a copper rod driven into the ground or to a convenient piece of conductive plumbing pipe, which ultimately runs into the ground. The white conductor (known as the *neutral*) is grounded when it is installed by the utility company.

The conclusion from the previous paragraph is that current flows from the black wire to *any* grounded conductive surface, of which there are many. The black conductor is safe to handle as long as you do not simultaneously touch the white conductor or any grounded item.

This type of electrical system is commonly called a “grounded electrical distribution system.”

Ungrounded System

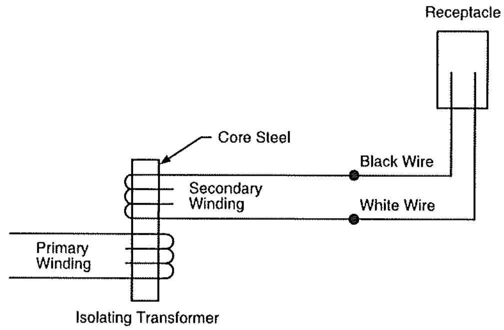
To convert available power from a receptacle into an *ungrounded service* is possible. The first step is to *isolate* the receptacle from the grounded service. There are several ways to isolate power, but the most common and economical is to use an isolating transformer.

The available grounded electrical power energizes a coil in the isolating transformer; this coil is called the *primary winding.* This induces a current in the *secondary winding,* which is completely insulated from the primary winding by electromagnetic induction. No direct electrical connection exists between the primary and secondary coils.

Hospital Isolated Power Systems
Isolated Systems

The following illustration shows how a transformer is constructed and connected to a receptacle.

Transformer Construction



When electrical devices are connected across two conductors on the transformer, they work as if they were connected directly to a grounded system. The conclusion to be drawn is the isolating transformer provides the same usable electrical energy as the grounded power circuit.

Repeating the experiments with the light bulb, we find current will not flow if a single terminal of the light touches either secondary conductor of the isolating transformer. No current flows if either secondary conductor of the transformer touches the plumbing (ground). Furthermore, no sparking occurs when either conductor touches the plumbing; the fuse or circuit breaker maintains the connection.

The conclusion is current does not flow from either conductor of the isolated system to ground. In more technical terms, **no hazardous potential to ground exists from either conductor of an isolated electrical system.**

System Comparison

The previous section illustrates that conductors of an isolated system are safer to handle than are the conductors of a grounded system. Now let's use the same kitchen receptacle to show a comparison between a grounded system and an isolated system.

When installing a new curtain rod at the window over the kitchen sink, one would probably use a small electric drill. If the residence was built within the last 30 years, the receptacle most likely has three openings, not two. The third opening is shaped to receive a pin (U slot) rather than a blade-shaped prong. The portable electric drill probably has a three-prong plug. This third point of contact simply connects the metal case of the drill to ground. The connection to ground from the pin on the receptacle is often made by a third wire run with the power conductors, or by a metal pipe (conduit) which encloses the two conductors serving the receptacle.

The electric drill has an electric motor which is completely enclosed in a conductive housing. The housing is connected to a third wire in the power cord, which in turn connects to ground.

The electrical portion of the motor must be completely insulated from the conductive enclosure. If it were not, arcing would result when the black conductor of the grounded system touched the plumbing. This "short circuit" would disengage the circuit breaker or blow the fuse as it did when the live conductor touched the plumbing.

Consider this scenario: The person using the drill touches his or her opposite hand on the plumbing fixture for support. If the drill is in good repair and the enclosure is properly grounded through the power plug, the procedure is safe.

However, what if the insulation around the drill motor is defective, allowing the live conductor of the grounded system to contact the metal enclosure? This is a dangerous situation. If the ground wire is properly attached to the enclosure and connected to ground through the ground pin in the plug, there will be arcing in the drill where it contacts the conductive enclosure. If there is good contact between the live conductor and grounded enclosure, sufficient current will flow to disengage the circuit breaker or blow the fuse.

Two paths to ground are possible, one down the ground wire in the cord into the receptacle ground, and one through the person holding the drill (who is grounded through the plumbing). Since the resistance through the human body is much higher than the resistance through a properly connected ground wire, most of the current follows the path of least resistance (the ground wire); the person holding the drill is safe.

The key to keeping the drill safe is in the ground connection from the drill enclosure to the ground at the receptacle. If this connection is broken (for example, if an improperly connected adapter is used), the only path for current in the enclosure to go to ground is through the drill user. A hazardous level of current could be maintained since the human body has sufficient resistance to keep the current below the level required to disengage the circuit breaker or blow the fuse. The level of current would be high enough to be deadly.

If, on the other hand, the drill is powered from an isolated circuit, and the ground from the drill enclosure is disconnected, there is little potential for current to flow through the drill user. Even if the ground is intact, not enough current flows to disengage the circuit breaker or blow the fuse.

This is a very important factor: if the drill was really a piece of life support equipment, such as a respirator, it would continue to run without disengaging the circuit breaker or blowing the fuse.

Imperfect Isolating

In the previous examples, we assumed a perfect system. Unfortunately, a perfect system is impossible to attain.

Returning to the example of the isolating transformer, we can convert the isolated system back to a grounded system easily, by connecting one secondary conductor of the transformer to ground. This would create the potential for current to flow from the opposite conductor to ground, as it would in any grounded electrical distribution system.

An isolated system can be unintentionally grounded. For example, if the drill is plugged into the system with the ground intact and there is a fault in the drill to the grounded enclosure, that single fault converts the entire system into a grounded system.

Keep in mind no perfect insulators exist either. What we commonly call "insulators," such as rubber or plastic coverings on wire, are actually just poor conductors. All materials conduct electricity to some degree. Thus, everything attached to the secondary conductors of an isolating transformer will partially ground the system. Examples of items that partially ground the system, without making direct connection to ground, include the following:

- Insulated wires enclosed in grounded metal conduit
- Electrical components within permanently installed electrical equipment
- Electrical components within portable devices housed in grounded enclosures (commonly referred to as the capacitance of the system)

Because an isolated system can easily become grounded without giving any indication to the user, a way must be found to monitor the integrity of the isolation in the system. With this monitoring, there must be some warning when the system becomes grounded. When the system becomes partially grounded, the warning is still necessary, but a limit must be set for the warning to be sounded. Limits are established by codes and standards, specifically the NEC.

See the "Codes and Standards" page 7 of this manual for additional information. Codes and standards state that an alarm must sound and display (it must be audible **and** visible). The alarm must activate when the integrity of an isolated ungrounded system degrades to the extent that 5 mA of current will flow from either secondary conductor to ground through a zero impedance fault.

Line Isolation Monitor (LIM)

Codes and standards not only specify the limits within which an isolated ungrounded system must operate, but also the method for checking system integrity. A LIM is required to continuously check the resistance (impedance) of the total isolated ungrounded system to ground. The LIM must respond audibly and visibly when the impedance of the system degrades to the extent that 5 mA of current will flow through either conductor of the system to ground in a zero impedance fault.

Several points should be considered:

1. The alarm condition does **not** mean there is imminent danger to the patient or anyone else. The alarm simply indicates the system has reverted to a grounded or partially grounded system, which is the same system contained in the rest of the hospital. Correct the problem as soon as possible; but do not interrupt procedures being conducted when the alarm sounds.
2. The LIM does not interrupt electrical service. Loss of integrity in the ungrounded system does not affect the operation of life support devices.
3. An activated alarm does not mean hazardous current is flowing. The LIM is a predictive device; by sounding an alarm, it predicts that 5 mA of current could flow from one conductor of the isolated system to ground if a path for the current is provided. This requires a **second** fault or electric failure to be present in the system before a true hazardous condition exists.

The LIM is equipped with a meter (also required by code) that gives continuous indication of the system's condition. The meter is calibrated in milliamperes (mA) of current. Its position indicates how much current could flow from either conductor of the isolated system to ground if a path was provided.

NOTE: Keep in mind that this meter merely predicts the possibility of the condition; it does not indicate that current is actually flowing.

Types of LIMs

Several types of line isolation monitors are available. Reviewing them not only helps determine requirements for a system, but helps identify the equipment currently used in the hospital.

Ground Detector. The first unit is not actually a LIM, but rather the original "ground detector," which is essentially a balanced bridge device. Ground detectors were standard equipment until about 1970, so many of these units are still in use. Inexpensive to build and reliable because of its simplicity, the ground detector is unaffected by and does not create any radio frequency (RF) interference. However, it only recognizes unbalanced resistive or capacitive faults; it cannot recognize a partially grounded system. This inability to sound an alarm (to recognized balanced fault systems) is the main reason codes and standards no longer allow its use.

Systems in the field have been observed to allow as much as 30 mA (30,000 μA) to flow from line to ground without sounding an alarm. This very hazardous condition can cause an electrical hazard to the patient or medical staff.

Ground detectors may still be used if they were installed before 1971. Even though not required by code, hospitals should consider revising these systems to match current standards.

Dynamic Ground Detector. The first dynamic ground detectors, now called line isolation monitors, were developed in Canada. They are called dynamic ground detectors, as opposed to static ground detectors, because the measuring circuit continually switches between the two isolated conductors and ground. In this way, it overcomes the greatest inadequacy of static ground detectors — the inability to recognize and sound an alarm at the occurrence of an excessive balanced fault condition.

Although this unit meets current codes and standards, it has two undesirable features:

1. This type of LIM connects to ground through a high resistance so that it can measure the impedance of the total system. This reduces the integrity of the isolated system by partially grounding it. With nothing connected to the system except the LIM, 1000 μA could flow from either line of the isolated system to ground. If the LIM is calibrated to sound an alarm when 2000 μA flow from either line to ground, approximately one-half of the capacity of the total system would be dedicated to the LIM. This limits the amount of equipment that can be connected to an isolated system, often requiring two systems in an operating room, rather than one.

2. Switching between the isolated conductors and ground causes interference on the isolated system. Sometimes, this interference can be detected on patient monitoring equipment, creating difficulty in gathering information needed by the medical staff. In extreme cases, it becomes impossible to use equipment such as an EEG without disconnecting the LIM.

The extent of difficulty encountered with these types of interference varies with the installation and design of the patient monitoring equipment.

The Square D brand, type EDD line isolation monitor is typical of the second generation of LIMs. This unit was the first of the low leakage LIMs. It contributes less leakage to the system because of its higher impedance connection ground. Rather than use half the system capacity for the LIM, this unit reduces LIM contribution to less than 25% of the system's capacity.

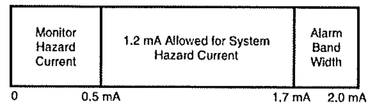
The type EDD LIM still uses a switching circuit and still causes interference with patient monitoring equipment.

IGD Iso-Gard® Line Isolation Monitor (LIM). This LIM represents the most recent generation of line isolation monitors. It virtually eliminates all of the undesirable features in the early dynamic ground detectors and line isolation monitors. It contributes only 50 µA of leakage to the system, about one percent of the system's usable capacity.

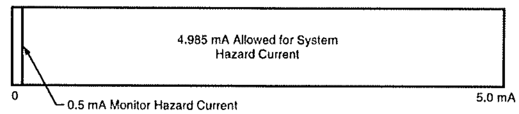
The special circuitry developed by Schneider Electric monitors both sides of the line continuously, eliminating the need for switching. It does not generate any interference that could affect patient monitoring devices. For detailed information on the Iso-Gard LIM, see page 62 of this bulletin, or request the Schneider Electric bulletin covering line isolation monitors.

Iso-Gard LIM

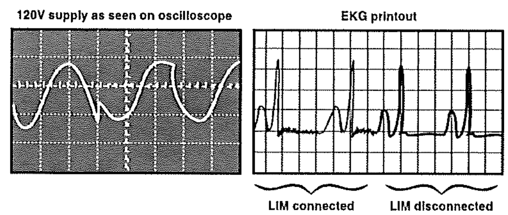
This figure compares the degree of interference produced by the Iso-Gard LIM with older LIMs.



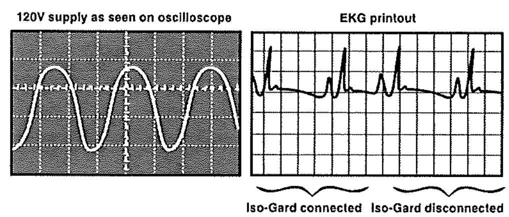
Older LIMs



ISO-GARD® LIM from SQUARE D



Interference produced by switching LIM



Absence of interference with ISO-GARD

Grounding

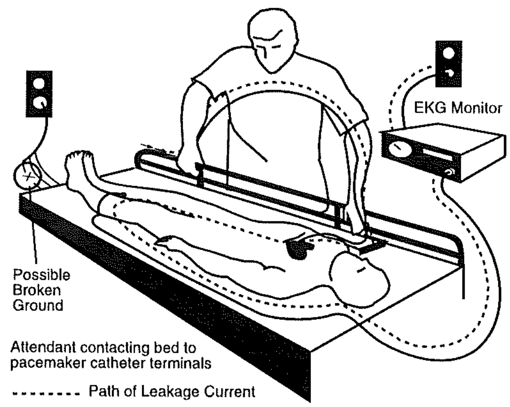
Grounding in a patient care or anesthetizing location is an important safeguard against shock and electrocution. Proper grounding dissipates static charges and shunts fault currents and normal leakage currents away from attendants. Grounding of circuits must be performed as required in Article 250 of the NEC.

Electric Equipment Power Cord Grounding

The green grounding conductor in an equipment power cord prevents static potentials from reaching dangerous values on noncurrent carrying parts such as housings, cases, and boxes of electrical appliances. If these parts are not properly grounded, a static charge could accumulate; the charge could reach a large enough value to automatically discharge as an electric static spark. This static charge could be a hazard to the patient and attendant if it ignited some flammable gas or material, or if it discharged to the patient as a shock.

This grounding conductor also provides a path for leakage current which could be conducted to an electrical appliance case. The magnitude of this leakage current depends on the characteristics of the appliance and its insulation. The leakage current could result in potential differences between pieces of equipment and could flow through vital organs of the patient, if a patient current path is established. For example, during cardiac catheterization, small amounts of current could cause ventricular fibrillation.

The following figure illustrates the current path for leakage current which could develop in an electrically operated patient bed. Since the patient provides a grounding path via the attendant and pacemaker, a current divider will result. However, the resistance through the power cord ground conductor is significantly lower, providing protection for the patient. However, if the ground wire is broken, most of the current would flow through the patient. In this example, we assume that non-isolated patient monitoring leads are used.



Because the resistance of a grounding conductor is extremely important, you must give it careful consideration. Wire resistance is inversely proportional to its cross-sectional area. The cross-sectional area is usually expressed in units of AWG (American Wire Gauge). The lower the AWG, the larger the wire. For example, the grounding conductor in a power cord is #18 AWG; it represents about 0.0064 ohms/foot. On the other hand, #10 AWG only represents 0.001 ohms/foot.

Current codes and standards for new construction of critical care areas require that no more than 40 mV exist between the reference point and exposed conductor surfaces in the patient's vicinity. This means, for a piece of electrical equipment using a #18 AWG ground wire in a 15-ft power cord, no more than 416 mA of fault current could develop without exceeding the 40 mV potential difference requirement.

These faults could develop through internal aborted components or poor power cord insulation. There is no certain way to prevent these faults; however, their magnitudes can be kept to a minimum through the use of an isolated power system. Using the isolated system, an initial line to ground fault can be kept as low as 5 mA, if the system is operating in the "safe" condition. The power cord ground wire could easily accommodate a 5 mA fault and stay well within the requirements of NFPA No. 99 and the NEC.

Permanently Installed Ground System (Hard Wiring)

Providing proper grounding for all electrical devices assumes that they connect to a sufficient ground system which interconnects to provide an equipotential ground plane for the patient. Current codes and standards require that all conductive surfaces within the patient vicinity must be properly grounded. The grounding system permits intermingling of electric appliances located near or applied to the patient without the hazard of leakage or fault current to the patient. By interconnecting all metal surfaces within the patient area, potential differences between the metal surfaces can be kept to a minimum.

Since a potential difference is required to produce a current flow, the entire ground plane can rise above ground zero as long as all metal is at the same potential. Even if a person contacts two pieces of metal, both at 10 V, a current path will not develop. This ground plane is established by the use of a properly connected ground system.

Equipotential Grounding

The NEC (1971, 1975, and 1978 editions) specified and dictated the use of an equipotential grounding system with maximum resistance for each branch of such a system. While these requirements are considerably reduced in the NEC and NFPA No. 99, grounding requirements still remain more demanding than those shown in Article 250 for other occupancies. Because of this, electrical design engineers should still plan for special grounding requirements in these areas. Carefully study the code to determine exactly what special grounding provisions must be provided in each project.

Ground Jacks

In previous codes, provisions for grounding conductive non-electrical devices were dictated. These provisions were met by supplying each critical patient care area with a specified type of ground jack. Each operating room was required to have a minimum of six ground jacks.

While this is no longer a code requirement, Schneider Electric recommends that at least one ground jack be placed in each critical care patient area. This ground jack provides connection to the grounding system for redundant grounding of exceptionally hazardous equipment. The jack also allows connection to the grounding system for testing. The cost of a single ground jack, or even several ground jacks, in a room is quite low.

Design Guide

I. System Concept

With the increased complexity of isolated systems, it is more important than ever to use a system approach in which all components work with each other to obtain a specific result. The components in an isolated power system can be purchased separately; however, it is much easier and makes more sense to purchase a complete system.

When manufacturers design and build complete systems, many factors are considered: proper and attractive packaging, convenient design, and ease of maintenance. The component system, on the other hand, invariably results in duplication of functions, high jobsite labor costs, excessive system leakages, and the lack of a dependable single vendor.

The variety of Square D brand modular system components gives the electrical consulting engineer and architect great design latitude. Consequently, a system to fit the special needs of each hospital is practical.

In spite of this great versatility, all Square D brand modules interface with each other perfectly. When designing the modules that make up its systems, the Schneider Electric engineering department considered every important requirement for isolated systems. Among these considerations are:

- Operating and panel face temperatures
- Sound levels
- Minimum leakage
- Ease of maintenance
- Interchangeability of components
- Pleasing appearance
- Ease of installation

II. Application

The design of isolated systems from Schneider Electric ensures that all pieces of a system are compatible with each other. This is the first step toward having a working system, but it is only one of four ingredients that make up a superior system. The second ingredient has been discussed but bears repeating: there must be good communication between the parties planning the system for the hospital. Poor communication causes poor planning, which will be very costly and time-consuming if the system must be modified after it is installed.

The consulting electrical engineer must be the nucleus of the team that makes the decisions. However, each team member contributes vital information to the system design.

In the past, projects run by capable consulting electrical engineers have required modifications costing several thousand dollars per operating room. This was not because of poor planning, but because the engineers did not receive the information needed to plan usable systems. This lack of information led to such errors as incorrect voltage for portable X-ray machines, insufficient receptacles, and insufficient capacity in isolating systems.

The team approach benefits all members of the hospital team, for example:

- The architect can make the proper provisions for mounting the equipment; this results in superior aesthetic quality. The architect can also specify the proper equipment, avoiding later difficulties.
- As part of the team, the hospital administrator can make informed decisions when ordering equipment for the operating room, specifying maximum leakages, and correct cords and connectors. The proper accessories are often available at no extra cost, if they are specified when the order is placed.
- The chief staff surgeon can specify a traffic flow within the operating room, allowing the engineer to provide proper receptacle placement.
- If included in the team, the hospital maintenance engineer will better understand the isolated system. This enables the engineer to perform maintenance more conveniently and efficiently.

III. General Application Criteria

A. System Size

The system must stay as small as possible to limit leakage currents. Remember that everything connected to the isolated system increases the total hazard index: LIM, transformer, circuit breakers, secondary wiring, and any peripheral equipment. The system hazard current must be kept well below maximum to allow for normal current leakage, which will come from the equipment operating on this power supply.

Additionally, the code states that the unloaded system, with the LIM disconnected, must have a minimum line-to-ground impedance of 200,000 Ω. On a 120 V system, this corresponds to 600 μA when measured through a milliammeter connected between line and ground.

When considering system size, we must include all wiring between the circuit breakers in the isolated panel and their receptacles. *Every foot of wire* contributes leakage, so we must keep the total footage to a *minimum.* This emphasizes the need to place the isolation panel as close as possible to the point of usage.

The use of a central system, containing individual distribution systems for several operating rooms or CCUs, is not practical except in rare circumstances. The only time a central system makes sense is when this location coincides with the closest placement of individual panels to each room. In other cases, the central system would result in longer runs from the panel to the receptacles and devices. This would increase system hazard current.

B. System Capacity

In selecting the capacity of an isolating transformer, remember that the patient care areas generally present an intermittent load condition and load diversity. A given area may contain equipment that requires power greater than the isolated system provides; but the hospital will not use every piece of equipment at the same time.

The isolated power requirement of the operating room is almost always under 5 kVA. However, the Square D brand, 5 kVA isolation panel incorporates a transformer built with a 220 °C insulation system, suitable for a 150 °C rise. The full load design temperature, however, is limited to an 80 °C maximum rise. Therefore, the transformer can easily provide power for loads up to 150% of its rating. This is an important feature in an isolating transformer since it provides for intermittent heavy loads, like those presented by hypothermia equipment. In critical care areas, where one transformer serves one bed, a 3 kVA transformer is recommended.

Since the amount of wire is often proportional to the number of circuit breakers, keep the number of circuit breakers to a minimum. This can be done by connecting two to four receptacles to one circuit breaker. In most cases, an operating room panel with eight or ten secondary breakers is sufficient. If additional receptacles are required, up to 16 secondary breakers can be used. Isolation panels serving a single bed in a critical care area require only eight secondary breakers.

C. System Wiring and Conduit

The selection of a proper conductor is one of the most important design criteria of an isolated power system. If improper conductor insulation is chosen, the result is the same as if the capacitive leakage is raised. A good commercially available wire insulation for this application is cross-linked polyethylene, having a mineral filler instead of a carbon black filler. A minimum wall thickness of 2/64-in. should be demanded for use in 120 V, 208 V, and 240 V applications. It is also important to specify wire with a dielectric constant of 3.5 or less, as recommended by the NEC and NFPA No. 99.

Standard Type THHN wire is definitely unsuitable. It can, however, be used for the ground conductor. The code demands that the #1 conductor in the system be color-coded orange, the #2 conductor color-coded brown, and the ground conductor color-coded green. In three-phase systems, the third conductor shall be color-coded yellow.

Schneider Electric is often asked to specify manufacturers and wire catalog numbers for the low leakage conductor. This is extremely difficult to do since the availability of these wires differs from region to region. Also, manufacturers have sometimes discontinued production of wire types that we have recommended. The most accessible XLP wire has been low leakage wire #FR-XLP (VW-1 XHHW-2).

Recently, manufactures have rescinded their notation in their specs for XHHW and XHHW-2. This note referred to the recommendation found in the NEC (517-160) concerning the 3.5 dielectric strength. The different compounds used in the manufacturing of the insulation have changed or are subject to change, and the 3.5 dielectric strength may not be obtained. The XHHW and XHHW-2 insulation is still the choice since it comes closest to meeting the recommendation. This is important to note since this could affect the overall installation of an isolated power system.

Avoid the use of wire pulling compound since it increases the capacitive coupling. The code no longer allows wire pulling compound to be used in conduits for isolated power systems. This compound is usually unnecessary, because most of the runs on an isolated system are short. Occasionally, difficulty occurs in circuits feeding portable equipment since these conductors are somewhat larger. These difficult runs can be anticipated and provided for by using oversized conduits to ease the situation.

Obviously, conduits must be dry or the leakage characteristics designed into the system will suffer. During construction, keep conduit ends capped so they remain free from moisture. The specifications should state that, if moisture accidentally enters the conduits, they must be swabbed and thoroughly dried before conductors are pulled. Use minimum fills for conduits; this results in a better random lay of the conductors within the conduit, which further reduces the capacitive coupling.

The table below shows the approximate expected hazard currents per foot of power conductor, using the various wiring schemes described in the preceding paragraphs.The consulting engineer can use this table to estimate the system hazard current at the design stages. Values given are approximate; variations in humidity, conduit moisture content, conduit fill, and wire insulation will give different results.

Hazard Current Leakage Contributed by Wiring

Materials Used	Result
TW wire, metal conduit. Wire pulling compound with ground conductor.	3 µA per ft of wire
XLP wire, metal conduit. No wire pulling compound with ground conductor.	1 µA per ft of wire

IV. System Design

A. Operating Room Layout

Before the electrical design of an operating room begins, some important information should be acquired from hospital personnel. Most hospital operating rooms have a set traffic pattern and positioning for the operating room table. This is usually restricted to the location of the overhead operating room light. However, since the position of the head of the operating room table can be varied, the hospital personnel should advise the electrical engineer of the table's standard position. The traffic pattern, along with the positioning of the surgeon and support team, should also be verified. The positioning of the electrical equipment in the operating room has a direct relationship to this information. In the following example, we will use the configuration shown on page 22.

The panel is located behind the support team, near the head of the operating room table. The location of this panel is important; correct placement will keep electrical and ground cords out of the traffic area.

A 5 kVA isolation panel is recommended for operating room use. Be sure to determine the load of secondary equipment being used; very few cases will require a 7.5 kVA transformer. The 5 kVA isolation transformer from Schneider Electric is capable of a 150% continuous overload within its maximum designed temperature. It is important to remember that an increased number of circuits will also increase the total hazard current.

Ten secondary circuit breakers are recommended for the panel in this example. Each circuit breaker should supply two duplex receptacles, or four outlets per circuit. The table below shows the recommended breaker-to-load schedule.

Secondary Circuit Breaker Schedule

Number of Breakers	Load
4	8 receptacles in panel (2 per breaker)
2	4 receptacles in anesthetist's module (2 per breaker)
2	4 receptacles in surgeon's module (2 per breaker)
1	Surgical light
1	Clocks

Square D brand isolation power panels use the QO snap-in breaker as standard. The snap-in breaker is recommended because of its ability to grab the bus and clamp down under heaver loads. Whether snap-in or bolt-on breakers are used, it is extremely important that the dead front for the panel be properly installed. It is recommended that bolt-on breaker bus connections be checked for tightness no less then once every 12 months.

Additional circuits should be added with caution, as this will increase the leakage. Schneider Electric recommends that no more then four outlets (2 duplex receptacles) be fed from one circuit. If an optional power ground module is used, two circuits should be used. If more circuits are required, consider the use of a second or even a third isolation power panel. If the state or local authority having jurisdiction (AHJ) allows the use of grounded power, this should be considered for non-life support, non-life-sustaining equipment such as film viewers and blanket warmers. Countertop areas may be served with grounded power when the power used is restricted to this area. All fluorescent lighting should be on grounded power.

When laying out the operating room electrical system, the location of power and ground receptacles is significant. Power and ground cords can be dangerous to circulating personnel; so, whenever possible, locate receptacles so cords do not lie within the major traffic area. Since the operating room support team uses most of the electrical outlets, the majority of the services should be placed behind them, near the head of the table.

Little traffic occurs between the support team and the anesthetist. Locate a power and ground module at the head of the table so the anesthetist can easily connect equipment.

Locate an additional module behind the surgeon, near the head of the table. This gives the surgeon easy access to power for surgical equipment.

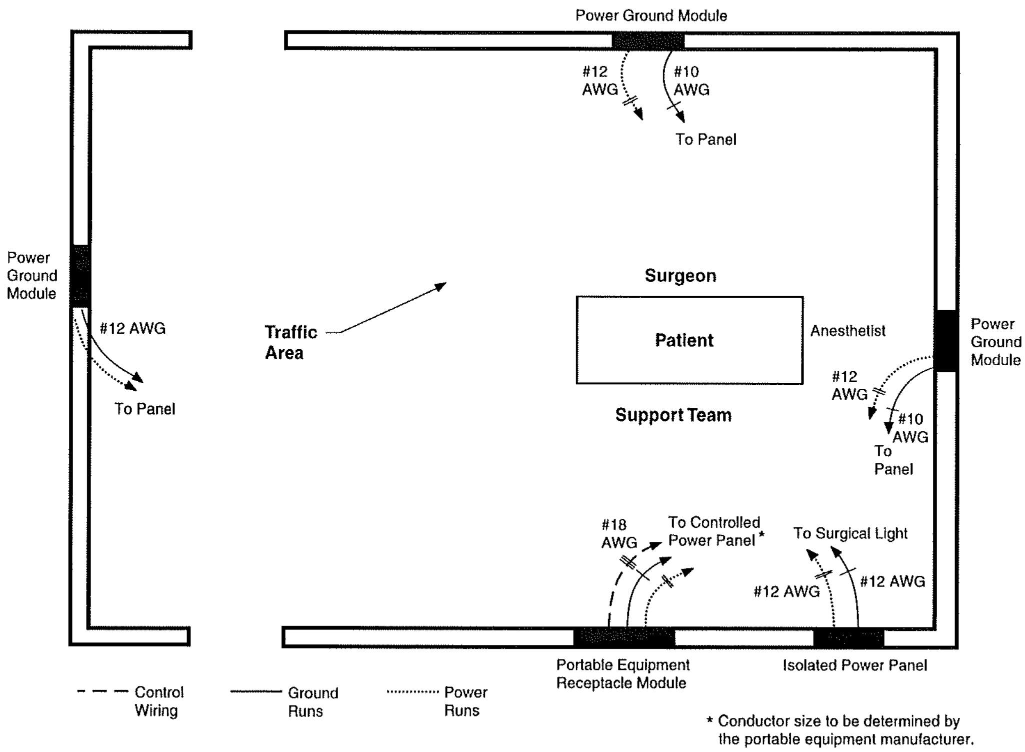
Proper location of the receptacles on these two panels, plus receptacles in the isolation panel, should eliminate tripping hazards in the traffic flow area.

There are distinct advantages to integrating power ground receptacles into one enclosure, rather than in individual power receptacles scattered around the room. The single enclosure places the receptacles at the point of usage and provides a lower resistance ground path between electrical appliances. Standard straight blade receptacles, NEMA Configuration #5-20R, are now acceptable in operating rooms.

A clock and elapsed-time indicator are required for most operating rooms, enabling the surgeon and anesthetist to easily see clock time and elapsed time. It also gives the support team easy access to the controls. Mount the control panel for the timer at the five foot level with the timer mounted at the seven foot level. Some OR teams prefer to place the control panel within reach of the anesthetist.

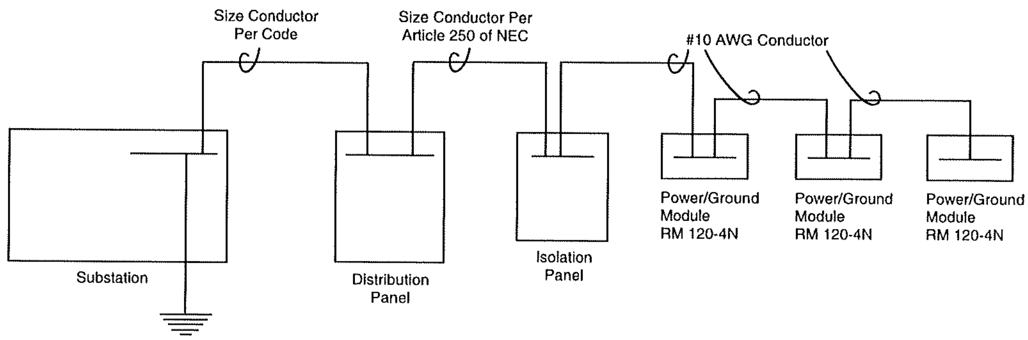
The use of articulating arms (booms) is commonplace and must be considered when they are installed in a procedure room using isolated power. Booms are typically wired with a cord that has PVC insulation and a PVC jacket. This causes a higher than desired leakage and can cause the total resistance to be below what is required by NFPA-99.

The following figure illustrates the size of power and ground conductors and their correct routing in a typical operating room.



Conductive flooring is still required by code in all flammable and mixed facilities. Conductive flooring is not required for rooms that are designed as nonflammable anesthetizing areas.

Typical Operating Room Ground System



B. Controlled Power Panels for portable Laser and X-Ray System

In operating rooms or critical care areas, the portable equipment outlets may require 208 V or 240 V, and will need a separate isolated distribution system (when isolated power is being used in that room). It is a common procedure to use a single isolated system to supply these circuits for more than one operating room. These circuits interlock so that only the required circuits can be energized at a given time. Leakage and capacity determine the number of circuits energized at one time allowing the panel to operate safely.

The circuit is selected by means of a switch located in the receptacle module or at a push button station in the panel or located in a secure area. The isolating transformer, circuit breakers, LIM, and control equipment are all mounted in an attractive flush-mounted enclosure.

When a Square D brand controlled power panel is used, locate it as centrally as possible in the area it will serve. Lay out circuit feeders for minimum length, as in the case of operating room 120 V circuits.

The system provides for a remote indicator alarm at each circuit outlet. The only indicator alarm operating is the energized circuit. When the circuit is energized, a green light on the remote indicator illuminates, telling operating room personnel that the circuit is energized and safe to use. Since the LIM is responding to total hazard current (THC), any energized remote will respond to an alarm. One advantage to turning the circuits and remote indicators on and off is the elimination of alarms where the power is not being used.

Be careful when connecting the ground terminal of the equipment receptacle to the grounding system; the ground terminal must connect to the ground system serving the patient who is served by the equipment receptacle. Connect the ground terminal of the LIM, which monitors the controlled power panel, to the equipment ground bus in the emergency distribution panel serving the 120 V isolated systems within these areas. In addition, connect a minimum #10 AWG ground wire between the controlled power panel and the equipment receptacle.

C. Interlocking Methods

There have been several different methods of controlling the interlocking system for equipment receptacles.

The method to be used is a matter of personal choice. Discuss the methods with the electrical consultant, hospital administration, and hospital radiology staff. Make the final selection after weighing the pros and cons of each method.

The most generally acceptable method is a PLC controlled system using the switch in the receptacle module. In the past, the common control system was a series of selector push buttons, located in the panel, which controlled the receptacle-energizing mode. If the panel was not accessible, the push button station was located in a separate module, built in a convenient location, or added to the operating room nurse's console. The push button control is still used, but it limits the number of circuits on at one time to one, and takes control of the circuit out of the room. This also allows someone to change circuits at will. The PLC controlled power panel puts control of the circuit in the rooms and can be programmed to allow more then one circuits to be energized at a time.

Schneider Electric supplies a variety of interlocking type panels and schemes; do not hesitate to ask us for the special system your hospital requires.

D. Surgical Facility Panels (SFP)

The surgical facility panel offers another method of providing isolated power in an operating room. This large panel condenses many of the electrical accessories normally found in an operating room into one unit.

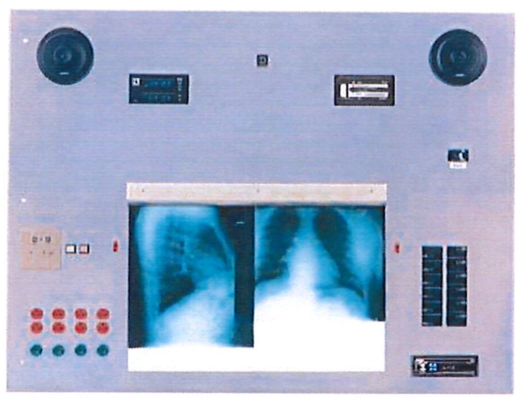
Components normally included in the surgical facility panel are:

- Isolation transformer
- Surgical clocks and timers
- Line isolation monitor (LIM)
- AM/FM, CD stereo system
- Audible indicator alarm
- Ground jacks
- Circuit breaker panel
- Double-size film illuminators
- Ground bus
- Power receptacles

Because all of these components are in the same panel, location of this panel within the operating room is critical. When specifying a surgical facility panel, consider which location is best for all concerned personnel.

Surgical facility panels are custom designed and assembled; this allows each hospital to specify the individual components needed in that hospital.

Typical Surgical Facility Panel



V. Field Test and Inspection

Because of the complexity of isolated power and the ground system, the manufacturer should field test the system before use. This is the only way to ensure the system is properly installed. The services of a factory technician are available from Schneider Electric. The factory trained technician performs the following on-site testing:

- All tests on the isolated system, ground network, and LIM are in accordance with Article 517 of the National Electrical Code and with NFPA No. 99.
- The ground test for power and ground receptacles is performed by applying a constant current between the room reference grounding bus and each ground contact of each receptacle, measuring the resulting voltage. The calculated resistance should be below 0.1 Ω. The potential difference between exposed conductive surfaces in the patient vicinity is checked; the difference cannot exceed 20 mV across a 1000 Ω resistor under normal operation.

- The LIM is tested as installed in the complete isolated system. Combinations of resistive and capacitive faults are placed on the isolated power system. The proper response of the line isolation monitor and its associated alarm device(s) is observed. Corrective steps are taken if improper operation is observed. The completed system is retested to ensure proper operation.
- The impedance of the isolated system (impedance to ground of either conductor) is tested. Impedance must exceed 200,000 Ω to conform with NFPA No. 99. The entire installation of the isolated equipment is inspected for conformance with applicable codes to ensure no code is violated.
- The technician gives a logbook to the hospital staff. The staff uses the book to record maintenance and periodic test data. The technician provides orientation to the system, and its maintenance and testing. During this orientation, the technician will answer any questions the hospital staff has about the system. Later, the hospital receives a letter containing the test results.

The above testing procedures are based on those required for isolated power systems in NFPA-99.

Electrical Maintenance

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Use extreme caution, some of the following procedures are performed when circuits are energized.
- Only trained personnel should perform these procedures.
- Use electrically insulated tools.

Failure to follow this instruction will result in death or serious injury.

A periodic maintenance program is essential to the safety of hospital patients and personnel. The services of a factory technician are available from Schneider Electric. Following a rigid maintenance program can reduce electrical hazards significantly.

Because of the size of hospital electrical systems, it is difficult to establish and follow a maintenance program which includes the entire hospital. However, checking anesthetizing and critical care areas more frequently than general patient areas is recommended.

Periodic testing for isolated power systems is required in NFPA-99.

Isolated Power System

Before using an isolated power system, conduct certain tests required in NFPA-99 to verify proper installation of the equipment and wiring. To conduct these tests, disconnect all secondary equipment from the secondary circuits. Conduct these tests before patient occupation. Follow the test procedures listed below:

LIM Test

1. Energize the isolation panel by closing the primary circuit breaker. Leave the secondary circuit breakers in the off position. Verify the LIM is operating. You should observe a slight meter deflection, indicating the monitor hazard current plus the hazard current for the isolation panel.
2. Press the push-to-test button on the LIM to ensure its test capability. Also check for audible and visible alarms attached to the LIM. The alarms should operate in the safe condition and in the alarm condition. Ensure the alarm will silence when the silence button is pressed.
3. Record the hazard current reading for the LIM with only the primary circuit breaker closed. Then close one secondary circuit breaker at a time, recording the hazard current reading for that circuit only. Close only one circuit breaker at a time; otherwise, the reading cannot be attributed to a specific circuit. If any circuit shows an unusually high hazard current compared to other circuits, investigate it immediately.
4. Determine the line-to-ground impedance between each of the power conductors and ground. Conduct this test at any of the receptacles; be sure all the secondary breakers are in the "on" position. Disconnect the LIM from the circuit during this test. To conduct this test, place a 0–1 milliammeter between either line to ground and measure the current. The value of current divided into the system voltage determines the system impedance. This impedance must be greater than 200 kilohm (kΩ) for either line to ground. For a 120 V system, this compares to 600 µA. Conduct this system impedance test without any secondary equipment connected to the circuits. If the impedance is less than that required by NFPA No. 99, investigate the system and correct the problem.

5. Test the LIM to ensure the proper alarm trip point. To perform this test, place a value of resistance between one line and ground to act as the fault impedance. The fault impedance should be inserted directly into the LIM with all secondary wiring disconnected. Use the following equation for fault impedance:

   E = System Voltage

   R = Fault Impedance in Ohms

   I = Alarm Trip Current-Monitor Hazard Current at Trip Point in Amperes

   $$R = \frac{E}{I}$$

For a capacitive fault, use the following equation:

E = System Voltage

R = Fault Impedance as Calculated Above in Ohms

C = Capacitance in Farads

$$C = \frac{1}{0.377R}$$

The LIM should alarm for an impedance of 10% of this value; if it does not alarm, contact the manufacturer.

NFPA No. 99 recommends the following formula be used to fault the LIM:

R = 200 X System Voltage

For example, if a system measures 120 V, the fault impedance would be:

R = 200 X 120

= 24 K ohms

Ground Test

6. For proper continuity, test the ground system associated with the isolated power system before its initial use. To perform the test, inject 20 A between the ground bus in the isolation panel and the grounded points on receptacles and ground jacks. The potential difference measured between these two points should not exceed 2 V. If it does exceed 2 V, inspect the ground for proper connection and properly sized wire. The 20 A ground test can also verify that all metal within the room is properly grounded. To perform this test, attach probes between metal surfaces and the room ground bus; verify the ground connection. This test can also be conducted with an 0–0.1 ohm meter.
7. Perform periodic testing, according to this schedule:

Test the LIM push-to-test button monthly. Check the associated alarms and silence functions.

Calculate an external fault impedance once every six months. At this time, take LIM readings with all circuit breakers closed and with all circuit breakers open. This provides a running history for the permanently installed wired system. If these values significantly increase, inspect the system and take corrective action.

Adapters and Extension Cords

The use of extension cords in patient areas and anesthetizing locations often presents an electrical hazard. Although extension cords offer flexibility, they are often abused. These cords may lie in traffic areas where people step on them and roll equipment over them. They may also lie in pools of fluid. It is safer to install a sufficient number of accessible receptacles than to use extension cords.

NFPA-99 prohibits the use of extension cords and multiple outlet devices in operating rooms except under certain conditions. Use of the cords can also allow higher than desired current leakage, causing the IPS to go into alarm. The equipment should be spread out through the system to avoid unnecessary alarms.

Medical Equipment Maintenance

The increased use of biomedical instruments presents another maintenance responsibility. Hospitals should establish routine programs to test and maintain such equipment as required in NFPA-99.

The maintenance program should apply to all patient care areas; but it is of greatest importance for special care units where the most seriously ill patients and the most complex equipment co-exist. The amount of equipment present varies by hospital, affecting the complexity of the program. However, the following items should be found in every medical equipment testing program:

- An established procedure ensuring that equipment serves the purpose for which it is intended, and that it is safe, reliable, and the best choice for its purpose
- Specifications that must be adhered to by manufacturers before lease/purchase of equipment
- Adequate customer support from the manufacturer, ensuring technical assistance, repair, and consultation as needed
- Periodic inspections, calibration, and preventive maintenance
- Immediate, thorough inspections when equipment malfunction or shock is considered a possibility
- Close monitoring of services provided by outside vendors
- A logging/reporting system that provides effective control and record keeping
- In-service training to ensure safe, effective use of medical equipment

Testing Personnel. Hospitals may choose to employ their own medical engineering personnel, share this personnel with other hospitals, or contract with an outside vendor to service medical equipment. Each hospital must choose the best option for its purposes.

The size of the hospital, presence of other hospitals in the area, and regional demographics will help each hospital make the appropriate decisions about testing personnel.

Leakage Current. All portable equipment has the potential for leakage current. Periodically test these pieces of equipment and tag the equipment, showing leakage current readings. Equipment that connects directly to patients should have its patient leads checked for leakage current. Each hospital should maintain the necessary testing equipment to conduct these testing procedures.

Testing Programs. Planning and implementing a medical equipment control program should include the following factors:

- The hospital should obtain competent, objective biomedical engineering assistance when planning and developing the program.
- A committee must be formed, which meets for the sole purpose of medical equipment control.
- All medical equipment must be defined and inventoried.
- The hospital should appraise several options for its equipment control, rather than choose the easiest or most available program.
- The appropriate medical engineering services must be obtained.
- The necessary test equipment must be leased/purchased, and be kept on site.
- The hospital must develop procedures, specifications, and additional program components to meet its needs.

Surgical Facility Panels (SFP)

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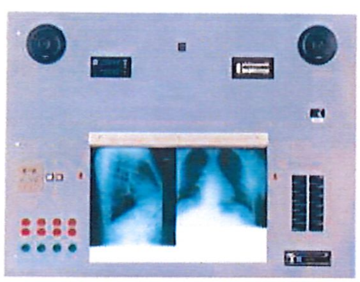
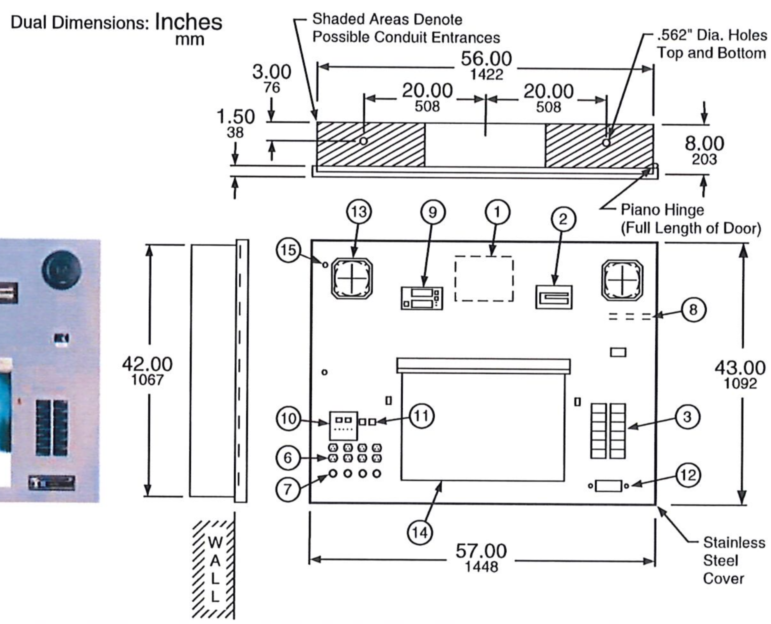
- Isolation transformer
- Surgical clocks and timers
- Line isolation monitor (LIM)
- AM/FM, CD stereo system
- Audible indicator alarm
- Ground jacks
- Circuit breaker panel
- Double-size film illuminators
- Ground bus
- Power receptacles

Because all of these components are in the same panel, location of this panel within the operating room is critical. When specifying a surgical facility panel, consider which location is best for all concerned personnel.

Surgical facility panels are custom designed and assembled; this allows each hospital to specify the individual components needed in that hospital.

For more information, contact your local Schneider Electric representative.





Item	Description	Item	Description
1	Isolation Transformer 3 kVA 120-120	8	Ground Bus Bar
2	Iso-Gard Line Isolation Monitor	9	Digital Elapsed Timer/Clock
3	Circuit Breaker Panel with: 1 — Primary Circuit Breaker – 30A, 2 Pole 8 — Secondary Branch Circuit Breakers – 20A, 2 Pole	10	Control for Digital Elapse Timer/Clock
		11	Hazard Indicator with Push-to-Test
		12	AM/FM, CD Stereo System
4■	Power Lock Receptacle	13	Speaker for Stereo System
5■	Single Receptacle, 20A, Hospital Grade	14	X-Ray Film Illuminator
6	Duplex Receptacle, 20A, Hospital Grade	15	Trim Lock
7	Ground Jack, 30A, Green		

■ Available, but not shown in illustration.

Isolation Panel Components

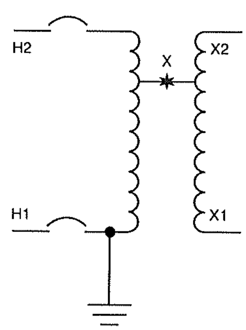
Square D brand hospital isolation panel components eliminate the difficulty in coordinating an effective isolated power distribution system for hospital anesthetizing locations and electrically susceptible patient areas.

The components are factory engineered, wired, and thoroughly tested to provide the ultimate in protection, reliability, and ease of installation.

Isolation Transformer

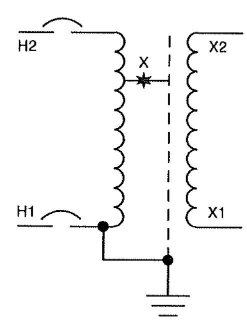
The heart of the system is the Square D brand isolation transformer. Since quiet operation is important in hospital applications, Schneider Electric followed rigid design criteria to provide a virtually inaudible transformer core and coil unit. Sound ratings of 30 dB or less are guaranteed on units 5.0 kVA and below, and 35 dB for units 7.5 kVA and above.

Unshielded Transformer



Because secondary windings of isolating transformers are ungrounded, a primary to secondary failure may not trip the circuit breaker. The result is a dangerously high secondary voltage (primary + secondary) because of auto-transformer action.

Shielded Transformer



Failures in the primary, which normally cause a dangerous secondary voltage condition, are shorted through the shield, thus activating the primary protective device.

The standard transformer uses a 220 °C rated insulation system. This insulation system allows, by NEMA–ANSI standards, a temperature rise of 150 °C above a 40 °C ambient. However, Schneider Electric limits the temperature rise of the isolation transformer to 80 °C maximum, further ensuring system reliability on all standard transformers.

Isolating the operating room system from normal building service is important. Take all possible safeguards to guarantee the transformer's isolating properties. To accomplish this, Schneider Electric provides an electrostatic shield between the primary and secondary windings as standard equipment in all transformers used in hospital isolated systems. Though not an NFPA code requirement, the shield is highly recommended by leading engineers.

Whether an electrostatic shield is necessary in a transformer used in a hospital isolation system has been widely discussed. Although the shield makes the electrical design of the coil more difficult, these two features make it desirable:

1. The shield establishes a ground plane between the primary and secondary. In an unshielded transformer, a potentially hazardous condition exists if the insulation between the primary and secondary fails for any reason. When this happens, a low resistance path would electrically connect one turn of the primary winding with one turn of the secondary winding. The transformer would function electrically with no indication of this failure. Only a LIM connected to the secondary would indicate the problem.

   In the unshielded transformer in the figure above, this failure occurred at "X." This, in effect, grounds the secondary through the primary. The secondary line-to-ground potential depends upon the portion of the primary winding between the ground and the fault, plus or minus the portion of the secondary winding. It could be from 1 V to approximately 240 V in a 120–120 V transformer.

Individuals coming in contact with a secondary lead and ground would complete the circuit and current would flow through their bodies.

The same failure occurring in a shielded transformer, as shown in the shielded transformer illustration on the preceding page, causes a high current flow in the primary. This causes the primary circuit breaker to open, removing the unit from service.

2. The shield attenuates common-made noise or disturbances that are frequently generated by equipment used in other locations such as Diathermy and X-ray equipment.

   The shield's attenuating characteristics prevent most of the signal from feeding into the distribution system and through it into other treatment or monitoring equipment.

Circuit Breaker Protection

All Schneider Electric hospital isolated systems include a primary circuit breaker and 2-pole secondary circuit breakers. All panels are designed to accept up to 16 secondary breakers per UL. The dual output voltage panel has space for two secondary breakers for the 208 V or 240 V side of the panel. Schneider Electric recommends using the QO® (snap-in) circuit breaker in isolated power panels because of the ability of the breaker to grab the bus. There is no maintenance recommendation for the QO circuit breaker. For the QOB™ (bolt-on) circuit breaker, Schneider Electric recommends checking the tightness of the bolted bus connection at least once each year.

Enclosures

Enclosure back boxes are constructed of cold-rolled steel that is degreased, phosphatized, and finished in gray baked enamel. The boxes are designed for flush mounting, but are available for surface mounting on request. The front trim is #304 stainless steel with a brushed finish, ensuring corrosion resistance and ease of cleaning.

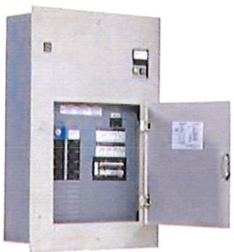
Square D brand isolation panels use a non-ventilated enclosure for most panel designs. The trim has no louvers or grilles for air circulation, which contributes to safe and easy cleaning. More important, no room air circulates through the transformer compartment, removing the danger of bacteria growth in the warm compartment. The hinged access door to the dead front circuit breaker and the LIM compartment has a lock to prevent unauthorized entry. The design prevents accidental entry into the transformer section when operating the circuit breakers or LIM test circuit.

While there are some panels designed to accept a ventilated trim, Schneider Electric recommends that these panels be placed in areas that are not required to maintain a sterile atmosphere, such as a non-sterile corridor.

Installation Convenience

The Square D brand hospital isolated power system was designed for convenient and economical installation by electrical contractors. The units are completely factory wired and tested. Field wiring simply involves the connection of the primary feeders and secondary circuits to clearly marked terminals. Back boxes for isolation panels and other modules can be shipped to the job site for "roughing-in" ahead of the interiors. The interiors, trims, and transformers can be shipped later.

Operating Room Panels



First introduced in the 1960s, this standard unit is most often used to supply 120 V service to the receptacles in an operating room. However, its use is not restricted to that application; it can also be used in critical care areas. This panel incorporates:

- The isolation transformer, which is a standard low-leakage, electrostatically shielded, 220 °C insulation system—80 °C temperature rise, 30 dB sound level isolating transformer
- A primary circuit breaker
- Eight secondary 2-pole circuit breakers
- A Square D brand Iso-Gard LIM

The panel is non-ventilated and has a #304 stainless steel trim with a brushed finish. Under continuous full load and normal hospital ambient conditions, the front trim panel's total temperature will be no greater than 50 °C.

See page 54 for panel-mounted indicator alarms which can be added to this panel.

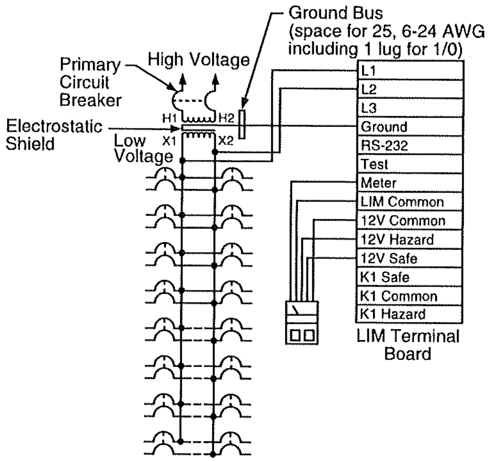
These panels are UL Listed under Section 1047 Isolated Power Systems Equipment. Schneider Electric also has a line of 3-phase isolation panels to provide power in operating rooms for specialized equipment such as operating room tables and electrosurgical laser machines.The 3-phase panel should be used for 3-phase applications only.

Interior						Trim Catalog Number	Back Box		Transformer Catalog Number
Catalog Number	kVA	Primary Voltage	Secondary Voltage	Primary Circuit Breaker	Secondary Circuit Breaker[1]		Flush Catalog Number	Surface Catalog Number	
3H5S11DDI	3	120	120	30A	8-20 A	OR 24350	53013BB	53017BB	See note 2
3H5S21DDI		208		20A					
3H5S31DDI		240		20A					
3H5S41DDI		277		15A					
5H5S11DDI	5	120		60A					
5H5S21DDI		208		30A					
5H5S31DDI		240		30A					
5H5S41DDI		277		25A					
5H5S51DDI		480		15A					
7H5S11DDI	7.5	120		80A		XR 29420	53015BB	53019BB	7XR11
7H5S21DDI		208		45A					7XR21
7H5S31DDI		240		40A					7XR31
7H5S41DDI		277		35A					7XR41
7H5S51DDI		480		20A					7XR51
10H5S11DDI	10	120		100A					10XR11
10H5S21DDI		208		60A					10XR21
10H5S31DDI		240		60A					10XR31
10H5S41DDI		277		45A					10XR41
10H5S51DDI		480		30A					10XR51

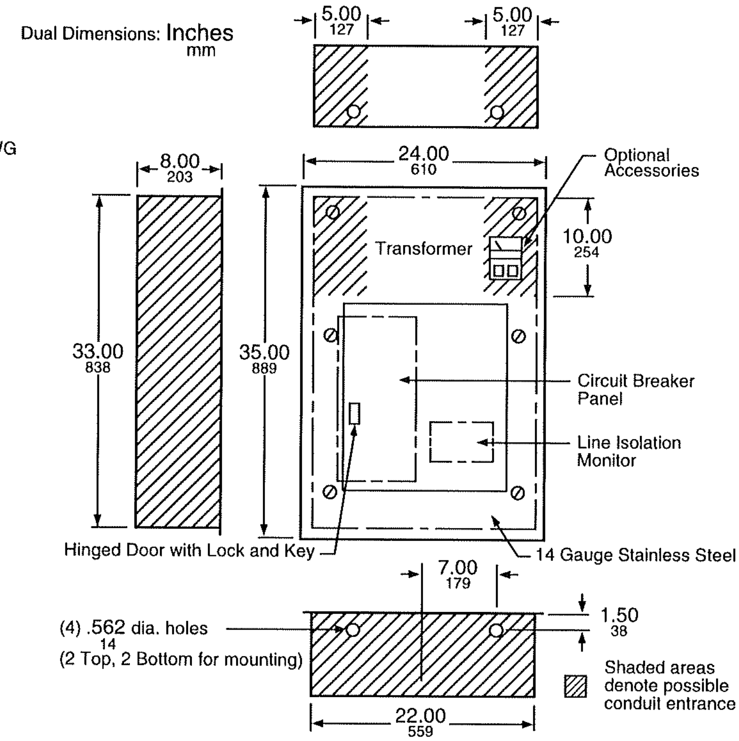
1 All panels contain 8-20/2 branch breakers and are field convertible to 16-20/2 branch circuit breakers. Order the appropriate number of circuit breakers #QO220.

2 Transformer included for 3 kVA and 5 kVA when interior is ordered.

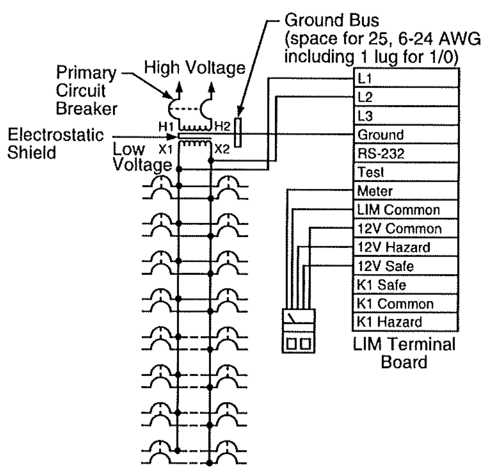
Wiring Diagrams and Dimensions



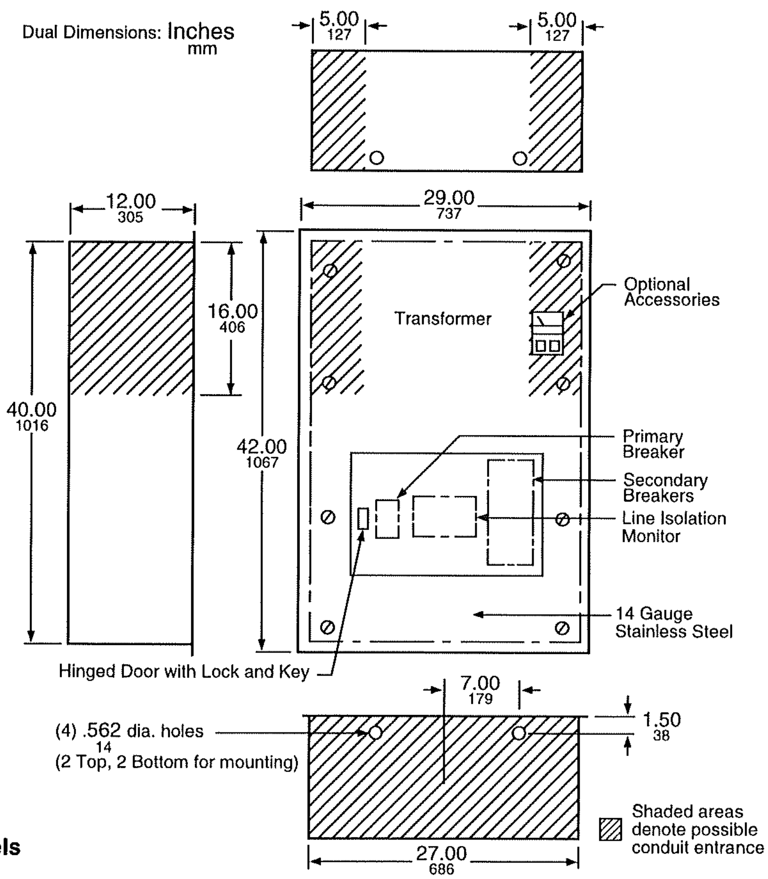
Panel Is field expandable to
16 secondary branch breakers (QO220)



3 kVA and 5 kVA Operating Room Panels



Panel Is field expandable to
16 secondary branch breakers (QO220)



7.5 kVA and 10 kVA Operating Room Panels

Low Profile Operating Room Panels

When isolated power system panels were introduced in the 1960's, Schneider Electric offered panels from 5 to 16 in. deep, depending on the application. The 5 in. panel eventually evolved into medical headwalls with isolated power. Designs for 6 and 8 in. panels were put aside in favor of the standard panels previously mentioned. The 6 in. low profile panel is available from 3 to 10 kVA and includes a NQOD type interior, accepting snap-in or bolt-on breakers. The low profile panel uses a common backbox for all voltages.

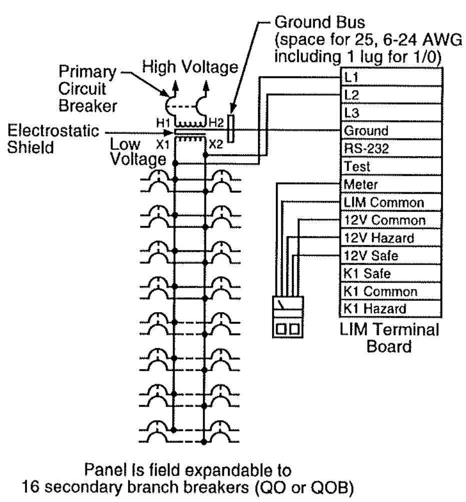
Interior						Trim Catalog Number	Back Box		Transformer Catalog Number
Catalog Number	kVA	Primary Voltage	Secondary Voltage	Primary Circuit Breaker	Secondary Circuit Breaker[1, 2]		Flush Catalog Number	Surface Catalog Number	
3H5S11DDIL	3	120	120	30A	8-20 A	53020BB	OR 29540	OR 27520	3SLP116
3H5S21DDIL		208		20A					3SLP216
3H5S31DDIL		240		20A					3SLP316
3H5S41DDIL		277		15A					3SLP416
5H5S11DDIL	5	120		60A					5SLP116
5H5S21DDIL		208		30A					5SLP216
5H5S31DDIL		240		30A					5SLP316
5H5S41DDIL		277		25A					5SLP416
5H5S51DDIL		480		15A					5SLP516
6H5S11DDIL	6.5	120		80A					6SLP116
6H5S21DDIL		208		45A					6SLP216
6H5S31DDIL		240		40A					6SLP316
6H5S41DDIL		277		35A					6SLP416
6H5S51DDIL		480		20A					6SLP516
7H5S11DDIL	7.5	120		80A			OR 29540V[3]	OR 27520V[3]	7SLP116
7H5S21DDIL		208		45A					7SLP216
7H5S31DDIL		240		40A					7SLP316
7H5S41DDIL		277		35A					7SLP416
7H5S51DDIL		480		20A					7SLP516
10H5S11DDIL	10	120		100A					10SLP116
10H5S21DDIL		208		60A					10SLP216
10H5S31DDIL		240		60A					10SLP316
10H5S41DDIL		277		45A					10SLP416
10H5S51DDIL		480		30A					10SLP516

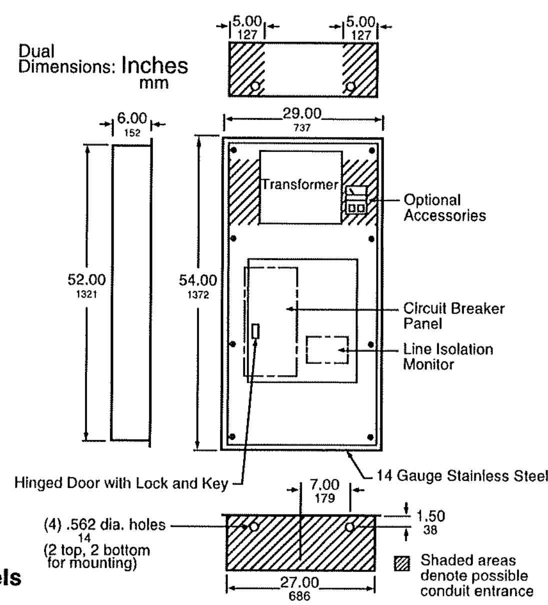
1 All panels contain 8-20/2 branch breakers and are field convertible to 16-20/2 branch circuit breakers. Order the appropriate number of QO or QOB circuit breakers.

2 For bolt-on, secondary circuit breakers, add a "B" to the end of the catalog number.

3 Vented trim. The 7.5 kVA panel is available with non-vented trim by using a 10 kVA transformer.

Wiring Diagram and Dimensions





3–10 kVA Low Profile Operating Room Panels

Intensive Care/Coronary Care Panels

These panels incorporate the same components and features as the operating room panels, but have the added feature of eight power receptacles and six approved grounding jacks which connect to a ground bus for attaching fixed equipment and building structural grounds. The power receptacles are "hospital only" locking-type receptacles. Duplex or single receptacles are available on request.

Although the panel is designed to serve the needs of a coronary care or intensive care bed, it has been widely applied to provide power within special procedure rooms, cardiovascular laboratories, and general operating rooms.

See page 54 for panel-mounted indicator alarms which you can add to this panel.

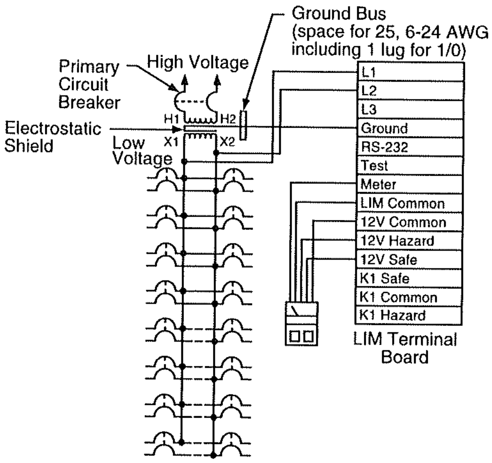
Interior						Trim Catalog Number	Back Box		Transformer Catalog Number
Catalog Number	kVA	Primary Voltage	Secondary Voltage	Primary Circuit Breaker	Secondary Circuit Breaker[1]		Flush Catalog Number	Surface Catalog Number	
3H5S11CDDI 3H5S21CDDI 3H5S31CDDI 3H5S41CDDI	3	120 208 240 277	120	30A 20A 20A 15A	8-20A	IC24440	53014BB	53018BB	See note 2
5H5S11CDDI 5H5S21CDDI 5H5S31CDDI 5H5S41CDDI 5H5S51CDDI	5	120 208 240 277 480	120	60A 30A 30A 25A 15A	8-20A	IC24440	53014BB	53018BB	See note 2
7H5S11CDDI 7H5S21CDDI 7H5S31CDDI 7H5S41CDDI 7H5S51CDDI	7.5	120 208 240 277 480	120	80A 45A 40A 35A 20A	8-20A	IC29510	53029BB	53037BB	7XR11 7XR21 7XR31 7XR41 7XR51
10H5S11CDDI 10H5S21CDDI 10H5S31CDDI 10H5S41CDDI 10H5S51CDDI	10	120 208 240 277 480	120	100A 60A 60A 45A 30A	8-20A	IC29510	53029BB	53037BB	10XR11 10XR21 10XR31 10XR41 10XR51

1 All Panels contain 8-20/2 branch breakers and are field convertible to 16-20/2 branch breakers. Order the appropriate number of circuit breakers #QO220.

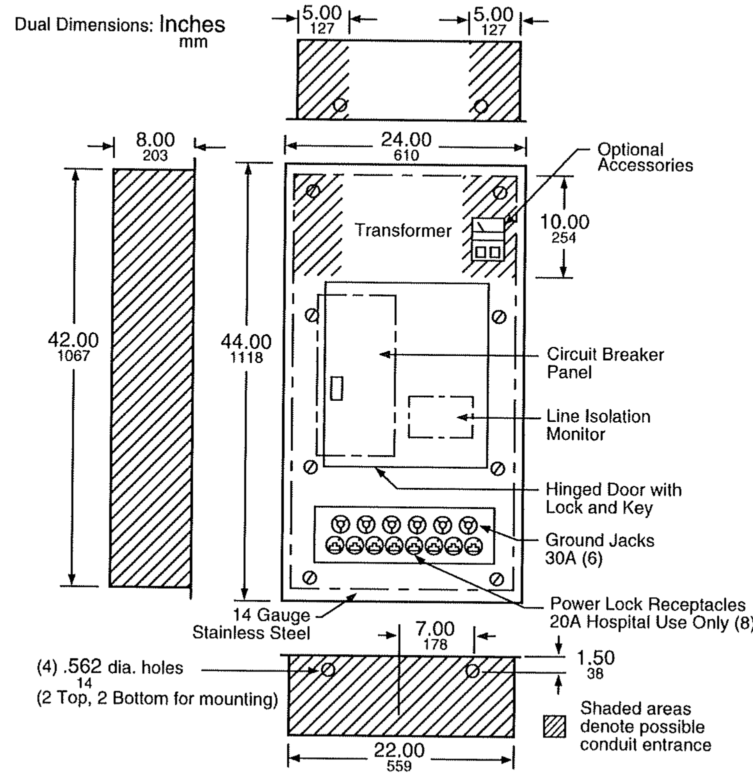
2 Transformer included for 3 kVA and 5 kVA when interior is ordered.

3 Panels available with red hospital-grade duplex receptacles. Change letter "C" to letter "D", e.g. 3H5S11CDDI to 3H5S11DDDI.

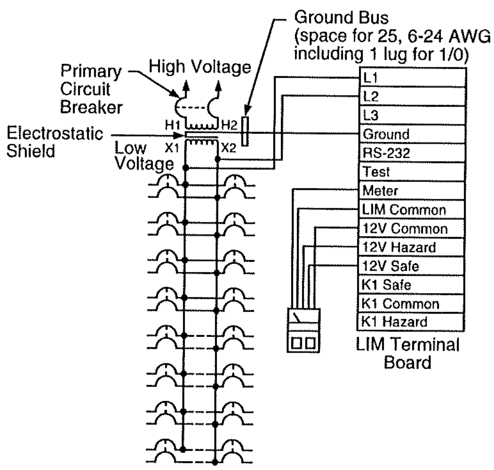
Wiring Diagrams and Dimensions



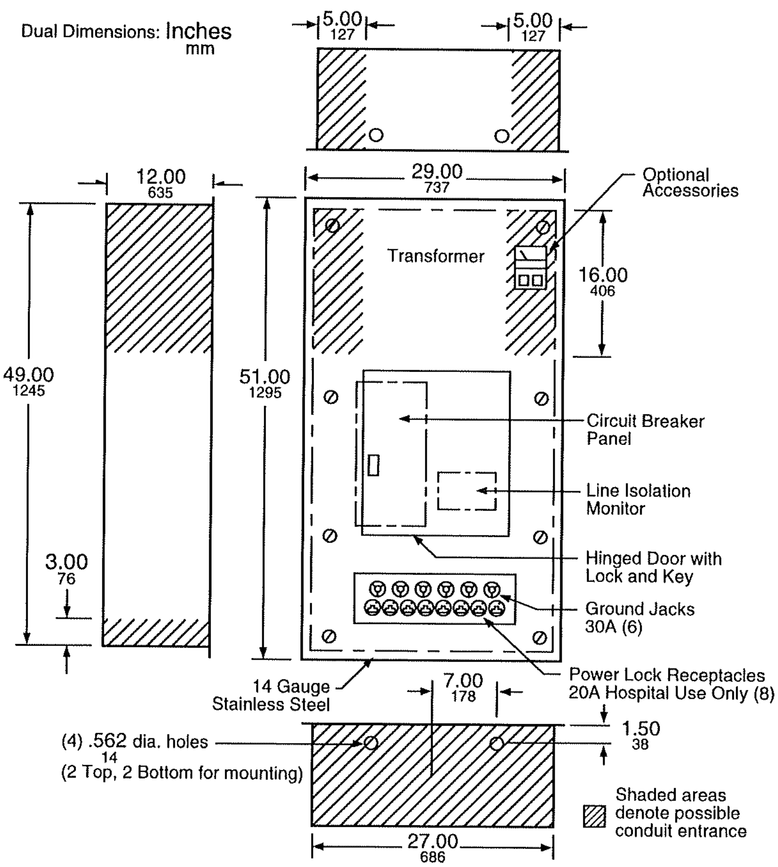
Panel Is field expandable to
16 secondary branch breakers (QO220)



3 kVA and 5 kVA ICU/CCU Panels

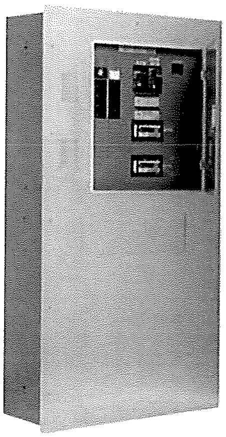


Panel Is field expandable to
16 secondary branch breakers (QO220)



7.5 kVA and 10 kVA ICU/CCU Panels

Dual Output Voltage Isolation Panels



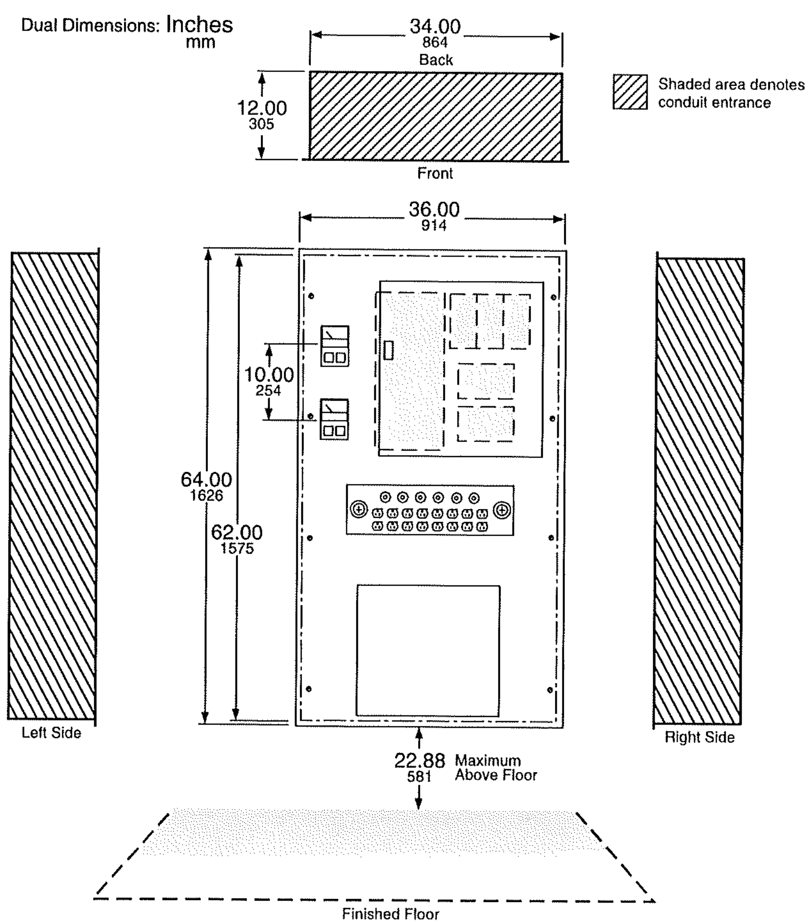
The dual output voltage hospital isolation panel is a single, ungrounded hospital isolation panel that can supply two different output voltages simultaneously. Similar to a standard distribution panel or load center, it can supply both 120/208 V or 120/240 V of ungrounded, isolated, single-phase power using only one isolation transformer. Other hospital isolation panels can supply only one output voltage.

Typically, the 208 or 240 V circuits of the dual output voltage panel supply power to operating room equipment such as mobile X-ray machines or surgical lasers. At the same time, the panel's 120 V circuits can supply power to convenience receptacles, surgical lights, X-ray film illuminators, sterilizers, and other 120 V appliances commonly found in operating rooms. This panel is ideally suited as a power supply to power/ground modules and X-ray indicator/receptacle modules, also manufactured by Schneider Electric.

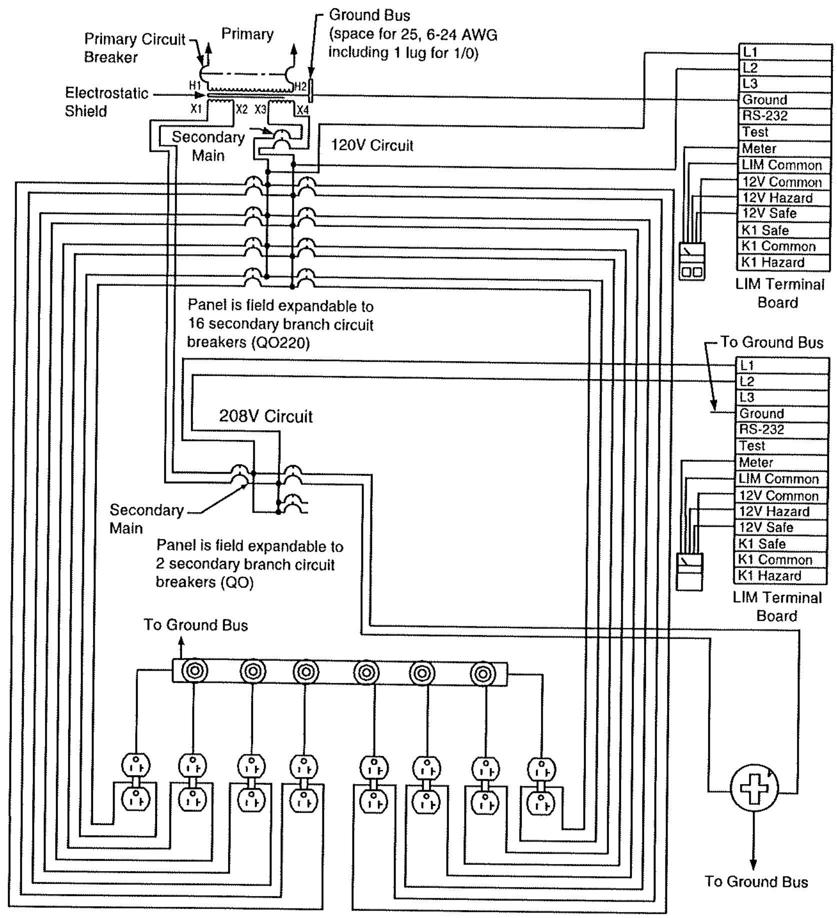
Transformers

All transformers for the dual output voltage isolation panels are single-phase only.

Dimensions



Wiring Diagram



Catalog Numbers

To order dual output voltage hospital isolation panels, specify the correct catalog number for the following items:

- Interior
- Trim
- Transformer
- Back box

NOTE: The interior, trim, transformer, back box, and optional panel mounted accessories for the LIM must be ordered separately. Only the accessories are optional.

The interior catalog number is a combination of codes, which are described in the "Interior Catalog Number Selections" table that follows the example below.

Interior Code Numbers		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Interior Catalog Number	DVP	2	B	7	6	6	R	X	D

- (8) D — 208/240 V Receptacle # 2 is NEMA Type 6 – 50R
- (7) X — 208/240 V Receptacle # 1 is Hubbell IN16494
- (6) R — 120 V Receptacles Colored Red
- (5) 6 — Six 120 V Receptacles
- (4) 6 — Six 30A Green Ground Jacks
- (3) 7 — Size Rating of 120 V Transformer Secondary is 7.5 kVA
- (2) B — Output Voltage is 120 V and 240 V
- (1) 2 — Primary Voltage = 208 V

Interior Catalog Number Selections

Selection Number	Options
(1) Primary voltage of dual output voltage isolation panel	2 = 208 V 3 = 240 V 4 = 277 V 5 = 480 V
(2) Output voltages	A = 120/208 V B = 120/240 V
(3) Size rating of 120 V secondary winding (kVA) Eight 20/2 branch circuit breakers are installed at the factory in the 120 V section of panel's interior. The section is field expandable to 16 branch circuit breakers by ordering additional circuit breakers, Schneider Electric catalog no. QO220.	5 = 5.0 kVA 7 = 7.5 kVA 1 = 10.0 kVA
(4) Number of 30A green ground jacks	1 = one 5 = five 2 = two 6 = six 3 = three 0 = none 4 = four
(5) Number of 120 V power receptacles	1 = one 6 = six 2 = two 7 = seven 3 = three 8 = eight 4 = four 0 = none 5 = five
(6) Type of 120 V power receptacles	R = 20A, **red** hospital-grade duplex (NEMA 5–20R) I = 20A, **ivory** hospital-grade duplex (NEMA 5–20R) B = 20A, **black** hospital-grade duplex (NEMA 5–20R) T = 20A, **brown** hospital-grade duplex (NEMA 5–20R) L = 20A, **black** hospital only, locking-type receptacle (Hubbell #23000HG or equivalent) 0 = No 120 V receptacles

(7) Configuration of 208 or 240 V receptacle #1
The circuit breaker matching the selected receptacle is installed at the factory in the 208 V or 240 V section of the panel's interior. If no receptacle is selected, the section is field expandable to two branch circuit breakers by ordering additional circuit breakers, Schneider Electric catalog no. QO210 through QO260. *Installation of circuit breakers rated higher than 60A voids the UL Listing.*
	X = Hubbell #IN16494 (equivalent to Hubbell #25603)
	A = NEMA #6-15R
	B = NEMA #6-20R
	C = NEMA #6-30R
	D = NEMA #6-50R
	E = NEMA #L6-15R
	F = NEMA #L6-20R
	G = NEMA #L6-30R
	0 = No 208 V or 240 V receptacle

(8) Configuration of 208 or 240 V receptacle #2
The circuit breaker matching the selected receptacle is installed at the factory in the 208 V or 240 V section of panel's interior. If no receptacle is selected, the section is field expandable to two branch circuit breakers by ordering Schneider Electric catalog no. QO210 through QO260. *Installation of circuit breakers rated higher than 60A avoids UL Listing.*
	X = Hubbell #IN16494 (equivalent to Hubbell #25603)
	A = NEMA #6-15R
	B = NEMA #6-20R
	C = NEMA #6-30R
	D = NEMA #6-50R
	E = NEMA #L6-15R
	F = NEMA #L6-20R
	G = NEMA #L6-30R
	0 = No 208 V or 240 V receptacle

Hospital Isolated Power Systems
Dual Output Voltage Isolation Panels

Transformer Catalog Numbers

120 V Winding Rating (in kVA)	Primary Voltage	Secondary Voltages	Catalog Number
5.0	208	208/120	DVT522
5.0	208	240/120	DVT523
5.0	240	208/120	DVT532
5.0	240	240/120	DVT533
5.0	277	208/120	DVT542
5.0	277	240/120	DVT543
5.0	480	208/120	DVT552
5.0	480	240/120	DVT553
7.5	208	208/120	DVT722
7.5	208	240/120	DVT723
7.5	240	208/120	DVT732
7.5	240	240/120	DVT733
7.5	277	208/120	DVT742
7.5	277	240/120	DVT743
7.5	480	208/120	DVT752
7.5	480	240/120	DVT753
10.0	208	208/120	DVT122
10.0	208	240/120	DVT123
10.0	240	208/120	DVT132
10.0	240	240/120	DVT133
10.0	277	208/120	DVT142
10.0	277	240/120	DVT143
10.0	480	208/120	DVT152
10.0	480	240/120	DVT153

Primary Circuit Breaker Information

Dual Voltage Panel Catalog Number	Dual Voltage Transformer Catalog Number	Primary Circuit Breaker		
		Voltage	Total kVA	Current
DVP2A5●	DVT522/DVT523	208	20	125
DVP3A5●	DVT532/DVT533	240		100
DVP4A5●	DVT542/DVT543	277		90
DVP5A5●	DVT552/DVT553	480		50
DVP2A7●	DVT722/DVT723	208	22.5	150
DVP3A7●	DVT732/DVT733	240		125
DVP4A7●	DVT742/DVT743	277		100
DVP5A7●	DVT752/DVT753	480		60
DVP2A1●	DVT122/DVT123	208	25	150
DVP3A1●	DVT132/DVT133	240		125
DVP4A1●	DVT142/DVT143	277		110
DVP5A1●	DVT152/DVT153	480		60

Trim

The trim catalog number is **DVC**.

Back Box

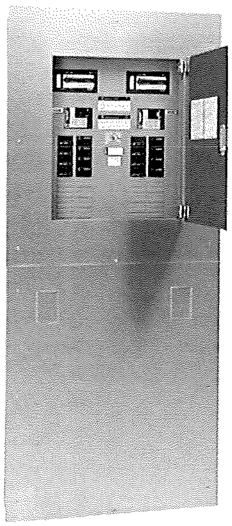
The back box catalog number selections include:

Flush back box = **DVBF**

Surface back box = **DVBS**

NOTE: Other receptacles are available. Please contact your Schneider Electric representative for details.

Duplex Isolation Panels



The duplex hospital isolation panel is a single enclosure containing two complete 120 V secondary hospital isolation systems. A divider in the unit's backbox separates the systems from top to bottom and front to back.

Each system has its own set of equipment:

- Primary circuit breaker
- Square D brand isolation transformer
- Reference ground bus bar
- Iso-Gard LIM
- Load center

The compact duplex design minimizes the width of the panel, which uses less horizontal wall space than two conventional isolation panels mounted side by side. This slim design is of particular benefit when the isolation panel is mounted in an operating room where wall space is limited.

The unit is available in 5 or 10 kVA ratings and includes a stainless steel cover. Because the panels provide power to life support equipment, a lockable door is included on all units. The door covers the branch circuit breakers and line isolation monitors to help restrict unauthorized access.

The unit is totally enclosed and non-ventilated to help keep out dust, dirt, recirculating air, and cleaning solutions. An optional surface mount backbox is available for remodeling applications. The entire panel assembly is listed under UL Standard 1047, Hospital Isolated Power Systems.

Duplex hospital isolation panels are ideally suited for large operating rooms where more than 14 circuits are required. The branch circuits can be divided between the two systems to keep branch circuit leakage current from exceeding the limits set by the National Fire Protection Association (NFPA) 99 Standard for Health Care Facilities.

For isolation systems with a 120 V secondary, the hazard current limit is 600 μA for the fixed wiring on the secondary of the isolation transformer. The limit is usually reached when 12 to 14 branch circuits are connected. The duplex hospital isolation panel accommodates 16 branch circuit breakers for each of its two systems.

The duplex hospital isolation panel can also be used to satisfy requirements of NFPA 70, the National Electrical Code ® (NEC) Article 517-19(a), Critical Care Areas. The panel can be applied to both critical systems and normal system power. One half of the panel can be used to supply critical system power, while the other half supplies normal system power.

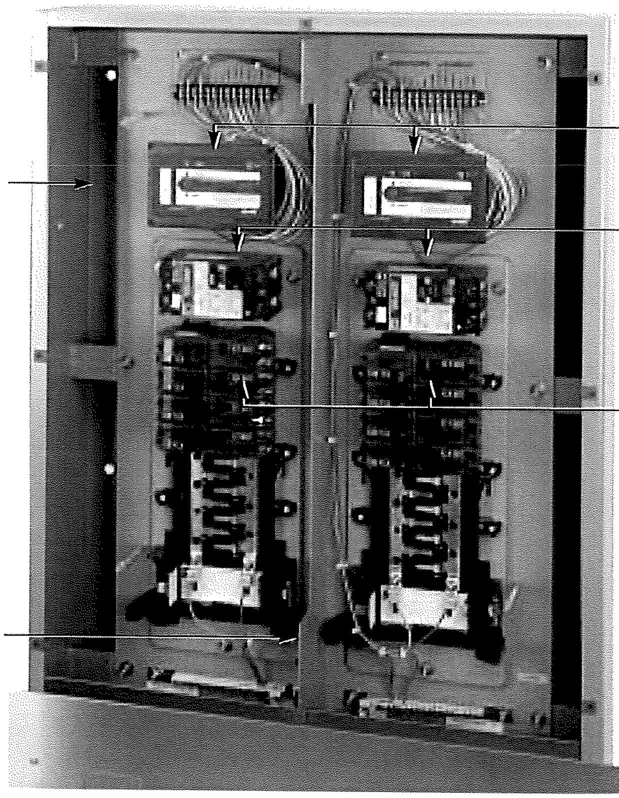
NOTE: Hospital operating rooms have been classified as Critical Care Areas since the 1993 issue of the NEC.

Features

Features of the duplex hospital isolation panel include:

- Two complete isolated power systems in one enclosure.
- Available in either 5 or 10 kVA ratings.
- Each system is capable of accepting up to 16 branch circuit breakers.
- Each panel includes two Iso-Gard Series D microprocessor-controlled line isolation monitors.
- Stainless steel trim with lockable door to restrict unauthorized access to circuit breakers and line isolation monitors.

Detailed Features of the Duplex Isolation Panel



Optional Accessories

Optional accessories for the duplex hospital isolation panel include:

- Surface mount backbox for remodeling applications.
- Panel-mounted indicator alarm and microammeter for operating room applications.
- Additional QO220 circuit breakers to increase panel from 8 to 16 branch circuits.

Advantages

The duplex hospital isolation panel provides the following advantages:

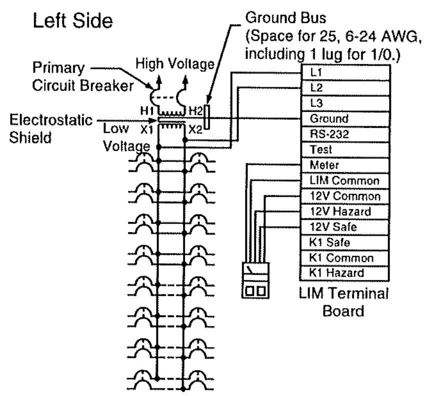
- Slim design to minimize the amount of horizontal wall space used in the operating room.
- Less installation labor than two panels.
- Ability to divide branch circuits between two isolation panels and still meet leakage current limits for branch circuit wiring as required in NFPA 99.
- Ability to provide both critical service and normal service power from one isolation panel.
- All branch circuits are located in one panel. This can be important when maintenance electricians are searching for a tripped circuit breaker in an emergency.
- Totally enclosed, non-ventilated design helps prevent air-borne dust, lint, or germs from recirculating through the panel. The design also helps keep cleaning solutions out of the panel when the walls are scrubbed down by housekeeping staff.

Catalog Numbers

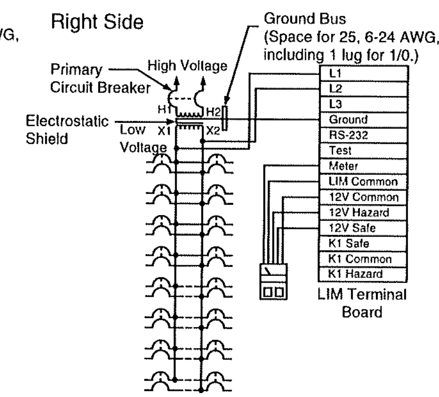
Interior						Trim	Backbox		Transformer
Catalog Number	kVA (each side)	Primary Voltage	Secondary Voltage	Primary Circuit Breaker	Secondary Circuit Breaker▲	Trim Catalog Number	Flush Catalog Number	Surface Catalog Number	Transformer Catalog Number
5/5H5S11DDI		120		60A					5/5XR11
5/5H5S21DDI		208		30A					5/5XR21
5/5H5S31DDI	5 + 5	240	120	30A	8 (20A)	OR32730	53047BB	53053BB	5/5XR31
5/5H5S41DDI		277		25A					5/5XR41
5/5H5S51DDI		480		15A					5/5XR51
7/7H5S11DDI		120		80A					7/7XR11
7/7H5S21DDI		208		45A					7/7XR21
7/7H5S31DDI	7.5 + 7.5	240	120	40A	8 (20A)	OR32730	53048BB	53052BB	7/7XR31
7/7H5S41DDI		277		35A					7/7XR41
7/7H5S51DDI		480		20A					7/7XR51

▲ Panels are field expandable to 16 branch circuit breakers. Order circuit breaker catalog number QO220.

Wiring Diagrams and Dimensions

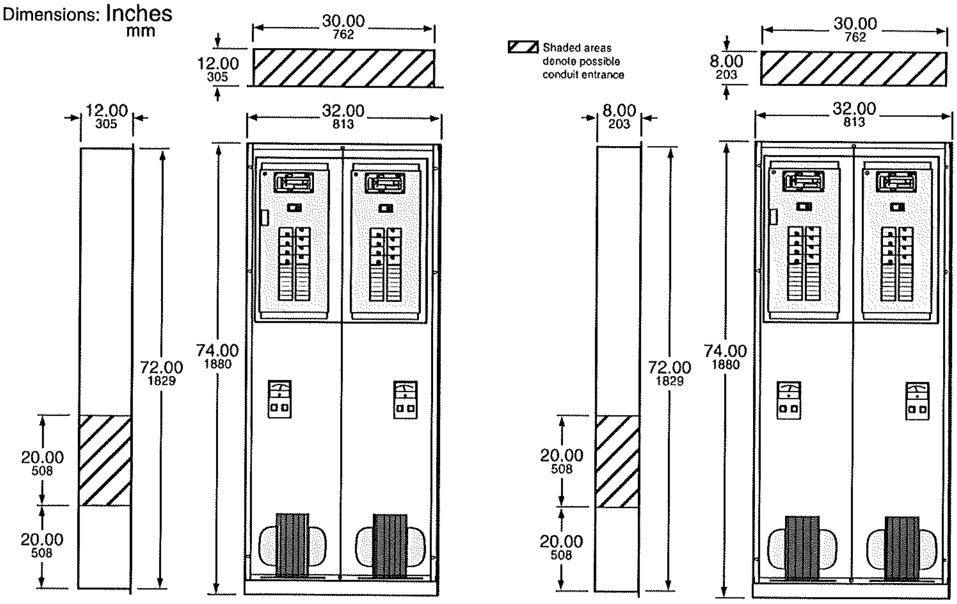


Panel is field expandable to
16 secondary branch breakers (QO220).



Panel is field expandable to
16 secondary branch breakers (QO220).

Dual Dimensions: Inches
mm



Three-Phase Isolation Panels

Three-phase hospital isolation panels are intended for use as a power supply for equipment such as surgical lasers, laminar airflow systems, and other three-phase specialty equipment used in hospital operating rooms. Three-phase isolation panels can range in size from 3.0 kVA to 25.0 kVA. Primary voltage to these panels can be either 208 or 480 V delta; the secondary voltage is usually 208 V. Use these panels for three-phase loads only; they cannot be used to supply power to 120 V single-phase loads. Under some types of ground faults, 120 V equipment can be subjected to higher than anticipated line-to-ground voltages.

Three-phase isolation panels can be supplied with up to four secondary branch breakers, which are rated from 10 through 60 amperes and are the 2-pole or 3-pole type. To comply with National Fire Protection Association (NFPA) 99 requirements for the maximum hazard current contributed by the branch circuit conductors (impedance of isolated wiring) on isolated power systems, the number of branch circuit breakers should be limited to four. Circuit runs must be kept to the shortest length possible.

Standard Features

All Square D brand, three-phase hospital isolation panels include the following components:

- Hospital isolation transformer from 3.0–25.0 kVA copper wound, low leakage, with electrostatic shield.
- Primary main circuit breaker sized in accordance with Article 450-3(b)(1) of the National Electrical Code (NEC).
- Iso-Gard Series D microprocessor-controlled line isolation monitor (LIM) manufactured by Schneider Electric.
- Maximum of four secondary branch circuit breakers.
- Totally enclosed, non-ventilated, flush enclosure with stainless steel trim.
- Ground bus bar with 25 terminals.

Optional Accessories

Optional items available with these panels are:

- Panel- or remote-mounted indicator alarms with or without analog LIM meter.
- Surface mount backbox.
- Combination 3-pole, 4-wire receptacle and indicator alarm module similar to the Square D brand X-Ray Indicator/Receptacle Module #XR-IAI.

  NOTE: Note: Customer must specify NEMA configuration of receptacle when ordering module

Optional accessories that can be included with the 3-phase isolation panel follow:

Item	Catalog Number	Description
Panel Mounted Indicator Alarms	ORIC-A	Green, amber, and red indicating lights and audible alarm mounted on front trim
	ORIC-A5C	Green, amber, and red indicating lights, audible alarm, and microammeter mounted on front trim
X-Ray/Laser Indicator and Receptacle Module	XRT30-IAI	X-ray receptacle with remote indicator alarm, Hubbell receptacle #2720, 30 A
	XRT60-IAI	X-ray receptacle with remote indicator alarm, Hubbell receptacle #8460, 60 A
	53007BB	Backbox for x-ray receptacle and indicator module[1]

[1] Backbox dimensions: 12 in. H x 8 in. W x 4 in. D

Catalog Numbers

To order three-phase hospital isolation panels, specify the correct catalog number for the following items:

- Interior
- Trim
- Backbox
- Transformer

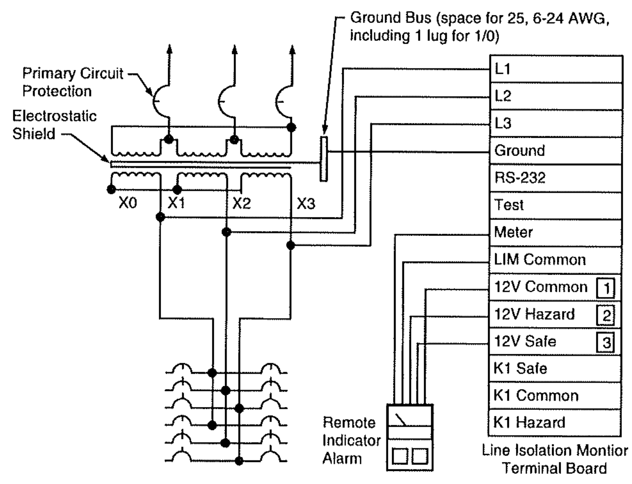
NOTE: The interior, trim, backbox, transformer, and optional panel mounted accessories for the LIM must each be ordered separately. Only the accessories are optional.

Panel interiors include one 3-pole secondary branch circuit breaker (Type QO). Contact Medical Products Marketing when multiple secondary circuits are necessary or for the availability of UL Listing.

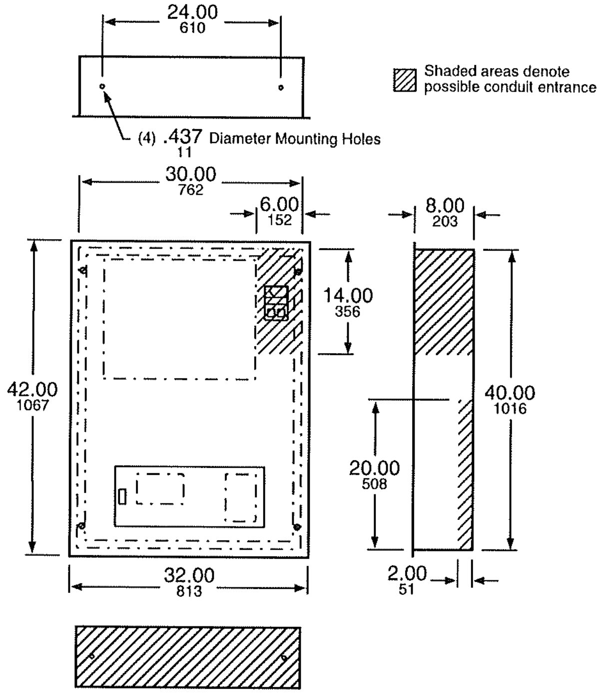
Catalog Numbers

Interior						Trim	Backbox		Transformer
Catalog Number	Primary kVA	Primary Voltage	Secondary Voltage	Primary Circuit Breaker	Secondary Circuit Breaker	Trim Catalog Number	Flush Catalog Number	Surface Catalog Number	Transformer Catalog Number
3H5ST22DDI	3	208	208	15A	(1) 15A	ORT32420	53042BB	53050BB	3XRT22
3H5ST52DDI		480		6A					3XRT52
6H5ST22DDI	6	208	208	20A	(1) 15A	ORT32420	53043BB	53051BB	6XRT22
6H5ST52DDI		480		10A					6XRT52
9H5ST22DDI	9	208	208	35A	(1) 30A	ORT32420	53043BB	53051BB	9XRT22
9H5ST52DDI		480		15A					9XRT52
15H5ST22DDI	15	208	208	60A	(1) 60A	ORT42600	53045BB	53046BB	15XRT22
15H5ST52DDI		480		25A					15XRT52
25H5ST22DDI	25	208	208	90A	(1) 60A	ORT42600	53045BB	53046BB	25XRT22
25H5ST52DDI		480		40A					25XRT52

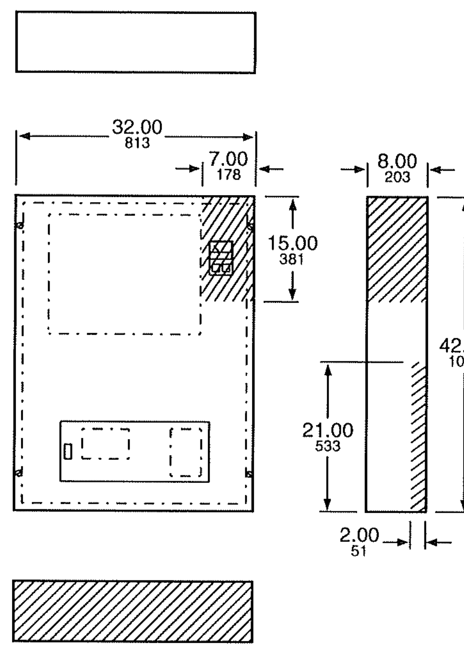
Wiring Diagram



Dimensions

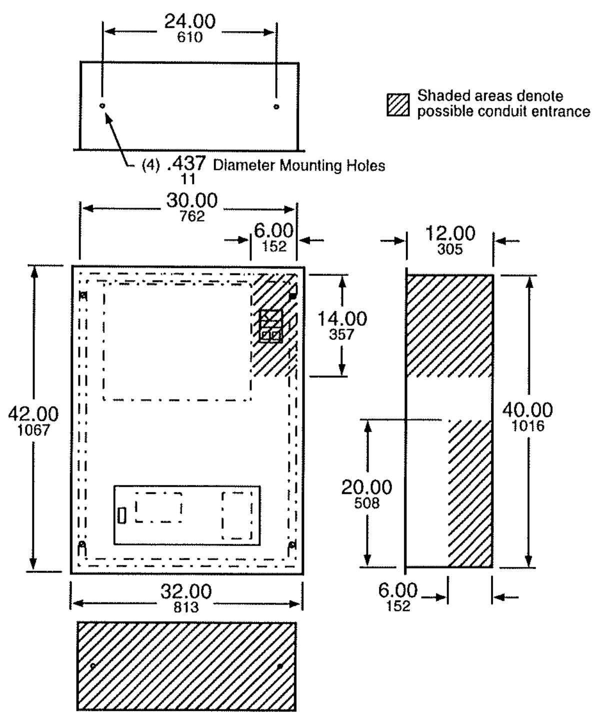


3 kVA, 3-Phase Flush Panel

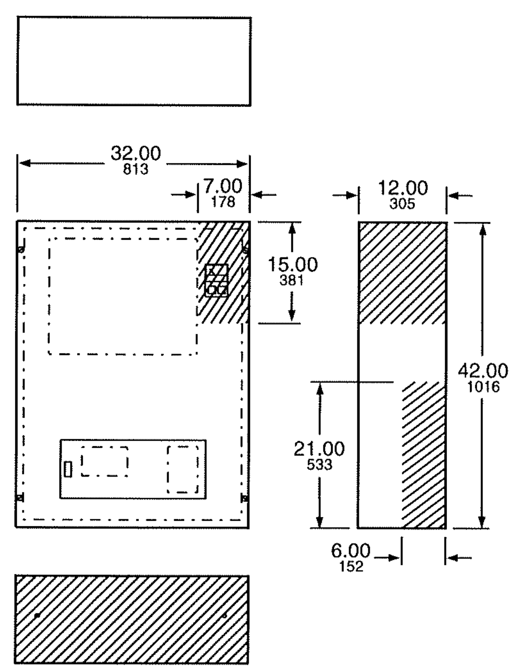


3 kVA, 3-Phase Surface Panel

Dual Dimensions: Inches
mm



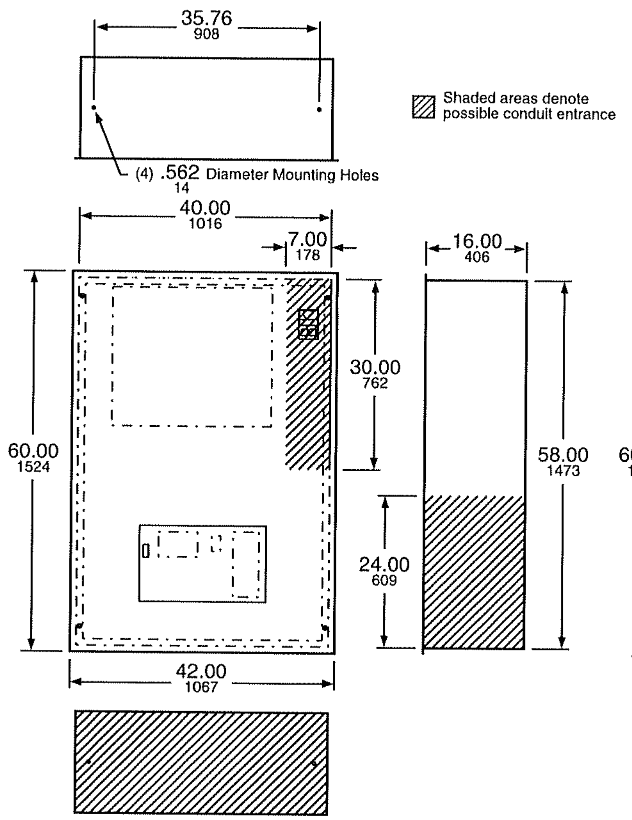
6 and 9 kVA, 3-Phase Flush Panel



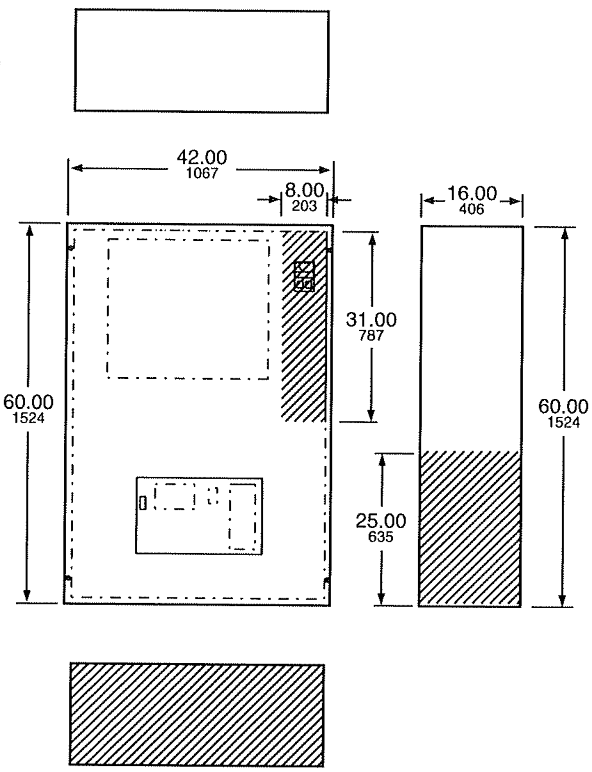
6 and 9 kVA, 3-Phase Surface Panel

Dual Dimensions: Inches
mm

Dimensions (cont.)



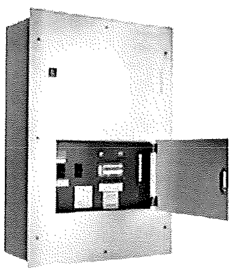
15 and 25 kVA, 3-Phase Flush Panel



15 and 25 kVA, 3-Phase Surface Panel

Dual Dimensions: Inches / mm

Controlled Power Panels



Square D brand controlled power isolation power panels are designed to provide power for portable equipment outlets. In the past, most equipment operated on 60 A circuits. Today, these loads vary from 20 to 60 A and multiple pieces of equipment are being used. By applying the proper kVA loading, a panel can now provide power to multiple rooms and maintain safe operating conditions. All of these panels are available in both one-phase and three-phase configurations with 5 to 25 kVA ratings.

The type of controls applied depends on the need. Schneider Electric has a variety of control schemes from push button to switches located in the operating room. The NEC requires that an audible and visual indication of alarm be available wherever isolated power is used. We use a receptacle module with a remote alarm indicator built into it for this purpose. A receptacle module without a remote alarm indicator is also available. The control of these circuits is important not only for the safety of turning them on and off, but they also turn the remote alarm indicators on and off at the same time. This reduces any confusion caused by an alarm going off in the operating room from circuits that don't need to be energized.

The basic control scheme is the mechanical interlock panel. The panel will serve various locations within the hospital. Interlocking circuitry allows predetermined locations to be used at any given time. Consequently, the line isolation monitor (LIM) monitors only the wiring and its inherent leakage to that single receptacle. Remote indicator alarm stations must be located at the receptacle location. A push button station located in the panel controls the interlocking system. If the panel location is inaccessible or inconvenient for operating personnel, the push button station is available in a separate module that can be installed at the nurses' station or any other convenient location. This can be an inconvenience since this type of control system requires someone to select which room will be turned on. It also poses a potential problem in that someone could easily push a button to turn the power on in another room, thus turning off the power in a room that may actually be using a piece of equipment.

The newer and more popular control scheme is the PLC controlled panel. Like the mechanical interlock panel, this panel will serve various locations. Because of the PLC, multiple locations can be served at one time. This panel is operated from the receptacle module in the room. The receptacle module contains a switch that sends a signal to the panel that power is required at the receptacle. The PLC is programmed to operate a predetermined number of circuits at one time. Once the predetermined number is achieved, the rest of the circuits are locked out. This also gives the control of the receptacle to the room. Push button control can be substituted for the switch in the receptacle module.

The interposing contact controlled panel is a panel with a maximum of four circuits available. This panel works like the PLC panel, but limits the output to only one circuit at a time. This panel is perfect for smaller applications where the facility has up to four operating rooms. The switch at the receptacle module energizes the appropriate contactor when activated, while locking out the remaining contactors. Push button control can be substituted for the switch in the receptacle module.

For facilities with limited equipment, a contactor control panel can be designed to fit individual needs. This panel would contain the secondary breakers needed and use either the receptacle module switch or push button control. The panel does not have lock-out features, but does have the ability to turn receptacles on and off where needed.

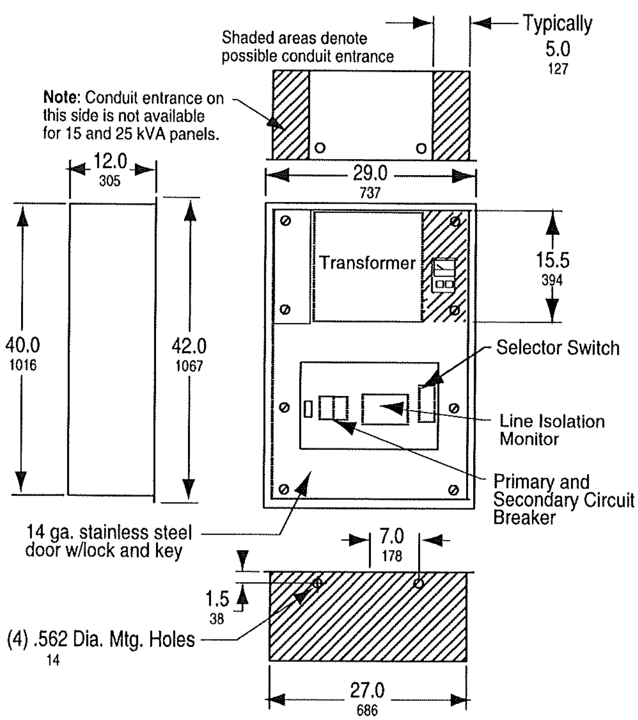
Mechanical Interlock Panels[1]

Interior						Trim Catalog Number	Back Box		Transformer Catalog Number
Interior Catalog Number	kVA	Primary Voltage	Secondary Voltage	Primary Circuit Breaker	Secondary Circuit Breaker [2]		Flush Catalog Number	Surface Catalog Number	
15H5S22DDI	15	208	208	90A	1-60 AMP Secondary Circuit Breaker	XR29420	53015BB	53019BB	15XR22
15H5S23DDI		208	240	90A					15XR23
15H5S32DDI		240	208	90A					15XR32
15H5S33DDI		240	240	90A					15XR33
15H5S42DDI		277	208	90A					15XR42
15H5S43DDI		277	240	90A					15XR43
15H5S52DDI		480	208	40A					15XR52
15H5S53DDI		480	240	40A					15XR53
25H5S22DDI	25	208	208	125A	1-60 AMP Secondary Circuit Breaker	XR29420	53015BB	53019BB	25XR22
25H5S23DDI		208	240	125A					25XR23
25H5S32DDI		240	208	125A					25XR32
25H5S33DDI		240	240	125A					25XR33
25H5S42DDI		277	208	125A					25XR42
25H5S43DDI		277	240	125A					25XR43
25H5S52DDI		480	208	65A					25XR52
25H5S53DDI		480	240	65A					25XR53

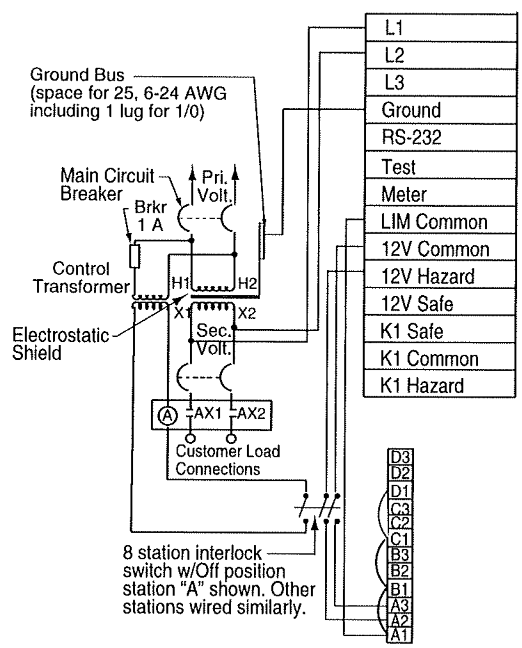
1 Up to 8 outlets can be controlled from these panels. No branch circuit should be longer than 150 ft. For more than 8 circuits, contact Schneider Electric Medical Products.

2 Any secondary circuit breaker can be used. Contact Schneider Electric Medical Products for more information.

Wiring Diagram and Dimensions



Dual Dimensions: Inches / mm

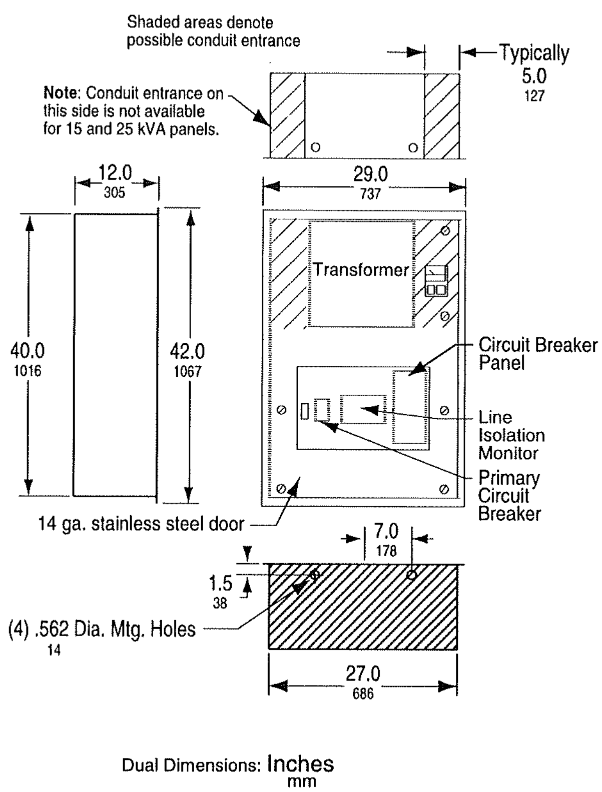


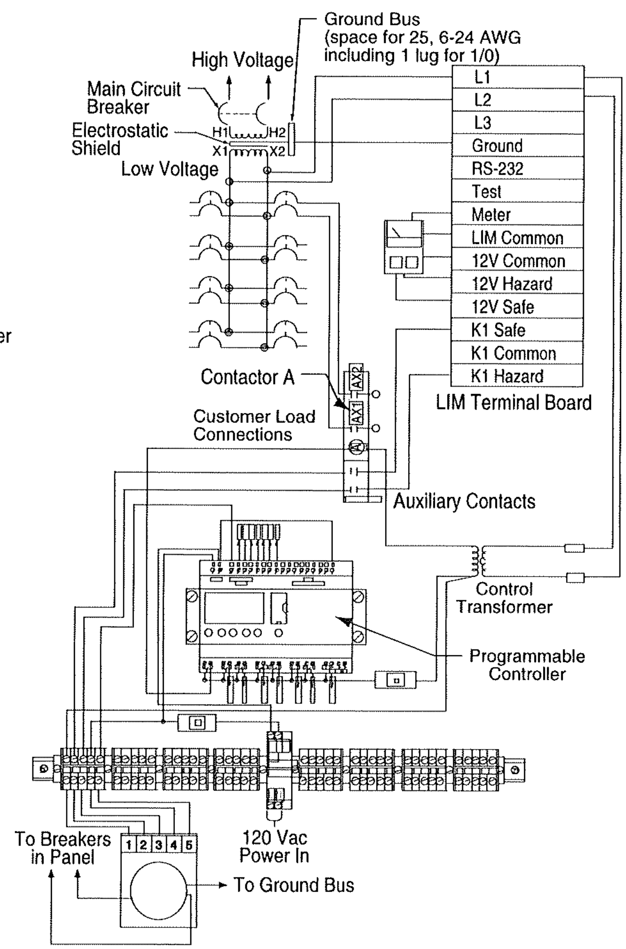
PLC Controlled Panels[1]

Interior						Trim	Back Box		Transformer
Interior Catalog Number	kVA	Primary Voltage	Secondary Voltage	Primary Circuit Breaker	Secondary Circuit Breaker	Trim Catalog Number	Flush Catalog Number	Surface Catalog Number	Transformer Catalog Number
15H5S22PLCIR	15	208	208	90A	8–20, 30 or 60 A Secondary Circuit Breaker or a combination thereof.	XR29420	53015BB	53019BB	15XR22
15H5S23PLCIR		208	240	90A					15XR23
15H5S32PLCIR		240	208	90A					15XR32
15H5S33PLCIR		240	240	90A					15XR33
15H5S42PLCIR		277	208	90A					15XR42
15H5S43PLCIR		277	240	90A					15XR43
15H5S52PLCIR		480	208	40A					15XR52
15H5S53PLCIR		480	240	40A					15XR53
25H5S22PLCIR	25	208	208	125A	8–20, 30 or 60 A Secondary Circuit Breaker or a combination thereof.	XR29420	53015BB	53019BB	25XR22
25H5S23PLCIR		208	240	125A					25XR23
25H5S32PLCIR		240	208	125A					25XR32
25H5S33PLCIR		240	240	125A					25XR33
25H5S42PLCIR		277	208	125A					25XR42
25H5S43PLCIR		277	240	125A					25XR43
25H5S52PLCIR		480	208	65A					25XR52
25H5S53PLCIR		480	240	65A					25XR53

1 Up to 8 outlets can be controlled from these panels. No branch circuit should be longer than 150 ft. For more than 8 circuits, contact Schneider Electric Medical Products.

Wiring Diagram and Dimensions





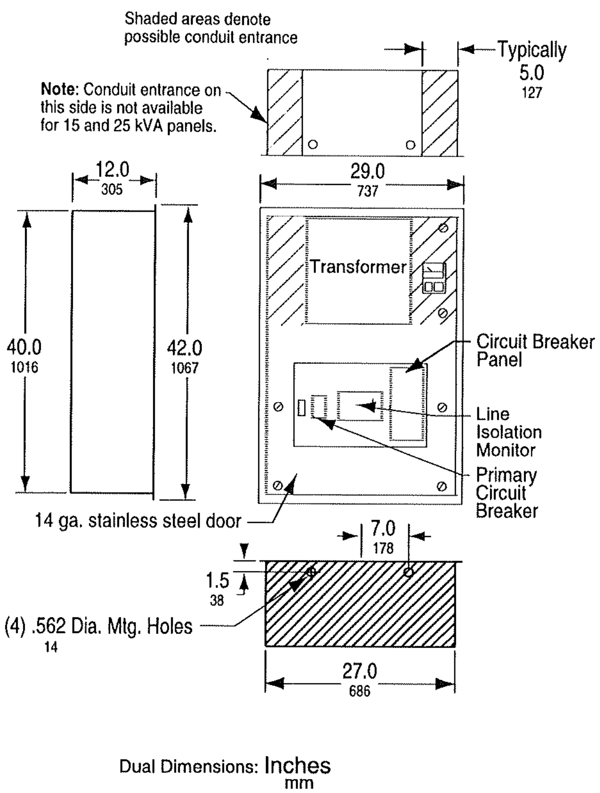
 SQUARE D 04/2008

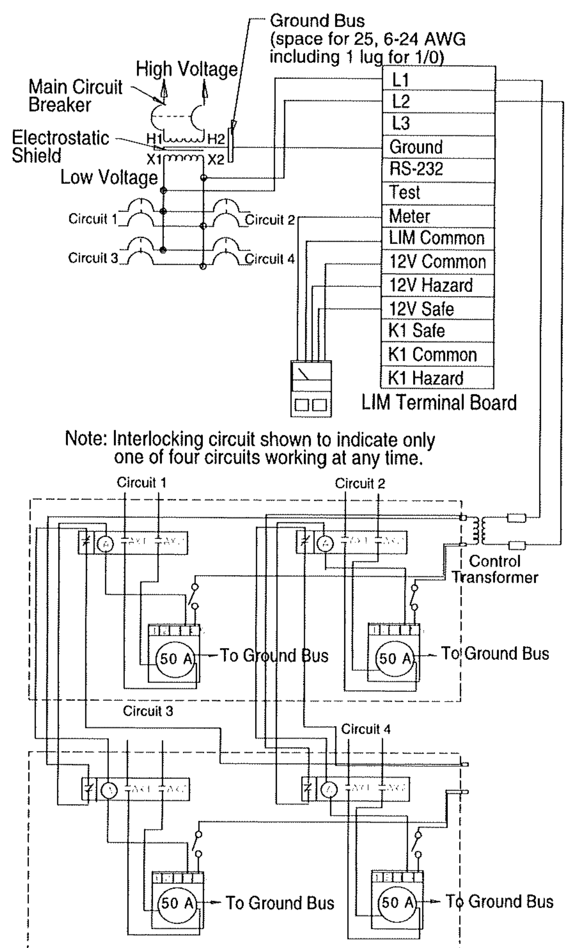
Interposing Contact Controlled Panels[1]

Interior						Trim Catalog Number	Back Box		Transformer Catalog Number
Interior Catalog Number	kVA	Primary Voltage	Secondary Voltage	Primary Circuit Breaker	Secondary Circuit Breaker		Flush Catalog Number	Surface Catalog Number	
15H5S22DDIC	15	208	208	90A	8–20, 30 or 60 A Secondary Circuit Breaker or a combination thereof.	XR29420	53015BB	53019BB	15XR22
15H5S23DDIC		208	240	90A					15XR23
15H5S32DDIC		240	208	90A					15XR32
15H5S33DDIC		240	240	90A					15XR33
15H5S42DDIC		277	208	90A					15XR42
15H5S43DDIC		277	240	90A					15XR43
15H5S52DDIC		480	208	40A					15XR52
15H5S53DDIC		480	240	40A					15XR53
25H5S22DDIC	25	208	208	125A	8–20, 30 or 60 A Secondary Circuit Breaker or a combination thereof.	XR29420	53015BB	53019BB	25XR22
25H5S23DDIC		208	240	125A					25XR23
25H5S32DDIC		240	208	125A					25XR32
25H5S33DDIC		240	240	125A					25XR33
25H5S42DDIC		277	208	125A					25XR42
25H5S43DDIC		277	240	125A					25XR43
25H5S52DDIC		480	208	65A					25XR52
25H5S53DDIC		480	240	65A					25XR53

1 Up to 4 outlets can be controlled from these panels. No branch circuit should be longer than 150 ft. For more than 4 circuits, contact Schneider Electric Medical Products.

Wiring Diagram and Dimensions





Hospital Isolated Power Systems
Controlled Power Panels

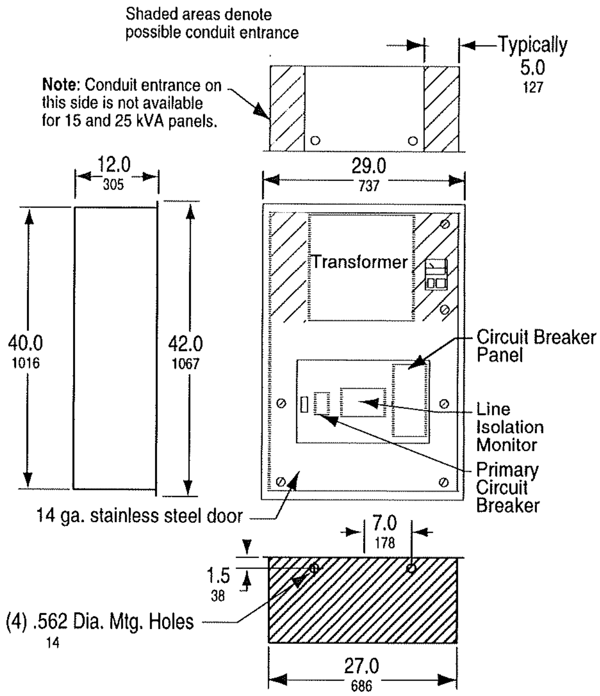
Contactor Controlled Panels[1]

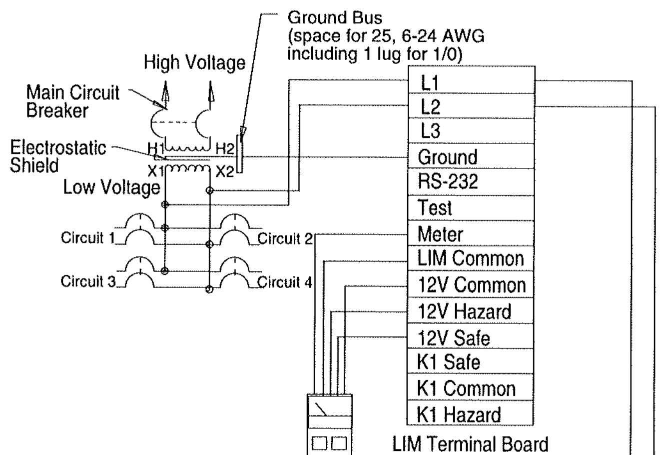
Interior						Trim Catalog Number	Back Box		Transformer Catalog Number
Interior Catalog Number	kVA	Primary Voltage	Secondary Voltage	Primary Circuit Breaker	Secondary Circuit Breaker [2]		Flush Catalog Number	Surface Catalog Number	
15H5S22DDCI	15	208	208	90A	8–20, 30 or 60 A Secondary Circuit Breaker or a combination thereof.	XR29420	53015BB	53019BB	15XR22
15H5S23DDCI		208	240	90A					15XR23
15H5S32DDCI		240	208	90A					15XR32
15H5S33DDCI		240	240	90A					15XR33
15H5S42DDCI		277	208	90A					15XR42
15H5S43DDCI		277	240	90A					15XR43
15H5S52DDCI		480	208	40A					15XR52
15H5S53DDCI		480	240	40A					15XR53
25H5S22DDCI	25	208	208	125A	8–20, 30 or 60 A Secondary Circuit Breaker or a combination thereof.	XR29420	53015BB	53019BB	25XR22
25H5S23DDCI		208	240	125A					25XR23
25H5S32DDCI		240	208	125A					25XR32
25H5S33DDCI		240	240	125A					25XR33
25H5S42DDCI		277	208	125A					25XR42
25H5S43DDCI		277	240	125A					25XR43
25H5S52DDCI		480	208	65A					25XR52
25H5S53DDCI		480	240	65A					25XR53

1 Up to 8 outlets can be controlled from these panels. No branch circuit should be longer than 150 ft. For more than 8 circuits, contact Schneider Electric Medical Products.

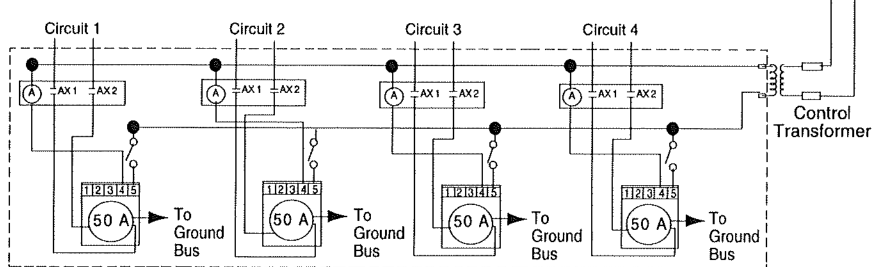
2 Any secondary circuit breaker can be used. Contact Schneider Electric Medical Products for more information.

Wiring Diagram and Dimensions





Typical of 4 Circuits



Dual Dimensions: Inches mm

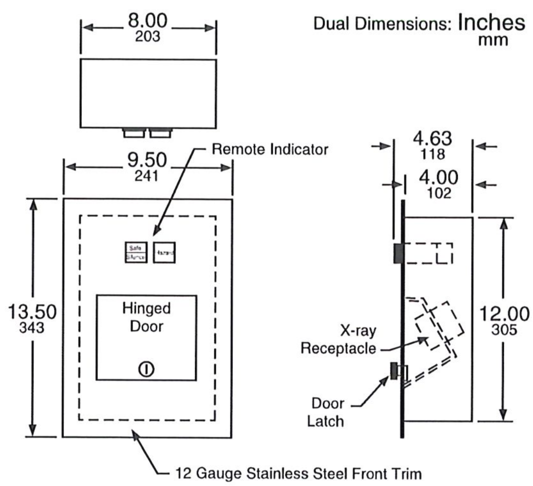
Combination X-Ray Receptacle (XRIAI–XRIADI Series) With Indicator Module

XRIAI

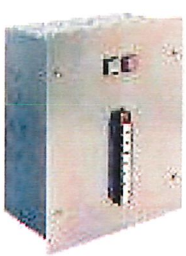
This unit contains a 60 A, 240 V single-phase approved X-ray receptacle plus a remote alarm indicator (described on page 54).

NOTE: Mount unit at least 48 in. above finished floor.

Dimensions



Supervisory Module For Mechanical Interlock Panel (8CIIAI)

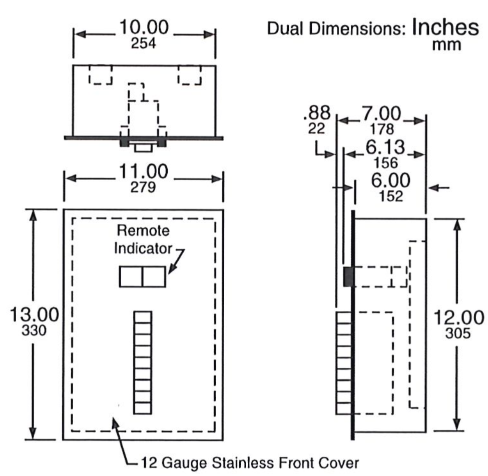


8CIIAI

This unit is a remote push button station for control of power to a portable X-ray receptacle.

NOTE: When ordering the 8CIIAI, modify the x-ray panel interior number by changing the second 'D' to 'N'. For example, change 15H5S22DDI to 15H5S22DNI. See the table on page 39.

Dimensions



Remote Alarm Indicators

Panel-Mounted Indicators

Panel-mounted indicator alarms are designed for use with Square D brand isolated power panels. The alarms indicate the condition of the LIM. Available as optional accessories, these alarms include various combinations of indicating lights (green = safe, yellow = silence, red = hazard), audible alarms, and milliammeters. They are furnished with stainless steel trim plates. Mounting space is provided within each Square D brand isolated power panel for easy installation.

RA1PM

The RA1 is the newest addition to the remote alarm indicators series. It comes complete with SILENCE, HAZARD, and SAFE indicators, a PUSH-TO-TEST button, and an LED light bar for metering. It is selectable for either 5mA or 2mA. The RA1PM model consists of the RA1 remote alarm indicator and a stainless steel mounting bracket (RA1PMB).

RA1PM (Panel Mount)

ORICA

The ORICA model is complete with green, yellow, and red indicating lights. It is mounted on a stainless steel trim plate, and includes an audible alarm.

ORICA

ORICAC and ORICA5C

Both of these models are furnished with green, yellow, and red indicator lights, plus a milliammeter. The ORICAC has a 2 mA milliammeter, while the ORICA5C has a 5 mA milliammeter.

ORICA5C

Wall-Mounted Indicators

When the flow to ground is within the predetermined limits for the circuits being monitored, a constant green light remains illuminated. When this predetermined limit is exceeded, the green light goes out, the red indicator illuminates, and an audible signal sounds. Pressing the silencing switch disconnects the audible signal. The yellow indicator illuminates, reminding personnel that the audible signal is disconnected. When the predicted leakage current to ground returns to an acceptable level, the unit automatically resets.

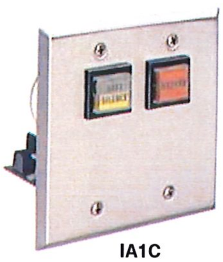
NOTE: Install indicator alarms above the five foot level in each operating room or anesthetizing location. Be sure they are clearly visible to personnel.

RA1WM

RA1WM (Wall Mount)

The RA1WM consists of the RA1 remote alarm indicator and a stainless steel, decorator-style cover plate. Designed to fit virtually anywhere a single-gang wiring device can be mounted, the RA1WM is complete with SILENCE, HAZARD, and SAFE indicators, a push-to-test button, and an LED light bar for metering. It is selectable for either 5mA or 2mA.

IA1C and IA1C-PTT



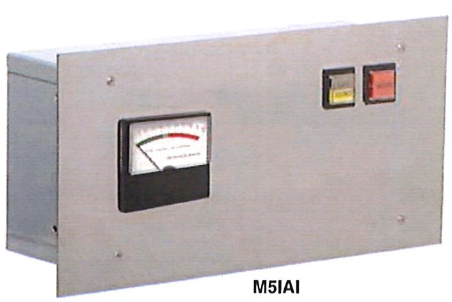
IA1C

The IA1C is the first in the series of low voltage remote alarm indicators. Designed to fit into a 2-gang, 3 1/2 in. deep (minimum) outlet box, this remote has SAFE/SILENCE and HAZARD indicators. In addition to these features, model IA1C-PTT provides push-to-test functionality.

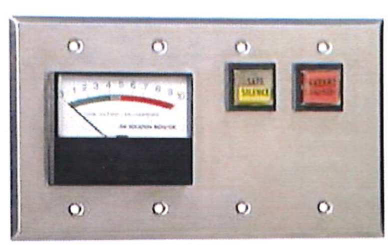
M5IAI and M5IAI50

Some physicians prefer to monitor the hazard current of the isolated system as devices are energized during surgery. This M5IAI and M5IAI50 remote indicator alarms contain a milliammeter like the one found in the panel, as well as a complete test switch facility. (The RA1 remote is also acceptable for this purpose.)

The M5IAI is the original remote indicator with a meter. It mounts in a 53008BB backbox (ordered separately). The M5IAI50 is a smaller version. It has the same features as the M5IAI, but mounts in a 4-gang, 3 1/2 in. deep (minimum) outlet box. A 2 mA meter is available for either style by changing the "M5" in the catalog number to "MM."



M5IAI



M5IAI50

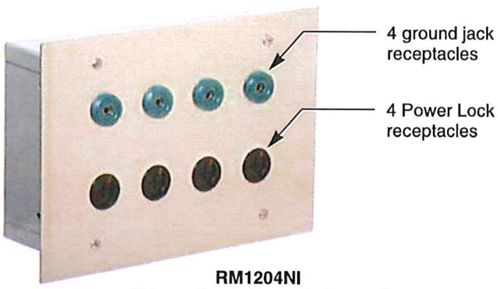
Power/Ground Modules

Power/Ground Modules—120 Series

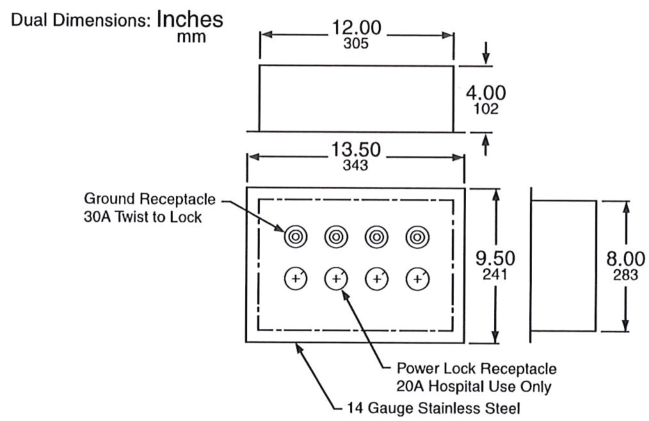
Where room ground extensions and power receptacles are both required, this module offers convenience and saves much labor in field wiring. The unit includes four power receptacles, four twist-to-lock ground jacks, and a ground bus with a generous number of lugs for external ground connections.

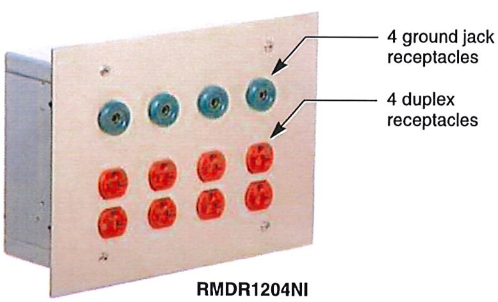
The main ground connection in the module accommodates up to a #1/0 cable. The unit is completely factory wired; only field power connections and ground connections are necessary. The front trim is #304 stainless steel with a #4 brushed finish.

Back boxes for the 120 Series are ordered separately. The size of the back box will depend on the outlet options for the overall device.

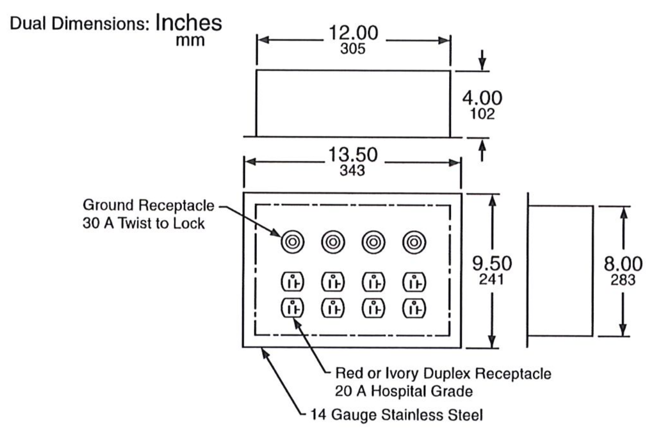


RM1204NI
4 Power Lock Receptacles and 4 Ground Jack Receptacles





RMDR1204NI
4 Red Duplex Receptacles and 4 Ground Jack Receptacles

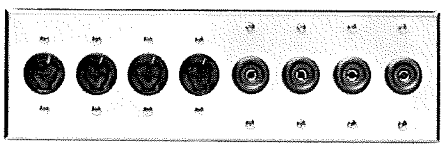


Power/Ground Modules—50 Series (To Fit Gang Boxes

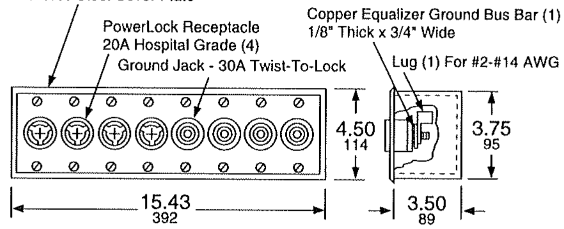
These modules contain both ground jack receptacles and power lock receptacles, but do not contain a ground bar with lugs. A single lug for #2 through #14 AWG wire is included for the incoming ground. These modules use standard electrical gang boxes, therefore back boxes are not included.

These modules can be used where additional ground jack receptacles and power lock receptacles are needed, but where lugs for hard grounding of non-electrical items are not required.

Back boxes for the 50 Series are customer provided. Suggested boxes are gangable outlet boxes.

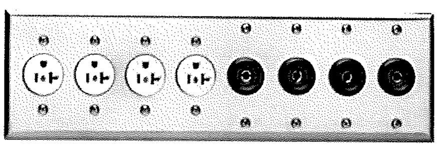


RM504NI
4 Power Lock Receptacles and 4 Ground Jack Receptacles

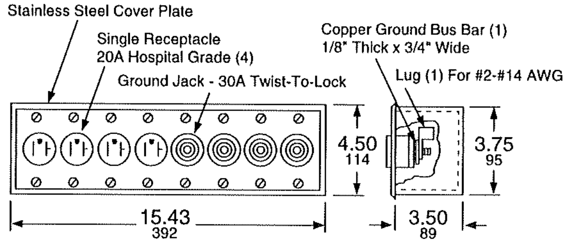


Note: 8-gang back box not supplied.

Dual Dimensions: Inches / mm

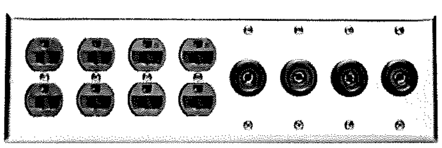


RMSI504NI
4 Ivory Single Receptacles and 4 Ground Jack Receptacles

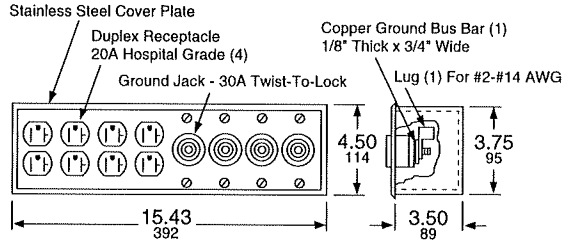


Note: 8-gang back box not supplied.

Dual Dimensions: Inches / mm



RMDR504NI
4 Red Duplex Receptacles and 4 Ground Jack Receptacles



Note: 8-gang back box not supplied.

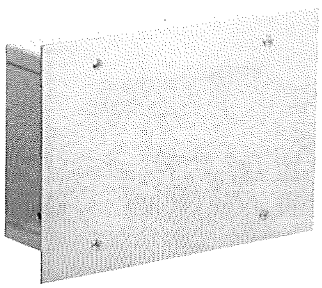
Dual Dimensions: Inches / mm

Master Grounding Station Module—120 Series

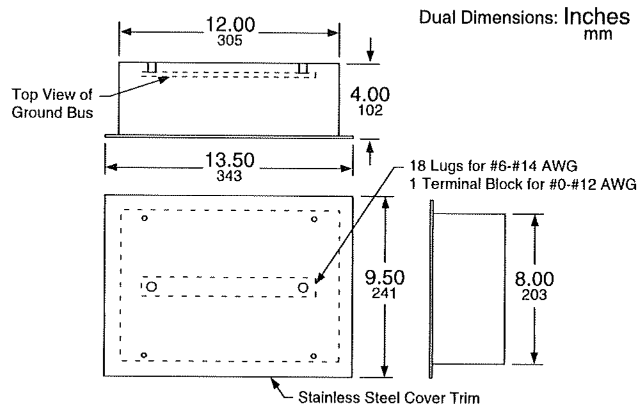
This unit can be used as a collection point for grounds in a large area such as a coronary care or intensive care ward. Primary application is where the equipment ground bus in the emergency distribution panel is not conveniently located or cannot accept the large number of connections, which may be required for the area.

This unit can connect to that point by a single conductor. However, it can be located in a more convenient location. The unit contains a bus bar with 18 lugs for field connections and has a Type #304 brushed stainless steel cover plate.

Back boxes for the 120 Series are ordered separately. The size of the back box will depend on the outlet options for the overall device.



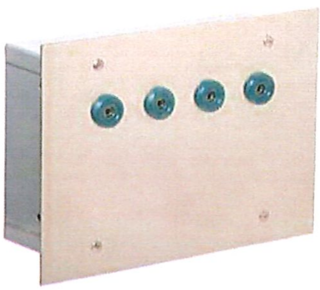
GS1200I



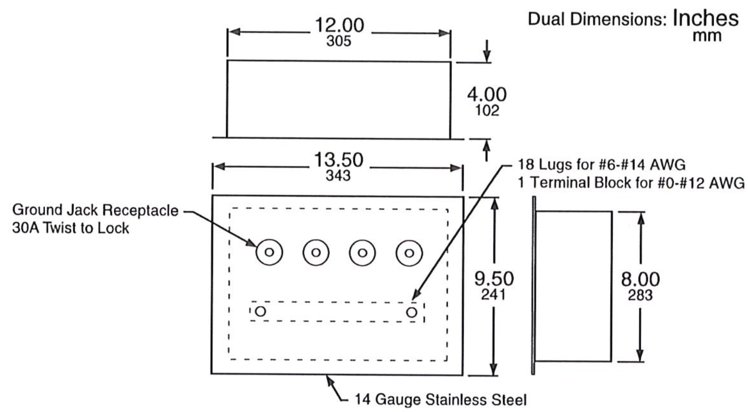
Ground Modules—120 and 50 Series

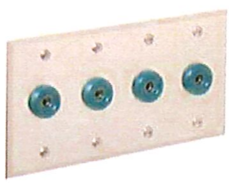
Ideal for room ground bus extensions to make ground connections in large operating rooms convenient. These units contain four ground jack receptacles and a ground bus. They are furnished with Type #304 brushed stainless trim.

Back boxes for the 120 Series are ordered separately. The size of the back box will depend on the outlet options for the overall device. Back boxes for the 50 Series are customer provided. Suggested boxes are gangable outlet boxes.

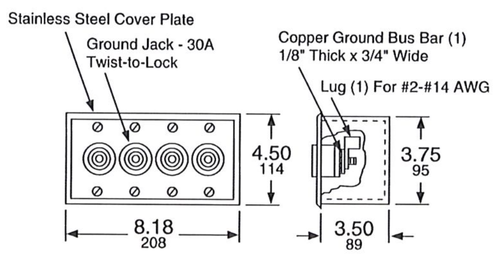


GS1204NI





GS504NI

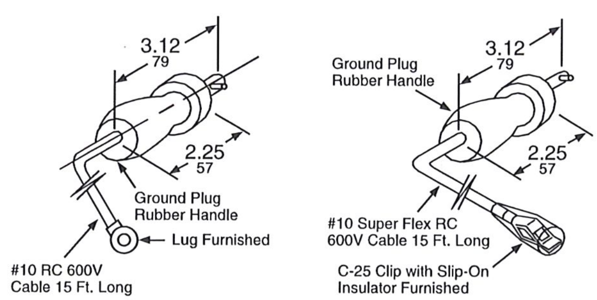


Note: 4-gang back box not supplied.

Ground Cord Assemblies

Schneider Electric offers various types of ground cord assemblies. The cord is an extra flexible #10 copper conductor with a green neoprene jacket. The cord's overall diameter is 5/16 in. The cords are designed to withstand hard usage. The cord is crimped to both the conductor and the insulation, providing maximum strain relief. The plug has a large rubber handle.

P753N



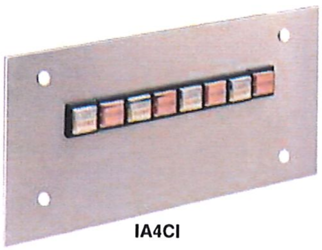
P751N P753N

Dual Dimensions: Inches
mm

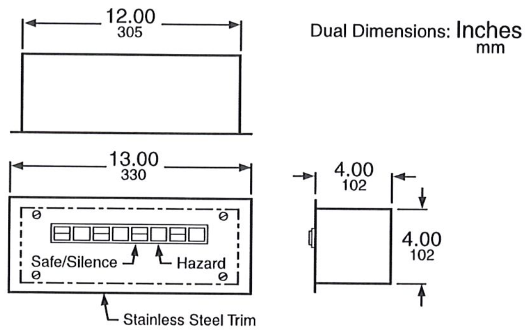
Remote Annunciator Panels

Annunciator Panel for 1 to 4 Circuits

Square D brand remote indicator alarms are available in an annunciator panel for monitoring from a single central location. Codes require an indicator alarm in each operating room. Many hospitals feel it necessary to monitor each operating room at a central location. These combined annunciator panel units meet this need.

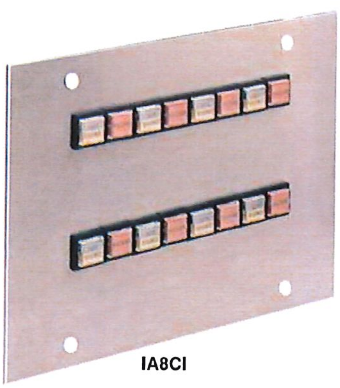


IA4CI

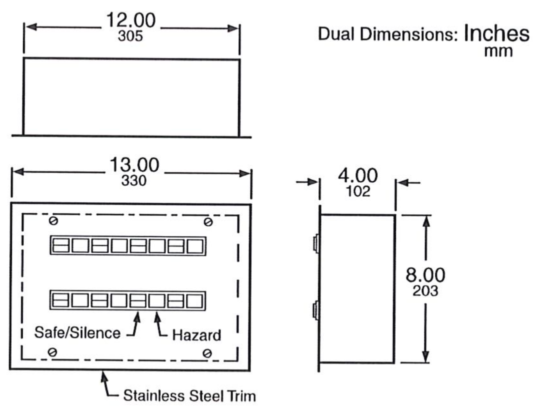


Annunciator Panel for 5 to 8 Circuits

This unit is available either surface or flush-mounted for use with a total quantity of 5 to 8 circuits.

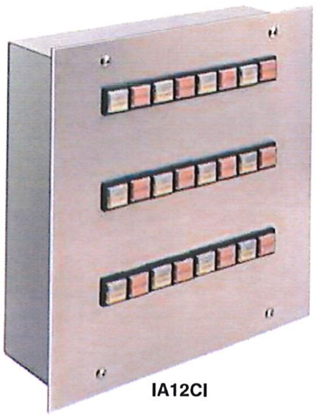


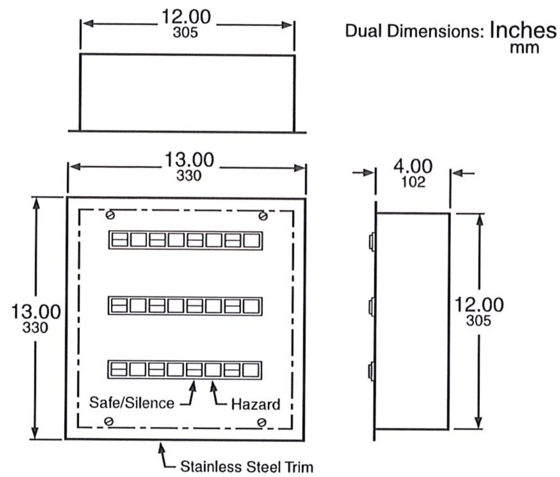
IA8CI



Annunciator Panel for 9 to 12 Circuits

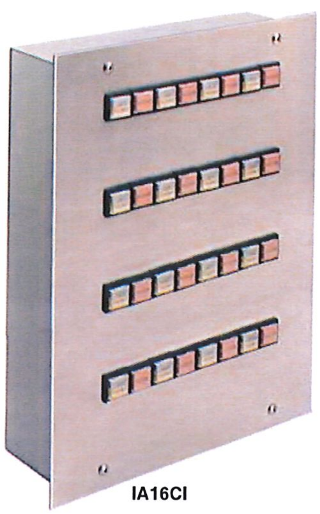
This unit is available either surface or flush-mounted for use with a total quantity of 9 to 12 circuits.

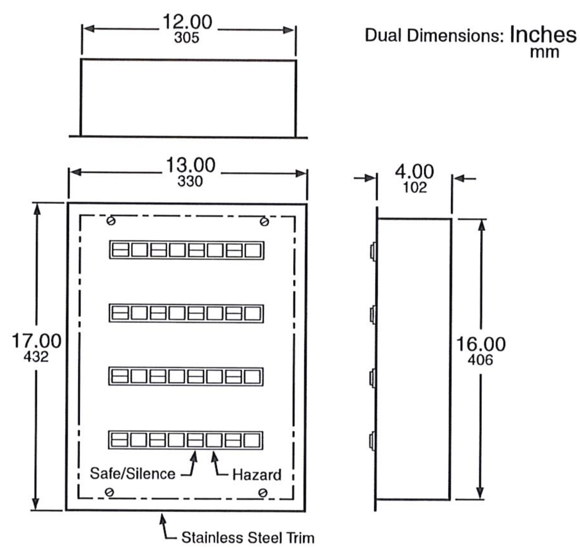

IA12CI



Annunciator Panel for 13 to 16 Circuits

This unit is available either surface or flush-mounted for use with a total quantity of 13 to 16 circuits. If you need annunciator panels with a greater number of circuits, contact your local Schneider Electric representative for dimensions and cost.


IA16CI



Iso-Gard® Line Isolation Monitor (LIM)

The Iso-Gard LIM has the following capabilities:

- Operating voltages of 85 through 265 Vac.
- Hazard current alarm levels of 2.0 or 5.0 mA.
- Operation at either 50 or 60 Hz.
- Operation either as a single-phase or three-phase unit.

With this selection of capabilities, the Iso-Gard LIM can meet the requirement of any application. External features of the Iso-Gard LIM include:

- Easily readable and understandable faceplate with a smooth surface for cleaning ease and pleasing appearance.
- Both analog and digital hazard current indication.
- Unique audible tone to avoid confusion with other equipment sounds in the operating room.

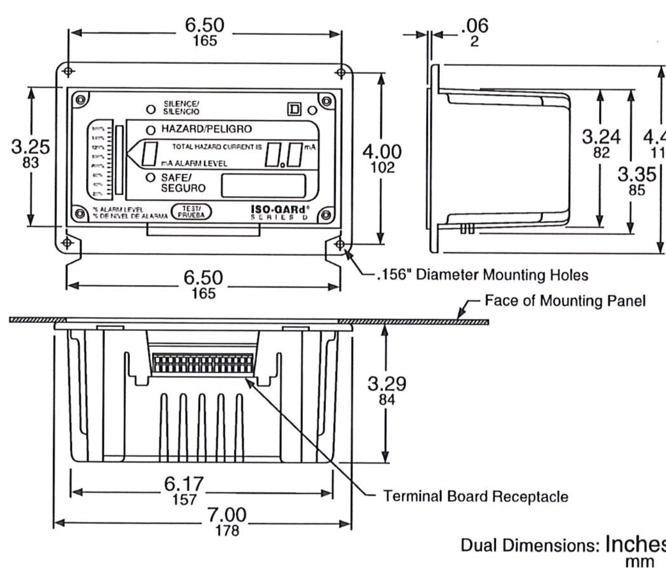
The Iso-Gard LIM is a distinct fifth-generation line isolation monitor. It uses microprocessor technology to improve the performance, versatility, and reliability of this unit over **any** previous LIMs. This monitor is included as a standard component of all Square D brand hospital isolation panels. The Iso-Gard LIM can also be purchased separately and installed as a replacement for any outdated line isolation monitor.

The Iso-Gard LIM exhibits a 50 µA monitor hazard current and an alarm band width of zero enabling the unit to sound an alarm at 5.0 mA of hazard current. This is significantly better than the other brands on the market which sound between 4.75 and 5.0 mA. The Iso-Gard LIM also self tests and self calibrates once every 65 minutes eliminating the need to manually test the unit periodically.

The Iso-Gard LIM, with its microprocessor-based technology, is impervious to all types of electrical noise interference found in hospital operating rooms. At the same time, the Iso-Gard LIM uses an advanced methodology to monitor hazard current without interfering with other sensitive patient monitoring equipment.

The unit has an extra set of normally opened and closed dry contacts for use with other external alarm systems. The Square D brand remote alarms for the Iso-Gard LIM operate at 12 Vac and do not add any additional hazard current to the isolated power system being monitored. The unit can also drive external analog meters as found in many remote alarm units such as the Square D brand remote alarm with ammeter.

The Iso-Gard LIM is component recognized by UL under UL1022 Standards for Line Isolation Monitors. The unit is compatible with all hospital isolation transformers and hospital isolation systems. The Iso-Gard LIM is manufactured in the United States by Schneider Electric.



Digital Clocks, Timers, and Accessories

MCT Series

Schneider Electric offers a line of digital clocks and elapsed time indicators uniquely adaptable to the hospital environment. The timepieces are designed for areas requiring rapid and precise time measurements. They are compact, solid state, and easily readable from 30 ft away. They operate in either the 12- or 24-hour time mode, depending on how the hospital wishes to use them. Since they are digital, they instantly reset, which eliminates annoying time delays for mechanical resets.

The elapsed time indicators can interface with a patient monitor, code blue alarm, or other equipment. An optional rechargeable battery pack can be purchased to prevent loss of time information during a power interruption. See page 66.

The MCT series of clocks/timers is designed for component mounting in various pieces of equipment such as modular walls, consoles, surgical facility panels, or building walls. This series is packaged in a durable flush mounting phenolic case. See Schneider Electric brochure No. 4890BR9201 for more complete information and specifications.

Accessory Control Panels

These control panels give hospitals the flexibility to mount digital time devices in a desired location. The MCT4RC control panel comes self-contained in a flush mounting back box with stainless steel trim. Both the MCT4RC and the MCTCT control units include a 15-foot wiring harness for connection to the clock/timer.

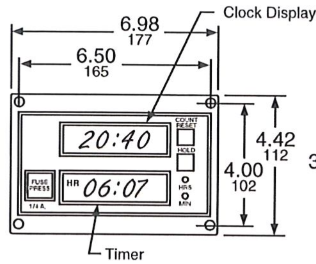
Description	Catalog Number	Dimensions (in.)				
		Trim		Backbox		
		H	W	H	W	D
Dual Display Clock/Timer[1]						
Clock/Timer with separate displays	MCT12B	4.25	11	8	12	4
Stainless steel trim plate	MCTS95135	9.5	13.5	—	—	—
Backbox to be used with MCT95135	53007BB	—	—	8	12	4
Remote control unit (optional)	MCTCT	4.5	4.5	—	—	—
Rechargeable battery pack (optional)	MCTBP	—	—	—	—	—
Surgical Chronometer						
Clock and three timers	MCT14B	16.5	13.5	15	12	4
Backbox	53006BB	—	—	15	12	4
Auxiliary control	MCT4RC	13.5	5.5	12	4	4
Backbox	53008BB	—	—	12	4	4

1 MCTS-95135 trim and 53007BB backbox must be ordered when installing clock/timers in building walls

Dual Display Clock/Timer (MCT12B)

This dual display timepiece is designed for surgical or patient care areas where simultaneous clock/timer displays are needed. The upper display is a time clock and the lower display is an elapsed timer. Controls for both displays are on the face of the unit. The displays can also be remotely controlled by the MCTCT remote control panel.

MCT12B

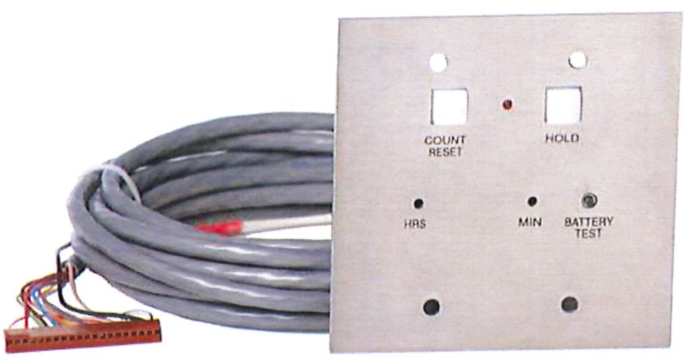


Dual Dimensions: Inches / mm

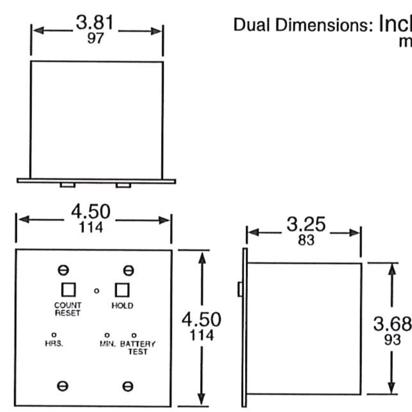
Control Panel (MCTCT)

Designed to operate with the MCT12B digital clock (see above). This control panel contains a set of controls for the timer and two push buttons to set the clock time display. Includes the MCTBP battery pack, see page 66.

NOTE: 2-gang back box not supplied.



MCTCT

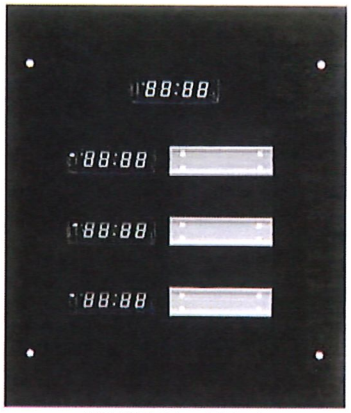


Dual Dimensions: Inches / mm

Note: 2-gang back box not supplied.

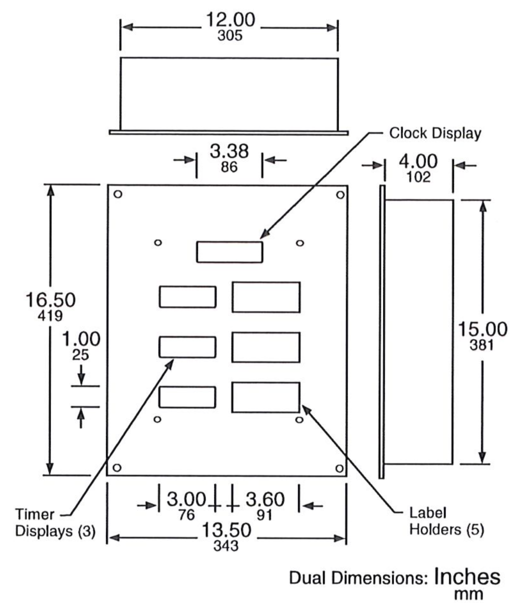
Surgical Chronometer (MCT14B)

Today's modern surgical techniques require the most up-to-date support equipment. This equipment includes elapsed time indicators for the operating room. Doctors will commonly require simultaneous timing of surgical procedures; the Square D brand surgical chronometer fills this need. This unit has three elapsed-time indicators and one clock integrated into a single, compact enclosure. The MCT4RC remote control panel can be mounted in a location selected for accessibility.



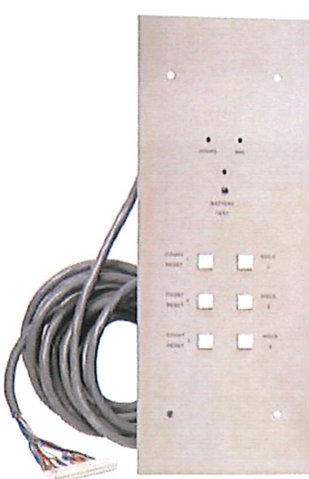
MCT14B (Front View)

MCT14B (Bottom View)

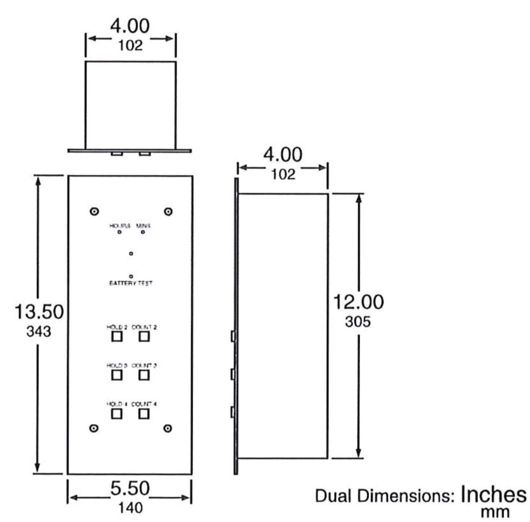


Control Panel (MCT4RC)

Designed to operate with the MCT14B surgical chronometer. This panel arrangement consists of three groups of timer controls and one group of push buttons to set the time for the 12/24 hour clock. Includes the MCTBP battery pack, see page 66.



MCT4RC



Accessory Equipment

Battery Pack (MCTBP)

This optional battery pack is designed for use in conjunction with the model MCT12B digital clock. It powers the “memory mode,” which prevents loss of time information on the digital clocks during a power interruption. The batteries are rechargeable, which eliminates the need to replace dead batteries.

Trim Plate (MCTS95135) and Back Box (53007BB)

These accessories, when ordered with the MCT12B digital clock, allow the timepiece to be wall-mounted. The MCTS95135 is a stainless steel trim panel with holes and studs for mounting the digital clock. 53007BB is the standard Square D brand back box (4 in. by 8 in. by 12 in.) for mounting the stainless steel trim.

Schneider Electric USA

1010 Airpark Center Drive
Nashville, TN 37217 USA
1-888-Square D
1-888-778-2733
www.us.SquareD.com

Replaces 4800CT9801 dated 02/1998

04/2008

File Attachments for Item:

ER-10 Installing Services (2020 NEC) (Jade Learning)

ESI (4 hours)

Staff Notes: This course is pages 1-5 of the attachment. Recommend approval, add BO, MPE, EPE, RBO, RPE.

ESIAC Recommendation: Recommend approval

Committee Recommendation:

[redacted]

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: Naomi Yencich
(Contact Name)

Organization: JADE Learning LLC
(Organization/Company)

Address: 11635 Northpark Dr Ste 360
(Include Room Number, Suite, etc.)

City: Wake Forest State: NC Zip: 27587

E-Mail: nyencich@jadelearning.com (approvals)/registrar@jadelearning.com

Telephone: 800-443-5233 Fax: N/A

Course Sponsor: JADE Learning LLC

COURSE INFORMATION:

Course Title: Installing Services (2020 NEC)

New Course Submittal: [X] Update Course: [ ] Prior Approval Number: ______

Purpose and Objective:
Please see attached outline

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

If Multi-Session, Number of Instructional Contact Hours Per Session: User-controlled (minimum of 4)

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 [X]
Location of ESI Course: online at www.jadelearning.com Date(s) of ESI Course(s): anytime

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:	please access online course for quiz questions	✓
Completed Application:		✓

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

JADELearning
Power Your Career

Course Name	Installing Services (2020 NEC)
Credit Hours	4 Hours
Course Description	This course will cover installing services definitions in 2020 NEC and requirements in the 2020 NEC for electrical installations with regards to installing services, including overhead service conductors, underground service conductors, service-entrance conductors, general service equipment, disconnecting means of service equipment, overhead protection for service equipment and practical application of installing services for a sample location.
Reference Materials	NFPA 70 National Electrical Code 2020 Edition

Learning Outcomes

At the completion of the course, licensees can expect to be able to:

- Define four terms related to installing services.
- Describe the requirements for installing services above a roof.
- Interpret Table 300.5 in the 2020 National Electricians Code.
- Describe the requirements for service entrance conductors.
- Identify what indicates service equipment has been field evaluated.
- Explain the requirements for disconnecting means of service equipment.
- Describe which types of conductors require overload protection.

Given a blueprint, the learner will be able to:

- Implement requirements for grounded conductors.
- Calculate the combined rating for service disconnects.
- Calculate the size of ungrounded conductors to carry an unbalanced load.
- Apply Table 310.16 in the 2020 National Electricians Code.
- Apply Table 250.102(C)(1) in the 2020 National Electricians Code.

Course Timed Syllabus Attached

Method of Presentation

This online course uses text and graphics. Multiple choice questions are used to test how well the student understands the material. Each answer choice has a response which tells the student whether the selected answer is correct or not. A running score is displayed so each person can track their progress through the class. The learning event is asynchronous and formatted as a visual lecture.

Attendance Verification

This course employs an inactivity timer, which will automatically log a licensee out of the training if the system does not sense a mouse click within 30 minutes.

At the end of the course, the licensee must affirm their name, that they are the one who completed the course, and verify that their registration information is correct.

Method of Assessment

The licensee must complete all 50 multiple choice questions with a score of at least 70% in order to get credit for the course. Question choices are randomized, so each participant will have a unique testing experience. The course is also timed; participants will not get credit until they spend at least 240 active minutes in the course.

Disclaimer

Both before registering for a course and at the start of the course, the following disclaimer is displayed:

JADE Learning offers courses based on the 2020 NEC. The 2020 NEC has NOT been adopted in Ohio. 2020 NEC courses on this page have been approved by the Board of Building Standards for continuing education, but are presented for INFORMATIONAL PURPOSES ONLY.

Schedule and Location

This course may be taken at any time at www.JadeLearning.com. The student may sign in and out of the course as many times as needed to complete the course.

Online Review Access

To review this course, go to www.JadeLearning.com. Click on the orange Login button on the top right and sign into the learning system using the login information below.

Username: OHItester
Password: OHItester

Cost

$49.00

Instructor(s)

Jerry Durham (resume attached)

JADELearning
Power Your Career

Installing Services (2020 NEC) Timed Syllabus

Section	Title	Questions	Minutes
	Service Basics		
1	230.1 Scope.	1	5
2	Article 100 Definitions: Service	1	5
	Part II Overhead Service Conductors.		
3	Article 100 Definitions: Service-Entrance Conductors, Overhead System.	1	5
4	Article 100 Definitions: Service-Entrance Conductors, Underground System.	1	5
5	Article 230.2 Number of Services.	1	5
6	Article 230.24(A) Clearances Above Roofs.	1	5
7	230.24(A) Clearances. Above Roofs. Exception No. 1.	1	5
8	230.24(A) Clearances. Above Roofs. Exceptions 2 and 3.	1	5
9	230.24(B) Vertical Clearance for Overhead Service Conductors.	1	5
10	230.28 Service Masts as Supports.	1	5
	Part III Underground Service Conductors.		
11	230.32 Protection Against Damage.	1	5
	Part IV. Service-Entrance Conductors.		
12	230.40 Number of Service-Entrance Conductor Sets.	1	5
13	230.42 Minimum Size and Ampacity.	1	5
14	310.12 Single-Phase Dwelling Services and Feeders.	1	5
15	230.43 Wiring Methods for 1000 Volts, Nominal, or Less.	1	5
16	230.46 Spliced Conductors.	1	5
17	230.50 Protection Against Physical Damage.	1	5
18	230.54(C) Service Heads and Goosenecks Above Service-Drop or Overhead Service Attachment.	1	5
	Part V Service Equipment - General.		
19	Article 100 Definitions Service Equipment.	1	5
20	230.66 Service Rated Equipment.	1	5
	Part VI Service Equipment - Disconnecting Means.		
21	230.70(A) Location.	1	5
22	230.70(B)&(C) Marking. Suitable for Use.	1	5
23	230.71 Maximum Number of Disconnects.	1	5
24	230.72 Grouping of Disconnects.	1	5
25	230.79 Rating of Service Disconnecting Means.	1	5
26	230.80 Combined Rating of Disconnects.	1	5
27	230.82 Equipment Connected to the Supply Side of Service Disconnect.	1	5
	Part VII. Service Equipment - Overcurrent Protection		
28	230.90 Where Required.	1	5

29	230.91 Location.	**1**	**5**
30	230.95 Ground-Fault Protection of Equipment.	**1**	**5**
	Strip Shopping Center		
31	Location of the 277/480 Volt Service.	**1**	**5**
32	Location of the 120/208 Volt Service.	**1**	**5**
33	The Rating of the 277/480 Volt Service.	**1**	**5**
34	The Rating of the 120/208 Volt Service.	**1**	**5**
35	Ungrounded Conductors to Tenant Spaces A, B, D, E and G.	**1**	**5**
36	Grounded Conductor to Tenant Spaces A, B, D, E and G.	**1**	**5**
37	Ungrounded Conductors to Tenant Space C (Sandwich Shop).	**1**	**5**
38	Grounded Conductor to Tenant Space C (Sandwich Shop).	**1**	**5**
39	Ungrounded Conductor to Tenant Space H (Print Shop).	**1**	**5**
40	Grounded Conductor to Tenant Space H (Print Shop).	**1**	**5**
41	Ungrounded Conductor to Tenant Space F (Restaurant).	**1**	**5**
42	Grounded Conductors in Parallel.	**1**	**5**
43	Location of the 120/208-Volt Service.	**1**	**5**
44	Conduit Installation to Tenant Spaces.	**1**	**5**
45	Location of Service Disconnects.	**1**	**5**
46	Two Services.	**1**	**5**
47	House Load Panel.	**1**	**5**
48	Identifying Service Location.	**1**	**5**
49	Service Requirements in the NEC.	**1**	**5**
50	Ground-Fault Protection.	**1**	**5**
	Totals:	**50**	**250**
	Time Required to Complete Course:		**240**

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: Naomi Yencich
(Contact Name)

Organization: JADE Learning LLC
(Organization/Company)

Address: 11635 Northpark Dr Ste 360
(Include Room Number, Suite, etc.)

City: Wake Forest State: NC Zip: 27587

E-Mail: nyencich@jadelearning.com (approvals)/registrar@jadelearning.com

Telephone: 800-443-5233 Fax: N/A

Course Sponsor: JADE Learning LLC

COURSE INFORMATION:

Course Title: Overcurrent Protection (2020 NEC)

New Course Submittal: [X] Update Course: [ ] Prior Approval Number: ______

Purpose and Objective: Please see attached outline

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

If Multi-Session, Number of Instructional Contact Hours Per Session: User-controlled (minimum of 4)

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 [X]
Location of ESI Course: online at www.jadelearning.com Date(s) of ESI Course(s): anytime

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:	please access online course for quiz questions	✓
Completed Application:		✓

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

JADELearning
Power Your Career

Course Name	Overcurrent Protection (2020 NEC)
Credit Hours	4 Hours
Course Description	This course will cover overcurrent protection definitions in 2020 NEC and requirements in the 2020 NEC for electrical installations with regards to overcurrent protection, including circuits, temperature, conductors, feeder taps, transformers, plugs, fuses, fuseholders, panelboards, appliances, motor circuits, circuit breakers, flexible cords, cables, and fixture wires. This course has no prerequisites.
Reference Materials	NFPA 70 National Electrical Code 2020 Edition
Learning Outcomes	At the completion of the course, licensees will be able to:

- Describe the main purpose of overcurrent protection.
- Define five terms relevant to overcurrent protection.
- Explain how to determine the minimum interrupting rating using available fault current.
- Interpret Table 310.16 in the 2020 National Electrical Code.
- Identify when ground fault protection is required for equipment.
- Calculate the minimum ampacity required for feeder taps.
- List the ampacity requirements for transformer secondary conductors.
- List the 2020 National Electrical Code requirements and applications for circuit breakers.
- Explain how a supervised industrial location affects overcurrent protection requirements.
- Identify when an overcurrent device is permitted to be installed in the grounded conductor.
- List and describe four specific rules for overcurrent devices installed in panelboards.
- List the steps to size a motor feeder overcurrent protective device.
- Identify the required overcurrent protection for transformers.
- List the locations where GFCI receptacles must be installed.
- Identify where AFCI protection is required.

Course Timed Syllabus

Attached

Method of Presentation

This online course uses text and graphics. Multiple choice questions are used to test how well the student understands the material. Each answer choice has a response which tells the student whether the selected answer is correct or not. A running score is displayed so each person can track their progress through the class. The learning event is asynchronous and formatted as a visual lecture.

Attendance Verification

This course employs an inactivity timer, which will automatically log a licensee out of the training if the system does not sense a mouse click within 30 minutes.

At the end of the course, the licensee must affirm their name, that they are the one who completed the course, and verify that their registration information is correct.

Method of Assessment

The licensee must complete all 50 multiple choice questions with a score of at least 70% in order to get credit for the course. Question choices are randomized, so each participant will have a unique testing experience. The course is also timed; participants will not get credit until they spend at least 240 active minutes in the course.

Disclaimer

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Schedule and Location

This course may be taken at any time at www.JadeLearning.com. The student may sign in and out of the course as many times as needed to complete the course.

Online Review Access

To review this course, go to www.JadeLearning.com. Click on the orange Login button on the top right and sign into the learning system using the login information below.

Username: OHItester
Password: OHItester

Cost	$49.00
Instructor(s)	Jerry Durham (resume attached)

JADELearning
Power Your Career

Overcurrent Protection (2020 NEC) Timed Syllabus

Section	Title	Questions	Minutes
1	240.1 Overcurrent Protection. Scope. Informational Note.	1	5
2	110.9 Interrupting Rating.	1	5
3	110.10 Circuit Impedance and Other Characteristics.	1	5
4	110.14(C) Temperature Limitations of Terminals.	1	5
5	Article 100 Definitions: Coordination (Selective).	1	5
6	240.2 Definitions: Current-Limiting Overcurrent Protective Device.	1	5
7	240.2 & 240.21 Definitions: Tap Conductors.	1	5
8	240.3 Other Articles: Protecting Equipment	1	5
9	240.4 Protection of Conductors.	1	5
10	240.4(B) Devices Rated 800 Amperes or Less.	1	5
11	240.4(D) Small Conductors.	1	5
12	240.5(A) Protection of Flexible Cords, Flexible Cables and Fixture Wires. Ampacities.	1	5
13	240.6 Standard Ampere Ratings.	1	5
14	240.10 Supplementary Overcurrent Protection.	1	5
15	240.13 Ground-Fault Protection of Equipment.	1	5
16	240.15 (A)and(B) Ungrounded Conductors.	1	5
17	240.21(B)(1) Feeder Taps. Taps Not Over 10 ft. Long.	1	5
18	240.21(B)(2) Feeder Taps. Taps Not over 25 ft. Long.	1	5
19	240.21(B)(4) Feeder Taps. Taps Over 25 ft. Long.	1	5
20	240.21(C)(1-3) Transformer Secondary Conductors.	1	5
21	240.21(C)(4) and (6) Outside Transformer Secondary Conductors and Transformer Secondary Conductors Not Over 25 ft. Long.	1	5
22	240.22 Grounded Conductor.	1	5
23	240.24 Location of Overcurrent Devices on the Premises.	1	5
24	240.30 Protection from Physical Damage. 240.33 Mounted in Vertical Position.	1	5
25	240.50 and 240.54 Plug Fuses, Fuseholders, and Adapters. General and Type S Fuses.	1	5
26	Part VI. 240.60(A-C) Cartridge Fuses and Fuseholders.	1	5
27	240.80 through 240.83 Circuit Breakers.	1	5
28	240.85 Applications of Circuit Breakers.	1	5
29	240.86 Series Rating.	1	5
30	240.90 and 240.2 Supervised Industrial Locations.	1	5
31	240.92 Overcurrent Protection in Industrial Locations.	1	5
32	240.100, 240.101 and 240.102 Overcurrent Protection over 1000 Volts, Nominal.	1	5
33	408.30 and 408.36 Overcurrent Protection for Panelboards.	1	5
34	408.36(A) through (D) Overcurrent Protection for Panelboards.	1	5
35	422.11 Overcurrent Protection for Appliances.	1	5
36	424.3(B) and 424.22(B) Fixed Electric Space-Heating Equipment Overcurrent Protection.	1	5
37	430.52 Motor Branch-Circuit Short-Circuit and Ground-Fault Protection.	1	5
38	430.52(C)(1) Ex. 2 When the Motor Will Not Start.	1	5
39	430.62 Motor Feeder Short-Circuit and Ground-Fault Protection.	1	5
40	430.72 Overcurrent Protection of Motor Control Circuits.	1	5
41	440.22 Motor Compressor Branch-Circuit Short-Circuit and Ground-Fault Protection.	1	5
42	450.3(A) Overcurrent Protection for Transformers Over 1000 Volts.	1	5
43	Table 450.3(B) Overcurrent Protection for Transformers 1000 Volts or less.	1	5
44	695.4 Continuity of Power for Fire Pumps.	1	5
45	230.90 Overcurrent Protection of Ungrounded Service Conductors.	1	5
46	230.94 Relative Location of the Service Overcurrent Device and Other Service Equipment.	1	5
47	210.8 Ground-Fault Circuit-Interrupter Protection for Personnel.	1	5
48	210.12 Arc-Fault Circuit-Interrupter Protection.	1	5
49	210.20(A) Overcurrent Protection. Continuous and Noncontinuous Loads.	1	5
50	210.21(B) Outlet Devices. Receptacles.	1	5
	Totals:	**50**	**250**
	Time Required to Complete Course:		**240**

Jerry L Durham

Certificates/Licenses

North Carolina Electrical Inspector Level III
North Carolina Plumbing Inspector Level I
North Carolina Mechanical Inspector Level I
Washington Electrical Adminstrator #DURHAJL821PQ
ICC Kentucky E1 Electrical Inspector, Masters Electrician, Journeyman Electrician
NCCER Core and Electrical Curriculum Instructor Certification

Work Experience

Instructor (JADE Learning, LLC) 2018 - Present
Write and develop course curriculum, technical articles, and related learning materials. Teach in-person classroom courses.

Electrical Inspector- LVL 3 (Alamance County Government) 2015 - 2018
Code enforcement officer, enforcing all guidelines set forth in the National Electrical Code and applicable State-issued code amendments, as they apply to residential and commercial electrical installations throughout the state of North Carolina.

Electrical Instructor (Alamance Community College) 2017- Present
Taught from six to thirty NC electrical inspectors per 40-hour training session. Taught basic electrical theory, Ohm's Law, circuitry, voltage drop calculations, box/pipefill calculations, junction and pull-box calculations, conductor derating and adjustment calculations, residential-service-calculations, and National Electrical Code.

Code Enforcement Officer (Louisville Metro Government) 2009 - 2015
City inspector, charged with determining property maintenance and health and safety code compliance and/or infractions for dwellings (interior/exterior), commercial structures, properties, parcels and lots. Included enforcement of local, state and federal code requirements pertaining to building, zoning, electrical, plumbing, HVAC and Land Development in the Louisville Metro area. The department's electrical instructor, performing classroom setting electrical instruction.

Electrical Instructor (ABC Trade School) 2010 - 2014
Instructor of 25 electrical trade students participating in their first through fourth year of a four-year electrical apprenticeship program. Also performed state approved Masters and Journeyman State Licensing preparatory courses.

Electrical Instructor (IEC Trade School) 2009 - 2010
Instructor of 25 electrical trade students in a four-year apprenticeship program.

Licensed Electrician (Curtsinger Electric Company) 2003 - 2009
Managed multiple electrical remodel and new-build projects, performing interior/exterior lighting design, installation and system troubleshooting. Diagnosis and repair of residential and commercial electrical, phone and cable installations. Continual training of apprentices in the areas of customer care, electrical theory/diagnosis, repair/installation and effective time management.

INTERNATIONAL CODE COUNCIL

JERRY DURHAM

The International Code Council attests that the individual named on this certificate has satisfactorily demonstrated knowledge as required by the International Code Council by successfully completing the prescribed written examination based on codes and standards then in effect, and is hereby issued this certification as:

Residential Electrical Inspector

Given this day of August 20, 2009

Certificate No. 8034465-E1

Adolf Zubia
President, Board of Directors

INTERNATIONAL CODE COUNCIL, INC.
CERTIFIED
WASHINGTON, D.C.

Richard P. Weiland
Chief Executive Officer

ICC INTERNATIONAL CODE COUNCIL®

North Carolina Code Officials

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA

Qualification Board
STANDARD CERTIFICATE

This is to certify that

JERRY LEE DURHAM
ID# 21791

HAVING GIVEN SATISFACTORY EVIDENCE SHOWING ALL THE NECESSARY QUALIFICATIONS WITH REGARD TO CHARACTER, EDUCATION, AND EXPERIENCE AS REQUIRED BY THE ACT OF THE GENERAL ASSEMBLY OF JUNE 13, 1977, AS AMENDED, WAS EXAMINED – DULY CERTIFIED – AWARDED THIS CERTIFICATE – AND IS HEREBY AUTHORIZED TO SERVE WHILE EMPLOYED BY A CITY, A COUNTY, OR THE STATE AS

ELECTRICAL INSPECTOR LEVEL III

NORTH CAROLINA CODE OFFICIALS QUALIFICATION BOARD * 1977 *

IN THE STATE OF NORTH CAROLINA

IN TESTIMONY WHEREOF: THE CODE OFFICIALS QUALIFICATION BOARD ISSUES THIS CERTIFICATE UNDER THE SEAL OF THE BOARD AND SIGNATURES OF THE CHAIRMAN AND SECRETARY:

THIS 25TH DAY OF APRIL 2017

27643
CERTIFICATE NUMBER

Attest: _______________ Secretary

_______________ Chairman

National Center for Construction Education and Research

This is to certify that

Jerry Durham

has fulfilled the requirements to serve as a

Electrical Instructor

in NCCER's standardized training curriculum
this Twenty-sixth day of August, 2009

Donald E. Whyte

Donald E. Whyte
President

File Attachments for Item:

ER-11 Most Unanswered NEC Code Questions (IAEI)

ESI, BO, BPE, MPE, EPE, BI, RBO, RPE (12 hours in 6 sessions)

Staff Notes: The slides are the questions. To allow for plenty of interaction, there is no quota of slides/questions to cover in a given session. Recommend approval.

ESIAC Recommendation: Recommend approval

Committee Recommendation:

[redacted]

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: Tom Moore (Contact Name)

Organization: IAEI Akron Division (Organization/Company)

Address: 3462 Brunk Road (Include Room Number, Suite, etc.)

City: Akron State: OH Zip: 44312

E-Mail: tmoore1767@aol.com

Telephone: (330) 289-7932 Fax:

Course Sponsor: Akron Div. IAEI

COURSE INFORMATION:

Course Title: Most Unanswered NEC Code Questions Lesson 4 of 6

New Course Submittal: [X] Update Course: [ ] Prior Approval Number:

Purpose and Objective: Power Point presentation with illustration of the most unanswered NEC code questions and answers. Upon completion of this interactive class attendees will view illustrated questions, answers and substantiation of some of the most questionable interpretations of of the NEC. This presentation is based on submitted questions to the Western Section IAEI as answered by known national NEC experts who are members of different NEC Code Panels. Each question and answer will be fully discussed to improve knowledge and show substantiation for the code rule(s).

Number of Instructional Contact Hours that can be obtained upon completion: 6 Separate Sessions (2 hrs for each session)

If Multi-Session, Number of Instructional Contact Hours Per Session: 2

Program Applicable for the Following Participants:

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

Res Bldg Official [X] Res Plans Exam [X] Res Bldg Inspector [ ] Res Plumbing Inspector [ ] Res IU Inspector [ ]
Res Mechanical Inspector [ ]

Electrical Safety Inspectors [X]
Electrical Safety Inspector Trainee Part I - Fundamentals of Electricity (Theory) [ ]
Electrical Safety Inspector Trainee Part II – ESI Refresher Course [ ]
Location of ESI Course: 501 Kelly Ave. Akron, Ohio 44306 Date(s) of ESI Course(s): May 25, 2021

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:		

RECEIVED
FEB 1 REC'D
Board of Building Standards

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

Form 1526

Title of Course: ***Most Unanswered NEC Code Questions***

Course Syllabus:

Topic Outline for Course

Reference	Subject	Date
Lesson 1 of 6	NEC Article 90 & Chapter 1	Feb. 23, 2021
Lesson 2 of 6	NEC Chapter 2	March 23, 2021
Lesson 3 of 6	NEC Chapters 3 & 4	April 27, 2021
Lesson 4 of 6	NEC Chapters 5 & 6	May 25, 2021
Lesson 5 of 6	NEC Chapters 7 & 8	June 22, 2021
Lesson 6 of 6	NEC Chapter 9 & Annexes	July 27, 2021

Course Description: This is an extensive and interactive program of some of the most unanswered code questions submitted by electricians from across the mid region of the country. The answers and slides were developed by NEC Code Panel Members, recognized as some of the most well-known NEC experts. This four-part PowerPoint presentation contains full-color slides that illustrate and clearly identifies and explains these answers. These interpretations will assist in promoting uniform interpretations. This class will promote uniformity based on the most common code questions and will include interactive discussion.

Course Objective: Upon completion of the class attendees will have the substantiation of and unanswered questions related to many of to the NEC questions. Additionally, a power point presentation and discussion will be presented on the most common electrical inspection code interpretations.

Method of Presentation: **Microsoft PowerPoint ®**

Tom Moore

Tom Moore, Akron Ohio, is past President of the IAEI Western Section, Ohio Chapter and Akron Division. Tom presently Serves on the IAEI IO Board of Directors, Assistant Secretary/Treasurer of the Western Section IAEI' President and Membership Chair of the Akron Division IAEI. He has been involved in the inspection industry since 1987 and the electrical industry for over 39 years. Has recently retired as the Assistant Building Commissioner with the City of Beachwood Ohio. And presently back-up electrical/building inspector with the City of Stow.

Tom is very active in the IAEI where he has represented the IAEI on NEC CMP 11 for the 2005, 2008, and 2011code cycles and previously CMP 5 for the 2002 Code Cycle. Currently Tom is Chair of CMP 16 for the 2014, 2017, 2020 and CMP 9 for the 2023 code cycles. Tom also serves on NFPA 915 (Remote Video Inspections). Tom was also a member of the first item writing committee for the IAEI/CEI Electrical Inspector Exam.

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Tom is a member of IBEW Local 306, where for the past 24 years has been a NJATC Apprenticeship Instructor along with Journeyman Training Instructor.

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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BOARD OF BUILDING STANDARDS STATE OF OHIO

COURSE SUBMITTER:

Course Submitter: Tom Moore
(Contact Name)

Organization: IAEI Akron Division
(Organization/Company)

Address: 3462 Brunk Road
(Include Room Number, Suite, etc.)

City: Akron State: OH Zip: 44312

E-Mail: tmoore1767@aol.com

Telephone: (330) 289-7932 Fax:

Course Sponsor: Akron Div. IAEI

COURSE INFORMATION:

Course Title: Most Unanswered NEC Code Questions Lesson 3 of 6

New Course Submittal: [X] Update Course: [ ] Prior Approval Number:

Purpose and Objective: Power Point presentation with illustration of the most unanswered NEC code questions and answers. Upon completion of this interactive class attendees will view illustrated questions, answers and substantiation of some of the most questionable interpretations of of the NEC. This presentation is based on submitted questions to the Western Section IAEI as answered by known national NEC experts who are members of different NEC Code Panels. Each question and answer will be fully discussed to improve knowledge and show substantiation for the code rule(s).

Number of Instructional Contact Hours that can be obtained upon completion: 6 Separate Sessions (2 hrs for each session)

If Multi-Session, Number of Instructional Contact Hours Per Session: 2

Program Applicable for the Following Participants:

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

Res Bldg Official [X] Res Plans Exam [X] Res Bldg Inspector [ ] Res Plumbing Inspector [ ] Res IU Inspector [ ]
Res Mechanical Inspector [ ]

Electrical Safety Inspectors [X]
Electrical Safety Inspector Trainee Part I - Fundamentals of Electricity (Theory) [ ]
Electrical Safety Inspector Trainee Part II – ESI Refresher Course [ ]
Location of ESI Course: 501 Kelly Ave. Akron, Ohio 44306 Date(s) of ESI Course(s): April 27, 2021

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:		

RECEIVED
FEB 1 REC'D
Board of Building Standards

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

Form 1526

Title of Course: ***Most Unanswered NEC Code Questions***

Course Syllabus:

Topic Outline for Course

Reference	Subject	Date
Lesson 1 of 6	NEC Article 90 & Chapter 1	Feb. 23, 2021
Lesson 2 of 6	NEC Chapter 2	March 23, 2021
Lesson 3 of 6	NEC Chapters 3 & 4	April 27, 2021
Lesson 4 of 6	NEC Chapters 5 & 6	May 25, 2021
Lesson 5 of 6	NEC Chapters 7 & 8	June 22, 2021
Lesson 6 of 6	NEC Chapter 9 & Annexes	July 27, 2021

Course Description: This is an extensive and interactive program of some of the most unanswered code questions submitted by electricians from across the mid region of the country. The answers and slides were developed by NEC Code Panel Members, recognized as some of the most well-known NEC experts. This four-part PowerPoint presentation contains full-color slides that illustrate and clearly identifies and explains these answers. These interpretations will assist in promoting uniform interpretations. This class will promote uniformity based on the most common code questions and will include interactive discussion.

Course Objective: Upon completion of the class attendees will have the substantiation of and unanswered questions related to many of to the NEC questions. Additionally, a power point presentation and discussion will be presented on the most common electrical inspection code interpretations.

Method of Presentation: **Microsoft PowerPoint ®**

Tom Moore

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APPLICATION
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Continuing Education Course Approval

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COURSE SUBMITTER:

Course Submitter: Tom Moore (Contact Name)
Organization: IAEI Akron Division (Organization/Company)
Address: 3462 Brunk Road (Include Room Number, Suite, etc.)
City: Akron State: OH Zip: 44312
E-Mail: tmoore1767@aol.com
Telephone: (330) 289-7932 Fax:
Course Sponsor: Akron Div. IAEI

COURSE INFORMATION:

Course Title: Most Unanswered NEC Code Questions Lesson 5 of 6

New Course Submittal: [X] Update Course: [ ] Prior Approval Number:

Purpose and Objective: Power Point presentation with illustration of the most unanswered NEC code questions and answers. Upon completion of this interactive class attendees will view illustrated questions, answers and substantiation of some of the most questionable interpretations of of the NEC. This presentation is based on submitted questions to the Western Section IAEI as answered by known national NEC experts who are members of different NEC Code Panels. Each question and answer will be fully discussed to improve knowledge and show substantiation for the code rule(s).

Number of Instructional Contact Hours that can be obtained upon completion: 6 Separate Sessions (2 hrs for each session)

If Multi-Session, Number of Instructional Contact Hours Per Session: 2

Program Applicable for the Following Participants:

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

Res Bldg Official [X] Res Plans Exam [X] Res Bldg Inspector [ ] Res Plumbing Inspector [ ] Res IU Inspector [ ]
Res Mechanical Inspector [ ]

Electrical Safety Inspectors [X]
Electrical Safety Inspector Trainee Part I - Fundamentals of Electricity (Theory) [ ]
Electrical Safety Inspector Trainee Part II – ESI Refresher Course [ ]
Location of ESI Course: 501 Kelly Ave. Akron, Ohio 44306 Date(s) of ESI Course(s): June 22, 2021

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:		

RECEIVED
FEB 1 REC'D
Board of Building Standards

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

Form 1524

Title of Course: ***Most Unanswered NEC Code Questions***

Course Syllabus:

Topic Outline for Course

Reference	Subject	Date
Lesson 1 of 6	NEC Article 90 & Chapter 1	Feb. 23, 2021
Lesson 2 of 6	NEC Chapter 2	March 23, 2021
Lesson 3 of 6	NEC Chapters 3 & 4	April 27, 2021
Lesson 4 of 6	NEC Chapters 5 & 6	May 25, 2021
Lesson 5 of 6	NEC Chapters 7 & 8	June 22, 2021
Lesson 6 of 6	NEC Chapter 9 & Annexes	July 27, 2021

Course Description: This is an extensive and interactive program of some of the most unanswered code questions submitted by electricians from across the mid region of the country. The answers and slides were developed by NEC Code Panel Members, recognized as some of the most well-known NEC experts. This four-part PowerPoint presentation contains full-color slides that illustrate and clearly identifies and explains these answers. These interpretations will assist in promoting uniform interpretations. This class will promote uniformity based on the most common code questions and will include interactive discussion.

Course Objective: Upon completion of the class attendees will have the substantiation of and unanswered questions related to many of to the NEC questions. Additionally, a power point presentation and discussion will be presented on the most common electrical inspection code interpretations.

Method of Presentation: **Microsoft PowerPoint ®**

Tom Moore

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COURSE SUBMITTER:

Course Submitter: Tom Moore (Contact Name)
Organization: IAEI Akron Division (Organization/Company)
Address: 3462 Brunk Road (Include Room Number, Suite, etc.)
City: Akron State: OH Zip: 44312
E-Mail: tmoore1767@aol.com
Telephone: (330) 289-7932 Fax:
Course Sponsor: Akron Div. IAEI

COURSE INFORMATION:

Course Title: Most Unanswered NEC Code Questions Lesson 6 of 6

New Course Submittal: [X] Update Course: [ ] Prior Approval Number:

Purpose and Objective: Power Point presentation with illustration of the most unanswered NEC code questions and answers. Upon completion of this interactive class attendees will view illustrated questions, answers and substantiation of some of the most questionable interpretations of of the NEC. This presentation is based on submitted questions to the Western Section IAEI as answered by known national NEC experts who are members of different NEC Code Panels. Each question and answer will be fully discussed to improve knowledge and show substantiation for the code rule(s).

Number of Instructional Contact Hours that can be obtained upon completion: 6 Separate Sessions (2 hrs for each session)

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Program Applicable for the Following Participants:

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

Res Bldg Official [X] Res Plans Exam [X] Res Bldg Inspector [ ] Res Plumbing Inspector [ ] Res IU Inspector [ ]
Res Mechanical Inspector [ ]

Electrical Safety Inspectors [X]
Electrical Safety Inspector Trainee Part I - Fundamentals of Electricity (Theory) [ ]
Electrical Safety Inspector Trainee Part II – ESI Refresher Course [ ]
Location of ESI Course: 501 Kelly Ave. Akron, Ohio 44306 Date(s) of ESI Course(s): July 27, 2021

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.

Title of Course: ***Most Unanswered NEC Code Questions***

Course Syllabus:

Topic Outline for Course

Reference	Subject	Date
Lesson 1 of 6	NEC Article 90 & Chapter 1	Feb. 23, 2021
Lesson 2 of 6	NEC Chapter 2	March 23, 2021
Lesson 3 of 6	NEC Chapters 3 & 4	April 27, 2021
Lesson 4 of 6	NEC Chapters 5 & 6	May 25, 2021
Lesson 5 of 6	NEC Chapters 7 & 8	June 22, 2021
Lesson 6 of 6	NEC Chapter 9 & Annexes	July 27, 2021

Course Description: This is an extensive and interactive program of some of the most unanswered code questions submitted by electricians from across the mid region of the country. The answers and slides were developed by NEC Code Panel Members, recognized as some of the most well-known NEC experts. This four-part PowerPoint presentation contains full-color slides that illustrate and clearly identifies and explains these answers. These interpretations will assist in promoting uniform interpretations. This class will promote uniformity based on the most common code questions and will include interactive discussion.

Course Objective: Upon completion of the class attendees will have the substantiation of and unanswered questions related to many of to the NEC questions. Additionally, a power point presentation and discussion will be presented on the most common electrical inspection code interpretations.

Method of Presentation: **Microsoft PowerPoint ®**

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[redacted]

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COURSE SUBMITTER:

Course Submitter: Tom Moore (Contact Name)
Organization: IAEI Akron Division (Organization/Company)
Address: 3462 Brunk Road (Include Room Number, Suite, etc.)
City: Akron State: OH Zip: 44312
E-Mail: tmoore1767@aol.com
Telephone: (330) 289-7932 Fax:
Course Sponsor: Akron Div. IAEI

COURSE INFORMATION:

Course Title: Most Unanswered NEC Code Questions Lesson 1 of 6

New Course Submittal: [X] Update Course: [ ] Prior Approval Number:

Purpose and Objective: Power Point presentation with illustration of the most unanswered NEC code questions and answers. Upon completion of this interactive class attendees will view illustrated questions, answers and substantiation of some of the most questionable interpretations of of the NEC. This presentation is based on submitted questions to the Western Section IAEI as answered by known national NEC experts who are members of different NEC Code Panels. Each question and answer will be fully discussed to improve knowledge and show substantiation for the code rule(s).

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Electrical Plans Exam. [X] Non-Res IU Inspector [ ]

Res Bldg Official [X] Res Plans Exam [X] Res Bldg Inspector [ ] Res Plumbing Inspector [ ] Res IU Inspector [ ]
Res Mechanical Inspector [ ]

Electrical Safety Inspectors [X]
Electrical Safety Inspector Trainee Part I - Fundamentals of Electricity (Theory) [ ]
Electrical Safety Inspector Trainee Part II - ESI Refresher Course [ ]
Location of ESI Course: 501 Kelly Ave. Akron, Ohio 44306 Date(s) of ESI Course(s): Feb. 23, 2021

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)	✓
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Instructor(s) Info.:	Resume of professional/educational qualifications & teaching/training experience/BBS certification	✓
Test Materials:	Copy of quizzes or tests to be given	✓
Completed Application:		

RECEIVED
FEB 1 REC'D
Board of Building Standards

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Form 1526 v030101

Title of Course: ***Most Unanswered NEC Code Questions***

Course Syllabus:

Topic Outline for Course

Reference	Subject	Date
Lesson 1 of 6	NEC Article 90 & Chapter 1	Feb. 23, 2021
Lesson 2 of 6	NEC Chapter 2	March 23, 2021
Lesson 3 of 6	NEC Chapters 3 & 4	April 27, 2021
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Course Objective: Upon completion of the class attendees will have the substantiation of and unanswered questions related to many of to the NEC questions. Additionally, a power point presentation and discussion will be presented on the most common electrical inspection code interpretations.

Method of Presentation: **Microsoft PowerPoint ®**

Tom Moore

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APPLICATION

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COURSE SUBMITTER:

Course Submitter: Tom Moore (Contact Name)

Organization: IAEI Akron Division (Organization/Company)

Address: 3462 Brunk Road (Include Room Number, Suite, etc.)

City: Akron State: OH Zip: 44312

E-Mail: tmoore1767@aol.com

Telephone: (330) 289-7932 Fax:

Course Sponsor: Akron Div. IAEI

COURSE INFORMATION:

Course Title: Most Unanswered NEC Code Questions Lesson 2 of 6

New Course Submittal: [X] Update Course: [ ] Prior Approval Number:

Purpose and Objective: Power Point presentation with illustration of the most unanswered NEC code questions and answers. Upon completion of this interactive class attendees will view illustrated questions, answers and substantiation of some of the most questionable interpretations of of the NEC. This presentation is based on submitted questions to the Western Section IAEI as answered by known national NEC experts who are members of different NEC Code Panels. Each question and answer will be fully discussed to improve knowledge and show substantiation for the code rule(s).

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Program Applicable for the Following Participants:

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Electrical Safety Inspectors [X]
Electrical Safety Inspector Trainee Part I - Fundamentals of Electricity (Theory) [ ]
Electrical Safety Inspector Trainee Part II – ESI Refresher Course [ ]
Location of ESI Course: 501 Kelly Ave. Akron, Ohio 44306 Date(s) of ESI Course(s): March. 23, 2021

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.

Form 1526 04/30/01

Title of Course: ***Most Unanswered NEC Code Questions***

Course Syllabus:

Topic Outline for Course

Reference	Subject	Date
Lesson 1 of 6	NEC Article 90 & Chapter 1	Feb. 23, 2021
Lesson 2 of 6	NEC Chapter 2	March 23, 2021
Lesson 3 of 6	NEC Chapters 3 & 4	April 27, 2021
Lesson 4 of 6	NEC Chapters 5 & 6	May 25, 2021
Lesson 5 of 6	NEC Chapters 7 & 8	June 22, 2021
Lesson 6 of 6	NEC Chapter 9 & Annexes	July 27, 2021

Course Description: This is an extensive and interactive program of some of the most unanswered code questions submitted by electricians from across the mid region of the country. The answers and slides were developed by NEC Code Panel Members, recognized as some of the most well-known NEC experts. This four-part PowerPoint presentation contains full-color slides that illustrate and clearly identifies and explains these answers. These interpretations will assist in promoting uniform interpretations. This class will promote uniformity based on the most common code questions and will include interactive discussion.

Course Objective: Upon completion of the class attendees will have the substantiation of and unanswered questions related to many of to the NEC questions. Additionally, a power point presentation and discussion will be presented on the most common electrical inspection code interpretations.

Method of Presentation: **Microsoft PowerPoint ®**

Tom Moore

Tom Moore, Akron Ohio, is past President of the IAEI Western Section, Ohio Chapter and Akron Division. Tom presently Serves on the IAEI IO Board of Directors, Assistant Secretary/Treasurer of the Western Section IAEI' President and Membership Chair of the Akron Division IAEI. He has been involved in the inspection industry since 1987 and the electrical industry for over 39 years. Has recently retired as the Assistant Building Commissioner with the City of Beachwood Ohio. And presently back-up electrical/building inspector with the City of Stow.

Tom is very active in the IAEI where he has represented the IAEI on NEC CMP 11 for the 2005, 2008, and 2011code cycles and previously CMP 5 for the 2002 Code Cycle. Currently Tom is Chair of CMP 16 for the 2014, 2017, 2020 and CMP 9 for the 2023 code cycles. Tom also serves on NFPA 915 (Remote Video Inspections). Tom was also a member of the first item writing committee for the IAEI/CEI Electrical Inspector Exam.

Tom is presently the Assistant Secretary/Treasurer of the West4ern Section IAEI. In addition to the past Western Section President, he has served as a member of the Ohio Chapter Board of Directors for 20 years as the Ohio Chapter Representative to the Western Section for 18. Tom has served two terms as Ohio Chapter President and multiple committees Chairman of the Ohio Chapter Code Clearing Committee and Public Relations Committee. He serves as President and Membership Chairman of the Akron Division IAEI. He was one of two IAEI members appointed by the Governor of the State Ohio to the NEC Ad-Hoc Committee for successful adoption of the 2008 NEC.

Tom is a member of IBEW Local 306, where for the past 24 years has been a NJATC Apprenticeship Instructor along with Journeyman Training Instructor.

National Electrical Code Forum

Your Questions Answered

Code Panel #2

1

Question #1 –Surge Protection

The 2020 NEC now requires surge protection devices to be installed on all dwelling units. Can you explain the difference in type 1 and type 2 SPD? In addition, the ultimate question is which way is going to cost the least amount?

[Don Iverson]

Answer: There are multiple options available in the market that are cost effective that will comply to this new requirement in 230.67.

Type 1: Intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device (service equipment).

Type 2: Intended for installation on the load side of the service disconnect overcurrent device (service equipment), including brand panel locations. Their main purpose is to protect the sensitive electronics and microprocessor based loads against residual lightning energy, motor generated surges and other internally generated surge events.

2

Question 2

Why are the bathroom, garage, and outside excluded from AFCI protection?

Because they have not been included, YET

Present required areas were in the 2014 NEC

Stay tuned for the 2023 Code Panel Meeting Actions

(210.12)

[David Williams]

3

Question 3

What are the placarding requirements when PV equipment i.e. Inverter, Production Meter, ESS etc…. cannot be installed in the same location as the utility service/ Main service Disconnect?

[ANSWER]

- 690.31(D)(2) Marking and labeling for wiring methods and materials. Part VI Marking 690.51 – 690.56.

4

Question 4

Is a Shower Steam unit equipped with a power cord (intended to be plugged into a receptacle) installed from the manufacturer (240V, 60A) legal to be installed? Or should it be hard wired with a rated disconnect switch?

[Steve Froemming]

5

4 answer; Yes, 422.16(B)2 & 422.33(A) disc means

- To facilitate the removal or disconnection of appliances that are fastened in place, where the fastening means and mechanical connections are specifically designed to permit ready removal for maintenance or repair and the appliance is intended or identified for flexible cord connection.

6

4 answer cont,

- This one is NOT cord eligible

7

Question #5

When three doors are located within 25' of a 2000-amp main switch and are required to swing out and have pressure plates what if the doors swing into an egress hallway. Building code and electrical code clash, if doors can't be relocated can the swing? who should win?

[Don Iverson]

Answer: The Key is if the doors are less than 25ft from equipment. The NEC takes precedence in this scenario. The door swing must remain in the direction of egress as stated in the code text. The focus here is to get the injured electrical worker out of the hazard to receive first aid.

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.

8

Question #5 (Cont.)

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

9

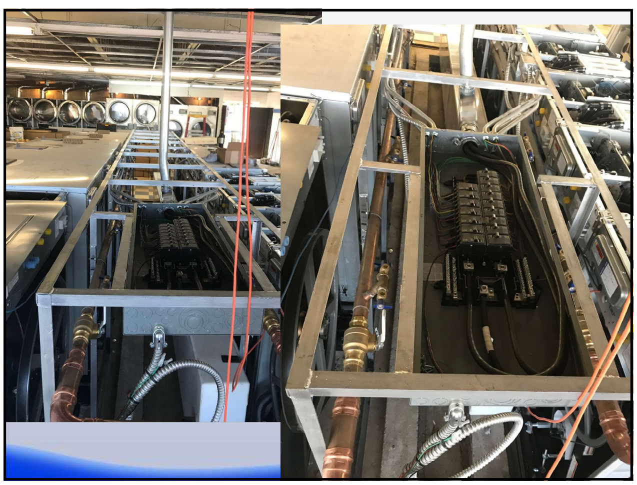
Question 6

Can a panelboard be installed on its back in the face up position? 2014 & 2017. Are there any changes to this in the 2020 NEC?

This is a new requirement that was added to the 2020 NEC. An installation in a face up position does not allow for safe working conditions, regarding workspace or a hazard of things falling into the panel

- **408.43 Panelboard Orientation.** Panelboards shall not be installed in the face-up position.
  [David Williams]

10



11

Question 7

I am being told that in the 2020 NEC that the concrete encased electrode (rebar) cannot be used as a grounding electrode. Is this true?

[Answer]

- NO, 250.52(A)(3) allows concrete encased electrode.

12

Question 8

If I install my own support wires above a grid ceiling to strap MC Cable to, is there a limit to the number of cables I can strap to each wire? Can this wire also be tied to the fixture? Is there a certain color it must be marked?

[Steve Froemming]

13

8 answer

- No
- Maybe
- Kinda

14

8 answer, cont;

- No, Maybe, Kinda
- 300.11(B)(1&2) Fire & Non–Fire-Rated Assemblies. Wiring located within the cavity of a non–fire-rated floor–ceiling or roof–ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires.
- An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means [secured on both ends]
- No mention of number of cables but (D) states cables cant support other cables
- If the fixture [luminaire] is attached to the grid on its own then maybe you could use it

15

Question 9

Can you run a three wire 240-volt Feeder to a barn (no equipment ground) 460 feet from the residence and drive a ground rod at the barn for the equipment grounding?

[Don Iverson]

Answer: Answer: No - New installations. Yes – previous code editions.

250.32(B) (1)

Supplied by a Feeder or Branch Circuit.

An equipment grounding conductor, as described in 250.118, shall be run with the supply conductors and be connected to the building or structure disconnecting means and to the grounding electrode(s). The equipment grounding conductor shall be used for grounding or bonding of equipment, structures, or frames required to be grounded or bonded. The equipment grounding conductor shall be sized in accordance with 250.122. Any installed grounded conductor shall not be connected to the equipment grounding conductor or to the grounding electrode(s).

16

Question #9 (Cont.)

Exception No. 1: For installations made in compliance with previous editions of this Code that permitted such connection, the grounded conductor run with the supply to the building or structure shall be permitted to serve as the ground-fault return path if all of the following requirements continue to be met:

(1) An equipment grounding conductor is not run with the supply to the building or structure.

(2) There are no continuous metallic paths bonded to the grounding system in each building or structure involved.

(3) Ground-fault protection of equipment has not been installed on the supply side of the feeder(s).

17

Question 10

- Does the code give a maximum length that the service conductors my run along the outside of a residence or building?
  No, there is no specific distance you can enter a building. **230.70(A)(1**) tells us that the service disconnect has to be outside or inside nearest the point of entrance of the service conductors.
  So that does limit the length of the service conductors when they enter the building.

[David Williams]

18

Question 11

What is the maximum voltage drop for any branch circuit installed in a sensitive electronic equipment panel board?

[Answer]

647.4(D) The voltage drop for any branch circuit shall not exceed 1.5 percent. The combined voltage drop of feeders and branch conductors shall not exceed 2.5 percent.

19

Question 12

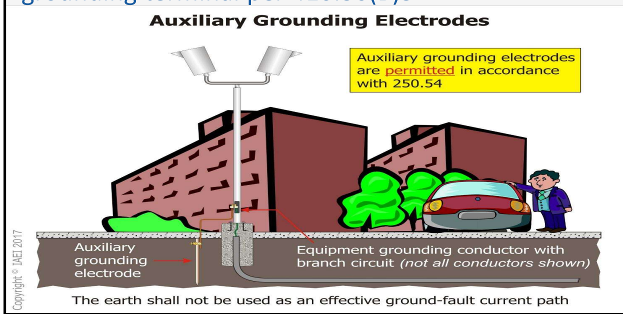
Engineers often require a ground rod at parking lot lights. Does the NEC require this? What do I do with this wire from the ground rod?

[Steve Froemming]

20

12 answer

- Not required as not a Building or Structure so, Auxiliary is allowed per 250.54 and bond to grounding terminal per 410.30(B)5



21

Question #13

Should free air plenum rated fire alarm cable that is installed to a legally required fire alarm system for tamper and flow devices in a retail mall be CI rated cable.

[Don Iverson]

Answer: 760.135(C) Maybe.

There is nothing in the NEC Article 760 that address's the submitters question. This would be a building code requirement where it requires the CI cable be installed in this application.

22

Question 14

I was turned down on a construction temporary because I used a bare ground wire in a ½ metal offset nipple. The inspector told me I either had to use an insulated ground or a grounding bushing. Is he correct?

I wish I knew what a bare ground wire is? If it is a grounding electrode conductor, the inspector would be partially correct. Because a GEC in a metal raceway is required to be bonded on both ends, it doesn't matter if it is insulated or bare. If a bare ground wire is an equipment grounding conductor the inspector would be wrong, but don't tell them I said so.

250.64(E)(1), 250.119

[David Williams]

23

Question 15

I am considering wiring my house with cooper clad aluminum. It looks like I am going to have to wire my 15-amp circuits with #12 and my 20 ampere circuits with #10, am I understanding this correctly?

[Answer]

- Yes 240.4(D)(4),and (6) 310.16 Table

24

Question 16

The 2020 NEC now requires GFCI protection for the condensing unit outdoors. I was told by the supply houses that ½ size (25, 35, and 45) ampere breakers are not available. How are we going to comply with code without under sizing or overcurrent protection? Do you see this creating a nuisance-tripping problem?

[Steve Froemming]

25

NEW

210.8(F) GFCI Protection For Outdoor Outlets

26

16 answer

New 210.8(F) GFCI needed if at a dwelling

- outdoors,
- single phase,
- less 150v to ground,
- 50a or less

Find the correct breaker in the standard sizes per 240.6

- GFCI should not nuisance-trip [many motors use them such as pools, hot tubs, spas]

27

Question #17

Do I have to use any special type of wire terminating device or connecting device for my tap in a parking lot light? I was told my standard wire nut was not suitable for a damp location and would not comply.

[Don Iverson]

Answer: Yes. UL Product IQ (AMVX) If the correct terminations are used for the environment which it's installed and the correct conductor is selected.

- In accordance with wiring methods where the connector is installed in enclosures rated for the environment and located in dry locations, damp locations, wet locations, below grade, or above grade.

28

Question #17 (Cont.)

In lighting systems operating at 30 V or less (rated 25 A and 30 V, 42.4 V peak, maximum) and lighting equipment connected to a Class 2 power source. Where the connector is located in dry locations, damp locations, wet locations, direct buried locations, below grade, or above grade where protected from direct exposure to sunlight. Sealed wire connectors used in these applications do not require the use of an enclosure.

29

Question 18

The six throws of the hand rule changed in the 2020 NEC; can you help us understand 230.71?

230.71 in the 2017 code stated you could have up to six means of disconnect. The 2020 code: states each service shall have only one disconnecting means, and then **230.71(B)** gives you the ability to have up to six means of disconnect. This was modified due to the safety concerns where there are exposed live parts in an enclosure. 2-6 disconnects permitted in 230.71(B) (1-4). **[David Williams]**

30

31

Question 19

My local utility company requires a disconnect in front of their 200 amperes 277/480-meter socket. Does the NEC allow this to be my service disconnect? Or will I have to add another one after the meter socket?

[Answer]

- The utility is responsible for all wiring methods on the line side of the metering. 230.66(B) shall be listed 230.70 refers to the location of the service dicconnect.

32

Question 20

I have added a generator as on a dwelling as a standby system. A propane tank was added to supply gas to the generator. Can I use the equipment-grounding conductor at the generator to bond the new gas line?

[Steve Froemming]

33

20 answer

- Yes,
  sized to Table 250.122 for circuit that may energize it
- **250.104(B) Other Metal Piping.**
- If installed in or attached to a building or structure, a metal piping system(s), including gas piping, that is likely to become energized shall be bonded to any of the following:
- (1)Equipment grounding conductor for the circuit that is likely to energize the piping system

34

Question 21

Can you explain the 2020 requirements for 210.8(A)(11)? How will this be enforceable?

[Don Iverson]

Answer: This is where the inspector must use some commonsense with identifying locations that are subject to damp or wet areas. As an example, pet bathing or an area in the home that is susceptible to water or dampness like a mud room that wouldn't necessarily have a sink located nearby.

35

Question 22

Can you explain the new requirements for the garage branch circuit for the 2020 NEC?

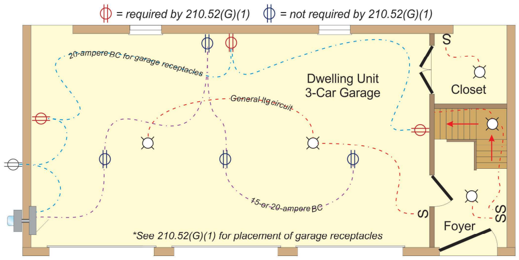
The 2017 code, in **210.11(C)(4)** required a 20 amp circuit to feed all the receptacles in the garage. 2020 code, the revised the language states only the receptacles required by **210.52(G)** are required to be on 20 ampere branch circuits. Those are the receptacles for each vehicle bay.

[David Williams]

36

210.11(C)(4) Garage Branch Circuit(s)

= required by 210.52(G)(1) = not required by 210.52(G)(1)



At least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle outlets required by 210.52(G)(1) in dwelling unit garages *(no other outlets)*

Exception permits supply of readily accessible outdoor receptacle outlets

37

Question 23

I am wiring a veterinarian surgical center. Are there any special requirements? Does article 517 apply? The engineer says no, but the AHJ has it held up in review trying to figure it out.

[Answer]

- No 517.1 Scope. This article applies to electrical construction and installation criteria in health care facilities that provide services to human being.

38

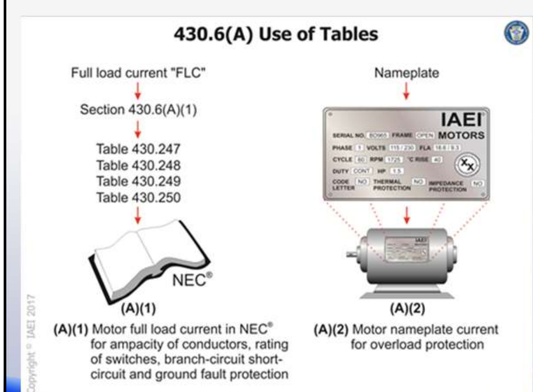
Question 24

When must I use the table value instead of motor nameplate current rating?

[Steve Froemming]

39

24 answer



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Question 25

Furniture feeds; this system has a LFMC whip with a wire type equipment grounding conductor. Is it legal to terminate into a plastic 4 square blank cover? Or is it required to use a metal cover to maintain the electrical continuity?

[Don Iverson]

Answer: No. 250.148 (A-D) There is a equipment grounding conductor in LFMC.

250.148 Continuity of Equipment Grounding Conductors and Attachment in Boxes.

41

Question 26

During a residential remodel project when replacing receptacles (devices only): Is an AFCI Receptacle, if installed in the 1st outlet acceptable? Or is it also required to protect the Homerun with an AFCI circuit breaker? Note: Older homes maybe wired with 3 wire (shared Neutral) branch circuits.

Section **406.4(D)(4)** applies to replacement of receptacles in areas where the current code requires AFCI protection, **210.12**. The section references three methods on how to accomplish this. (1) A listed outlet branch-circuit type arc-fault circuit-interrupter receptacle. (2) A receptacle protected by a listed outlet branch-circuit type arc-fault circuit-interrupter type receptacle. (3) A receptacle protected by a listed combination type arc-fault circuit-interrupter type circuit breaker. **[David Williams]**

42

Question 27

Does the metal skin of a stick framed structure need to be bonded to the GEC or ECG at the service?

[Answer]

- No. Some jurisdiction may require bonding to the service equipment so check with your local AHJ.

43

Question 28

What is the minimum size copper THWN conductor required to supply an air conditioner condensing unit with a minimum circuit ampere requirement of 23 Amperes? All terminals are rated 75° C.

[Steve Froemming]

44

28 answer

- **440.6 Ampacity and Rating.**
- The size of conductors for equipment covered by this article shall be selected from Table 310.16………shall be determined according to 440.6(A) and 440.6(B).
- A & B both state to use the nameplate
- Part IV Branch-Circuit Conductors in 440.35 also sends you there.
- Table 310.16 [was 310.15(B)16] 75 degree C, #12 copper good for 25a

45

Question 29

Are there any new load calc requirements (Derating Factors) that maybe applied to the Table 220.12 values for Dwelling LED lighting? The exceptions apply to commercial installations only.

[Don Iverson]

Answer: Article 220.12 was extensively revised during the 2020 NEC revision cycle. The previous calcs have been in place since the early 70's. Now with expanded LED lighting available today it has aided in the significant reduction in lighting loads. The table in 220.12 saw a significant reduction in volts per sq ft in multiple commercial occupancies. The residential single & multi-family dwellings) portion that we saw in pervious editions of the NEC have been relocated to 220.12(J).

46

Question 30

Can I use the 110.24-required available short-circuit current making to determine my arc-flash PPE? Some experts have told me yes and other expert have told me no.

The experts know, but it depends on the installation. If you know the fault current used in **110.24** you could look in **70E** Hazard Risk Tables to determine the PPE. In some instances, if you're above the Maximum fault current threshold you can't use the table. You also can use the fault current from **110.24**, use the **70E** formulas to determine the incident energy, but you'll need to know the clearing time.

[David Williams]

47

Question 31

In Art. 702.10 does the term "general wiring" include Service Entrance Conductors?

[Answer]

- No. 230.7 Conductors other than service conductors shall not be installed in the same service raceway or service cable in which the service conductors are installed.

48

Question 32

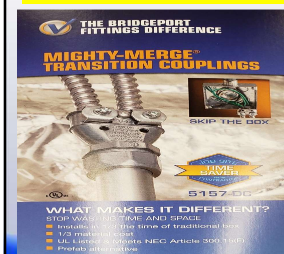
I have been told that when I install a go-from (EMT to Type MC Cable) that the fitting has to be accessible, is that accurate? If why?

[Steve Froemming]

49

32 answer 310.15(F)

- A fitting identified for the use shall be permitted in lieu of a box or conduit body where conductors are not spliced or terminated within the fitting.
  The fitting shall be accessible after installation, unless listed for concealed installation.



50

Question #33 Utility Meters

Can a Construction Meter be attached to a Residential Single-Family Dwelling (SFD) under construction? No info found in Art. 230, Art. 590, or the IRC is this an Insurance or Utility requirement?

[Don Iverson]

Answer: I'm assuming that your addressing a pre-construction meter that is installed onsite before the building is constructed. There is nothing in the NEC that restricts a construction meter to be installed. In most cases the utility would have jurisdiction over the type of meter being installed on the structure.

51

Question 34

We have a spread footer that has multiple short pieces of rebar tied together that does = 20' in a 2'x2' concrete pad that is in contact with the earth. Does this installation meet the intent and therefore is a compliant installation for a concrete encased electrode?

No, **250.52(A)(3)** requires 20 linear feet of one or more sections of ½" or larger rebar. This type of installation was discussed by CMP-5 and there was not testing that would verify it would qualify as a grounding electrode.

[David Williams]

52

Question 35

Is it permissible to install LFNC underground for a feeder raceway from one structure to another such as a house to a detached garage?

[Answer]

- Yes. 356.10

53

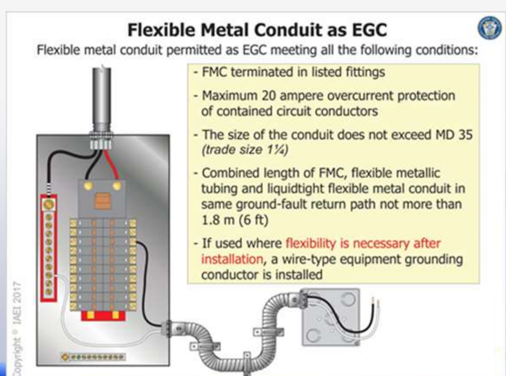
Question 36

A 100a feeder is installed with EMT however both ends transition to flex or sealtight for flexibility, would it be required to install an exterior bonding jumper sized off the 100-Amp OCPD?

[Steve Froemming]

54

36 answer, depends, 250.118(5),(6),(7)



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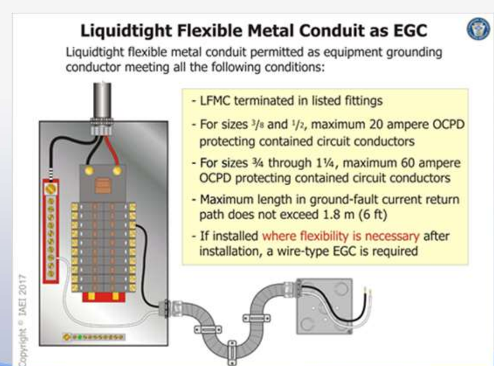
36 answer cont, 250.118(6)



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36 answer cont, 250.118(7)

- (7) **Flexible metallic tubing** where the tubing is terminated in listed fittings and meeting the following conditions:
  - (a) Conductors contained in the tubing are protected at not more than 20 amperes
  - (b) The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground-fault current return path does not exceed 1.8 m (6 ft)

57

Question #37 - Show Window Receptacles

Banks normally have windows throughout the building for security, they typically hang non- electrified signs. Does 210.62 apply and should the contractor install receptacles throughout? This is a tough one to enforce as an inspector.
[Don Iverson]

Definition: Show Window.

Any window, including windows above doors, used or designed to be used for the display of goods or advertising material, whether it is fully or partly enclosed or entirely open at the rear and whether or not it has a platform raised higher than the street floor level. (CMP-2)

58

Question #37 (Cont.)

Answer: Yes.

210.62 Show Windows.

At least one 125-volt, single-phase, 15- or 20-ampere-rated receptacle outlet shall be installed within 450 mm (18 in.) of the top of a show window for each 3.7 linear m (12 linear ft) or major fraction thereof of show window area measured horizontally at its maximum width.

59

Question 38

Is a DC disconnecting means required for a battery system under 50-volts?

The Scope of Article 480 for Storage Batteries states it includes all stationary installations of storage batteries. **480.7** for DC Disconnects only requires a disconnect for the ungrounded conductors of battery systems that have a voltage over 60 volts dc.

No. 480.7

[David Williams]

60

Question 39

We have several jurisdictions in our State that only allow (2) NM-B cables to be installed through a single hole in a wood framing member, no matter how large the hole. Even if the hole is sealed with sealing foam and requires derating for the number of current-carrying conductors where there are more than two cables, the number of cables does not appear to be limited by the NEC. Especially with TGIs, it seems like overkill to limit a hole to (2) cables. Is this a Building Code requirement or a local jurisdiction interpretation?

[Answer]

- 310.15(C)(1) It is the call of the local AHJ

61

Question 40

When installing a PV system via a Line Side Tap: your 1st AC disconnect switch constitutes a new "Service Disconnect". Are there any exceptions in the installation of the MBJ and GEC terminations at the Grounded (Neutral) conductor terminal to avoid a parallel path with the original service (Utility) Grounded Conductor?

[Steve Froemming]

62

40 answer, nothing in 690

- No, normal 'Service' grounding/bonding
- 250.24(A)1 for Grounding Electrode Conductor connection at any accessible point …..
- (B) Main Bonding Jumper
- (C) Grounded [neutral] Conductor

63

Question 41

A separate structure has a 3 phase 50-amp feeder, and a single phase 15-amp branch circuit going to it as allowed by 225.30 (D). What grounding electrode system would be required and how would it connect to the feeder and branch circuit?

[Don Iverson]

Answer: 250.32 (A) You would need to establish grounding electrode system for the 3phase feeder. However, the code isn't clear for the single-phase circuit. See exception in 250.32(A). See next slide..

64

Question 41

In 250.32(A) A building(s) or structure(s) supplied by a feeder(s) or branch circuit(s) shall have a grounding electrode system and grounding electrode conductor installed in accordance with Part III of Article 250. Where there is no existing grounding electrode, the grounding electrode(s) required in 250.50 shall be installed.

65

Question 42

Does the round-up rule of Article 240.4 (B) allow two parallel runs of 2/0 AWG, Type THWN aluminum conductors to be protected at 300 amperes?

2/0 THWN, Aluminum is rated at 135 amps at 75 C. Paralleled would be 270 which is not a standard size (240.6) and is able to be rounded up to a 300-amp OCPD.

YES. Table 310.16, 240.6 and 240.4(B)

[David Williams]

66

Question 43

We have town houses that have fire rated demising walls between them but share a common foundation. There is a meter stack with 100-amp breakers attached at one end of the building. Does each unit require a grounding electrode and a main for the homeowner's panel for separate structure or does the meter stack breakers and Grounding electrode at the end of the building suffice?

[Answer] Two part answer grounding electrode No

- 250.24. A main is required for the homeowner 230.70, 230.72

67

Question 44

I have an installation that an inspector requires me to install a wall space required receptacle put in an island. I'm sure that if a top is installed on this island, I do not need to install it. What does the code say?

[Steve Froemming]

68

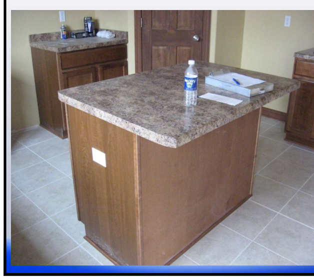
44 answer

- 210.52 for an Island new (C)2
- (a) At least one receptacle outlet shall be provided for the first 0.84 m^2 (9 ft^2), or fraction thereof, of the countertop or work surface.
- A receptacle outlet shall be provided for every additional 1.7 ^{2} (18 ft^2), or fraction thereof, of the countertop or work surface.
- (b)At least one receptacle outlet shall be located within 600 mm (2 ft) of the outer end of a peninsular countertop or work surface.
- Additional required receptacle outlets shall be permitted to be located as determined by the installer, designer, or building owner.

69

44 answer cont,

- IF this is 'flat' these rules apply, however if there is a 'Wall' or bump up area like a wall, then the regular 2'-4' wall spacing applies per 210.52(C)1



70

Question 45

With new elevator systems that have all the solid-state controls in the door, does the area around that door have to comply with 620.23?

[Don Iverson]

Answer: Yes. 620.22(A) Car Light Receptacles, Auxiliary Lighting, and Ventilation.

A separate branch circuit shall supply the car lights. The car lights branch circuit shall be permitted to supply receptacles, accessory equipment (alarm devices, alarm bells, monitoring devices not part of the control system), auxiliary lighting power source, and ventilation on each elevator car or inside the operation controller. The overcurrent device protecting the branch circuit shall be located in the elevator machine room, control room, machinery space, or control space. Where there is

71

Question #45 (Cont.)

The overcurrent device protecting the branch circuit shall be located in the elevator machine room, control room, machinery space, or control space. Where there is no machine room, control room, machinery space, or control space outside the hoistway, the overcurrent device shall be located outside the hoistway and accessible to qualified persons only.

72

Question 47

Some jurisdictions require that holes drilled in floor joists for the installation of wiring must be drilled in the center third of the joist and in the outside third of the joist span – no holes in the middle third of the span. Is this an actual Building Code requirement that everyone should be following

[Answer]

- This is a building code requirement

73

Question 48

Does the 6’7” maximum height requirement for “Readily Accessible” found in Art. 240.24 (A) apply to the disconnect switch contained in PV Inverters?

[Steve Froemming]

74

48 answer, 690.15 Isolating Equipment

NO, Inverters needs to be ‘isolated’ by device or disconnecting means.

690.15(A) Location

- Within the equipment or
- Within sight and 10’ or
- Remotely as long as you can actuate that within 10’ of the equipment
- Note 690.13 ‘system disc.’ must be readily accessible
- **240.24(A) is for switched fuses and breakers and doesn’t require the 6’7” for supplementary OR when adjacent**

75

Question #49

I installed a 1 ¼” fitting for my AC installation. The inspector wants a plastic bushing installed. Why did he not ask for a ground bushing, and for what reason does he require a bushing anyway?

[Don Iverson]

Answer: With the information provided in the question I suspect the conductors were #4 AWG or larger which triggers a requirement in Article 300.4 (G).

300.4(G) Fittings.

Where raceways contain 4 AWG or larger insulated circuit conductors, and these conductors enter a cabinet, a box, an enclosure, or a raceway, the conductors shall be protected in accordance with any of the following: **See next Slide**

76

Question #49 (Cont.)

(1)An identified fitting providing a smoothly rounded insulating surface

(2)A listed metal fitting that has smoothly rounded edges

(3)Separation from the fitting or raceway using an identified insulating material that is securely fastened in place

(4)Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure, or raceway providing a smoothly rounded or flared entry for conductors

Conduit bushings constructed wholly of insulating material shall not be used to secure a fitting or raceway. The insulating fitting or insulating material shall have a temperature rating not less than the insulation temperature rating of the installed conductors.

77

Question 50

210.8 (A)(1) GFCI protection for outlets in bathrooms. Once you have met the required 20-amp circuit can you add an additional 15-amp circuit to the bathroom as long as the receptacles are GFCI protected?

Section 210.8(A)(1) requires GFCI protection for bathrooms and the question is regarding the 20-amp bathroom circuit requirement of 210.11(C)(3) which was revised in the 2020 code. The 20-amp circuit requirement only applies to receptacles installed that are required by 210.52(D) for countertop and worksurface receptacles. If a 15-amp circuit is feeding other receptacles, it is permitted by this change.

210.11(C)(3) 210.52(D) **[David Williams]**

78

Question 51

Are the branch circuit conductors feeding an EV Charger, rated 80 Amps on the Nameplate, required to be full sized? Even though the installer/ owner can internally select a lesser ampacity charging output based on the vehicle charging requirements.

[Answer]

625.42 Shall be sized for the maximum load permitted.

79

Question 52

We have a 45 KVA transformer installed above a lay in tile ceiling, is a light required?

[Steve Froemming]

80

52 answer, NO mostly

- Not required by 110.26 as not a service, switchboard, switchgear, panelboard, motor control center.
- Not required by 210.70(C) as not an attic, underfloor space, utility room or basement
- Not mentioned in 450
- **BUT** 110.34(D) would require illumination if over 1000v and likely to need service, exam, maintenance or adjustment while energized, **BUT** then it needs to be readily accessible per 450.13

81

Question #53

Is an individual branch circuit required for cord-connected range hood?

[Don Iverson]

Answer: Yes. 422.16(B)(4) Range Hoods and Microwave Oven/Range Hood Combinations.

Range hoods and over-the-range microwave ovens with integral range hoods shall be permitted to be cord-and-plug-connected with a flexible cord identified as suitable for use on range hoods in the installation instructions of the appliance manufacturer, where all of the following conditions are met:

(1) The length of the cord is not less than 450 mm (18 in.) and not over 1.2 m (4 ft).

(2) Receptacles are located to protect against physical damage to the flexible cord.

(3) The receptacle is supplied by an individual branch circuit.

(4) The receptacle shall be accessible.

(5) The flexible cord shall have an equipment grounding conductor and be terminated with a grounding-type attachment plug.

82

[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: Tom Moore (Contact Name)
Organization: IAEI Akron Division (Organization/Company)
Address: 3462 Brunk Road (Include Room Number, Suite, etc.)
City: Akron State: OH Zip: 44312
E-Mail: tmoore1767@aol.com
Telephone: (330) 289-7932 Fax:
Course Sponsor: Akron Div. IAEI

COURSE INFORMATION:

Course Title: Most Unanswered NEC Code Questions Lesson 6 of 6

New Course Submittal: [X] Update Course: [ ] Prior Approval Number:

Purpose and Objective: Power Point presentation with illustration of the most unanswered NEC code questions and answers. Upon completion of this interactive class attendees will view illustrated questions, answers and substantiation of some of the most questionable interpretations of of the NEC. This presentation is based on submitted questions to the Western Section IAEI as answered by known national NEC experts who are members of different NEC Code Panels. Each question and answer will be fully discussed to improve knowledge and show substantiation for the code rule(s).

Number of Instructional Contact Hours that can be obtained upon completion: 6 Separate Sessions (2 hrs for each session)

If Multi-Session, Number of Instructional Contact Hours Per Session: 2

Program Applicable for the Following Participants:

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

Res Bldg Official [X] Res Plans Exam [X] Res Bldg Inspector [ ] Res Plumbing Inspector [ ] Res IU Inspector [ ]
Res Mechanical Inspector [ ]

Electrical Safety Inspectors [X]
Electrical Safety Inspector Trainee Part I - Fundamentals of Electricity (Theory) [ ]
Electrical Safety Inspector Trainee Part II – ESI Refresher Course [ ]
Location of ESI Course: 501 Kelly Ave. Akron, Ohio 44306 Date(s) of ESI Course(s): July 27, 2021

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 if 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:		

RECEIVED FEB 1 REC'D Board of Building Standards

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

Form 1505

Title of Course: ***Most Unanswered NEC Code Questions***

Course Syllabus:

Topic Outline for Course

Reference	Subject	Date
Lesson 1 of 6	NEC Article 90 & Chapter 1	Feb. 23, 2021
Lesson 2 of 6	NEC Chapter 2	March 23, 2021
Lesson 3 of 6	NEC Chapters 3 & 4	April 27, 2021
Lesson 4 of 6	NEC Chapters 5 & 6	May 25, 2021
Lesson 5 of 6	NEC Chapters 7 & 8	June 22, 2021
Lesson 6 of 6	NEC Chapter 9 & Annexes	July 27, 2021

Course Description: This is an extensive and interactive program of some of the most unanswered code questions submitted by electricians from across the mid region of the country. The answers and slides were developed by NEC Code Panel Members, recognized as some of the most well-known NEC experts. This four-part PowerPoint presentation contains full-color slides that illustrate and clearly identifies and explains these answers. These interpretations will assist in promoting uniform interpretations. This class will promote uniformity based on the most common code questions and will include interactive discussion.

Course Objective: Upon completion of the class attendees will have the substantiation of and unanswered questions related to many of to the NEC questions. Additionally, a power point presentation and discussion will be presented on the most common electrical inspection code interpretations.

Method of Presentation: **Microsoft PowerPoint ®**

Tom Moore

Tom Moore, Akron Ohio, is past President of the IAEI Western Section, Ohio Chapter and Akron Division. Tom presently Serves on the IAEI IO Board of Directors, Assistant Secretary/Treasurer of the Western Section IAEI' President and Membership Chair of the Akron Division IAEI. He has been involved in the inspection industry since 1987 and the electrical industry for over 39 years. Has recently retired as the Assistant Building Commissioner with the City of Beachwood Ohio. And presently back-up electrical/building inspector with the City of Stow.

Tom is very active in the IAEI where he has represented the IAEI on NEC CMP 11 for the 2005, 2008, and 2011code cycles and previously CMP 5 for the 2002 Code Cycle. Currently Tom is Chair of CMP 16 for the 2014, 2017, 2020 and CMP 9 for the 2023 code cycles. Tom also serves on NFPA 915 (Remote Video Inspections). Tom was also a member of the first item writing committee for the IAEI/CEI Electrical Inspector Exam.

Tom is presently the Assistant Secretary/Treasurer of the West4ern Section IAEI. In addition to the past Western Section President, he has served as a member of the Ohio Chapter Board of Directors for 20 years as the Ohio Chapter Representative to the Western Section for 18. Tom has served two terms as Ohio Chapter President and multiple committees Chairman of the Ohio Chapter Code Clearing Committee and Public Relations Committee. He serves as President and Membership Chairman of the Akron Division IAEI. He was one of two IAEI members appointed by the Governor of the State Ohio to the NEC Ad-Hoc Committee for successful adoption of the 2008 NEC.

Tom is a member of IBEW Local 306, where for the past 24 years has been a NJATC Apprenticeship Instructor along with Journeyman Training Instructor.

National Electrical Code Forum

Your Questions Answered

Code Panel #1

1

Question 1

Is it permissible to bury EMT in the earth?

[Ray Horner]

2

Answer

- Yes, Article 358.10(B)(1) States that Galvanized EMT Elbows and fittings shall be permitted to be installed in concrete, in direct contact with the earth and in areas subject to sever corrosive influences where protected by corrosion protection and approved as suitable for the condition. Column 3 of table 300.5 covers other raceways and is used as the depth for EMT.
- 358.10 also allows EMT to be used in Wet Locations. One area classified as a wet location is underground.
- The UL 797 standard states that Aluminum EMT intended to be direct buried in the earth requires a supplementary corrosion protection.
- Direct Contact with earth is used for all the steel raceways to show that it can be in direct contact with the earth either from directly burying the conduit/tubing or it emerging through the earth after being encased in concrete.

3

Question 2 Equipotential Bonding Conductor

Should the equipotential bonding grid be extended to the ground bar in a panel installed just for pool equipment? If this panel is mounted on a 6x6 post is this considered another structure? Would I set up a grounding electrode system at the pool panel?

Answer a. Not required to	**680.26(B)**
b. No	**Article 100 Structure**
c. Not Required	**250.32**

[Tom Moore]

4

Equipotential Bonding Conductor(Continued)

- 680.23(B) The parts specified in 680.26(B)(1) through (B)(7) shall be bonded together using solid copper conductors, insulated covered, or bare, not smaller than 8 AWG or with rigid metal conduit of brass or other identified corrosion-resistant metal. Connections to bonded parts shall be made in accordance with 250.8. An 8 AWG or larger solid copper bonding conductor provided to reduce voltage gradients in the pool area shall not be required to be extended or attached to remote panelboards, service equipment, or electrodes.

5

Equipotential Bonding Conductor(Continued)

Article 100 "Structure"

That which is built or constructed, other than equipment.

6

Question 3

The 2020 NEC now has a zone near the tub and shower where a receptacle cannot be installed. Can you explain how this is going to work in a small bathroom?

[Keith Lofland]

7

Keith Lofland

Question 3 Answer:

Answer: The key to applying this new bathroom receptacle placement rule is the new exception at 406.9(C).

Code Reference: 406.9(C) and Exception, 210.52(D)

8

406.9(C) Bathtub or Shower Stall Restricted "Zone" (Receptacles)

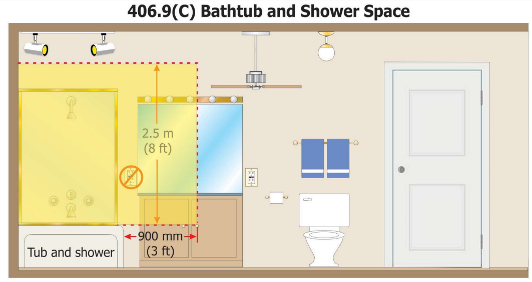
- Receptacle outlet(s) located in the area around a **bathtub or shower stall** have been revised to include a **restricted "zone"** similar to luminaires in said areas with an exception added for smaller space bathrooms
- Receptacles are now prohibited from being installed within a zone measured **900 mm (3 ft) horizontally** and **2.5 m (8 ft) vertically** from the top of the bathtub rim or shower stall
- In bathrooms with dimensions less than the required zone, receptacle(s) are permitted to be installed opposite the bathtub rim or shower stall threshold on the **farthest wall within the room**
- Previous language at 406.9(C) stated that receptacles were not be installed "within or directly over a bathtub or shower stall"
- This language was **vague** leading to **confusion** and **inconsistent interpretation** as to what defined the bathtub or shower stall "area"

9

Question 3 Answer:

Keith Lofland

406.9(C) Bathtub and Shower Space



Receptacles shall not be installed 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.

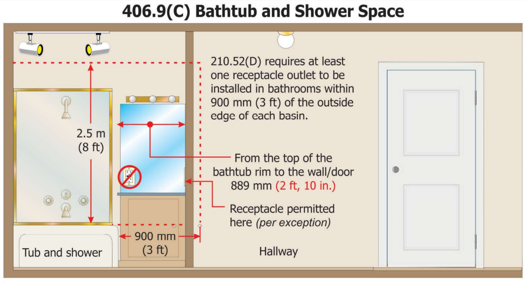
Exception: In bathrooms with less than the required zone the receptacle(s) permitted to be installed opposite the bathtub rim or shower stall threshold on the farthest wall within the room.

10

Question 3 Answer:

Keith Lofland

406.9(C) Bathtub and Shower Space



Receptacles shall not be installed 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.

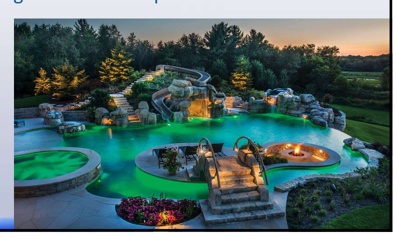
Exception: In bathrooms with less than the required zone the receptacle(s) permitted to be installed opposite the bathtub rim or shower stall threshold on the farthest wall within the room.

11

Question 4

My pool has a light installed in it, but it doesn't provide enough illumination around the deck. I need to light up my barbeque, ping pong table, and wet bat. I want lights installed on the screen enclosure directly above the pool so I can host parties. My neighbor said it was OK to put lights any place I wanted. I met a guy at the local hardware store that said that if he didn't get an electrical permit then the lights can go anywhere I wanted but if he got an electrical permit then there would be limitations to where the lights can go. I'm totally confused at this point. Can I or can't I put lights above my pool?

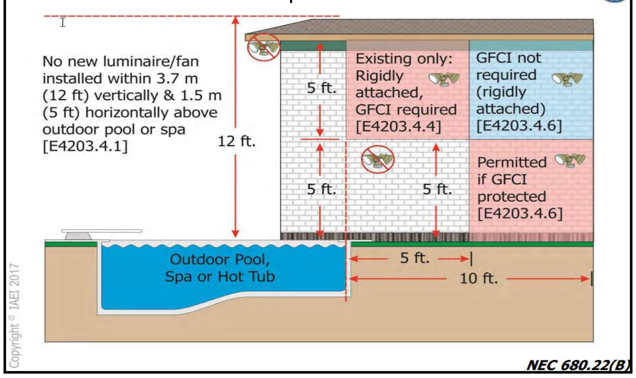
[Dean Hunter's Pool]



12

Question 4

Answer: Yes - you may put lights up, but there are restrictions and requirements in the NEC.



13

Question 4

Reference: 680.22(B) Luminaires, Lighting Outlets, and Ceiling-Suspended (Paddle) Fans.

680.22(B)(1) New Outdoor Installation Clearances.

Over and within 5' horizontally from the edge of the pool the luminaires shall be installed at a height not less than 12 ft above the maximum water level of the pool.

680.22(B)(3) Existing Installations.

Over and within 5' horizontally from the edge of the pool the luminaires shall be installed at a height not less than 5 ft above the maximum water level of the pool, and shall be GFCI protected.

14

Question 4

References cont.: 680.22(B) Luminaires, Lighting Outlets, and Ceiling-Suspended (Paddle) Fans.

680.22(B)(4) GFCI Protection in Adjacent Areas.

Luminaires, lighting outlets, and ceiling-suspended (paddle) fans installed in the area extending between 5 ft and 10 ft horizontally from the inside walls of a pool shall be protected by a ground-fault circuit interrupter unless installed not less than 5 ft above the maximum water level and rigidly attached to the structure adjacent to or enclosing the pool.

15

Question 4

References cont.: 680.22(B) Luminaires, Lighting Outlets, and Ceiling-Suspended (Paddle) Fans.

680.22(B)(6) Low-Voltage Luminaires.

Listed low-voltage luminaires not requiring grounding, not exceeding the low-voltage contact limit, and supplied by listed transformers or power supplies that comply with 680.23(A)(2) shall be permitted to be located less than 5 ft from the inside walls of the pool.

16

Question 4

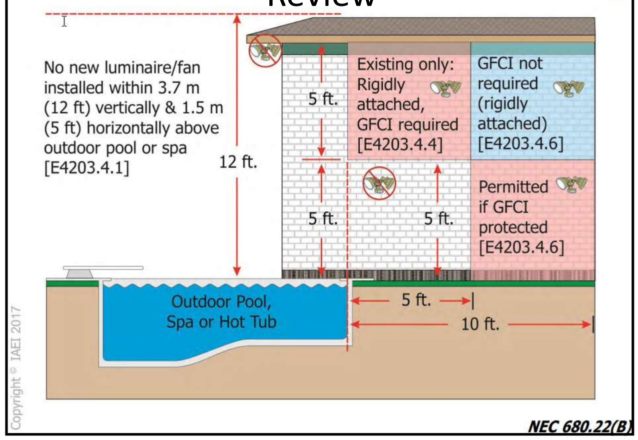
References cont.: 680.22(B) Luminaires, Lighting Outlets, and Ceiling-Suspended (Paddle) Fans.

680.22(B)(8) Measurements.

In determining the dimensions in this section addressing luminaires, the distance to be measured shall be the shortest path an imaginary cord connected to the luminaire would follow without piercing a floor, wall, ceiling, doorway with hinged or sliding door, window opening, or other effective permanent barrier.

17

Review



NEC 680.22(B)

18

Question 5

The NEC requires metal piping to be bonded. The NFPA requires that a fire sprinkler pipe not be used as a grounding electrode conductor. Then must the fire sprinkler pipe be bonded, and if so where?

[Ray Horner]

19

Answer – Fire Sprinkler Systems

- Yes, the Fire Sprinkler system is required to be bonded.
- How depends on the classification.
  - Larger systems that contain jockey pumps, controls, etc. or an air compressor for a dry system it would fall under “other metal piping” Likely to become energized and would fall under 250.104(B). This will be bonded by the EGC feeding the equipment and will be sized per 250.122.

20

Answer – Fire Sprinkler Systems Cont.

- If it is a smaller system with no electrical equipment, then you would bond it in accordance with 250.104(A)(1) and the EGC would be sized in accordance with 250.102

21

Question 6

Do receptacles near aquariums in a pet or bait and tackle store require GFCI protection?

[Tom Moore]

22

Equipotential Bonding Conductor(Continued)

- 680.23(B) The parts specified in 680.26(B)(1) through (B)(7) shall be bonded together using solid copper conductors, insulated covered, or bare, not smaller than 8 AWG or with rigid metal conduit of brass or other identified corrosion-resistant metal. Connections to bonded parts shall be made in accordance with 250.8. An 8 AWG or larger solid copper bonding conductor provided to reduce voltage gradients in the pool area shall not be required to be extended or attached to remote panelboards, service equipment, or electrodes.

23

Equipotential Bonding Conductor(Continued)

Article 100 "Structure"

That which is built or constructed, other than equipment.

24

Question 7

Several micro-breweries are springing up in the area. I have some concern over the grain handling process which can be rather dusty and combustible. Would any of these areas likely be considered a class II location?

[Keith Lofland]

25

Question 7

Several micro-breweries are springing up in the area. I have some concern over the grain handling process which can be rather dusty and combustible. Would any of these areas likely be considered a class II location?

[Keith Lofland]

26

Keith Lofland

Question 7 Answer:

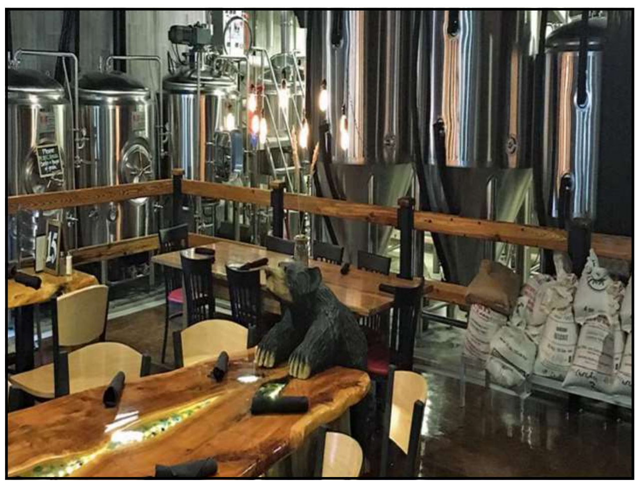
Answer: Yes, No, Maybe?

Will they be milling their own grains or using a pre-packaged grains or malted liquid extract product? Unless the micro-brewery is milling their own grains, it would probably not be classified as a Class II area.

Who determines the electrical area classification *(EAC)* of an electrical installation? ***It is not the AHJ's job to determine electrical area classification (EAC). It is the AHJ's job to enforce appropriate NEC rules once the EAC has been determined.***

Code Reference: 500.5(C), Article 502

27



28

Question 8

Does a 40-ampere 240-volt range receptacle located 5ft from the edge of a sink in a dwelling unit kitchen require GFCI protection in the 2017 NEC? Did this change in 2020?

[Dean Hunter]

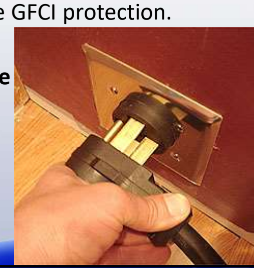
29

Question 8

Answer: In the 2017 NEC, No GFCI protection is required.

Reference: 210.8(A) All 125 volt 15 & 20 ampere receptacles installed in the locations specified in 210.8(A)(1) through (10) shall have GFCI protection.

The 40 ampere 240-volt receptacle outlets would not require GFCI protection.



30

Question 8

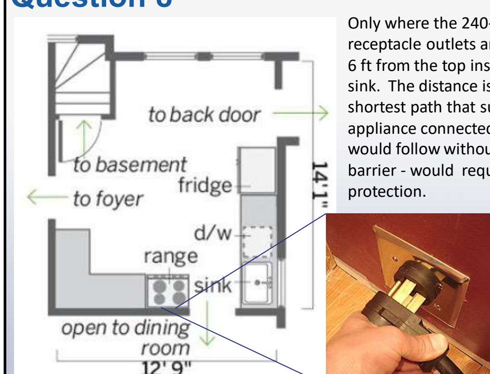
Answer: 2020 NEC, Maybe, but not likely.

Reference: 210.8(A) All 125-volt through 250-volt receptacles installed in the locations specified in 210.8(A)(1) through (A)(11) and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel.

Only where the 240-volt range receptacle outlets are installed within 6 ft from the top inside edge of the sink. The distance is measured as the shortest path that supply cord of an appliance connected to the receptacle would follow without piercing a fixed barrier - would require GFCI protection.

31

Question 8



Only where the 240-volt range receptacle outlets are installed within 6 ft from the top inside edge of the sink. The distance is measured as the shortest path that supply cord of an appliance connected to the receptacle would follow without piercing a fixed barrier - would require GFCI protection.

32

Question 9

NM and SE cables are generally considered to be fixed wiring methods and securing is typically required close to the termination point. If that statement is true, would open NM cable be permitted to extend out of a wall to an appliance such as a dishwasher or disposal without being secured?

[Ray Horner]

33

Answer- NM/SE Cable Support

- The Securing and Supporting requirements of NM Cable (334.30) does not permit NM cable to extend out of a wall to an appliance such as a dishwasher or disposal without being secured. I would also add that the NM needs protection where exposed to physical damage, as is certainly the case for the disposal and possibly the dishwasher.

34

Question 10 Sign Disconnects

The sign I'm wiring is so big I'm going to have to run a feeder to it and install a sub-panel. Do I need a disconnect external to the sign or not?

Answer: No

Code Reference: 600.6(A)(1) – 680.5(D)(3)

[Tom Moore]

35

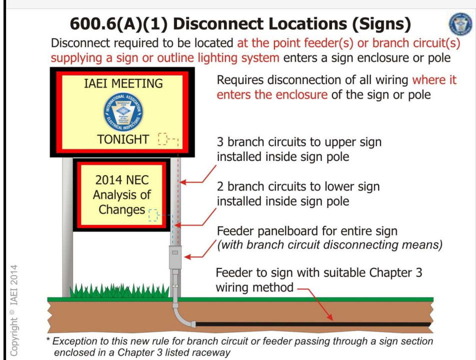
Sign Disconnect Continued

Assuming the proposed feeder panel would be mounted on a sign pole it would be code compliant to install the branch circuits inside the pole as permitted by 600.5(D)(3). This also satisfies the requirements found in 600.6(A)(1)

600.5(D)(3) Metal or nonmetallic poles used to support signs shall be permitted to enclose supply conductors, provided the poles and conductors are installed in accordance with 410.30(B).

600.6(A)(1) The disconnect shall be located at the point the feeder circuit or branch circuit(s) supplying a sign or outline lighting system enters a sign enclosure, a sign body, or a pole in accordance with 600.5(D)(3). The disconnect shall open all ungrounded conductors where it enters the enclosure of the sign or pole.

36



37

Question 11

The NEC requires a laundry circuit for the receptacle required in a laundry area. If the single-family dwelling does not have a laundry area, then does the code require a dedicated circuit anywhere I chose?

[Keith Lofland]

38

Question 11

The NEC requires a laundry circuit for the receptacle required in a laundry area. If the single-family dwelling does not have a laundry area, then does the code require a dedicated circuit anywhere I chose?

[Keith Lofland]

39

Keith Lofland

Question 11 Answer:

- **Answer:** No, not where you choose.
- AHJ should request (require) builder to designate a “laundry area” somewhere in the dwelling (closet, etc.).

Code Reference: 210.11(C)(2), 210.52(F), 210.50(C)

40

41

42

Question 12

If I connect my grounding electrode conductor to the rebar in the concrete on a wood framed house, is a ground rod also required? What if there is a plastic vapor barrier that separates the concrete from touching the soil?

[Dean Hunter]

43

Question 12

Answer: No, if it is determined that the rebar is considered a concrete encased electrode meeting the conditions of 250.52.(A)(3).

- 250.53(A)(2) only requires rod, pipe and plate electrodes to be supplemented by an additional electrode of a type specified in 250.52(A)(2) through (A)(8)
- 250.53(D)(2) requires a metal underground water pipe shall be supplemented by an additional electrode of a type specified in 250.52(A)(2) through (A)(8).

(Note: a metal underground water pipe is not recognized as a supplemental electrode by the code.)

44

Question 12

Answer cont.: When a plastic vapor barrier is installed it does not qualify as a concrete encased electrode because the concrete is not in direct contact with the earth. See 250.52(A)(3)(2) and the informational note following. A grounding electrode would be required in accordance with 250.50.

References: 250.50, 250.52(A) and 250.53

45

Question 13

I understand that the 2017 NEC allows type TC cable for interior wiring. We have seen people try to use this cable as they would nm cable for mini splits and things like that.(Question 1) Will this be a straight up substitution for nm in the 2017 code?(Question 2)

[Ray Horner]

46

Answer- TC Cable for Interior wirign

- Yes, TC cable rated TC-ER that is permitted for specific occupancies and for specific uses for applications requiring both power and control circuits within the same cable. i.e. Generators and Mini-split where power and control circuits are required
- Yes, if the TC Cable has both power and control conductors and used for applications as discussed in first part of the question and except where installed through structural members. The cable must be additional rated "JP" for joist pull performance when pulling through structural members.

47

Question 14

When performing a residential load calculation, how is an electric vehicle charging system calculated in this process? What if I have more than one charger?

[Tom Moore]

48

Question 14 EV Load Calculations

When performing a residential load calculation, how is an electric vehicle charging system calculated in this process? What if I have more than one charger?

Answer: Nameplate rating of each charger at 125% with demand factors where permitted.

Code Reference: 220.3 Other Articles for Specific-Purpose Calculations.

220.82(B)(3)(a) Optional Calculation

220.14(A) Standard Calculation

625.41 Overcurrent Protection

[Tom Moore]

49

EV Load Calculations Continued

- Table 220.3 provides references for specific-purpose calculation requirements not located in Chapters 5, 6, or 7 that would amend or supplement the requirements of article 220. This table does not reference EV changers.
- There are no load calculation requirements found in Article 625.
- Section 220.14(J) for other loads would not permit inclusion of such loads to be included in the 3 volt-amps/ft^2.
- Section 220.14(A) requires calculation to be based on the ampere rating of the appliance or load served.

50

Question 15

I just won the bid to wire a manufacturing facility where they do a lot of custom welding. It will have 10 individual welding stations, each with its own welder. The plans show 2 runs of cable tray down the factory floor. One for general use branch circuit wiring and the other to handle all the welding cables. I plan on running one cable tray for all the wiring, thus saving me time and money. Am I good to go?

[Keith Lofland]

51

Question 15

I just won the bid to wire a manufacturing facility where they do a lot of custom welding. It will have 10 individual welding stations, each with its own welder. The plans show 2 runs of cable tray down the factory floor. One for general use branch circuit wiring and the other to handle all the welding cables. I plan on running one cable tray for all the wiring, thus saving me time and money. Am I good to go?

[Keith Lofland]

52

Keith Lofland

Question 15 Answer:

Answer: **No**. Two separate cable trays required.

Code Reference: 630.42, 300.21

53

630.42 Welding Cable Installation

Cables shall be permitted to be installed in a ***dedicated cable tray*** as provided in 630.42(A), (B) , and (C).

(A) Cable Support. The cable tray shall provide support at not greater than 150-mm (6-in.) intervals.

(B) Spread of Fire and Products of Combustion. The installation shall comply with 300.21.

(C) Signs. A permanent sign shall be attached to the cable tray at intervals not greater than 6.0 m (20 ft). The sign shall read as follows:

CABLE TRAY FOR WELDING CABLES ONLY

54

55

Question 16

The interior of a panelboard got a little overspray from the drywall installation. How do we determine what to do with the panel interior?

[Dean Hunter]

56

Question 16

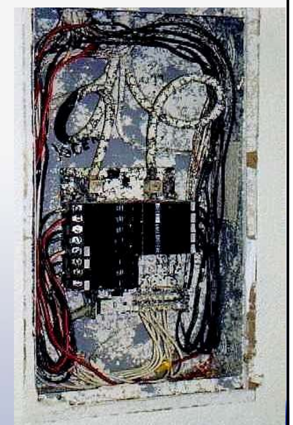
Answer: The contaminated parts of the panelboard will need to be replaced unless manufacturing instructions give direction as to how they are to be cleaned. Contaminated components will result in improper connection of stab-in/bolt-in circuit breakers contacts with the busbar, which may cause unwanted heating.

57

Question 16

References: 110.11 Deteriorating Agents.

Unless identified for use in the operating environment, no conductors or equipment shall be located in damp or wet locations; where exposed to gases, fumes, vapors, liquids, or other agents that have a deteriorating effect on the conductors or equipment; or where exposed to excessive temperatures.



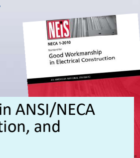
58

Question 16

References: 110.12 Mechanical Execution of Work.

(B) Integrity of Electrical Equipment and Connections.

Internal parts of electrical equipment, including busbars, wiring terminals, insulators, and other surfaces, shall not be damaged or contaminated by foreign materials such as paint, plaster, cleaners, abrasives, or corrosive residues. There shall be no damaged parts that may adversely affect safe operation or mechanical strength of the equipment such as parts that are broken; bent; cut; or deteriorated by corrosion, chemical action, or overheating.



Informational Note: Accepted industry practices are described in ANSI/NECA 1-2015, Standard for Good Workmanship in Electrical Construction, and other ANSI-approved installation standards

59

Question 17

As an inspector, I am not sure how the new requirements in 680.21(D) can be enforced. Can you go over the new requirements and your thoughts on enforcement? **[Ray Horner]**

60

Answer- 680.21(D)

- Section 680.21(D) states "Where a pool pump motor in 680.21(C) is replaced for maintenance or repair, the replacement pump motor shall be provided with ground-fault circuit-interrupter protection"
- The intent of this rule was to ensure that outlets supplying the replacement pump are provided with Class A ground fault circuit interrupter protection. The intent of the rule was not meant to require the pump to have built in protection, so you are looking for the outlet to have GFCI protection.

61

Question 18

I have been seeing job specifications calling for automatic receptacle control and energy monitoring in certain buildings. Where are these requirements coming from?

[Tom Moore]

62

Question 18 Energy Management

I have been seeing job specifications calling for automatic receptacle control and energy monitoring in certain buildings. Where are these requirements coming from?

Answer: Initially the model energy codes ASHRAE 90 or IECC

Code Section: 406.3(E) Controlled Receptacle Marking

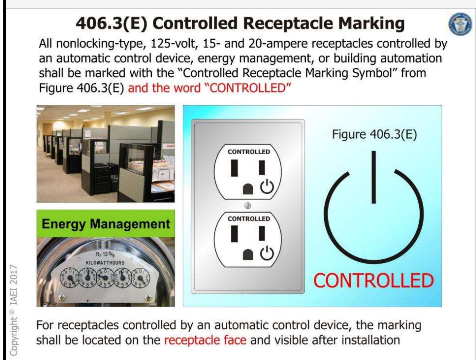
[Tom Moore]

63

Energy Management Continued

Most all buildings are now required to comply with a model energy code. We see more effects of these systems in the NEC. One very significant revision is in Section 220.12 where the volt-amps/ft^2 loads are reduced based on different types of occupancies. This would typically require an energy management system of some sort. If receptacles are part of these systems, the user needs to be aware that the receptacle could be load shedding. The additional requirement in the next slide of "controlled" removes any misunderstanding that might not be understood by the end user.

64



65

Question 19

I heard at my supply house that I will be required to install Surge Protection on the homes that I wire with the 2020 NEC®. What are the new requirements for new homes? What if I replace/upgrade a service?

[Keith Lofland]

66

Question 19

I heard at my supply house that I will be required to install Surge Protection on the homes that I wire with the 2020 NEC®. What are the new requirements for new homes? What if I replace/upgrade a service?

[Keith Lofland]

67

Keith Lofland

Question 19 Answer:

Answer: **Yes**, whole-house surge protection is required at dwelling units with the 2020 *NEC*.

Yes, this would apply to a service replacement/upgrade at an existing dwelling unit.

Code Reference: 230.67

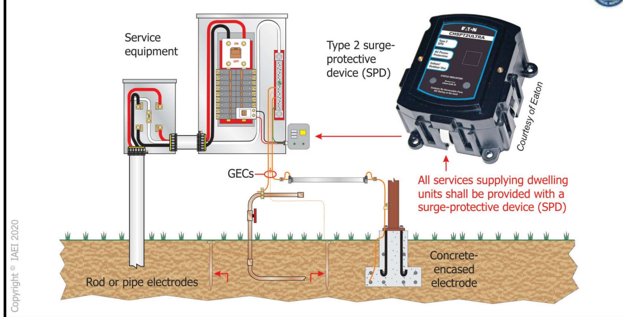
68

230.67 Surge Protection

- New requirement added for **surge protection** on all **services at dwelling units**
- The surge protection device (SPD) must be an **integral part of the service equipment** or **located immediately adjacent to the service equipment**
- Exception permits alternate location provided an SPD is located at **each next level distribution equipment** downstream toward the load
- This SPD required to be either a **Type 1** or **Type 2** SPD
- Applies to **replacement** of residential service equipment as well

69

230.67 Surge Protection for Dwelling Units



70

Question 20

An electrical equipment room contains equipment rated 800 amperes or more. Are there any special requirements included in the NEC for the doors and hardware? Does this change at 1200 amperes? Are there any changes in the 2020 NEC regarding this?

[Dean Hunter]

71

Question 20

Answer: Yes, there are requirements in 110.26(C)(3) for door(s) and hardware intended for entrance to and egress from the working space that are less than 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

Note: In the 2017 NEC, the current threshold was dropped from the 1200 amps and lowered to 800 amps.

In the 2020 NEC, 110.26(C)(3) "or listed fire exit hardware" was added.

72

Question 20

References: 110.26(C)(2) and (C)(3)

110.26(C)(3) Personnel Doors less than 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

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 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.

73

Question 21

There are general purpose receptacles, subpanel, snap switches, light fixtures, and an exhaust fan in a pool equipment room that is considered a corrosive area. Section 680.14 wiring methods be listed and identified for the corrosive area. Does the equipment previously mentioned require any corrosive listings also?

[Ray Horner]

74

Answer – Pool Equipment Room

- No, the equipment room itself is required to have drainage that prevents water accumulation according to 680.12. The room also should have proper ventilation in accordance with ANSI/APISP -11 to reduce the accumulation of corrosive vapers and help protect the receptacles, subpanel, snap switches, light figures and exhaust from corrosion and this equipment isn't considered to be "wiring methods" so 680.14 doesn't apply.

75

Question 22

What is this Fire Fighter Disconnect for residential that I am hearing about? 230.85 of the 2020 version of the NEC permits equipment that is marked suitable for use as service equipment on the supply side of the service disconnect to be labeled as emergency disconnect not service equipment. When would I use this allowance and do I have to bring the GEC into this enclosure? Do I bond neutral to EGC there?

[Tom Moore]

76

Question 22 Emergency Service Disconnect

What is this Fire Fighter Disconnect for residential that I am hearing about? 230.85 of the 2020 version of the NEC permits equipment that is marked suitable for use as service equipment on the supply side of the service disconnect to be labeled as emergency disconnect not service equipment. When would I use this allowance and do I have to bring the GEC into this enclosure? Do I bond neutral to EGC there?

Answer: See following slides

Code Reference: 230.85 Emergency Disconnects (NEW)

230.82 Equipment Connected to the Supply Side of Service Disconnect

[Tom Moore]

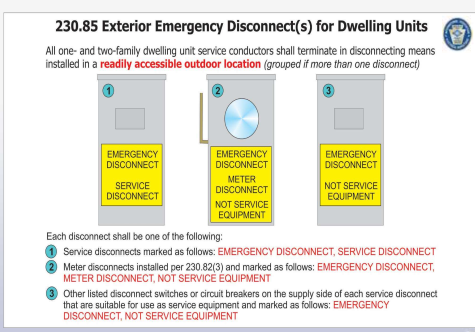
77

Emergency Service Disconcert Continued

a. Section 230.85 is new and requires an emergency disconnect outdoor at a readily accessible location for all dwelling units. The main purpose is for first responders to safely disconnect the power during an emergency situation such as a fire, gas leak, structural damage, flooding, etc.

b. & c. Section 230.82(10) Permits Emergency disconnects in accordance with 230.85, are permitted to be installed on the line side of service equipment if all metal housings and service enclosures are grounded in accordance with Part VII and bonded in accordance with Part V of Article 250.

78



79

Question 23

At a boat dock on the river, the wiring for lighting and two GFCI protected receptacles is installed in schedule 80 PVC with 12/3 AWG w/G UF cable pulled through the PVC for added protection. Is this legal?

[Keith Lofland]

80

Question 23

At a boat dock on the river, the wiring for lighting and two GFCI protected receptacles is installed in schedule 80 PVC with 12/3 AWG w/G UF cable pulled through the PVC for added protection. Is this legal?

[Keith Lofland]

81

Keith Lofland

Question 23 Answer:

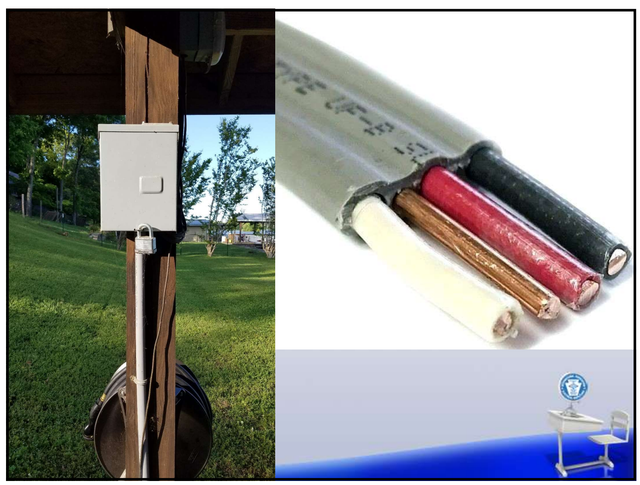
Answer: **NO**, not a legal installation.

Need an insulated EGC.

Code Reference: 300.5(B), 300.9, 352.22, 340.12, 555.34(B)(4), 555.37(B)

82

83



84

Question 24

Are receptacle outlets required to be installed above a built-in desk located in the living room of a dwelling unit?

[Dean Hunter]

85

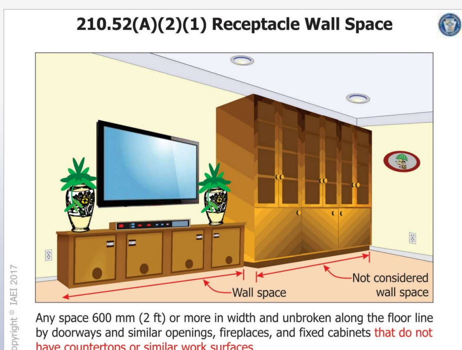
Question 24

Answer: There are no specific requirements for the receptacle to be above the built-in desk. However, a general receptacle would be required by section 210.52(A). The built-in desk would need to be included in the general provisions for wall space measurements that require receptacles specified in 210.52(A)(1) through (A)(4), specifically 210.52(A)(2)(1).

Reference: 210.52(A)

86

Question 24



87

Question 25

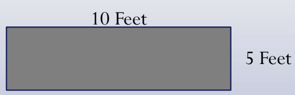
Can you explain the 2020 kitchen island requirements? 210.52(C)(2).

[Ray Horner]

88

Answer – Kitchen Island

- It is my understanding that on any island is required to have one receptacle for the first 9 ft^2 and then another receptacle for every 18ft^2 or fraction thereof.
- For Instance if you have a counter such as



89

Answer- Kitchen Island Cont.

- Area = Length multiplied by Width for Rectangle
- Area = 10 X 5
- Area = 50 ft^2
  - First receptacle is mandated for 9 ft^2 so we need at least 1 receptacle 50 ft^2 – 9 ft^2 = 41 ft^2
  - Now we need another receptacle for every 18 ft^2.
  - We would take 41 and divide it by 18 which gives us 2.27
  - Therefor we would need an additional 3 receptacles bringing the total for this island to 4 receptacles.

90

Question 26

Section 408.40 states "Where the panelboard is used with nonmetallic raceway or cable or where separate equipment grounding conductors are provided, a terminal bar for the equipment grounding conductors shall be secured inside the cabinet." Does this mean I cannot use multiple ground lugs and fasten them to the box?

[Tom Moore]

91

Question 26 Grounding of Panelboards

Section 408.40 states "Where the panelboard is used with nonmetallic raceway or cable or where separate equipment grounding conductors are provided, a terminal bar for the equipment grounding conductors shall be secured inside the cabinet." Does this mean I cannot use multiple ground lugs and fasten them to the box?

Answer: No

Code References(s): 408.40

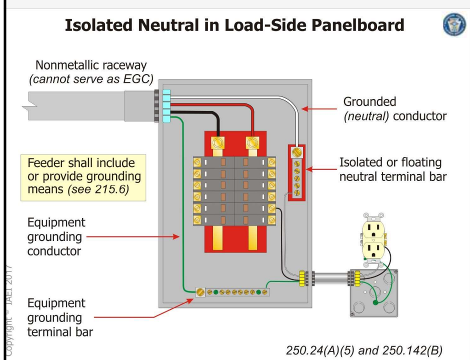
[Tom Moore]

92

Grounding of Panelboards Continued

Section 408.40 requires that Panelboard cabinets and panelboard frames, if of metal, shall be in physical contact with each other and shall be connected to an equipment grounding conductor. Where the panelboard is used with nonmetallic raceway or cable or where separate equipment grounding conductors are provided, a terminal bar for the equipment grounding conductors shall be secured inside the cabinet. All EGC's are required to be connected to the enclosure. Are multiple equipment grounding bars permitted yes. We need to follow the rules in 110.3(B) and 250.8.

93



94

Question 27

I recently installed a 120-volt circuit utilizing RMC to power a fuel pump that is mounted on top of a 300-gallon, metal diesel tank. The inspector left a correction requiring that I install seal-off fittings at the boundaries of the hazardous area. I have been told that diesel fuel is not a classified liquid and, therefore, seal-offs are not required. Your take?

[Keith Lofland]

95

Question 27

I recently installed a 120-volt circuit utilizing RMC to power a fuel pump that is mounted on top of a 300-gallon, metal diesel tank. The inspector left a correction requiring that I install seal-off fittings at the boundaries of the hazardous area. I have been told that diesel fuel is not a classified liquid and, therefore, seal-offs are not required. Your take?

[Keith Lofland]

96

Keith Lofland

Question 27 Answer:

Answer: As diesel fuel is typically not considered a Class I flammable liquid, seal-offs are typically not required *(unclassified area)*.

Having said that, if the AHJ says "Paint the conduits pink," your next option is to go buy some pink paint!

Code Reference: Article 100, Part III (Unclassified Locations) (Volatile Flammable Liquid)

97

98

99

Question 28

The Feeder and branch-circuit conductors that are installed on docking facilities shall be provided with GFPE set to open at currents not exceeding 100 milliamperes in the 2020 NEC. What exactly is this and how do I explain it to the counter guy at the supply house? Why can't I just use a GFCI breaker?

[Dean Hunter]

100

Question 28

Answer: First, the NEC is minimum safety standard for the electrical and you may exceed the requirements of the NEC anytime. This means that you could install a Class A GFCI (4-6 mA) breaker to meet the requirements of 555.35. However, this may lead to nuisance tripping. Many manufactures provide products (relays or circuit breakers) with various levels of GFPE protection, some of these products have means to adjust the level of sensitivity required.

Reference: 555.35

101

Question 29

Is it necessary for the AC disconnect of a PV system to be grouped with the service disconnect?

[Ray Horner]

102

Answer- AC Disconnect

- No, Section 690.13(A) states that the PV System disconnecting means shall be installed at a readily accessible location. Where disconnecting means of systems above 30V 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.
- Section 230.72 Grouping of Service disconnects makes no mention of PV AC disconnects being grouped with the service disconnect.

103

Question 30

I am adding a circuit breaker to an existing service installation that has 4 disconnects and no main. Do I have to now enforce the new barriers for this installation? Can I simply add the new breaker to the installation?

[Tom Moore]

104

Question 30 Service Equipment Barriers

I am adding a circuit breaker to an existing service installation that has 4 disconnects and no main. Do I have to now enforce the new barriers for this installation? Can I simply add the new breaker to the installation?

Answer: No

Code Section: 230.62

[Tom Moore]

105

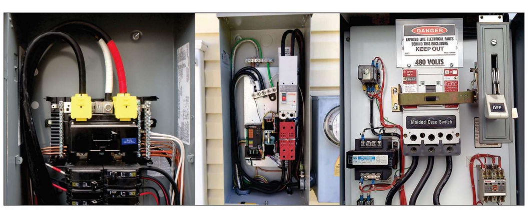
Service Equipment Barriers Continued

The NEC is not retroactive for the most part. While it is advisable to always check with the local AHJ. Nothing I 230.62(C) covering the barrier requirements in service equipment of an existing installation.

106

230.62(C) Service Equipment - Barriers

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



Service Panelboard | Transfer switches marked suitable for use as service equipment | Motor control center marked suitable for use as service equipment

107

Question 31

My inspector told me that I might have to put a bedroom outlet on GFCI if it is too close to the bathroom door. What is he talking about?

[Keith Lofland]

108

Question 31

My inspector told me that I might have to put a bedroom outlet on GFCI if it is too close to the bathroom door. What is he talking about?

[Keith Lofland]

109

Keith Lofland

Question 31 Answer:

Answer: See the parent text at 210.8 for measurement provisions to determine GFCI protection.

GFCI protection is not tied to how close the bedroom receptacle outlet is to the bathroom door, it has to do with how close the bedroom receptacle outlet is to the bathroom sink.

CMP-2 removed "door" and "doorway" from the list of obstacles that should not be measured through for the 2020 *NEC*.

Code Reference: 210.8

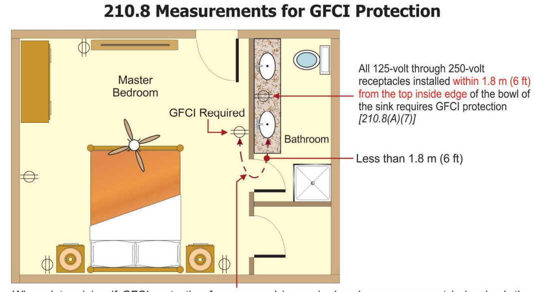
110

210.8 Measurements for GFCI Protection

- When determining if GFCI protection is required and a measurement is involved, the distance from a receptacle is required to be measured as the "shortest path" the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or the shortest path without passing through a ~~door, doorway, or~~ window
- Revision removed "**door**" and "**doorway**" from the list of obstacles that should not be measured through for this *Code* cycle
- A receptacle under the kitchen sink behind cabinet door for the garbage disposer will once again require 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 a sink requires GFCI protection *(including bedroom receptacles, etc.)*

111

210.8 Measurements for GFCI Protection



When determining if GFCI protection for personnel is required and a measurement is involved, the distance from a receptacle is required to be measured as the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or the shortest path without passing through a ~~door, doorway, or~~ window *[210.8]*

112

Question 32

Can you explain the new box fill calculations in article 314.16(B) (5)?

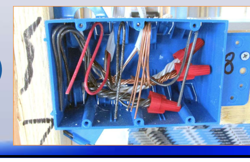
[Dean Hunter]

113

Question 32

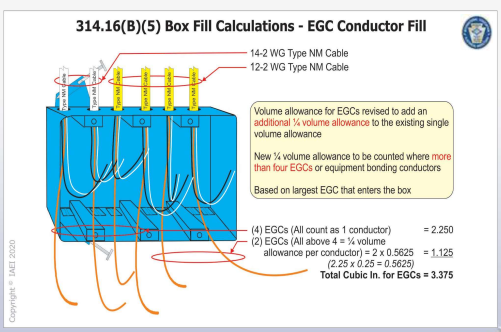
Answer: In previous code cycles we took only one volume allowance based on the largest EGC - for all EGCs in the box. This was not always adequate and resulted in significant crowding of conductors which would not allow heat to dissipate from the contained conductors or devices. In the 2020 NEC, the first four (4) EGC conductors are counted as one volume plus ¼ volume for each conductor <u>over</u> four based on largest EGC conductor in the box.

Reference: 314.16(B)(5)



114

Question 32



115

Question 33

A water pump is also being used for fire mitigation. Is it required to install a breaker remote from the main panel?

[Ray Horner]

116

Answer- Dual Purpose Water Pump

- I am not sure that you can have a dual-purpose water pump for fire mitigation without some serious NEC violations.

117

Question 34

We are experiencing a lot of florescent luminaires being converted to LED type luminaires via retro fit kits. Does this conversion affect the original listing of the luminaire?

[Tom Moore]

118

Question 34 LED Retro Kits

We are experiencing a lot of florescent luminaires being converted to LED type luminaires via retro fit kits. Does this conversion affect the original listing of the luminaire?

Answer: Not if installed in accordance with manufacture instructions

Code Reference: 410.6, 110.3(B)

[Tom Moore]

119

Led Retrofit Kits Continued

There are different product categories depending on the type of retrofit kits used. There are different product categories for direct lamp replacement vs re-wiring of the fixture. Bottom line is the manufactures installation instructions must be followed.

410.6 Listing Required.

All luminaires, lampholders, and retrofit kits shall be listed.

120

Question 35

I am being told that section 110.14(C)(2) allows me to use the 90°C ampacity rating for THHN/THWN between terminations. Can you explain this section and how would this be properly applied?

[Keith Lofland]

121

Question 35

I am being told that section 110.14(C)(2) allows me to use the 90°C ampacity rating for THHN/THWN between terminations. Can you explain this section and how would this be properly applied?

[Keith Lofland]

122

Keith Lofland

Question 35 Answer:

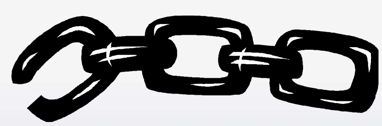
Answer: The 90°C ampacity ratings of the conductors can only be used ***IF*** the rating of the terminations is also rated at 90°C.

110.14(C)(2) - Separately installed pressure connectors shall be used with conductors at the ampacities not exceeding the ampacity at the listed and identified temperature rating of the connector.

Code Reference: 110.14(C)(2)

123

Ampacity Calculations with Wire Terminations



- The weakest link determines the strength of a chain
- Conductor final ampacity is determined by the weakest link in a circuit
- Most often, the weakest link is the conductor termination

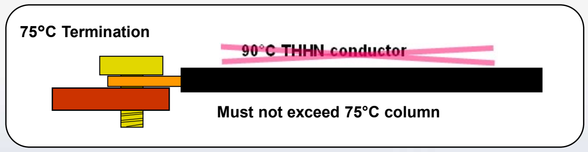
124

Ampacity Calculations with Wire Terminations

- Step 1
  - Determine the temperature rating of each piece of equipment in the circuit
- Step 2
  - Do not exceed lowest temperature rating *(weakest link)* for any single piece of equipment in the circuit

125

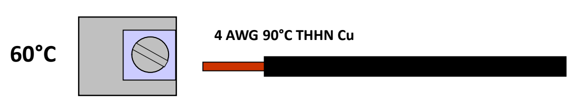
Ampacity Calculations with Wire Terminations



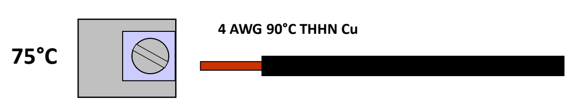
- Chain with two links: termination + conductor
- Termination @ 75°C + Conductor @ 90°C
- Weakest link is 75°C termination
- Therefore, the conductor final ampacity can NOT exceed Table 310.16, 75°C column

126

Two Examples



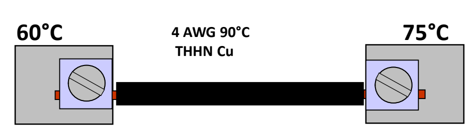
Ampacity changes from 95 amps to 70 amps



Ampacity changes from 95 amps to 85 amps

127

Both Ends Must Be Considered



Circuit ampacity adjusts from 95 amps to 85 amps to a final ampacity of 70 amps

128

Question 36

On a typical 100-amp, residential service, the contractor installed an RMC nipple between the meter enclosure and the main service disconnect. He then ran the 4 AWG concrete encased grounding electrode conductor thru the lug on the bonding bushing and on to the bonded neutral bus. Does this installation meet the Exception to 250.121 Use of Equipment Grounding Conductors?

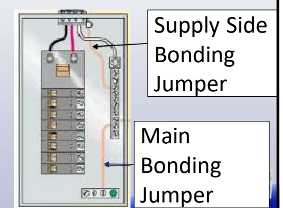
[Dean Hunter]

129

Question 36

Answer: Assuming that the meter enclosure is on the supply side of the service disconnect, the conductor bonding the RMC nipple would be considered a "supply side bonding jumper". NEC section 250.121 addresses equipment grounding conductors and would *not* apply in this situation.

References: 250.121 and Article 100 Definitions for "Equipment Grounding Conductor" and "Supply Side Bonding Jumper"



130

Question 37

I understand that a single-phase pool pump motor must be GFCI protected in the voltage range of 120 through 250 volts regardless of ampacity, does this apply to electric pool heaters also?

[Ray Horner]

131

Answer- Electric Pool Heater

- This depends on the installation of the electric pool heater. If the heater is a plug and cord type heater and is plugged into a receptacle then section 210.8 and 680.22 will apply and require that all outdoor receptacles have GFCI protection. If the system is hardwired than No GFCI protection is required as 680.10 does not require GFCI protection

132

Question 38

There have been rumors circulating about damage to building footings due to lightning when using concrete encased electrodes. Is there any truth to these rumors? Builders are asking if there are any options other than using the rebar as an electrode?

[Tom Moore]

133

Question 38 Concrete Encased Electrode

There have been rumors circulating about damage to building footings due to lightning when using concrete encased electrodes. Is there any truth to these rumors? Builders are asking if there are any options other than using the rebar as an electrode?

Answer: a. Just a rumor to my knowledge

b. No

134

Concrete Encased Electrode Continued

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) through (A)(8) shall be installed and used.

Exception: Concrete-encased electrodes of existing buildings or structures shall not be required to be part of the grounding electrode system where the steel reinforcing bars or rods are not accessible for use without disturbing the concrete.

135

Question 39

The last sentence in section 312.2 addresses the type of connectors installed in enclosures in a wet location where the connector will penetrate the enclosure above live parts. Section 312.2 simply states the fittings used (connectors) must be listed for wet locations. The general practice across my area is that this section requires a Myers Hub be installed in these locations and nothing else. However, isn't the typical PVC male connector not listed for use in a wet location?

[Keith Lofland]

136

Question 39

The last sentence in section 312.2 addresses the type of connectors installed in enclosures in a wet location where the connector will penetrate the enclosure above live parts. Section 312.2 simply states the fittings used (connectors) must be listed for wet locations. The general practice across my area is that this section requires a Myers Hub be installed in these locations and nothing else. However, isn't the typical PVC male connector not listed for use in a wet location?

[Keith Lofland]

137

Keith Lofland

Question 39 Answer:

Answer: The use of a "Myers Hub and nothing else" is more restrictive than the minimum standards of the *NEC*. Any fittings listed for a wet location is acceptable here.

Listed PVC fittings are suitable for use in wet locations.

However, the integrity of the "weatherproof" enclosure (110.28) must also be taken into account. Openings made into an enclosure must be designed for and installed to maintain the enclosure rating (NEMA 250 / UL 651).

Code Reference: 312.2, 110.28

138

Question 39 Answer:

Keith Lofland

"**NEMA 250, Section 3.6 Openings.** Openings provided in an enclosure shall comply with the tests for the enclosure type with the openings unfilled except that openings in accordance with 3.6.1 if provided in the test enclosure shall be filled to maintain the environmental integrity of the enclosure."

"**NEMA 250, Section 3.6.1 Equipment Openings.** All enclosures may be provided with openings that are intended to be closed at installation by equipment. Such openings shall comply with the performance requirements in this standard and with the requirements in the appropriate end product standard when the intended equipment is installed. See 4.6."

"**NEMA 250, Section 4.5.** A Type 4, 4X, 6, or 6P enclosure shall be marked to indicate that watertight fittings are required to be used."

"**NEMA 250, Section 4.6 Equipment Openings.** Enclosures provided with equipment openings intended to be closed at installation by field installed equipment shall be marked to indicate that the field installed equipment shall be suitable for the same environmental conditions and shall be installed in accordance with the installation instructions provided."

139

Question 39 Answer:

Keith Lofland

- Rainproof, raintight, or watertight equipment can fulfill the requirements for weatherproof.
- See UL-DWTT (UL 514B) for guidance on conduit fittings certified as liquid-tight or rain-tight.
- The use of a neoprene flat sealing washer between the enclosure and the PVC terminal adaptor may be one solution.
- Refer the manufacturer's installation instructions for on how openings are to be made and closed to maintain the integrity of the enclosure's environmental rating.

140

Question 39 Answer:

Keith Lofland

UL 651 (Standard For Safety For Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings) includes a wet-locations test. A fitting that has been found acceptable for specific conditions of installation, for use with a specific conduit or cable construction, or for use with certain wiring systems shall be marked to indicate the condition of installation or the intended use on the smallest unit carton in which the product is packaged. Table 9.1 specifies the condition of use and the associated carton marking.

Condition of use or installation	Carton marking[a]
For use in dry locations	Dry locations
For use in wet locations	Wet locations[b]
For use in wet locations only with a separate gasket installed between the box and fitting	In wet locations, use [c] between box and fitting
For use with specific type of rigid nonmetallic conduit above or below ground	For [d] rigid nonmetallic conduit
[a] The carton marking specified above shall be prefixed by "Suitable for" instead of "For" or shall use the word "only" as desired or appropriate.	
[b] "Raintight" is also acceptable for the carton marking.	
[c] Blank to be filled in with specific identification of the component to be used, including the part number, to identify the gasket, seal or the like that must be installed to provide a raintight connection.	
[d] Blank to be filled in with the use of the appropriate type of conduit, such as "PVC underground," as required or appropriate.	

141

Question 40

I was field threading several sections of rigid metal conduit when the inspector turned up and asked, “what are you using to coat the threaded ends of the conduit with”? These raceways are not being used for direct burial. Where does the code tell me to do this and with what?

[Dean Hunter]

142

Question 40

Answer: Where corrosion protection is necessary and the conduit is threaded in the field, the threads shall be coated with an approved electrically conductive, corrosion-resistant compound.

Reference: 300.6(A)

143

Question 41

Can you explain the 2020 requirements in 410.118 for access above a hard ceiling?

[Ray Horner]

144

Answer- 410.118 Requirments

- 410.118 is simply stating that you can use recessed luminaire spaces to access boxes or conduit bodies that are an integral part of the lighting, but you may not use the luminaire as an access point to boxes, conduit bodies, outlets, etc.. that are separate from the luminaire. You still need a separate access point for these items.

145

Question 42

517.19(C)(1) says hospital surgical rooms need 36 receptacles how many branch circuits are needed?

[Tom Moore]

146

Question 42 Operating room Receptacles

517.19(C)(1) says hospital surgical rooms need 36 receptacles how many branch circuits are needed?

Answer: At least two

Code Reference: 517.19(C)(1)

147

Operating Room Receptacles Continued

517.19(C)(1) Minimum Number and Supply.

Each operating room shall be provided with a minimum of 36 receptacles divided between at least two branch circuits. At least 12 receptacles, but no more than 24, shall be connected to either of the following:

(1) The normal system branch circuit required in 517.19(A)

(2) A critical branch circuit supplied by a different transfer switch than the other receptacles at the same location

148

Question 43

We have a 277/480 V. system that is being converted to a 120/208 V. system. Can we re-use the existing 600 V. rated distribution equipment on the 208 V. system, assuming all fault current ratings are adequate?

[Keith Lofland]

149

Question 43

We have a 277/480 V. system that is being converted to a 120/208 V. system. Can we re-use the existing 600 V. rated distribution equipment on the 208 V. system, assuming all fault current ratings are adequate?

[Keith Lofland]

150

Keith Lofland

Question 43 Answer:

Answer: Yes, No, Maybe?

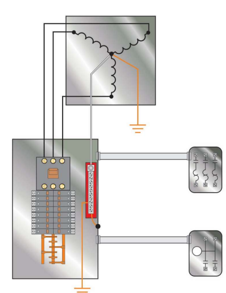
Yes, if 110.4, 110.9, and 110.10 are still in compliance at the newly applied voltages

The voltage rating of electrical equipment shall not be less than the normal voltage of a circuit to which it is connected. [110.4]

Code Reference: 110.4, 110.9, and 110.10

151

110.9 Interrupting Ratings

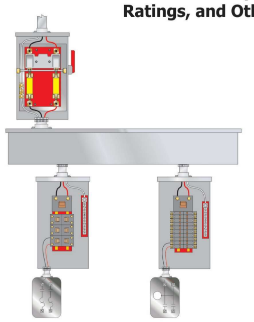


Equipment intended to interrupt current at fault levels shall have an interrupting rating at normal circuit voltage sufficient for the *(fault)* current that is available at the line terminals of the equipment

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

152

110.10 Circuit Impedance, Short-Circuit Ratings, and Other Characteristics



- Overcurrent protective devices
- Total impedance
- Component short-circuit current rating
- Other characteristics of circuit

The above shall be selected and coordinated to permit circuit protective devices to clear fault without extensive damage to the electrical equipment of the circuit

Listed products applied in accordance with their listing are considered to meet requirements of *NEC* 110.10

Fault assumed to be between:
- Two or more of the circuit conductors
- Any circuit conductor and the grounding conductor or enclosing metal raceway

153

Question 44

An existing ceiling fan is being replaced, and the new ceiling fan is mounted by a means that is now considered a receptacle by Article 100. Would this be considered a modification of the circuit and would it now be required to have AFCI protection?

[Dean Hunter]

154

Question 44

Answer: Yes, assuming this is a dwelling unit. This would not be considered a "replacement" receptacle as covered in 406.4(D)(4) and it is not the installation of a new branch circuit covered by 210.12(A).

However it is a branch circuit modification, and 210.12(D) would require AFCI protection. This installation does not meet the exception, because a receptacle outlet device is being added.

155

Question 44

References: Article 100 definitions of "Receptacles" and "Device". 210.12(D) and 406.4(D).

156

Question 45

Is there a Code compliant way to connect EMT to a weatherproof junction box with threaded hubs?

[Ray Horner]

157

Answer – EMT to Weatherproof Box

- Yes, you can use a rigid nipple to extend out of the hub and then use a rigid to EMT transition compression fitting that is rated for wet locations.

158

Question 46

If a NM-B support is used as listed, such as a Gardner Bender Multicable Staple Snapshot, is there a need to derate for bundling? For example, the packaging says each support can be used for (8) 12-2/G NM-B cables.

[Tom Moore]

159

Question 46 NM Cable Derating

If a NM-B support is used as listed, such as a Gardner Bender Multicable Staple Snapshot, is there a need to derate for bundling? For example, the packaging says each support can be used for (8) 12-2/G NM-B cables.

Answer: Maybe

Code Reference: 334.80, 310.15(C)(1)

[Tom Moore]

160

NM Cable Derating Continued

334.80 in part … Where more than two NM cables containing two or more current-carrying conductors are installed in contact with thermal insulation without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).

310.15(C)(1) in part… where single conductors or multiconductor cables not installed in raceways are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.). Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

161

Question 47

Is a Construction Meter/ Temp. Construction Service subjected to the same Grounding & Bonding requirements in Art.250 as a Permanent Service? i.e. SSBJ, MBJ, GEC's from electrodes connected to the Grounded (Neutral) Conductor.

[Keith Lofland]

162

Question 47

Is a Construction Meter/ Temp. Construction Service subjected to the same Grounding & Bonding requirements in Art.250 as a Permanent Service? i.e. SSBJ, MBJ, GEC's from electrodes connected to the Grounded (Neutral) Conductor.

[Keith Lofland]

163

Keith Lofland

Question 47 Answer:

Answer: Yes

Code Reference: 590.4(A)

164

165

166

Question 48

Is it necessary to connect all 125 V. receptacles in a dwelling unit garage to the 210.11(C)(4) required branch circuit or can we have additional, individual branch circuit-supplied receptacles for specific appliances, i.e.: central vac or freezer?

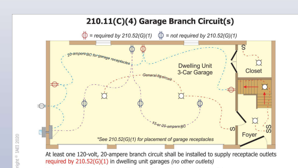
[Dean Hunter]

167

Question 48

Answer: *"At least one 120-volt, 20-ampere branch circuit needs to be installed to supply receptacle outlets required by 210.52 (G)(1)."*

- The NEC is minimum safety standard and is not intended as a design specification. The installer may have more than one 20-amp branch- circuit supplying receptacle outlets in the garage.



168

Question 48

Reference: 210.11(C)(4) Garage Branch Circuits.

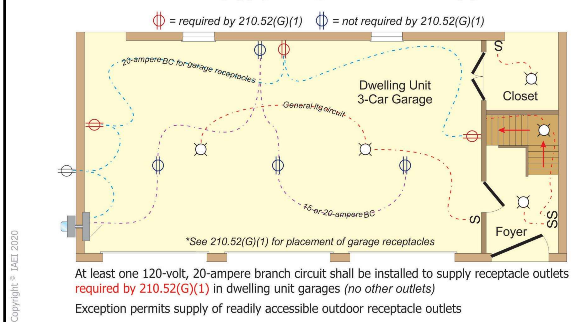
In addition to the number of branch circuits required by other parts of this section, at least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle outlets required by 210.52(G)(1) for attached garages and in detached garages with electric power. This circuit shall have no other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

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

169

Question 48

210.11(C)(4) Garage Branch Circuit(s)



At least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle outlets required by 210.52(G)(1) in dwelling unit garages *(no other outlets)*

Exception permits supply of readily accessible outdoor receptacle outlets

170

Question 49

At a single-family dwelling renovation, a non-grounding type receptacle was being used for the refrigerator. As no equipment grounding means was available in the device box a GFCI type receptacle was installed and marked “no equipment ground” as per section 406.4(D)(2)(b). The inspector says that I may not do this and that I must physically ground the receptacle because it supplies a refrigerator. I see no reference to that in Article 406. Is the inspector correct?

[Ray Horner]

171

Answer- GFCI Marked “no equipment ground”

- Yes, The inspector is correct. Informational note 1 in the section states that some equipment or appliances require a grounding conductor and Informational note 2 sends you to section 250.114 for a list of appliances and equipment that require an equipment grounding conductor. 250.114(3)a lists a refrigerator as one such piece of equipment.

172

Question 50

A panel is mounted on sloped roof rafters in an attic. Assuming we have the height and clearance, is the panel location compliant? Temperature is not an issue as this is a sealed attic.

[Tom Moore]

173

Question 51

Are anti short bushings required when MC Cable is terminated to a box or enclosure?

[Keith Lofland]

174

Question 51

Are anti short bushings required when MC Cable is terminated to a box or enclosure?

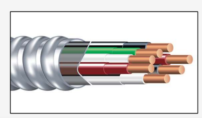
[Keith Lofland]

175

Keith Lofland

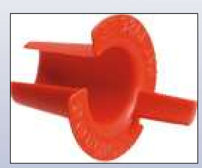
Question 51 Answer:

Answer: No



Anti-short bushings are not required for Type MC cable in accordance with the listing for the product.

Code Reference: 330.6



176

Question 52

If you run a size #10 wire in and out of a 20-amp receptacle circuit, to avoid voltage drop on a long run, and connected the device with #12 pigtails, then would you count the device as 2 wires based on #12 or #10 conductors. The code states based on the largest conductor connected to the device but is that the intent?

[Dean Hunter]

177

Question 52

Answer: Yes. I agree that is the way the language is written, so I would assume that is what CMP intended.

Reference: **314.16(B)(4) Device or Equipment Fill.**

For each yoke or strap containing one or more devices or equipment, a double volume allowance in accordance with Table 314.16(B) shall be made for each yoke or strap based on the largest conductor connected to a device(s) or equipment supported by that yoke or strap.

Table 314.16(B) Volume Allowance Required per Conductor

Size of Conductor (AWG)	Free Space Within Box for Each Conductor cm^3	in.^{3}
12	36.9	2.25
10	41.0	2.50

178

Question 53

For years I have been arguing that it was non-compliant in many cases to have 2 garage doors and the receptacles in the garage on the same 20-amp circuit because of section 210.23(A)(2). Now after reading 220.60 on non- coincidental loads I am thinking it may be allowed. Can you clarify?

[Ray Horner]

179

Answer – Garage Doors

- One 20-amp circuit would be acceptable based on 220.60 because it is unlikely that both garage door motors will be running simultaneously.

180

Question 54

An existing building has battery backup lighting packs in all egress fixtures, the fixtures are switched, and the battery ballast are fed with a constant hot. A new nonemergency rated generator is to be installed for all lighting, must the switch to the emergency lights then be removed or is it considered normal under generator power.

[Tom Moore]

181

Question 54 Emergency Egress Lighting

An existing building has battery backup lighting packs in all egress fixtures, the fixtures are switched, and the battery ballast are fed with a constant hot. A new nonemergency rated generator is to be installed for all lighting, must the switch to the emergency lights then be removed or is it considered normal under generator power.

Answer: The original installation *may* remain compliant

Code Reference: 700.5(D), 700.12(I)(2)(3

[Tom Moore]

182

Emergency Egress Lighting Continued

If I understand the question the installation consists of a multi-lamp fluorescent luminaire with one ballast that operates for instance 2 lamps switched for normal lighting. And the other 2 lamps are connected to a battery back up with constant supply. A typical type I have encountered is a Bodine emergency ballast. Assuming the supply to the emergency lighting complies with 700.12(I)(2)(3)(a) or (b). Therefore if installing a new nonemergency generator for all lighting and all required emergency/egress lighting is installed as pointed out in the question an Article 702 optional standby system would not have an effect. (see next slide).

183

Emergency Egress Lighting Continued

It is important that if an emergency generator is installed to supply required egress lighting it must meet all the requirements of Article 700. Such as but not limited to, a common violation of a typical residential Optional Standby type very possibly will not meet the required 10 second pick up time (700.12) or be listed and marked as suitable for emergency use (700.5(A)).

184

Question 55

Section 230.72 indicates the two to six service disconnects permitted in Section 230.71 must be grouped. There is no maximum distance in between the two to six disconnects, so how far is too far before the installation would not meet the grouping requirement?

[Keith Lofland]

185

Question 55

Section 230.72 indicates the two to six service disconnects permitted in Section 230.71 must be grouped. There is no maximum distance in between the two to six disconnects, so how far is too far before the installation would not meet the grouping requirement?

[Keith Lofland]

186

Keith Lofland

Question 55 Answer:

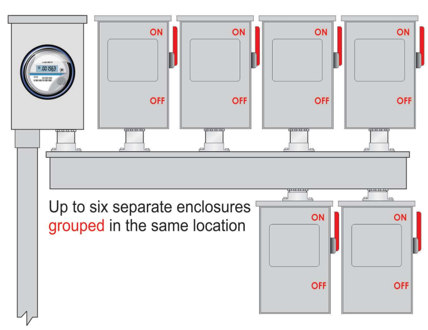
Answer: Yes, No, Maybe?

Who will determine what "grouped" means? The **AHJ**

Code Reference: 230.72(A)

187

230.72(A) Grouping of Service Disconnects



230. 72 Grouping of Disconnects.
(A) General. The two to six disconnects, if permitted in 230.71, shall be grouped.

188

189

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File Attachments for Item:

ER-12 Motor Circuits 2020 NEC Article 430 (Independent Electrical Contractors)

ESI, EPE (2 hours)

Staff Notes: Handouts only, no slides. Recommend approval, add BO, MPE, RBO, RPE.

ESIAC Recommendation: Recommend approval

Committee Recommendation:

[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: Barbara A. Tipton
(Contact Name)
Organization: IEC Central Ohio-AEC-IEC
(Organization/Company)
Address: 3128-H East 17th Ave.
(Include Room Number, Suite, etc.)
City: Columbus State: OH Zip: 43219
E-Mail: btipton@ieccentraloh.org
Telephone: 614-473-1050 Fax 614-473-1359
Course Sponsor: IEC Central Ohio-AEC-IEC

COURSE INFORMATION:

Course Title: Motor Circuits - NEC Article 430

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

Purpose and Objective: Review requirements of 2020 NEC Article 430 for installing conduit, conductors and other components of a motor circuit.

Objective: Review Wiring and Components from branch circuit Device

Number of Instructional Contact Hours that can be obtained upon completion: 2.0 hours

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: IEC Central Ohio-AEC-IEC Date(s) of ESI Course(s): April 20, 2021 - 5pm - 7pm

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:		na
Completed Application:		✓

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

INSTRUCTOR BIO

Clay Carroll
614-557-1147

Clay has been in the electrical field for over 45 years serving in many capacities including apprentice, journeyman, service tech, estimator, business owner, even Safety Director.

He has held a state of Ohio Contractors Certification since its inception as well as a Master Electricians certification in 12 other states and a General Contractors Certification for the State of Florida
State of Ohio Fire Alarm Installers Certificate.

Credentials:
Conducted Continuing Education Classes on the NEC since 1988
Has taught apprenticeship classes for the past 16 years
Is a certified trainer of OSHA 10 and 30
Certified First Aid/ CPR/ AED instructor
Mobile Elevated Work Platform Operator Instructor
Forklift Operator Instructor

Beyond the Electrical Industry Clay has served his local community in the following capacities:

Mayor of the Village of Buckeye Lake
Village Council member
Planning and Zoning Commission
Tree and Landscape Commission
Member of the Masonic Lodge

OCILB License # 12911

COURSE OUTLINE:

Motor Circuits – NEC Article 430

Scope:
Review requirements of 2020 NEC Article 430 for installing conduit, conductors and other components of a motor circuit.

Special focus on 430.6, 430.22, 430.32, 430.52 and the FLC. Tables 430.247 – 250.

Will also review conduit / conductor sizing.

- Definitions
- Wiring Methods
- SC / GF protection
- OL protection

Course will review the wiring and components from the branch circuit protective device to the motor using the name plate information from several different motors nameplates on the power point.

Motor Circuits – NEC Article 430

Article 430, with its tough subject and thirteen parts, presents a challenge. At first glance, correctly applying Article 430 may seem impossible. But, a closer look shows reveals usability features-such as its tables-that make Article 430 more user-friendly than many people realize. One especially notable feature is Figure 430.1, which provides a graphical representation of how to apply Article 430. Figure 430.1 allows you to proceed through Article 430 methodically and not miss a key requirement. Let's see what some of those requirements are.

Part I. General Requirements

- Full load currents. Use the motor full load current rating (see Tables 430.147, 430.148, or 430.150) when determining conductor ampacity [430.22], the branch-circuit short-circuit and ground-fault protection device [430.52 and 62], and the ampere rating of switches [430.110]. Do not use the current rating on the motor nameplate for this purpose (Figure 430-2).

- Motor nameplate current rating. Use the motor nameplate current rating when selecting devices intended to protect motors, motor control apparatus, and motor branch-circuit conductors against excessive heating due to motor overloads and failure to start [430.31].
- Motor controller terminals. Connect motor controllers and terminals of control circuit devices with copper conductors, unless identified otherwise. Torque motor control conductors 14 AWG and smaller at a minimum of 7 lb-in. for screw-type pressure terminals, unless identified otherwise. See [430.9], [110.3(B)], and [110.14 FPN].
- Motor locations. Locate motors to facilitate maintenance and provide adequate ventilation [430.14].

Part II. Conductor Size

- Single motors. Per [430.22], size motor branch-circuit conductors no smaller than 125 percent of the motor FLC rating listed in Table 430.147 or 430.148 (Figure 430-4). Size the branch-circuit short-circuit and ground-fault protection device per 240.6(A) and 430.52(C)(1) Ex. 1.
- Multiple motors. Per [430.24], size multiple motor conductors as follows. First, multiply the full-load current rating of the highest-load motor by 1.25. Then, add up the full-load current ratings of all the other motors in the group. Add these two numbers. That's your motor load for calculating ampacity. Add any other loads on that conductor, to calculate total conductor ampacity.

Part III. Overload Protection

An overload is not a short-circuit or ground fault. It's an operating current that is just too high. Overload protection devices will interrupt a current that is too high, when it persists for too long (typically on the order of seconds). The time factor allows for the starting current of the motor, which is higher than the operating current but only momentary. A branch-circuit short-circuit and ground-fault protection device protects the motor, the motor control apparatus, and the conductors against short circuits or ground faults, but not against overload (Figure 430-11).

You must protect each motor branch circuit against short circuit and ground fault by a protection device sized no greater than the percentages listed in Table 430.52. Motor branch-circuit conductors are protected against overcurrent by overloads sized at 115 to 125 percent of motor nameplate current rating [430.32].

Part VI. Motor Control Circuits

You must provide motor control circuit conductors with a disconnecting means that opens all conductors of the motor control circuit [430.74]. The controller disconnect can serve as the disconnecting means for control circuit conductors, if the control circuit conductors are tapped from the controller disconnect [430.102(A)]. If the control circuit conductors are not tapped from the controller disconnect, provide a separate disconnect for the control circuit conductors and locate it adjacent to the controller disconnect (Figure 430-17). The control circuit disconnect cannot not be higher than 6 ft 7 in. above the floor or working platform, unless located adjacent to the equipment it supplies [404.8(A)].

Part V. Feeder Short-Circuit and Ground-Fault Protection

Per [430.62], protect feeder conductors against short circuits and ground faults by a protection device sized:

- Not greater than the largest rating of the branch-circuit short-circuit and ground-fault protective device for any motor
- Plus the sum of the full-load currents of the other motors in the group.

Part VII. Motor Controllers

Each motor requires its own controller [430.87]. Select an enclosure suitable for the environment that controller occupies, per Table 430.91.

Controllers other than circuit breakers and molded case switches must have a horsepower rating no less than that of the motor. A circuit breaker can serve as a motor controller [430.111]. A molded case switch, rated in amperes, can serve as a motor controller.
For stationary motors rated at 2-hp or less and 300V or less, the controller can be either of the following:

- A general-use switch having an ampere rating not less than twice the full-load current rating of the motor.
- A general-use snap switch where the motor full-load current rating is not more than 80 percent of the ampere rating of the switch.

The motor controller is required to open only as many conductors of the circuit as necessary to start and stop the motor [430.84]. For example, one conductor must open to control a 2-wire, 1Ø motor; two conductors must open to control a 3-wire, 3Ø motor (see Figure 430-19). The controller starts and stops the motor; it is not a disconnecting means [430.103].

Part IX. Disconnecting Means

You need a disconnect for each motor controller. You must locate it within sight of the controller (see Figure 430-20). "Within sight" means visible and not more than 50 ft from each other [Article 100]. Under certain circumstances, [430.102(B)] allows exceptions to this requirement.

The controller disconnect must open all circuit conductors simultaneously [430.103] (see Figure 430-21). The controller disconnect can serve as the disconnect for motor control circuit conductors [430.74] and the motor [430.102(B) Ex.].

The disconnecting means for the motor controller and the motor must open all ungrounded supply conductors simultaneously [430.103] (see Figure 430-24).

The disconnecting means must be legibly marked to identify its intended purpose [110.22 and 408.4]. When operated vertically, the "up" position corresponds to the "on" state [240.81 and 404.6(C)]. The controller disconnect or motor disconnect required by [430.102] must be readily accessible (Figure 430-25).

File Attachments for Item:

ER-13 NEC 2020 Commercial and Industrial Power Systems (Electrical League of Ohio)

ESI, BO, MPE, BPE, EPE, BI, RBO, RPE (4 hours)

Staff Notes: Recommend approval.

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: Electrical League of Ohio

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: NEC 2020 Commercial and Industrial Power Systems

New Course Submittal: [X] Update Course: [ ] Prior Approval Number:

Purpose and Objective: Class wilkl explore the code requirements for designing electrical power systems in commercial and industrial facilities. The course will cover topics including service entrance requirements, ground fault protection, distribution equipment layout, conduit and cable tray conductor fill calculations and equipment connections.

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

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

Program Applicable for the Following Participants:

Building Official [X] Master Plans Examiner [X] Building Inspector [X] Fire Protection Inspector [ ] Mechanical Inspector [ ]
Building Plans Exam. [✓] Plumbing Inspector [ ]
Plumbing Plans Exam. [ ] Non-Res IU Inspector [ ]
Electrical Plans Exam. [X]
Mechanical Plans Exam. [ ]
Fire Protect. Plans Exam. [ ]

Res Building Official [X] Res Plans Examiner [X] Res Building Inspector [ ] Res Mechanical Inspector [ ] Res IU Inspector [ ]

Electrical Safety Inspectors [ ]
Location of ESI Course: 20575 Corporate Drive ZOOM Date(s) of ESI Course(s): February 10, 2021

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.

Form: 1526

BBS 81028110

Electrical League of Ohio
National Electrical Code Education Class
4-hour Course Outline

"Commercial and Industrial Power Systems"
February 10, 2021

Presented By: Timothy G. Pool, PE, RCDD, ESI 7011

Executive Summary of course: This class will explore the code requirements for designing electrical power systems in commercial and industrial facilities. The class will cover code topics including service entrance requirements, ground fault protection, distribution equipment layout, conduit and cable tray conductor fill calculations, and equipment connections.

Service Entrance Requirements	**Class Time**
• Article 100 and Article 230 Definition of Service Equipment	20 min
• Article 230.71 and 230.79 Service Disconnects	20 min
• Article 230.82 Equipment Permitted ahead of Service Equipment	10 min
• Article 230.91 Location of Overcurrent Device	10 min

Ground Fault Protection (GFP)	**Class Time**
• Article 230.95 Ground Fault Protection and Proper Setting	30 min

Distribution Equipment Layout	**Class Time**
• Article 210.19 Maximum Branch Circuit and Feeder Length	30 min
• Article 210.22 & 23 Dedicated vs. Multiple Outlet Branch Circuits	20 min

Conduit and Cable Tray Fill Calculations	**Class Time**
• Article 342.22 and Chapter 9, Table 1	20 min
• Article 392 Cable Tray Fill and Cable Types Permitted	40 min

Equipment Connections	**Class Time**
• Article 342.30(B) and 344.30(B) Conduit Supports	20 min
• Article 404.8 Accessibility and Grouping of Switches	20 min

Total	4 hours

Tim Pool, PE, RCDD
Tec Inc. Engineering & Design

Executive Vice President, Engineering

Tim Pool is driven to produce fantastic finished projects for all of our clients. With nearly 30 years of experience working on electrical engineering projects with Tec Inc., Tim performs his work with the skills and precision necessary to perform at a high level on a wide variety of job types. During his time with the firm, Tim has assisted in many higher education and library projects, though his resume includes an ever-growing list of various spaces.

Interested in contributing to the engineering profession, Tim is a Registered Communication Distribution Designer (RCDD), a licensed Electrical Saftey Inspector with the State of Ohio, and frequently acts as an instructor for the Electric League of Ohio.

In his role as Executive Vice President, Tim devotes time to training the firm's electrical project team, providing the leadership and coordination needed to perform and generate great projects.

p. 440.953.8760 ext. 112

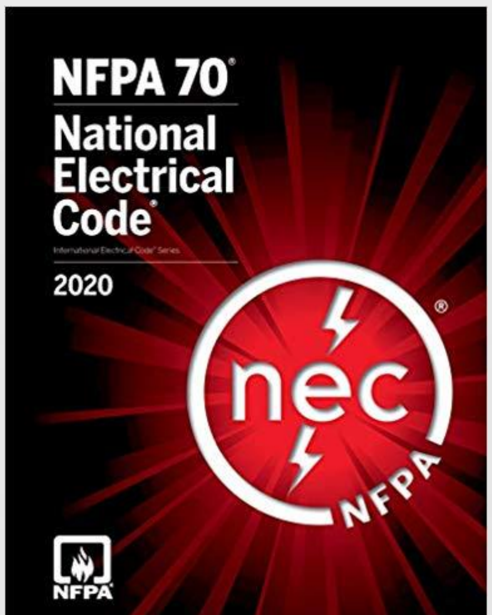
33851 Curtis Blvd, Suite 216, Eastlake, OH 44095

Electrical League of Ohio
February 10, 2020

Commercial Wiring Systems

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

Intro to 2020 NEC Updates



Article 242 Overvoltage Protection – All dwelling unit service must have a type 1 or type 2 surge protection device. Consolidated Articles 280 and 285.

Article 311 Medium Voltage Conductors and Cable – type MV consolidated from articles 310 and 328

Article 337 Type "P" Cable (Hazardous locations and Harsh Environments like offshore oil drilling rigs)

Article 805 General Requirements for Communications Systems – consolidated articles

Introduction

Changes to the 2020 edition are highlighted with gray shading and delta symbols. New figures or paragraphs are denoted with an *N* in the margin.

90.1 Purpose.

(A) Practical Safeguarding. The purpose of this *Code* is the practical safeguarding of persons and property from hazards arising from the use of electricity. This *Code* is not intended as a design specification or an instruction manual for untrained persons.

N

Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet (•) between the paragraphs that remain.

Δ **Table 430.72(B)**

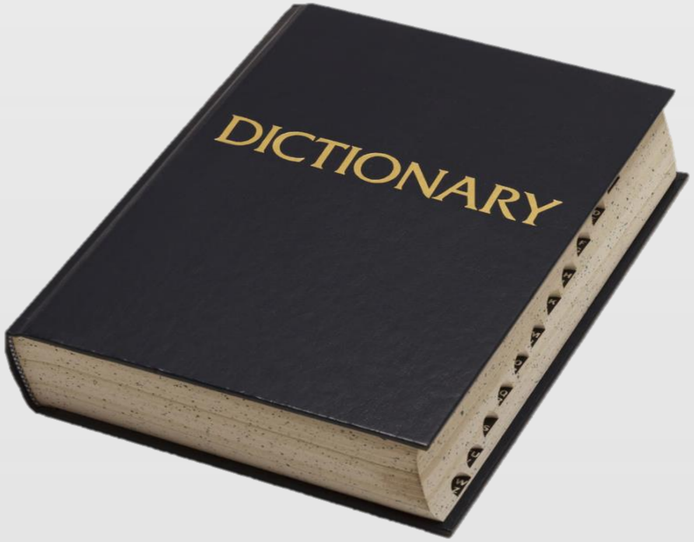
Signaling Circuit. Any electrical circuit that energizes signaling equipment.

•

Special Permission. The written consent of the authority having jurisdiction.

ARTICLE 100 - Definitions

<u>**Definitions used in 2 or more Articles were divided into three parts**</u>



Part 1 General

Part 2 Over 1000 Volts

Part 3 Hazardous (Classified) Locations.

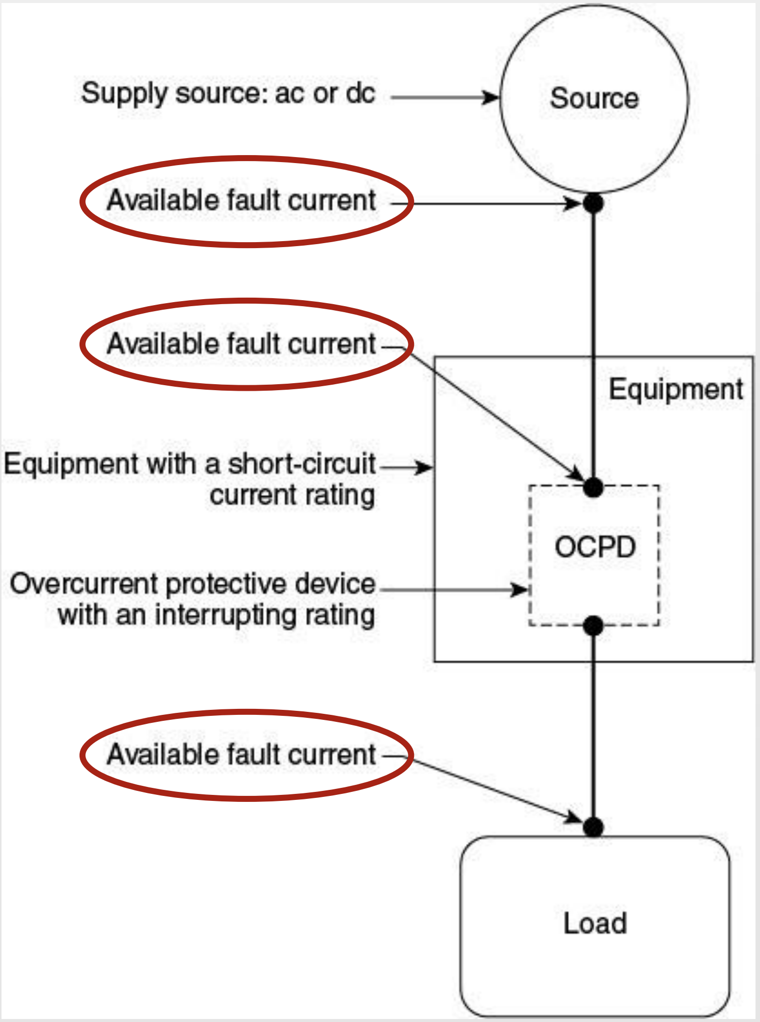
ARTICLE 100 - Definitions

Fault Current.

The current delivered at a point on the system during a short-circuit condition. (CMP-10)

Fault Current, Available (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)



Article 110.14 Requirements for Electrical Installations

110.14 Electrical Connections

(D) Terminal Connection Torque. Tightening torque values for terminal connections **shall** be as indicated on equipment or installation instructions provided by the manufacturer. An approved means shall be used to achieve the indicated torque value.

New Informational Notes:

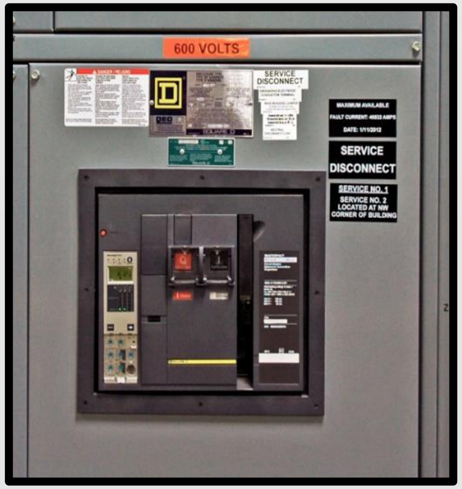
Approved means include torque tools such as shear bolts or break-away style devices.

See Annex I or UL Standard 486A-486B Wire Connectors

NFPA 70B Electrical Equipment Maintenance

Article 110.22 Identification of Disconnecting Means.

DISCONNECT F-25
FED FROM MSB CKT 4



110.22 Identification of Disconnecting Means.

(A) 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.

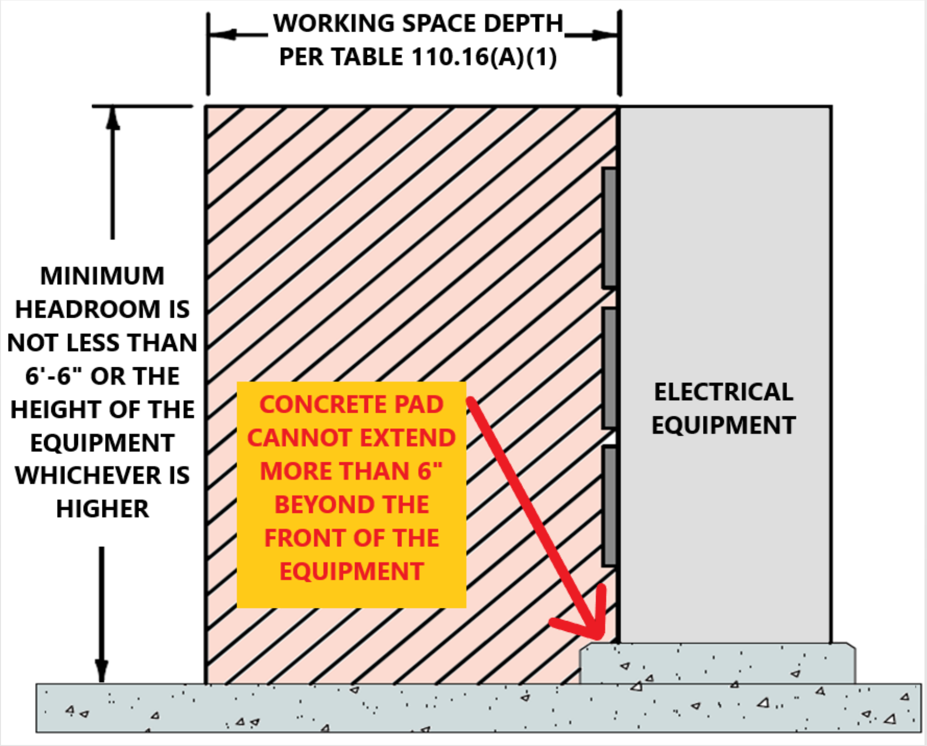
ARTICLE 110.24 Available Fault Current

New Informational Notes Reference NFPA 70E-2018 and Obtaining the Available Fault Current from the Electric Utilities

110.24 Available Fault Current.

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

ARTICLE 110.26 Spaces About Electrical Equipment



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 a height of **2.0 m (6 1/2')** **or** the height of the equipment, whichever is greater. Within the height, other equipment or support structures, such as concrete pads, 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.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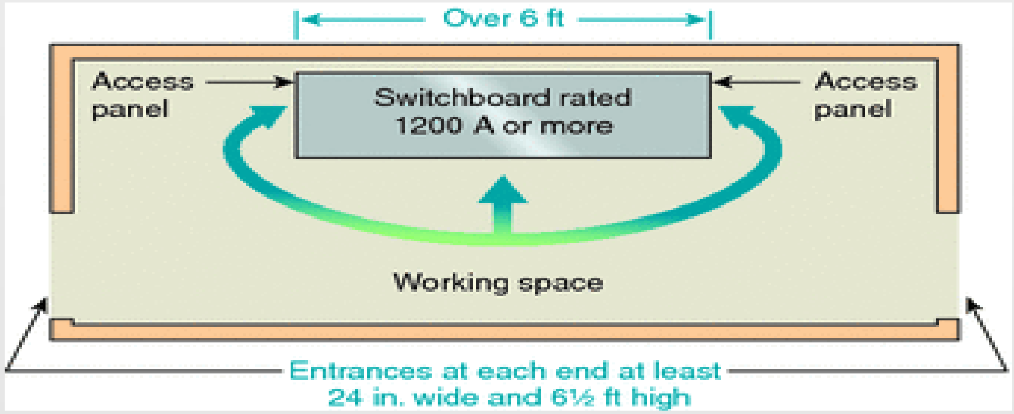
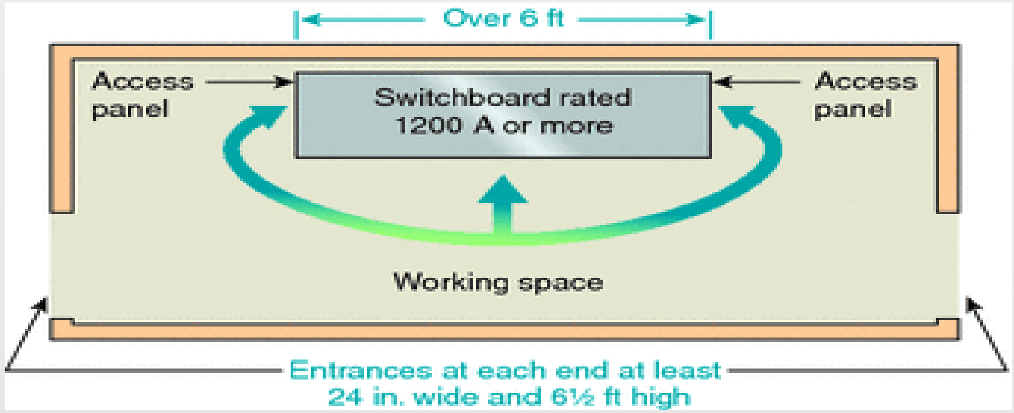
ARTICLE 110.26 Spaces About Electrical Equipment

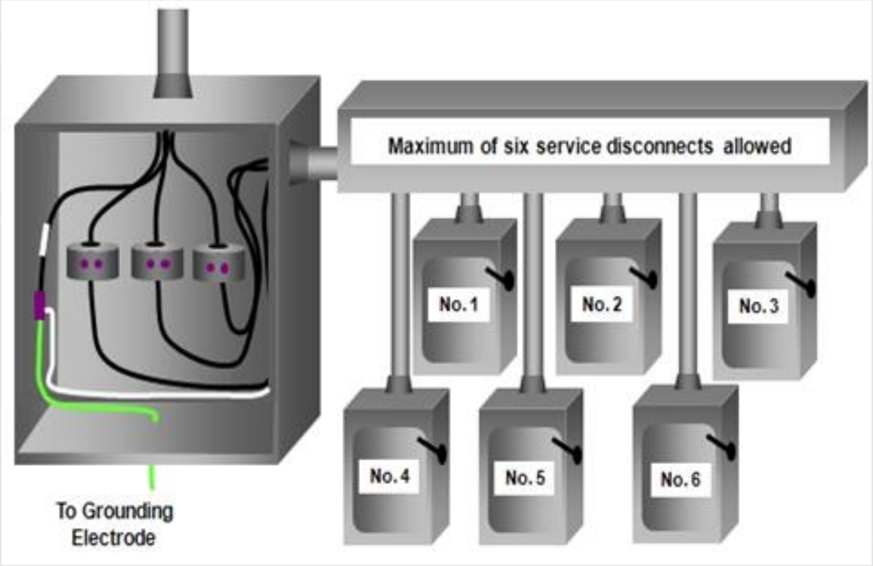


110.26(C) Entrance to Working Space

(2) Large Equipment. For large equipment that contains overcurrent devices, switching devices, or control devices, there shall be one entrance to and egress from the required working space not less than 610 mm (24 in.) wide and 2.0 m (6 1/2 ft) high **at each end of the working space**. This requirement shall apply to either of the following conditions:

ARTICLE 110.26 Spaces About Electrical Equipment





110.26(C) Entrance to Working Space

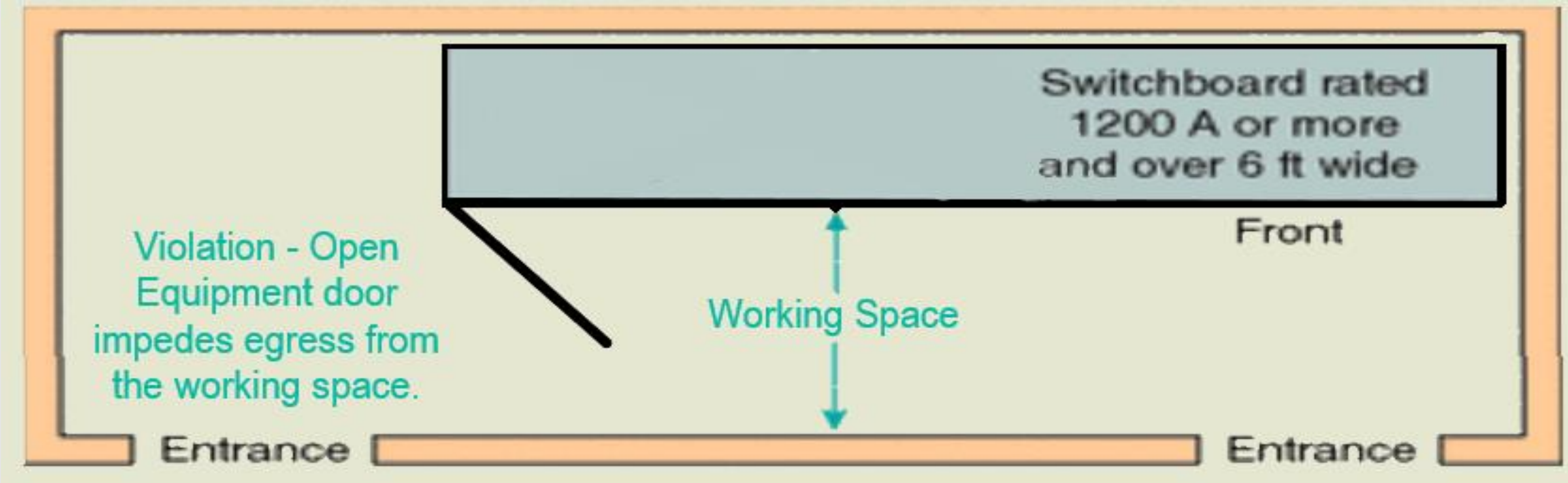
(1) For equipment rated 1200 amperes or more **and** over 1.8 m (6 ft) wide.

(2) 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.

ARTICLE 110.26 Spaces About Electrical Equipment

110.26(C) Entrance to Working Space

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



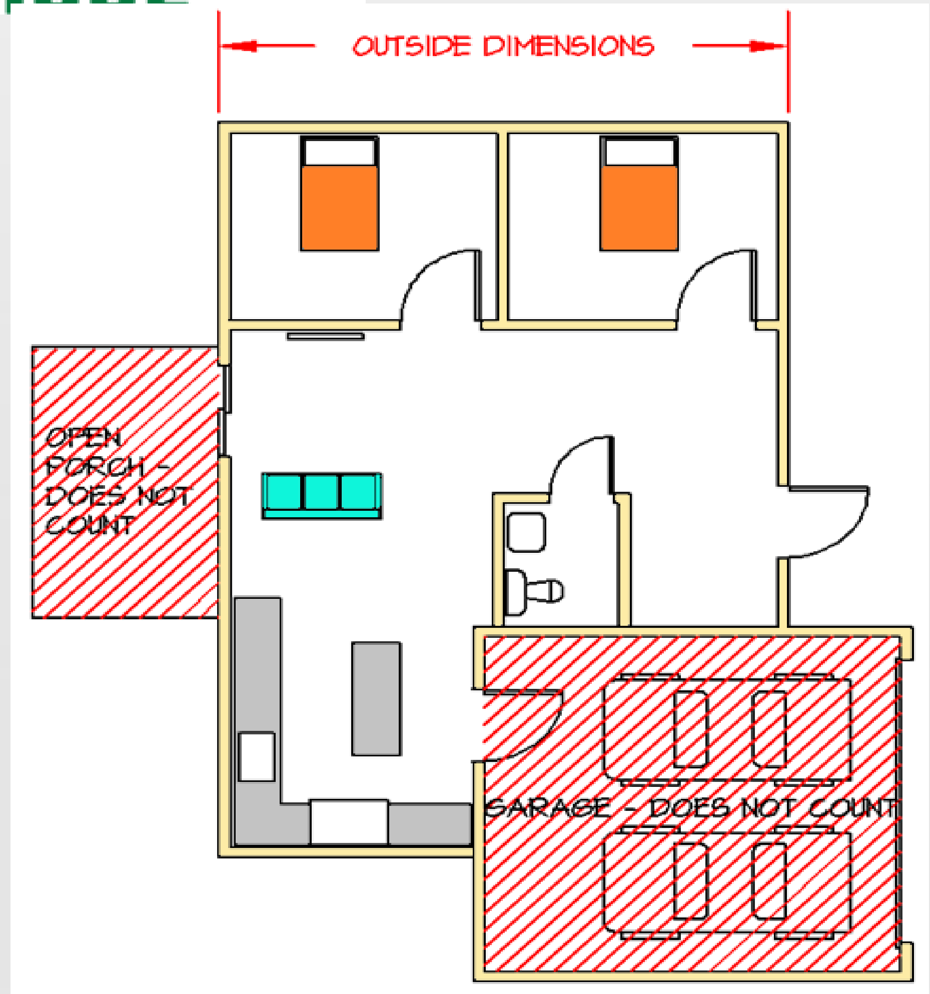
Article 210.5 Identification for Branch Circuits

300.3(C)(1) permits mixing 120 with 480

(C) Identification of Ungrounded Conductors

(1) Branch Circuits Supplied from More Than One Nominal Voltage System. Where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each ungrounded conductor of a branch circuit shall be identified by phase and by system voltage class at all termination, connection, and splice points in compliance with 210.5(C)(1)(a) and (b). Different systems within the same premises that have the same system voltage class shall be permitted to use the same identification.

Article 220.11 Floor Area



220.11 Floor Area. The floor area for each floor shall be calculated from the outside dimensions of the building, dwelling unit, or other area involved. For dwelling units, the calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use.

Article 220.12 Lighting Load for Non-Dwelling Occupancies

More types of Occupancy

Table 220.12 General Lighting Loads by Non-Dwelling Occupancy		
	Unit Load	
Type of Occupancy	Volt-amperes/ m^2	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

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

Article 220.12 Lighting Load for Non-Dwelling Occupancies

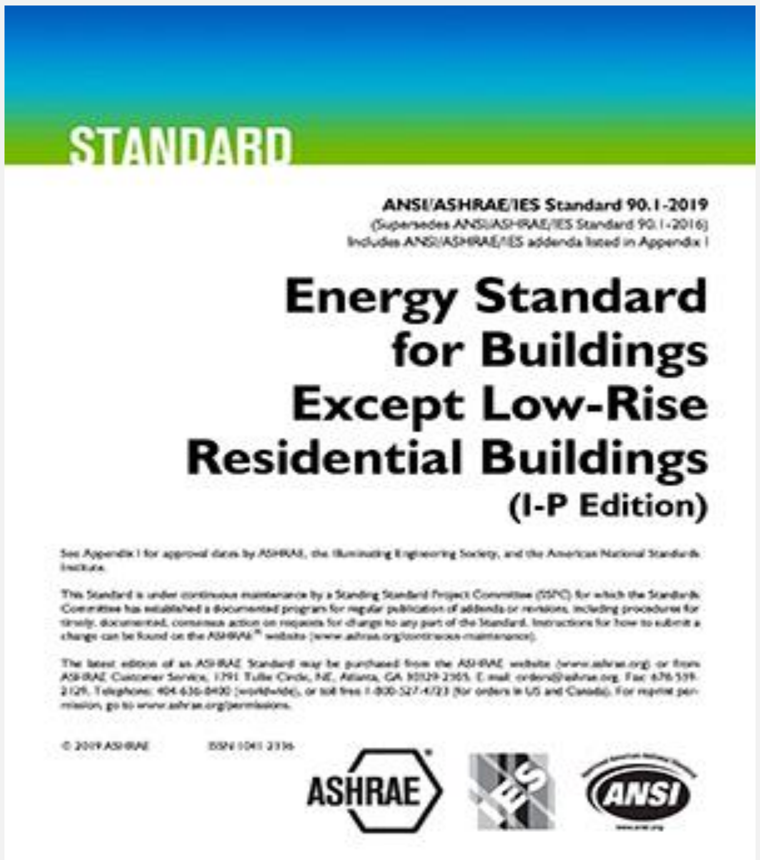
Table 220.12 General Lighting Loads by Non-Dwelling Occupancy		
	Unit Load	
Type of Occupancy	Volt-amperes/m²	Volt-amperes/ft²
Automotive facility	16	1.5
Convention center	15	1.4
Courthouse	15	1.4
Dormitory	16	1.5
Exercise center	15	1.4
Fire station	14	1.3
Gymnasium[a]	18	1.7
Health care clinic	17	1.6
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

[a]Armories & Auditoriums = gyms

[b]Lodge rooms = hotels / motels

[c]Industrial Comm. = manufacturing

Article 220.12 Lighting Load for Non-Dwelling Occupancies


STANDARD

ANSI/ASHRAE/IES Standard 90.1-2019

(Supersedes ANSI/ASHRAE/IES Standard 90.1-2016)

Includes ANSI/ASHRAE/IES addenda listed in Appendix I

Energy Standard for Buildings Except Low-Rise Residential Buildings

(I-P Edition)

220.12 Lighting Load for Non-Dwelling Occupancies.

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

Article 220.12 Lighting Load for Non-Dwelling Occupancies

220.12 Lighting Load for Non-Dwelling Occupancies. (A) General.

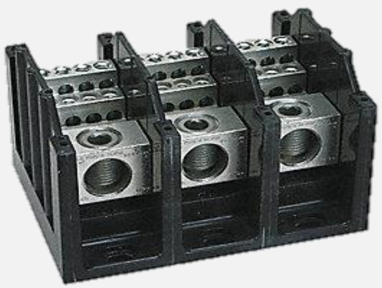
(1) A power monitoring system is installed that will provide continuous information regarding the total general lighting load of the building.

(2) The power monitoring system will be set with alarm values to alert the building owner or manager if the lighting load exceeds the values set by the energy code. Automatic means to take action to reduce the connected load shall be permitted.

(3) The demand factors specified in 220.42 are not applied to the general lighting load.

(4) A continuous load multiplier of 125 percent shall be applied.

Article 230 Services



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, pressure connectors, and devices for splices and taps shall be listed. Power distribution blocks installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.

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

Article 230 Services

230.62 Service Equipment — Enclosed or Guarded.

230.62(C) Barriers.

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

Relocated from 408.3(A)

Exception was removed for more than one service disconnect within a single enclosure – this is no longer permitted

Article 230 Services

230.66 Marking.

(A) General. Service equipment rated at 1000 volts or less shall be marked to identify it as being suitable for use as service equipment. All service equipment shall be listed or field evaluated.

(B) Meter Sockets. Meter sockets shall not be considered service equipment but shall be listed and rated for the voltage and current rating of the service.

Exception: Meter sockets supplied by and under the exclusive control of an electric utility shall not be required to be listed.

nec 2020

Article 230 Services

230.67 Surge Protection.

(A) Surge-Protective Device.

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

(B) Location.

The SPD shall be an integral part of the service equipment or shall be located immediately adjacent thereto.

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

Article 230 Services

230.67 Surge Protection.

(C) Type.

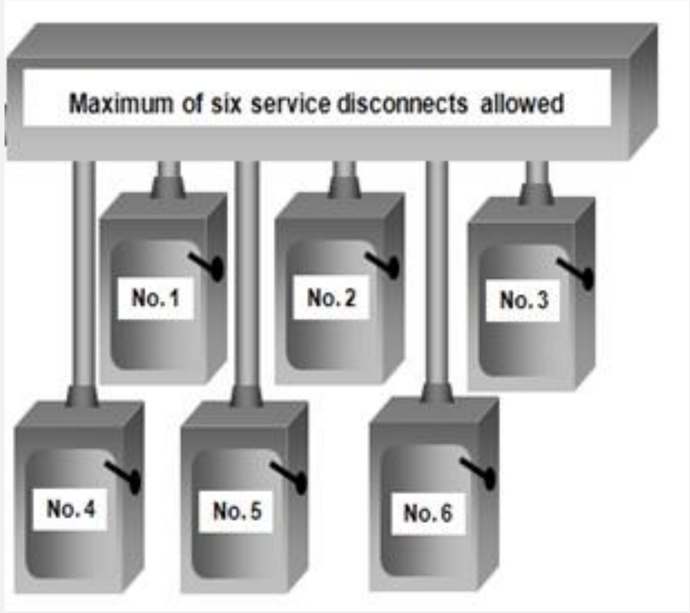
The SPD shall be a Type 1 or Type 2 SPD.

(D) Replacement.

Where service equipment is replaced, all of the requirements of this section shall apply.

Article 230 Services

230.71(B) Two to Six Service Disconnecting Means.



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

(1) Separate enclosures with a main service disconnecting means in each enclosure

(2) Panelboards with a main service disconnecting means in each panelboard enclosure

Article 230 Services

No longer permitted!

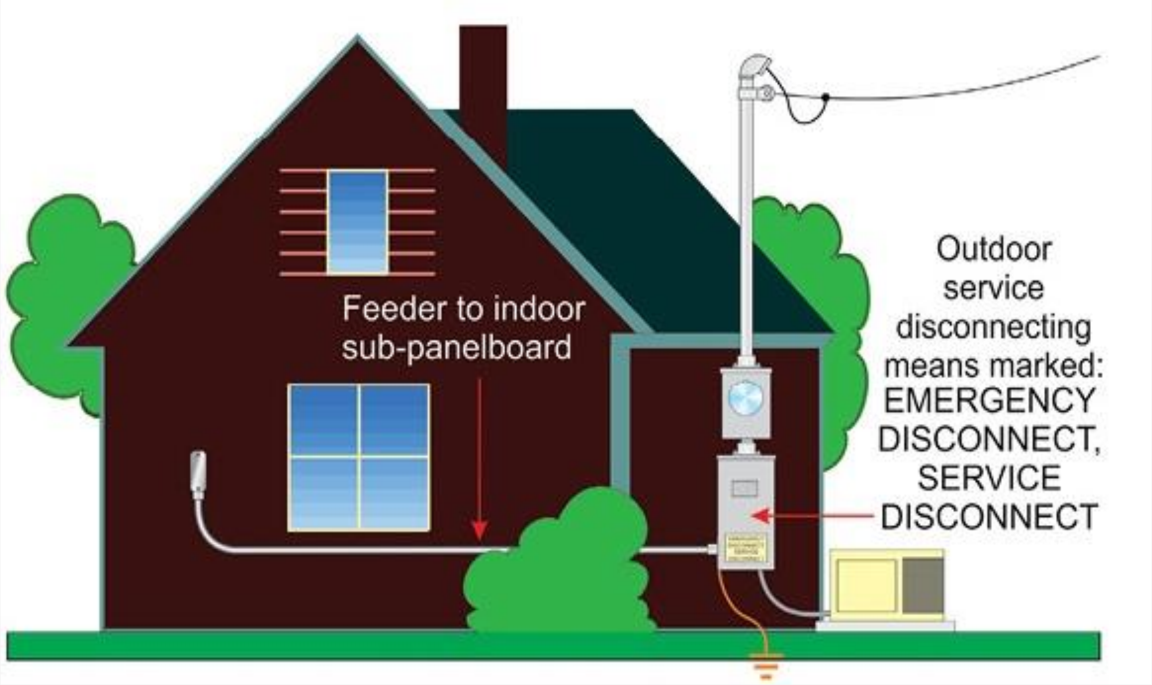
230.71(B) Two to Six Service Disconnecting Means.

(3) Switchboard(s) where there is only one service disconnect in each separate vertical section where there are barriers separating each vertical section

(4) Service disconnects in switchgear or metering centers where each disconnect is located in a separate compartment

Article 230 Services

Intent to protect firefighters / other emergency personnel.



230.85 Emergency Disconnects.

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

Article 230 Services

230.85 Emergency Disconnects.

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

(2) Meter disconnects installed per 230.82(3) (Adequate Short Circuit Current Rating) and marked as follows:

EMERGENCY DISCONNECT,
METER DISCONNECT,
NOT SERVICE EQUIPMENT

Article 230 Services

230.85 Emergency Disconnects.

(3) Other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are suitable for use as service equipment and marked as follows:

EMERGENCY DISCONNECT,
NOT SERVICE EQUIPMENT

Markings shall comply with 110.21(B).

Article 250

Article 250

Grounding and Bonding

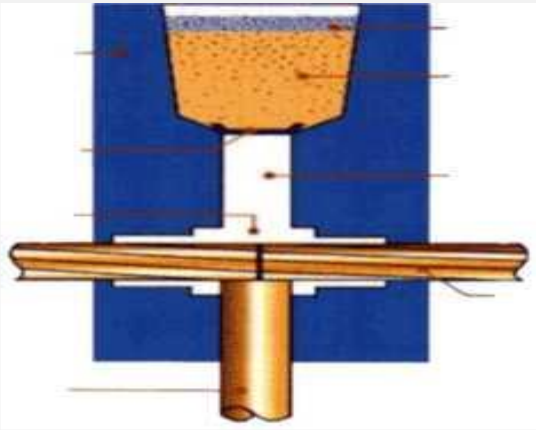
Ungrounded Systems

250.4(B)(4) Path for Fault Current.

Electrical equipment, wiring, and other electrically conductive material likely to become energized shall be installed in a manner that creates a low-impedance circuit from any point on the wiring system to the electrical supply source to facilitate the operation of overcurrent devices should a second ground fault from a different phase occur on the wiring system. The earth shall not be considered as an effective fault-current path.

Ground detectors must be installed per 250.21(B)

Article 250
Grounding and Bonding



250.8 Connection of Grounding and Bonding Equipment.

(A) Permitted Methods. Equipment grounding conductors, grounding electrode conductors, and bonding jumpers shall be connected by one or more of the following means:

(1) Listed pressure connectors

(2) Terminal bars

(3) Pressure connectors listed as grounding and bonding equipment

(4) Exothermic welding process

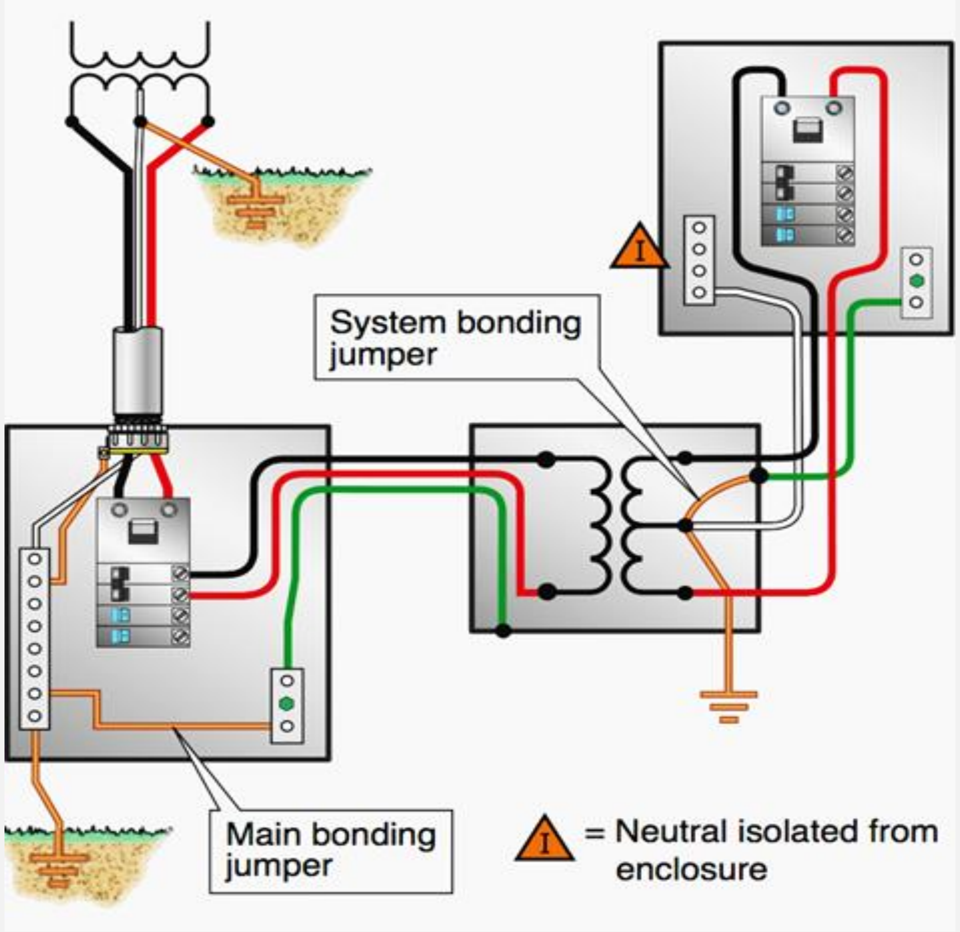
(5) Machine screw-type fasteners that engage not less than two threads or are secured with a nut

(6) Thread-forming machine screws that engage not less than two threads in the enclosure

(7) Connections that are part of a listed assembly

(8) Other listed means

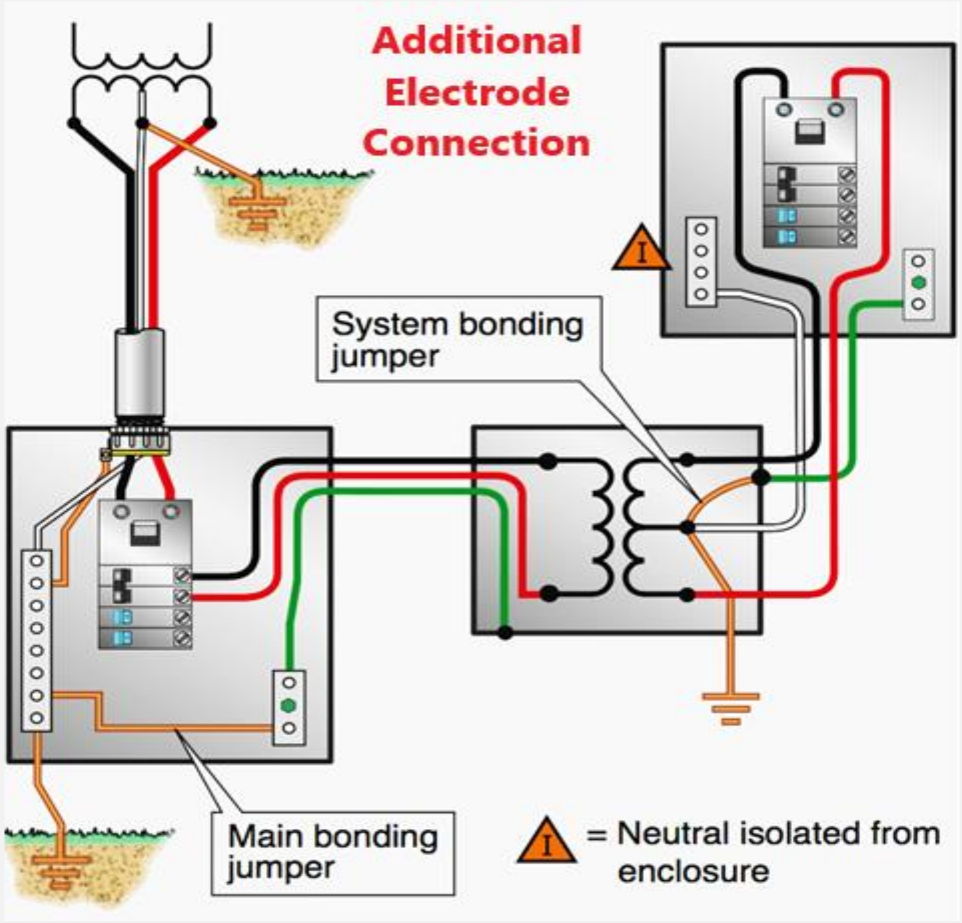
Article 250
Grounding and Bonding



250.24(A)(1) General.

The grounding electrode conductor connection shall be made at any accessible point from the load end of the overhead service conductors, service drop, underground service conductors, or service lateral to, including the terminal or bus to which the grounded service conductor is connected at the service disconnecting means.

Article 250
Grounding and Bonding

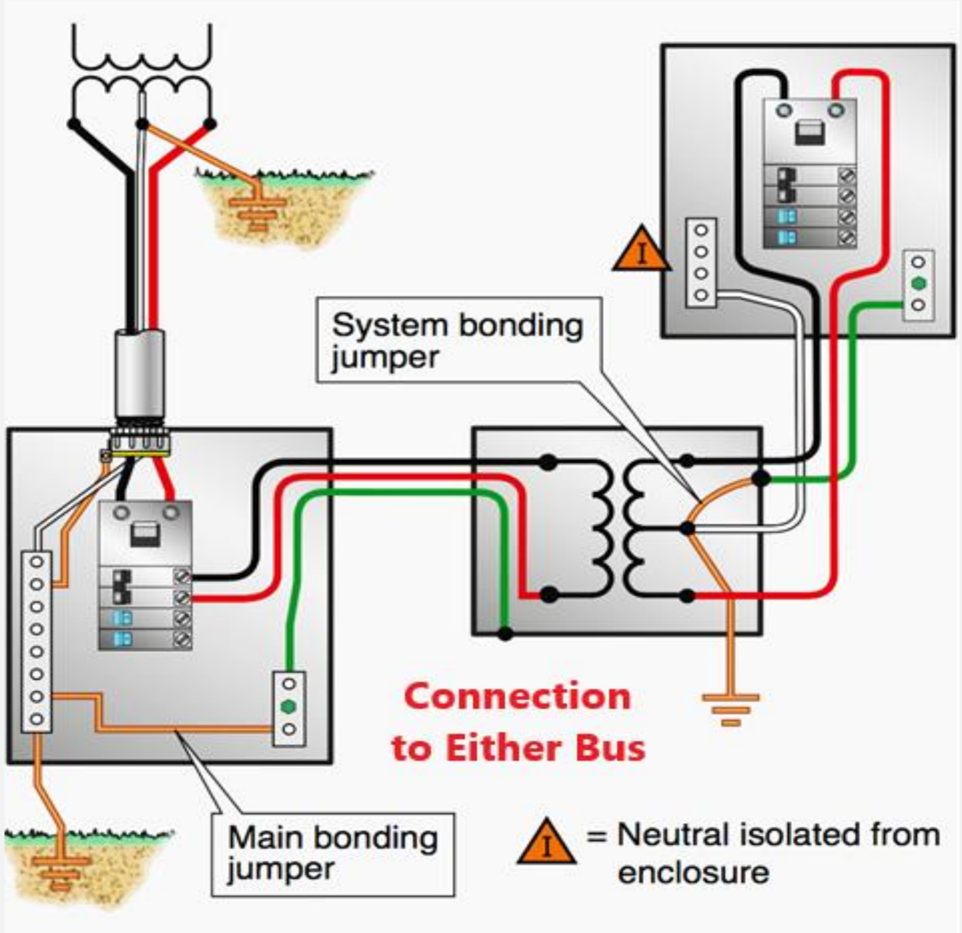


250.24(A)(2) Outdoor Transformer.

Where the transformer supplying the service is located outside the building, at least one additional grounding connection shall be made from the grounded service conductor to a grounding electrode, either at the transformer or elsewhere outside the building.

Exception: The additional grounding electrode conductor connection shall not be made on high-impedance grounded neutral systems. The system shall meet the requirements of 250.36.

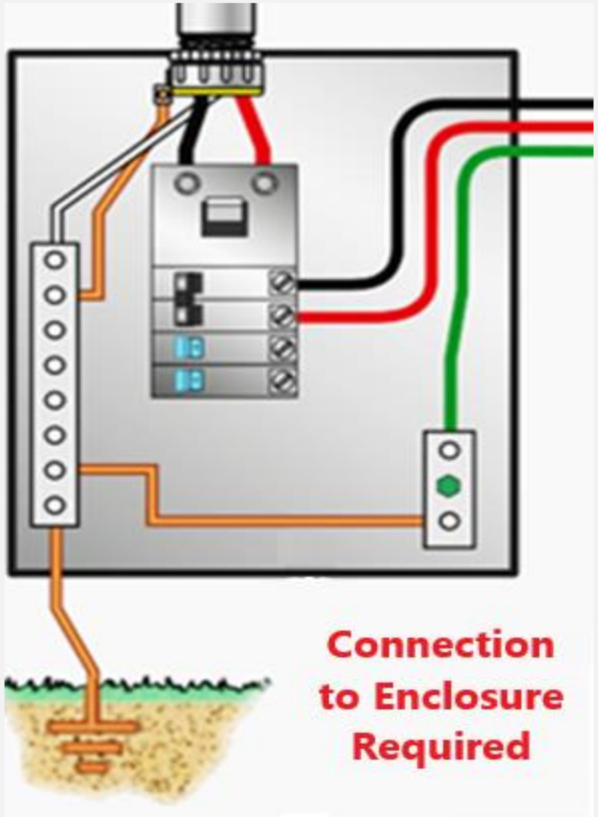
Article 250
Grounding and Bonding



250.24(A)(4) Main Bonding Jumper as Wire or Busbar.

Where the main bonding jumper specified in 250.28 is a wire or busbar and is installed from the grounded conductor terminal bar or bus to the equipment grounding terminal bar or bus in the service equipment, the grounding electrode conductor shall be permitted to be connected to the equipment grounding terminal, bar, or bus to which the main bonding jumper is connected.

Article 250
Grounding and Bonding



250.24(B) Main Bonding Jumper.

For a grounded system, an unspliced main bonding jumper shall be used to connect the equipment grounding conductor(s) and the service-disconnect enclosure to the grounded conductor within the enclosure for each service disconnect in accordance with 250.28.

Exception No. 1: Where more than one service disconnecting means is located in an assembly listed for use as service equipment, an unspliced main bonding jumper shall bond the grounded conductor(s) to the assembly enclosure.

Article 250
Grounding and Bonding

250.24(C) Grounded Conductor Brought to Service Equipment.

Where an ac system operating at 1000 volts or less is grounded at any point, the grounded conductor(s) shall be routed **with the ungrounded conductors to each service disconnecting means and shall be connected to each disconnecting means grounded conductor(s) terminal or bus**. A main bonding jumper shall connect the grounded conductor(s) to each service disconnecting means enclosure. The grounded conductor(s) shall be installed in accordance with 250.24(C)(1) through (C)(4).

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Grounding and Bonding

Table 250.102(C)(1) Grounded Conductor, Main Bonding Jumper, System Bonding Jumper, and Supply-Side Bonding Jumper for Alternating-Current Systems

Size of Largest Ungrounded Conductor or Equivalent Area for Parallel Conductors (AWG/kcmil)		Size of Grounded Conductor or Bonding Jumper* (AWG/kcmil)	
Copper	Aluminum or Copper-Clad Aluminum	Copper	Aluminum or Copper-Clad Aluminum
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	See Notes	

250.24(C)(1) Sizing for a Single Raceway or Cable.

The grounded conductor shall not be smaller than specified in Table 250.102(C)(1).

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Grounding and Bonding

250.24(C)(2) Parallel Conductors in Two or More Raceways or Cables.

If the ungrounded service-entrance conductors are installed in parallel in two or more raceways or cables, the grounded conductor shall also be installed in parallel. The size of the grounded conductor in each raceway or cable shall be based on the total circular mil area of the parallel ungrounded conductors in the raceway or cable, as indicated in 250.24(C)(1), but not smaller than 1/0 AWG.

Informational Note: See 310.10(G)for grounded conductors connected in parallel.

Article 250
Grounding and Bonding

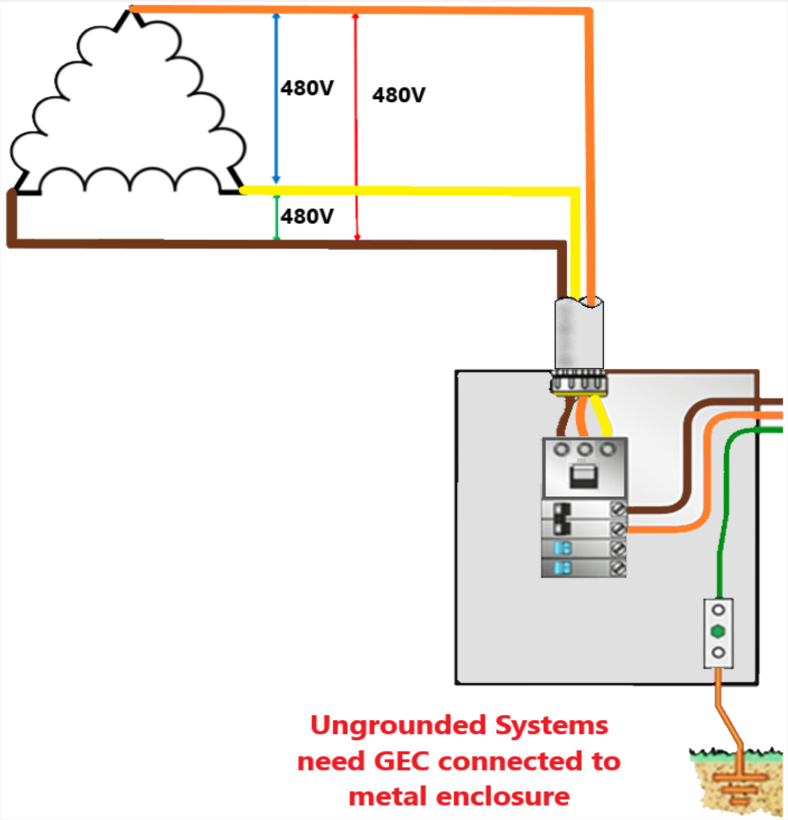
Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

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

250.24(D) Grounding Electrode Conductor.

A grounding electrode conductor shall be used to connect the equipment grounding conductors, the service-equipment enclosures, and, where the system is grounded, the grounded service conductor to the grounding electrode(s) required by Part III of this article. This conductor shall be sized in accordance with 250.66.

Article 250
Grounding and Bonding



250.24(E) Ungrounded System Grounding Connections.

A premises wiring system that is supplied by an ac service that is **ungrounded** shall have, at each service, a grounding electrode conductor connected to the grounding electrode(s) required by Part III of this article. The grounding electrode conductor shall be connected to a metal enclosure of the service conductors at any accessible point from the load end of the overhead service conductors, service drop, underground service conductors, or service lateral to the service disconnecting means.

Article 250
Grounding and Bonding

250.25 Grounding Systems Permitted to Be Connected on the Supply Side of the Disconnect.

The grounding of systems connected on the supply side of the service disconnect, as permitted in 230.82, that are in enclosures separate from the service equipment enclosure shall comply with 250.25(A) or (B).

(1) Cable Limiters

(2) Meters Sockets

(3) Meters and Meter Disconnects "Not Service Equipment"

(4) Instrument Transformers

(5) Load Management Devices

(6) Solar Photovoltaic

(7) Control Power to CB

(8) GFP and SPD Devices

(9) Listed Comm Equip

(10) Emergency Disconnects

(11) Meter Mounted Transfer Switches

Article 250
Grounding and Bonding

(A) System Grounding Connections

(B) Main Bonding Jumper

(C) Grounded Conductor Brought to Service Equipment

(D) Grounding Electrode Conductor

250.25(A) Grounded System.

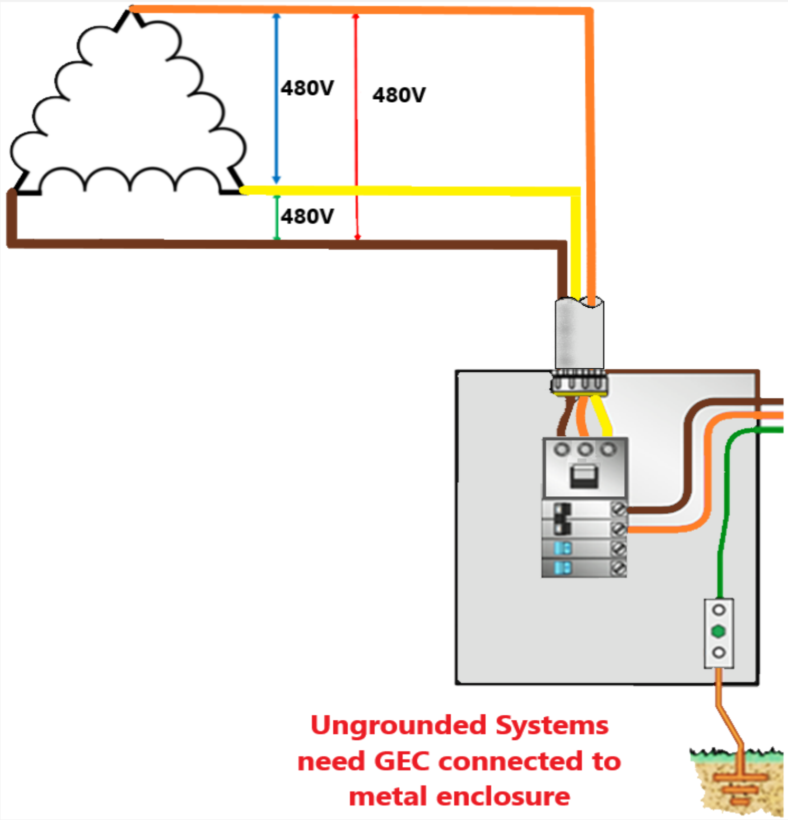
If the utility supply system is grounded, the grounding of systems permitted to be connected on the supply side of the service disconnect and are installed in one or more separate enclosures from the service equipment enclosure shall comply with the requirements of 250.24(A) through (D).

Article 250
Grounding and Bonding

250.25(B) Ungrounded Systems.

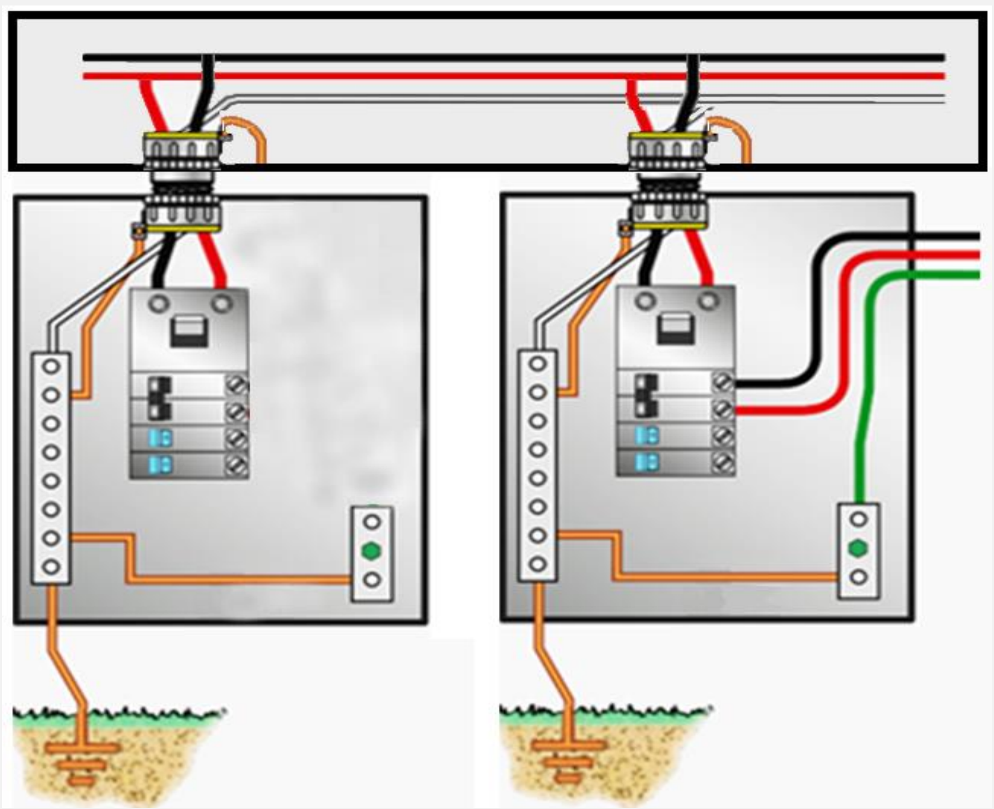
If the utility supply system is ungrounded, the grounding of systems permitted to be connected on the supply side of the service disconnect and are installed in one or more separate enclosures from the service equipment enclosure shall comply with the requirements of 250.24(E).

(E) Grounding Electrode Connection to metal Enclosure



Ungrounded Systems need GEC connected to metal enclosure

Article 250
Grounding and Bonding

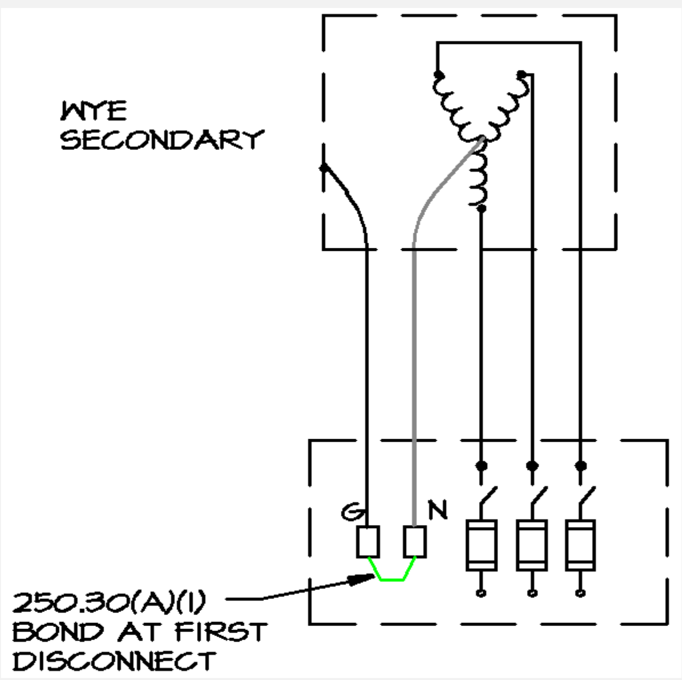


250.28(D)(2) Main Bonding Jumper for Service with More Than One Enclosure.

If a service consists of more than a single enclosure as permitted in 230.71(B), the main bonding jumper for each enclosure shall be sized in accordance with 250.28(D)(1) based on the largest ungrounded service conductor serving that enclosure.

Article 250

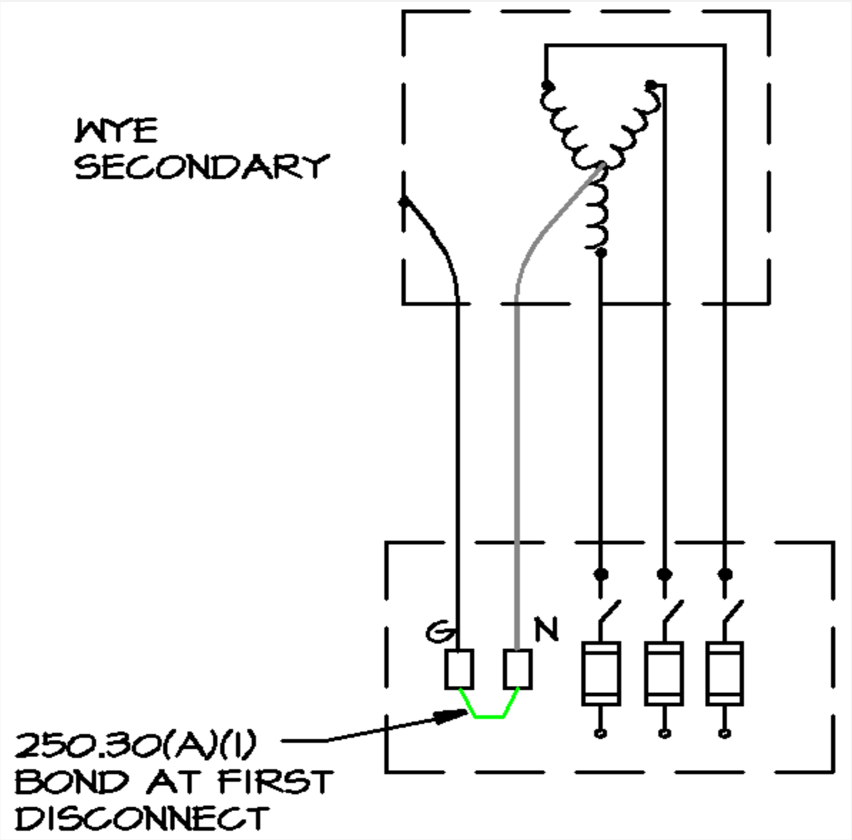
Grounding and Bonding

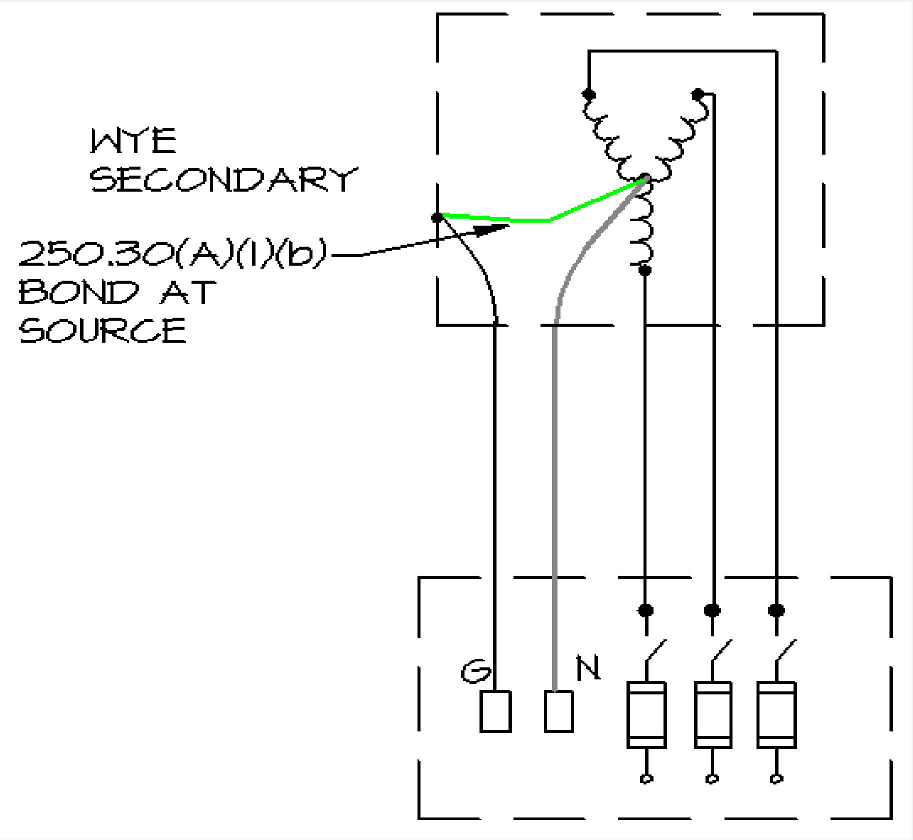


250.30 Grounding Separately Derived Alternating-Current Systems. (A) Grounded Systems.

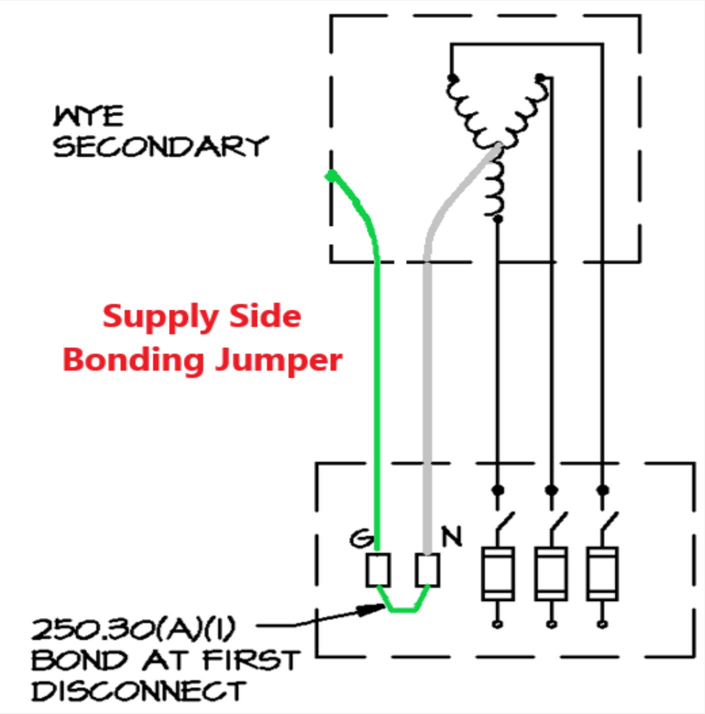
(1) System Bonding Jumper. An unspliced system bonding jumper shall comply with 250.28(A) through (D). This connection shall be made at any single point on the separately derived system from the source to the first system disconnecting means or overcurrent device, or it shall be made at the source of a separately derived system that has no disconnecting means or overcurrent devices, in accordance with 250.30(A)(1)(a) or (A)(1)(b). The system bonding jumper shall remain within the enclosure where it originates. **If the source is located outside the building or structure supplied, a system bonding jumper shall be installed at the grounding electrode connection in compliance with 250.30(C).**

Article 250
Grounding and Bonding





Article 250
Grounding and Bonding



250.30(A) Grounding Separately Derived Alternating- Current Systems.

(2) Supply-Side Bonding Jumper. If the source of a separately derived system and the first disconnecting means are located in separate enclosures, a supply-side bonding jumper shall be installed with the circuit conductors from the source enclosure to the first disconnecting means. A supply-side bonding jumper shall not be required to be larger than the derived ungrounded conductors. The supply-side bonding jumper shall be permitted to be of nonflexible metal raceway type or of the wire or bus type as follows:

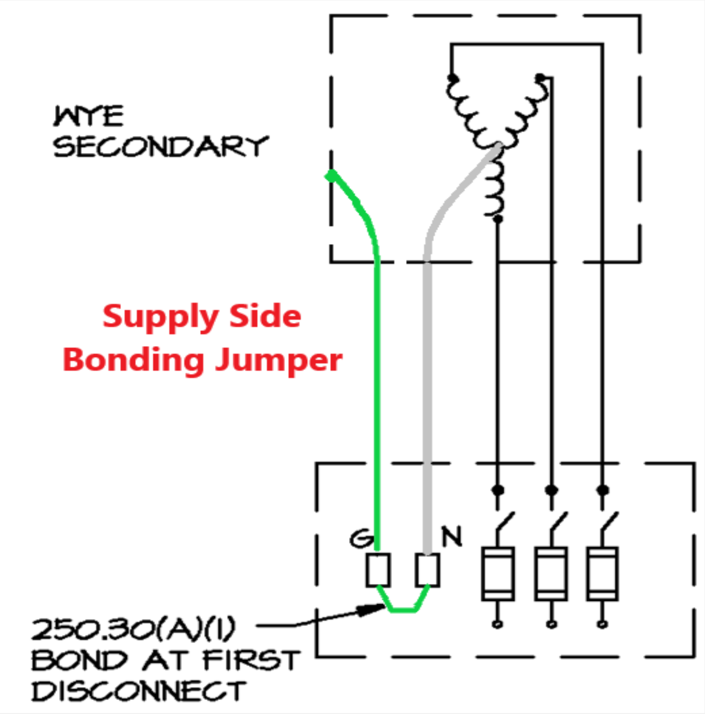
(a) A supply-side bonding jumper of the wire type shall comply with **250.102(C)**, based on the size of the derived ungrounded conductors.

Article 250
Grounding and Bonding

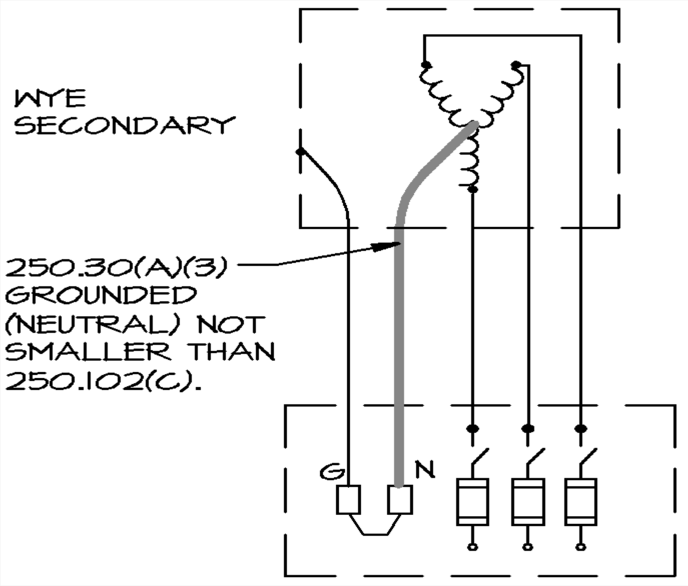
250.30(A) Grounding Separately Derived Alternating- Current Systems.

(2) Supply-Side Bonding Jumper. (Cont.)

(b) A supply-side bonding jumper of the bus type shall have a cross-sectional area not smaller than a supply-side bonding jumper of the wire type as determined in 250.102(C).



Article 250
Grounding and Bonding



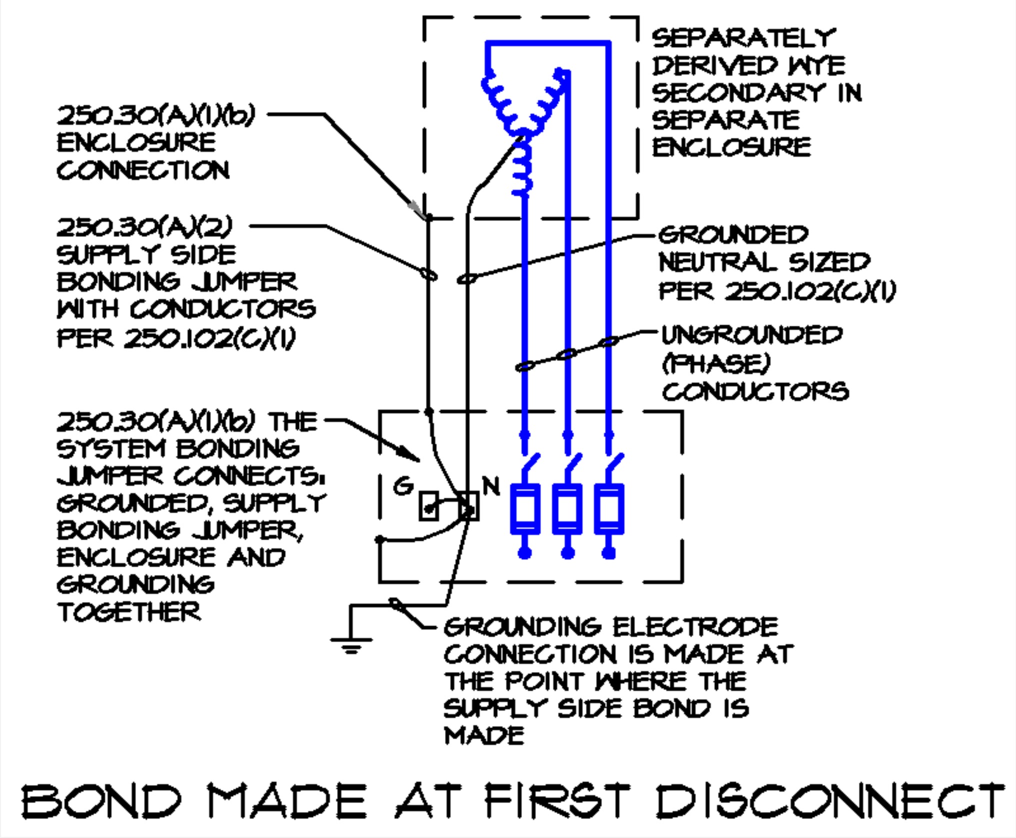
250.30(A) Grounding Separately Derived Alternating- Current Systems.

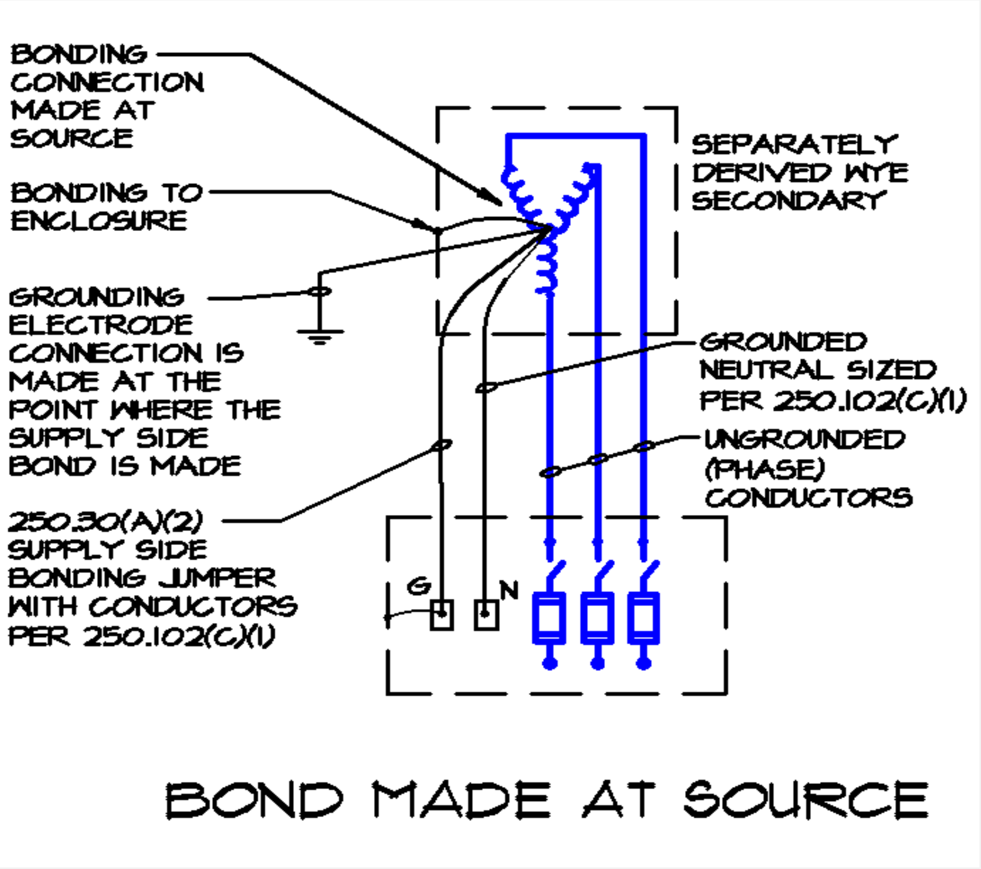
(3) Grounded Conductor. If a grounded conductor is installed and the system bonding jumper connection is not located at the source, 250.30(A)(3)(a) through (A)(3)(d) shall apply.

(a) *Sizing for a Single Raceway.* The grounded conductor shall not be smaller than specified in Table 250.102(C)(1).

(b) *Parallel Conductors in Two or More Raceways.* If the ungrounded conductors are installed in parallel in two or more raceways, the grounded conductor shall also be installed in parallel. The size of the grounded conductor in each raceway shall be based on the total circular mil area of the parallel derived ungrounded conductors in the raceway as indicated in 250.30(A)(3)(a), but not smaller than 1/0 AWG.

Article 250
Grounding and Bonding





Article 250
Grounding and Bonding

Table 250.102(C)(1) Grounded Conductor, Main Bonding Jumper, System Bonding Jumper, and Supply-Side Bonding Jumper for Alternating-Current Systems

Size of Largest Ungrounded Conductor or Equivalent Area for Parallel Conductors (AWG/kcmil)		Size of Grounded Conductor or Bonding Jumper* (AWG/kcmil)	
Copper	Aluminum or Copper-Clad Aluminum	Copper	Aluminum or Copper-Clad Aluminum
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	See Notes	

250.102 Bonding Conductors and Jumpers.

(C) Size — Supply-Side Bonding Jumper.

(1) Size for Supply Conductors in a Single Raceway or Cable. The supply-side bonding jumper shall not be smaller than specified in Table 250.102(C)(1).

Article 250
Grounding and Bonding

1. If the ungrounded supply conductors are larger than 1100 kcmil copper or 1750 kcmil aluminum, the grounded conductor or bonding jumper shall have an area not less than **12 1⁄2 percent** of the area of the largest ungrounded supply conductor or equivalent area for parallel supply conductors. The grounded conductor or bonding jumper shall not be required to be larger than the largest ungrounded conductor or set of ungrounded conductors.

2. If the ungrounded supply conductors and the bonding jumper are of different materials (copper, aluminum, or copper-clad aluminum), the minimum size of the grounded conductor or bonding jumper shall be based on the assumed use of ungrounded supply conductors of the same material as the grounded conductor or bonding jumper and will have an ampacity equivalent to that of the installed ungrounded supply conductors.

3. If multiple sets of service-entrance conductors are used as permitted in 230.40, Exception No. 2, or if multiple sets of ungrounded supply conductors are installed for a separately derived system, the equivalent size of the largest ungrounded supply conductor(s) shall be determined by the largest sum of the areas of the corresponding conductors of each set.

4. If there are no service-entrance conductors, the supply conductor size shall be determined by the equivalent size of the largest service entrance conductor required for the load to be served.

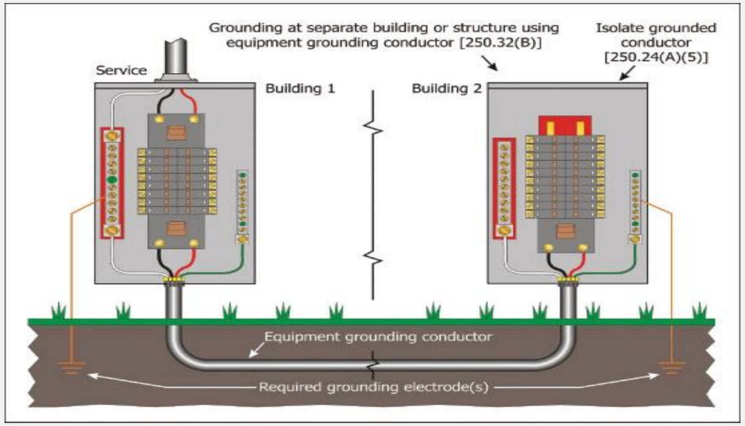
*For the purposes of this table, the term *bonding jumper* refers to main bonding jumpers, system bonding jumpers, and supply-side bonding jumpers.

Article 250
Grounding and Bonding

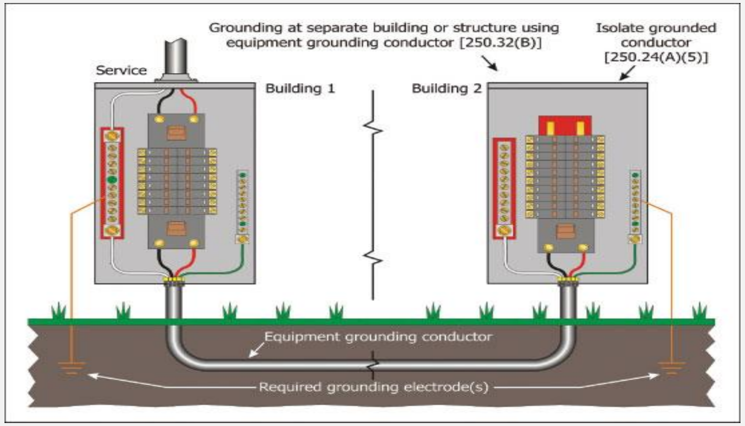
250.32 Buildings or Structures Supplied by a Feeder(s) or Branch Circuit(s).

(A) Grounding Electrode. Building(s) or structure(s) supplied by feeder(s) or branch circuit(s) shall have a grounding electrode or grounding electrode system installed in accordance with Part III of Article 250. The grounding electrode conductor(s) shall be connected in accordance with 250.32(B) or (C). Where there is no existing grounding electrode, the grounding electrode(s) required in 250.50 shall be installed.

Exception: A grounding electrode shall not be required where only a single branch circuit, including a multiwire branch circuit, supplies the building or structure and the branch circuit includes an equipment grounding conductor for grounding the normally non–current-carrying metal parts of equipment.



Article 250
Grounding and Bonding



250.32 Buildings or Structures Supplied by a Feeder(s) or Branch Circuit(s).

(B) Grounded Systems.

(1) Supplied by a Feeder or Branch Circuit. An equipment grounding conductor, as described in 250.118, shall be run with the supply conductors and be connected to the building or structure disconnecting means and to the grounding electrode(s). The equipment grounding conductor shall be used for grounding or bonding of equipment, structures, or frames required to be grounded or bonded. The equipment grounding conductor shall be sized in accordance with 250.122. Any installed grounded conductor shall not be connected to the equipment grounding conductor or to the grounding electrode(s).

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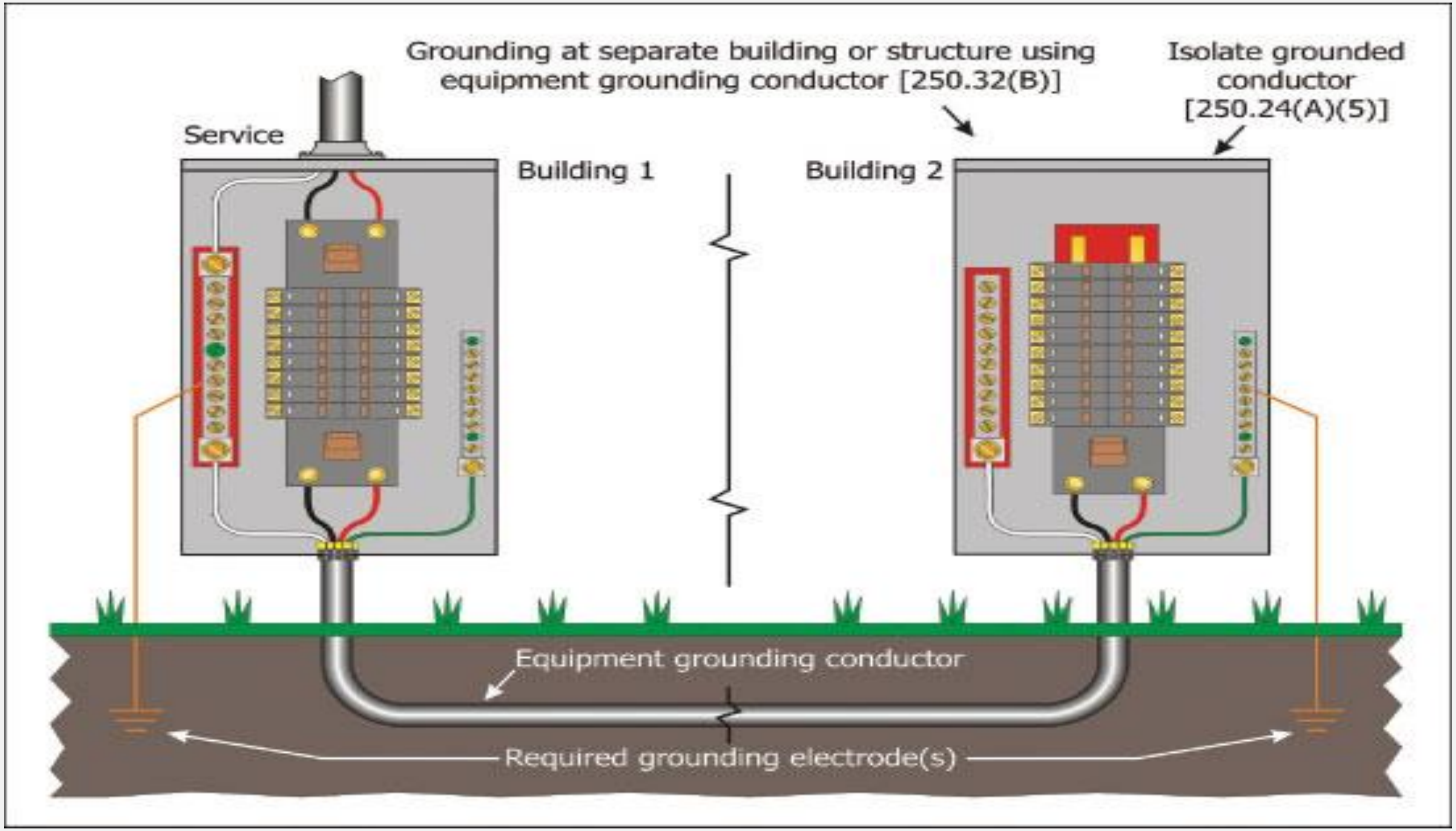
Grounding and Bonding

Look at Exception to 250.32(B)(1)



Grounding Electrode System

Article 250
Grounding and Bonding

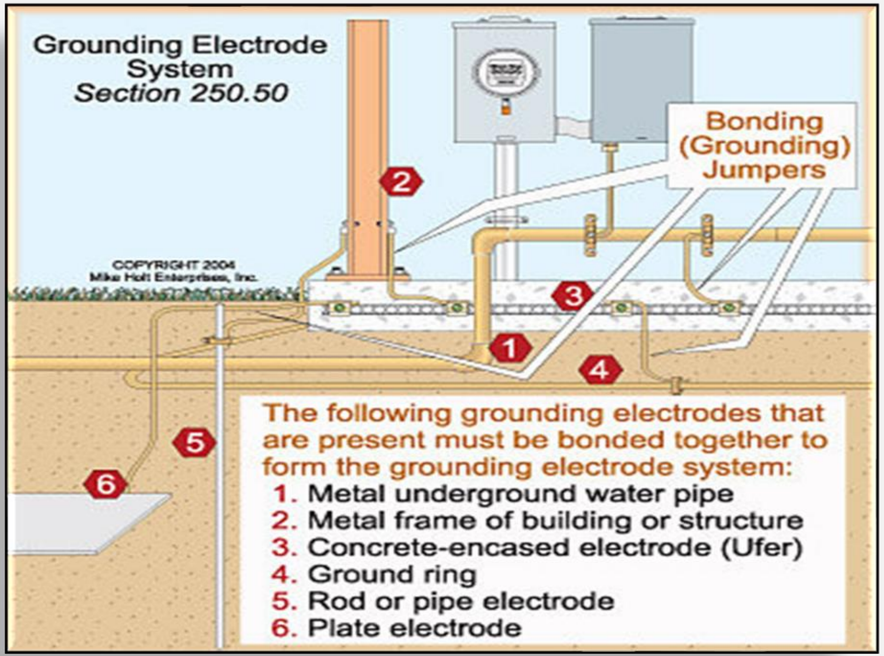
250.50 Grounding Electrode System.

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.

Exception: Concrete-encased electrodes of existing buildings or structures shall not be required to be part of the grounding electrode system where the steel reinforcing bars or rods are not accessible for use without disturbing the concrete.

Article 250
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 In-Ground Support Structure. (in 10’ of earth – w/ or w/out concrete)

(3) Concrete-Encased Electrode. (in 20’ of earth with ½” min rebar)

(4) Ground Ring. (2 AWG Min, 20’ min)

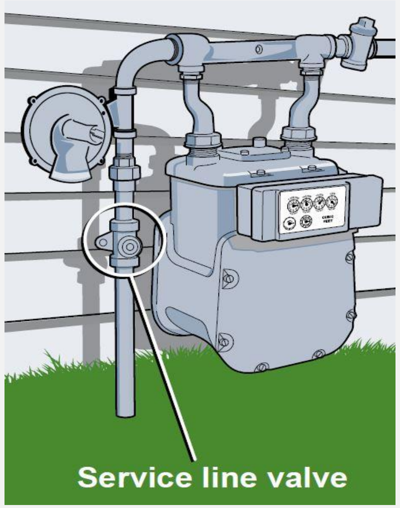
(5) Rod and Pipe Electrodes. (8’ min x 5/8” rod diameter min – stainless or copper coated)

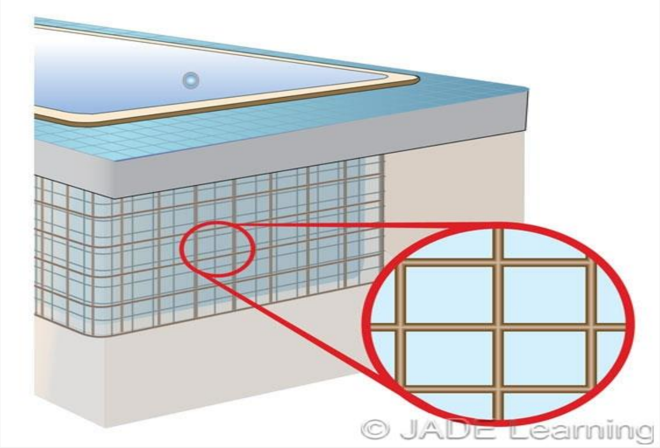
(6) Other Listed Electrodes

(7) Plate Electrodes. (2 ft^2 min, ¼” thick)

(8) Other Local Metal Underground Systems or Structures.

Article 250
Grounding and Bonding





250.52 Grounding Electrodes.

(B) Not Permitted for Use as Grounding Electrodes. The following systems and materials shall not be used as grounding electrodes:

(1) Metal underground gas piping systems

(2) Aluminum

(3) The structures and structural reinforcing steel described in 680.26(B)(1) and (B)(2)

Article 250
Grounding and Bonding

Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

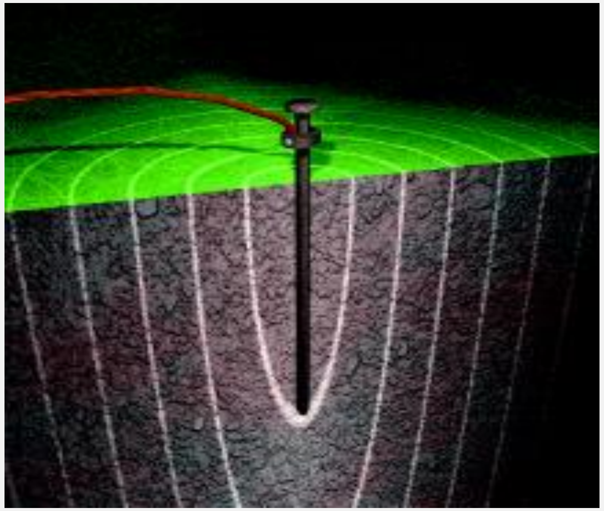
Size of Largest Ungrounded Service-Entrance Conductor or Equivalent Area for Parallel Conductors[a] (AWG/kcmil)		Size of Grounding Electrode Conductor (AWG/kcmil)	
Copper	Aluminum or Copper-Clad Aluminum	Copper	Aluminum or Copper-Clad Aluminum[b]
2 or smaller	1/0 or smaller	8	6
1 or 1/0	2/0 or 3/0	6	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 at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system of a grounded or ungrounded ac system shall not be less than given in **Table 250.66**, except as permitted in 250.66(A) through (C).

Article 250
Grounding and Bonding

250.53 Grounding Electrode System Installation.

(A) Rod, Pipe, and Plate Electrodes. Rod, pipe, and plate electrodes shall meet the requirements of 250.53(A)(1) through (A)(3).

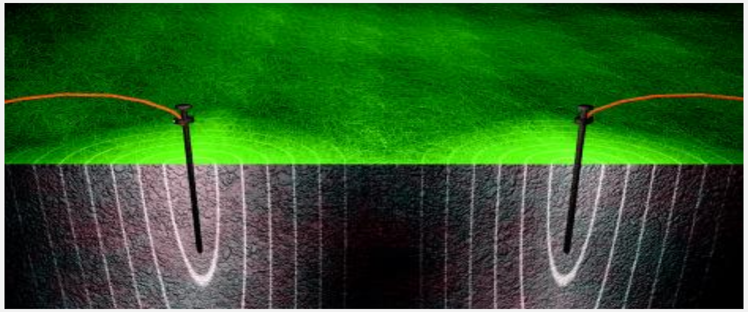


(1) Below Permanent Moisture Level. If practicable, rod, pipe, and plate electrodes shall be embedded below permanent moisture level. Rod, pipe, and plate electrodes shall be free from nonconductive coatings such as paint or enamel.

Article 250
Grounding and Bonding

250.53 Grounding Electrode System Installation.

(2) Supplemental Electrode Required. A single rod, pipe, or plate electrode shall be supplemented by an additional electrode of a type specified in 250.52(A)(2) through (A)(8). The supplemental electrode shall be permitted to be bonded to one of the following:



(1) Rod, pipe, or plate electrode

(2) Grounding electrode conductor

(3) Grounded service-entrance conductor

(4) Nonflexible grounded service raceway

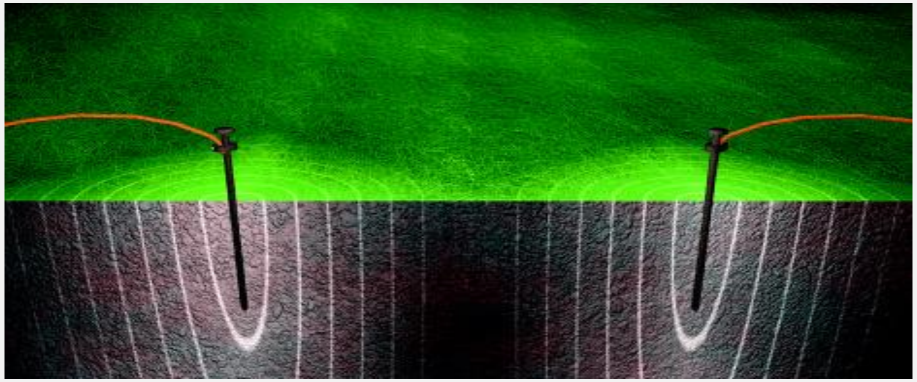
(5) Any grounded service enclosure

Exception: If a single rod, pipe, or plate grounding electrode has a resistance to earth of 25 ohms or less, the supplemental electrode shall not be required.

Article 250
Grounding and Bonding

250.53 Grounding Electrode System Installation.

(3) Supplemental Electrode. If multiple rod, pipe, or plate electrodes are installed to meet the requirements of this section, they shall not be less than 1.8 m (6 ft) apart.



Article 250
Grounding and Bonding

250.53 Grounding Electrode System Installation.

(D) Metal Underground Water Pipe. If used as a grounding electrode, metal underground water pipe shall meet the requirements of 250.53(D)(1) and (D)(2).

(1) Continuity. Continuity of the grounding path or the bonding connection to interior piping shall not rely on water meters or filtering devices and similar equipment.

Article 250
Grounding and Bonding

250.53 Grounding Electrode System Installation.

(2) Supplemental Electrode Required. A metal underground water pipe **shall be supplemented** by an additional electrode of a type specified in 250.52(A)(2) through (A)(8). If the supplemental electrode is of the rod, pipe, or plate type, it shall comply with 250.53(A). The supplemental electrode shall be bonded to one of the following:

(1) Grounding electrode conductor

(2) Grounded service-entrance conductor

(3) Nonflexible grounded service raceway

(4) Any grounded service enclosure

(5) As provided by 250.32(B)

Exception: The supplemental electrode shall be permitted to be bonded to the interior metal water piping at any convenient point as specified in 250.68(C)(1), Exception.

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Grounding and Bonding

250.53(C) Bonding Jumper.

The bonding jumper(s) used to connect the grounding electrodes together to form the grounding electrode system shall be installed in accordance with 250.64(A), (B), and (E), shall be sized in accordance with 250.66, and shall be connected in the manner specified in 250.70. Rebar shall not be used as a conductor to interconnect the electrodes of grounding electrode systems.

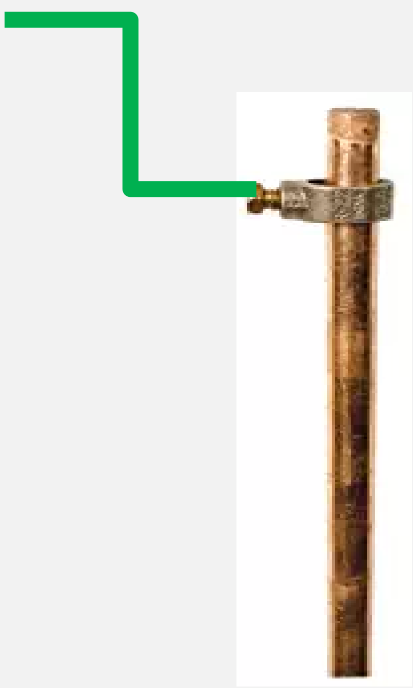
2020 change

Article 250
Grounding and Bonding

250.53 Grounding Electrode System Installation.

(E) Supplemental Electrode Bonding Connection Size. Where the supplemental electrode is a rod, pipe, or plate electrode, that portion of the bonding jumper that is the sole connection to the supplemental grounding electrode shall not be required to be larger than **6 AWG copper wire** or 4 AWG aluminum wire.

6 AWG copper max



6 AWG must be protected per 250.64

Article 250
Grounding and Bonding

250.53 Grounding Electrode System Installation.

(G) Rod and Pipe Electrodes. The electrode shall be installed such that at least 2.44 m (8 ft) of length is in contact with the soil. It shall be driven to a depth of not less than 2.44 m (8 ft) except that, where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from the vertical or, where rock bottom is encountered at an angle up to 45 degrees, the electrode shall be permitted to be buried in a trench that is at least 750 mm (30 in.) deep. The upper end of the electrode shall be flush with or below ground level unless the aboveground end and the grounding electrode conductor attachment are protected against physical damage as specified in 250.10.

Article 250
Grounding and Bonding

250.54 Auxiliary Grounding Electrodes. One or more grounding electrodes shall be permitted to be connected to the equipment grounding conductors specified in 250.118 and shall not be required to comply with the electrode bonding requirements of 250.50 or 250.53(C) or the resistance requirements of 250.53(A)(2) Exception, but the earth shall not be used as an effective ground-fault current path as specified in 250.4(A)(5) and 250.4(B)(4).

Article 250
Grounding and Bonding

250.64 Grounding Electrode Conductor Installation.

(B) Securing and Protection Against Physical Damage. Where exposed, a grounding electrode conductor or its enclosure shall be securely fastened to the surface on which it is carried. Grounding electrode conductors shall be permitted to be installed on or through framing members.

(1) Not Exposed to Physical Damage. A 6 AWG or larger copper or aluminum grounding electrode conductor not exposed to physical damage shall be permitted to be run along the surface of the building construction without metal covering or protection.

Article 250
Grounding and Bonding

250.64 Grounding Electrode Conductor Installation.

(2) Exposed to Physical Damage. A 6 AWG or larger copper or aluminum grounding electrode conductor exposed to physical damage shall be protected in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid polyvinyl chloride conduit (PVC), reinforced thermosetting resin conduit Type XW (RTRC-XW), electrical metallic tubing (EMT), or cable armor.

Article 250
Grounding and Bonding

250.64 Grounding Electrode Conductor Installation.

(3) Smaller Than 6 AWG. Grounding electrode conductors smaller than 6 AWG shall be protected in RMC, IMC, PVC, RTRC-XW, EMT, or cable armor.

Article 250
Grounding and Bonding

250.64 Grounding Electrode Conductor Installation

(C) Continuous. Except as provided in 250.30(A)(5) and (A)(6), 250.30(B)(1), and 250.68(C), grounding electrode conductor(s) shall be installed in one continuous length without a splice or joint. If necessary, splices or connections shall be made as permitted in (1) through (4):

(1) Splicing of the wire-type grounding electrode conductor shall be permitted only by irreversible compression-type connectors listed as grounding and bonding equipment or by the exothermic welding process.

(2) Sections of busbars shall be permitted to be connected together to form a grounding electrode conductor.

(3) Bolted, riveted, or welded connections of structural metal frames of buildings or structures.

(4) Threaded, welded, brazed, soldered or bolted-flange connections of metal water piping.

Article 250
Grounding and Bonding

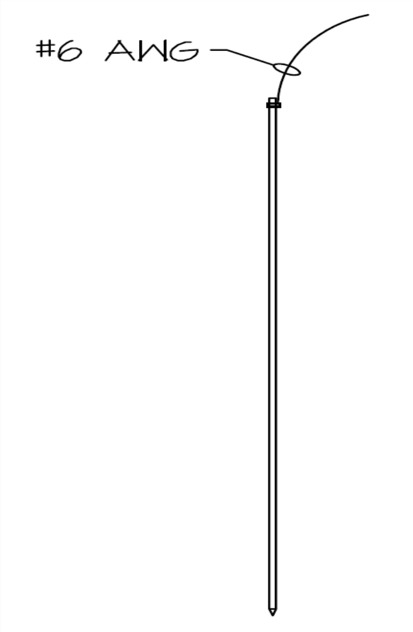
Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

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 at the service, at each building or structure where supplied by a feeder(s) or branch circuit(s), or at a separately derived system of a grounded or ungrounded ac system shall not be less than given in Table 250.66, except as permitted in 250.66(A) through (C).

Article 250
Grounding and Bonding

250.66 (A) Connections to a Rod, Pipe, or Plate Electrode(s).



(A) Connections to a Rod, Pipe, or Plate Electrode(s). If the grounding electrode conductor or bonding jumper connected to a single or multiple rod, pipe, or plate electrode(s), or any combination thereof, as described in 250.52(A)(5) or (A)(7), does not extend on to other types of electrodes that require a larger size conductor, the grounding electrode conductor shall not be required to be larger than 6 AWG copper wire or 4 AWG

Be careful of physical protection of #6 AWG grounding electrode conductor requirements in NEC 250.64(B)

Article 250
Grounding and Bonding

250.68(C) Grounding Electrode Conductor Connections. Grounding electrode conductors and bonding jumpers shall be permitted to be connected at the following locations and used to extend the connection to an electrode(s):

(1) Interior metal water piping that is electrically continuous with a metal underground water pipe electrode and is located not more than 1.52 m (5 ft) from the point of entrance to the building shall be permitted **to extend the connection to an electrode(s). Interior metal water piping located more than 1.52 m (5 ft) from the point of entrance** to the building shall not be used as a conductor to interconnect electrodes of the grounding electrode system.

Exception: In industrial, comm, & inst. buildings, if conditions of maintenance and supervision ensure that only qualified persons service the installation, interior metal water piping located more than 1.52 m (5 ft) from the point of entrance to the building shall be permitted.

Article 250
Grounding and Bonding

250.68(C) Grounding Electrode Conductor Connections.

(2) The metal structural frame of a building shall be permitted to be used as a conductor to interconnect electrodes that are part of the grounding electrode system, or as a grounding electrode conductor. Hold-down bolts securing the structural steel column that are connected to a concrete-encased electrode complying with 250.52(A)(3) and is located in the support footing or foundation shall be permitted to connect the metal structural frame of a building or structure to the concrete encased grounding electrode. The hold-down bolts shall be connected to the concrete-encased electrode by welding, exothermic welding, the usual steel tie wires, or other approved means.

Article 250

Grounding and Bonding

250.68(C) Grounding Electrode Conductor Connections.

(3) A rebar-type concrete-encased electrode installed in accordance with 250.52(A)(3) with an additional rebar section extended from its location within the concrete foundation or footing to an accessible location that is not subject to corrosion shall be permitted for connection of grounding electrode conductors and bonding jumpers in accordance with the following:

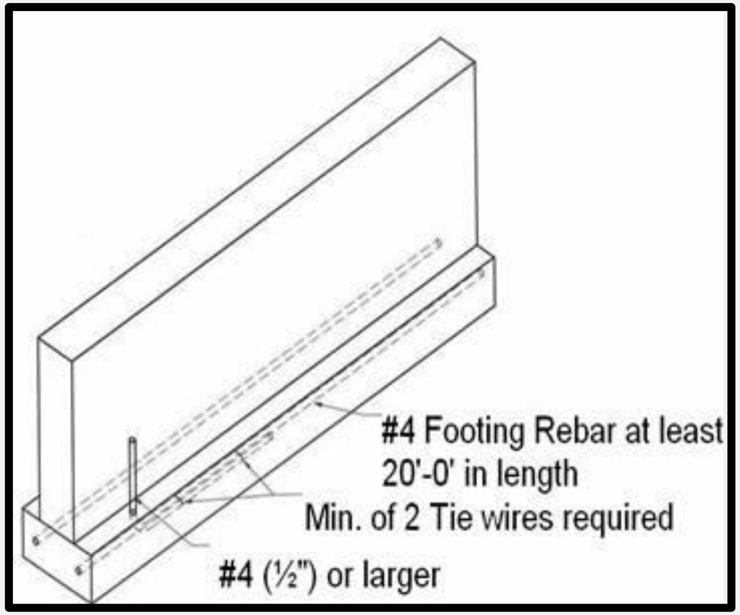
Article 250
Grounding and Bonding

250.68(C) Grounding Electrode Conductor Connections.

a. The additional rebar section shall be continuous with the grounding electrode rebar or shall be connected to the grounding electrode rebar and connected together by the usual steel tie wires, exothermic welding, welding, or other effective means.

b. The rebar extension shall not be exposed to contact with the earth without corrosion protection.

c. Rebar shall not be used as a conductor to interconnect the electrodes of grounding electrode systems.



Article 250
Grounding and Bonding

250.94 Bonding for Communication Systems.
Communications system bonding terminations shall be connected in accordance with (A) or (B).

(A) The Intersystem Bonding Termination Device. An intersystem bonding termination (IBT) for connecting intersystem bonding conductors shall be provided external to enclosures at the service equipment or metering equipment enclosure and at the disconnecting means for any additional buildings or structures. If an IBT is used, it shall comply with the following:

(1) Be accessible

(2) Be a set of Terminals

(3) Allow opening of equipment

(4) Securely Fastened

(5) #6 AWG bond min

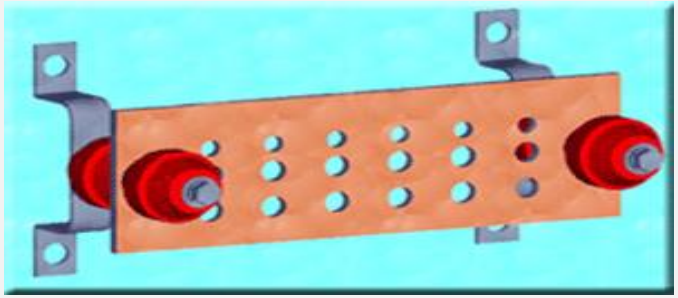
(6) Be Listed

Article 250
Grounding and Bonding

250.94 Bonding for Communication Systems.

(B) Other Means. Connections to an aluminum or copper busbar not less than 6 mm thick × 50 mm wide (1⁄4 in. thick × 2 in. wide) and of sufficient length to accommodate at least three terminations for communication systems in addition to other connections. The busbar shall be securely fastened and shall be installed in an accessible location. Connections shall be made by a listed connector. If aluminum busbars are used, the installation shall also comply with 250.64(A).

Exception to (A) and (B): Means for connecting intersystem bonding conductors are not required where communications systems are not likely to be used.



An IBT will reduce noise on the communication system

Article 250
Grounding and Bonding

250.102 Grounded Conductor, Bonding Conductors, and Jumpers.

(A) Material. Bonding jumpers shall be of copper, aluminum, copper-clad aluminum, or other corrosion-resistant material. A bonding jumper shall be a wire, bus, screw, or similar suitable conductor.

(B) Attachment. Bonding jumpers shall be attached in the manner specified by the applicable provisions of 250.8 for circuits and equipment and by 250.70 for grounding electrodes

Article 250
Grounding and Bonding

Exception: metal frame of building can be used and is bonded to metal water pipe

250.104(D) Separately Derived Systems. Metal water piping systems and structural metal that is interconnected to form a building frame shall be bonded to separately derived systems in accordance with 250.104(D)(1) through 250.104(D)(3).

(1) Metal Water Piping System(s). The **grounded conductor** of each separately derived system shall be bonded to the nearest available point of the metal water piping system(s) in the area served by each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1) based on the largest ungrounded conductor of the separately derived system.

Article 250
Grounding and Bonding

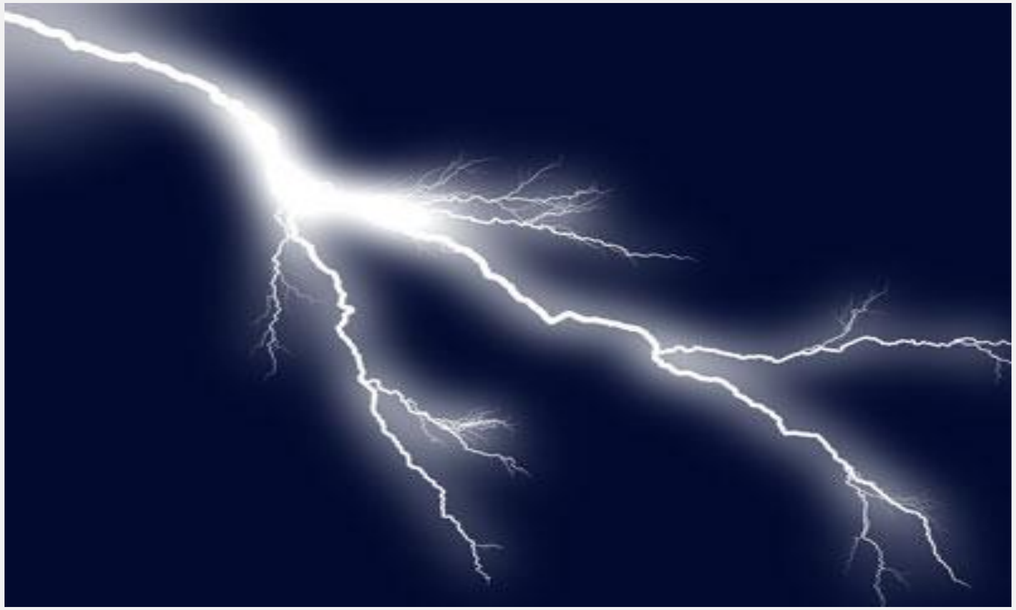
250.104(D) Separately Derived Systems.

(2) Structural Metal. If exposed structural metal that is interconnected to form the building frame exists in the area served by the separately derived system, it shall be bonded to the **grounded conductor** of each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table 250.102(C)(1) based on the largest ungrounded conductor of the separately derived system.

Exception: If metal frame is used as grounding electrode or water line is used

Article 250
Grounding and Bonding

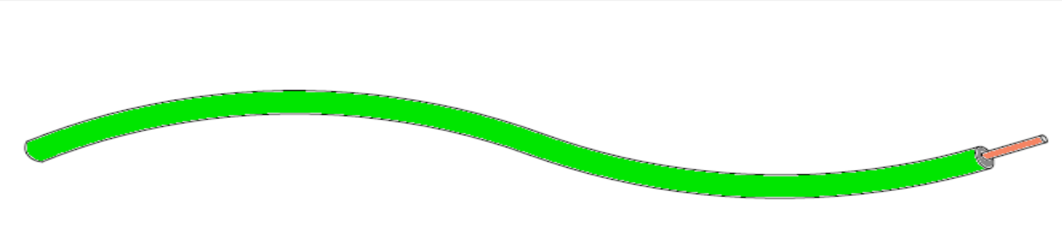
250.106 Lightning Protection Systems. The lightning protection system ground terminals shall be bonded to the building or structure grounding electrode system.



Article 250
Grounding and Bonding

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 Grounding and Bonding

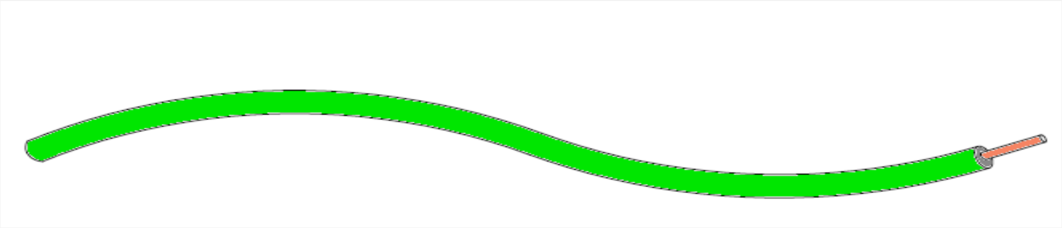


Table 250.122 Minimum Size Equipment Grounding Conductors for Grounding Raceway and Equipment

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
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0
800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	350
2000	250	400
2500	350	600
3000	400	600
4000	500	750
5000	700	1250
6000	800	1250

Article 250
Grounding and Bonding

250.122(B) Increased in Size. Where ungrounded conductors are increased in size from the minimum size that has sufficient ampacity for the intended installation, wire-type equipment grounding conductors, where installed, shall be increased in size proportionately according to the circular mil area of the ungrounded conductors.

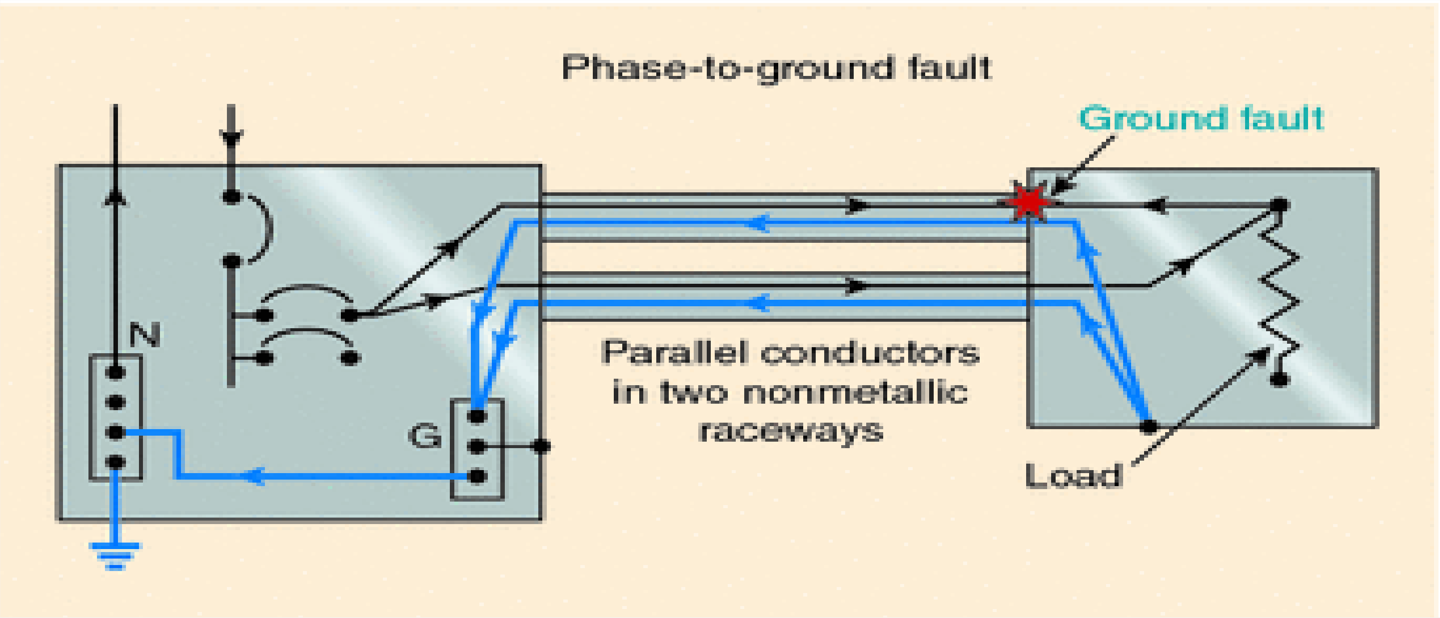
Article 250
Grounding and Bonding

250.122 (F) Conductors in Parallel. Where conductors are installed in parallel in multiple raceways or cables as permitted in 310.10(H), the equipment grounding conductors, where used, shall be installed in parallel in each raceway or cable. Where conductors are installed in parallel in the same raceway, cable, or cable tray as permitted in 310.10(H), a single equipment grounding conductor shall be permitted. Equipment grounding conductors installed in cable tray shall meet the minimum requirements of 392.10(B)(1)(c).

Each equipment grounding conductor shall be sized in compliance with 250.122.

Article 250
Grounding and Bonding

Grounding paths for ground fault at the load supplied by parallel conductors in two nonmetallic raceways, illustrating the reason for the requirement of 250.122(F)(1).



Chapter 3
Cables and Raceways
Type AC Cable

ARTICLE 320
Armored Cable: Type AC

320.6 Listing Requirements.

Type AC cable and associated fittings shall be listed.

A listing was added in 2017 NEC as a requirement in each article for cable assemblies

ARTICLE 320
Armored Cable: Type AC

320.30 Securing and Supporting.

(A) General. Type AC cable shall be supported and secured by staples; cable ties listed and identified for securement and support; straps, hangers, or similar fittings; or other approved means designed and installed so as not to damage the cable.

(B) Securing. Unless otherwise permitted, Type AC cable shall be secured within 300 mm (12 in.) of every outlet box, junction box, cabinet, or fitting and at intervals not exceeding 1.4 m (4 1⁄2 ft).

ARTICLE 320
Armored Cable: Type AC

320.30 Securing and Supporting.

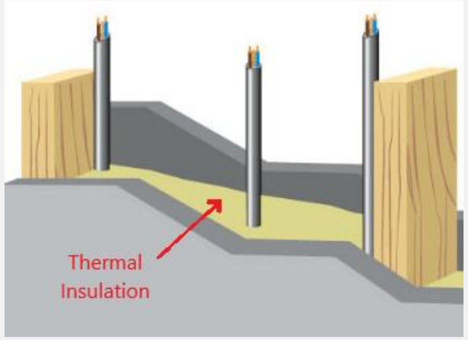
(C) Supporting. Unless otherwise permitted, Type AC cable shall be supported at intervals not exceeding 1.4 m (4 1⁄2 ft).

Horizontal runs of Type AC cable installed in wooden or metal framing members or similar supporting means shall be considered supported where such support does not exceed 1.4 m (4 1⁄2 ft) intervals.

ARTICLE 320
Armored Cable: Type AC

320.80(A) Thermal Insulation.

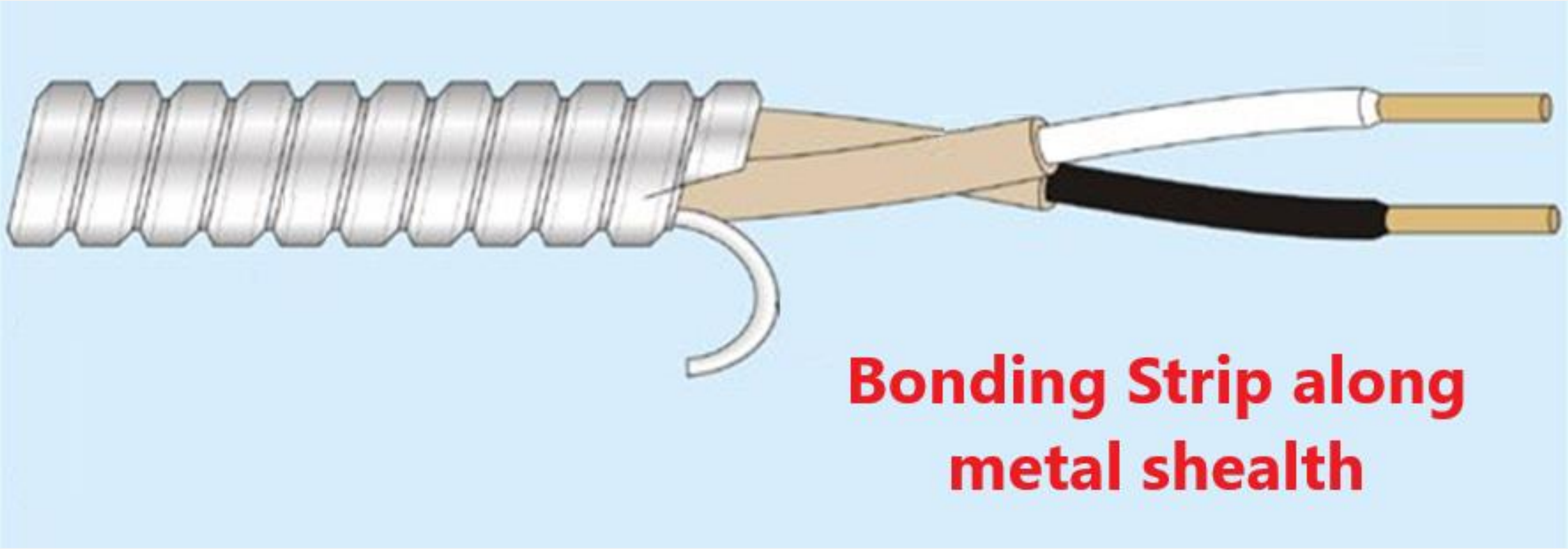
Armored cable installed in thermal insulation shall have conductors rated at 90°C (194°F). The ampacity of cable installed in these applications shall not exceed that of a 60°C (140°F) rated conductor. The 90°C (194°F) rating shall be permitted to be used for ampacity adjustment and correction calculations; however, the ampacity shall not exceed that of a 60°C (140°F) rated conductor.



Where more than two 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).

ARTICLE 320
Armored Cable: Type AC

320.108 Equipment Grounding Conductor. Type AC cable shall provide an adequate path for fault current as required by 250.4(A)(5) or (B)(4) to act as an equipment grounding conductor.



Chapter 3
Cables and Raceways
Type MC Cable

ARTICLE 330
Metal-Clad Cable: Type MC

330.10 Uses Permitted.

(A) General Uses. Type MC cable shall be permitted as follows:

(1) For services, feeders, and branch circuits.

(2) For power, lighting, control, and signal circuits.

(3) Indoors or outdoors.

(4) Exposed or concealed.

(5) To be direct buried where identified for such use.

(6) In cable tray where identified for such use.

(7) In any raceway.

(8) As aerial cable on a messenger.

(9) In hazardous (classified) locations where specifically permitted by other articles in this *Code*.

ARTICLE 330
Metal-Clad Cable: Type MC

330.10 Uses Permitted.

(10) In dry locations and embedded in plaster finish on brick or other masonry except in damp or wet locations.

(11) In wet locations where a corrosion-resistant jacket is provided over the metallic covering and any of the following conditions are met:

a. The metallic covering is impervious to moisture.

b. A jacket resistant to moisture is provided under the metal covering.

c. The insulated conductors under the metallic covering are listed for use in wet locations.

(12) Where single-conductor cables are used, all phase conductors and, where used, the grounded conductor shall be grouped together to minimize induced voltage on the sheath.

ARTICLE 330
Metal-Clad Cable: Type MC

330.12 Uses Not Permitted. Type MC cable shall not be used under either of the following conditions:

(1) Where subject to physical damage

(2) Where exposed to any of the destructive corrosive conditions in (a) or (b), unless the metallic sheath or armor is resistant to the conditions or is protected by material resistant to the conditions:

a. Direct buried in the earth or embedded in concrete unless identified for direct burial

b. Exposed to cinder fills, strong chlorides, caustic alkalis, or vapors of chlorine or of hydrochloric acids

ARTICLE 330
Metal-Clad Cable: Type MC

330.15 Exposed Work. Exposed runs of cable, except as provided in 300.11(B), shall closely follow the surface of the building finish or of running boards. Exposed runs shall also be permitted to be installed on the underside of joists where supported at each joist and located so as not to be subject to physical damage.

ARTICLE 330
Metal-Clad Cable: Type MC

330.30 Securing and Supporting.

(A) General. Type MC cable shall be supported and secured by staples, cable ties listed and identified for securement and support; straps, hangers, or similar fittings or other approved means designed and installed so as not to damage the cable.

ARTICLE 330
Metal-Clad Cable: Type MC

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. In vertical installations, listed cables with ungrounded conductors 250 kcmil and larger shall be permitted to be secured at intervals not exceeding 3 m (10 ft).

ARTICLE 330
Metal-Clad Cable: Type MC

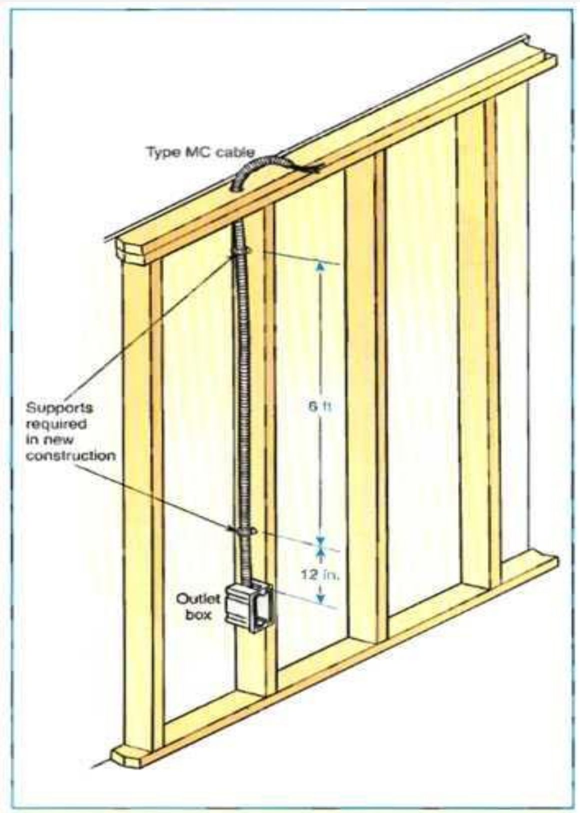


Exhibit 330.2 An application of 330.30(A) and (C), showing Type MC cable supported and secured at intervals not exceeding 6 ft and within 12 in. of the box.

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

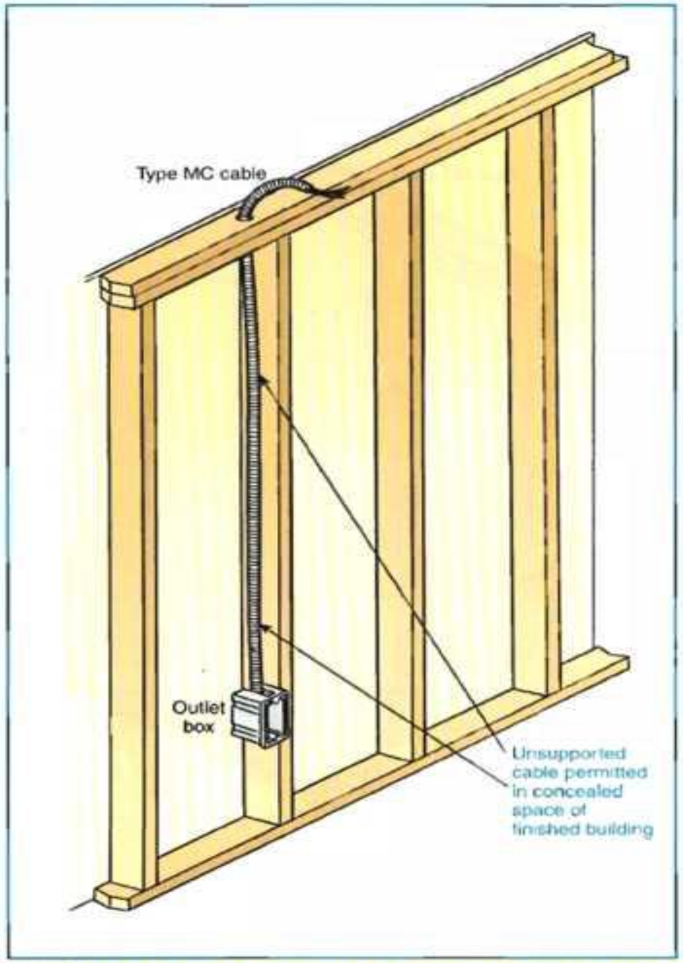


Exhibit 330.3 An application of 330.30(B), which permits Type MC cable to be fished in walls, floors, or ceilings.

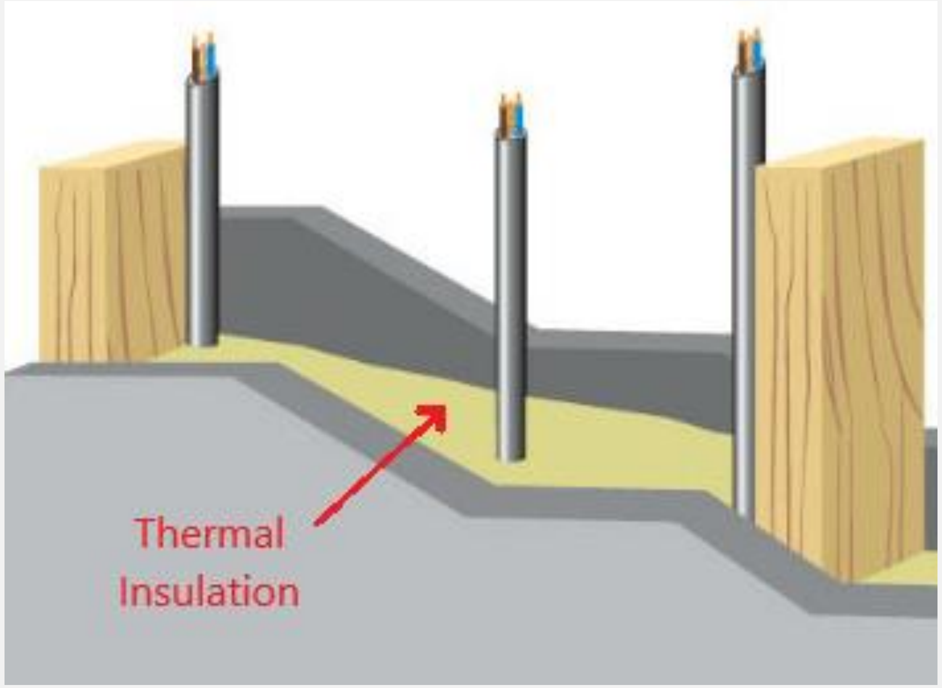
330.30 Securing and Supporting.

(D) Unsupported Cables. Type MC cable shall be permitted to be unsupported and unsecured where the cable complies with any of the following:

(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.

ARTICLE 330
Metal-Clad Cable: Type MC



330.80(C) Thermal Insulation.

Where more than two 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).

ARTICLE 330
Metal-Clad Cable: Type MC

330.130 Hazardous (Classified) Locations.

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.

Chapter 3

NEW Article 337

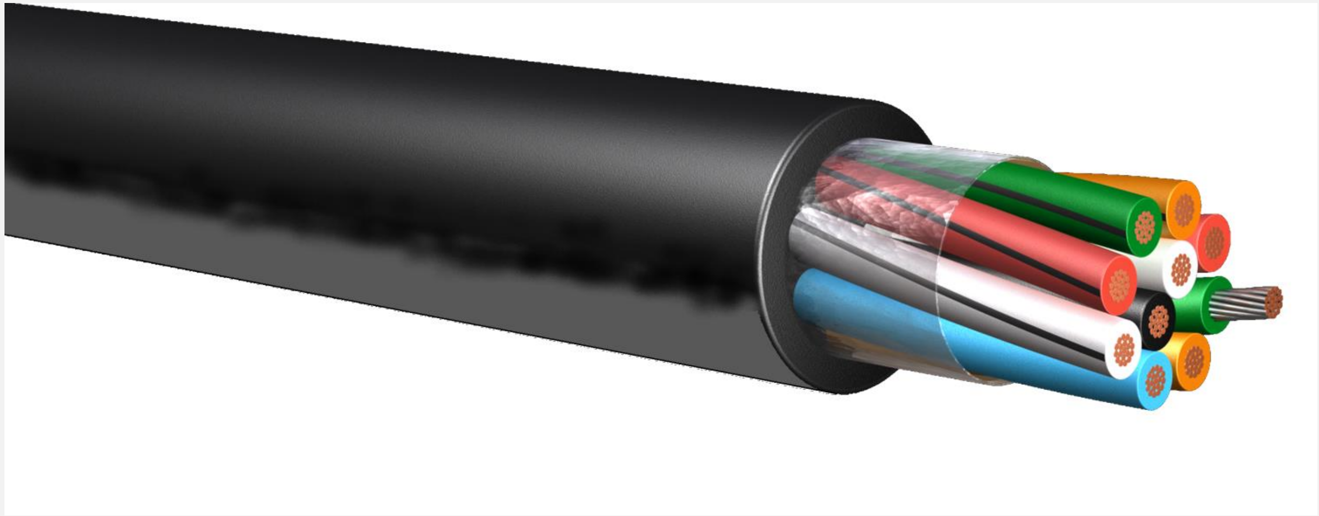
Type P Cable

ARTICLE 337
Type P Cable

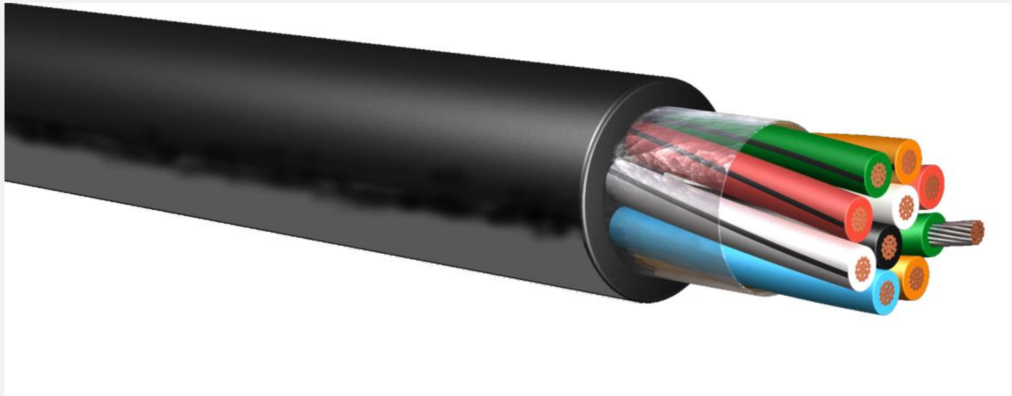
337.1 Scope.

This article covers the use, installation, and construction specifications for up through 2000 volt Type P cable (armored and unarmored).

New 2020 Code



ARTICLE 337
Type P Cable



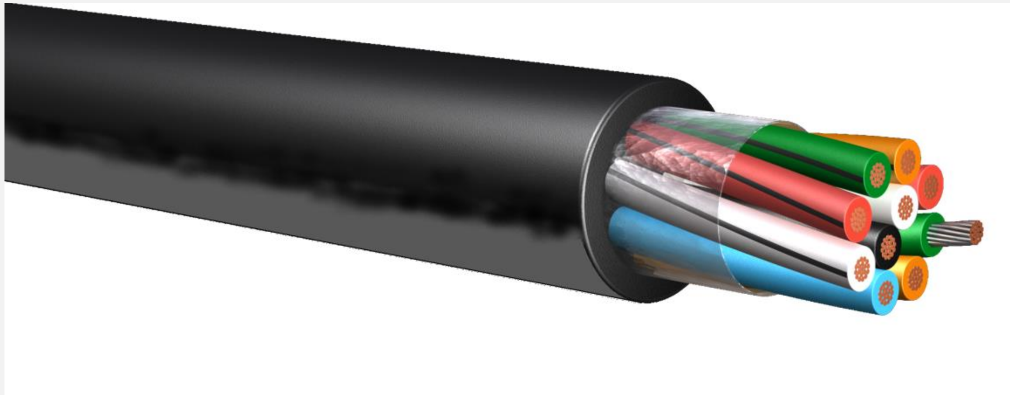
337.10 Uses Permitted.

Type P cable shall be permitted to be used:

(1) Under engineering supervision in industrial installations where conditions of maintenance and supervision ensure that only qualified persons monitor and service the system.

(2) In hazardous (classified) locations where specifically permitted by other articles in this Code.

ARTICLE 337
Type P Cable



337.12 Uses Not Permitted.

Type P cable shall not be installed or used:

(1) Where it will be exposed to physical damage

(2) Where not specifically permitted by other articles in the Code

ARTICLE 337
Type P Cable

337.12 Uses Not Permitted.

337.104 Conductors.

Conductors shall be of tinned copper. Conductors shall employ flexible stranding. The minimum conductor size shall be 18 AWG.

337.108 Equipment Grounding Conductor.

An equipment grounding conductor complying with 250.122 shall be provided within the cable.

337.112 Insulation.

Insulated conductors shall be a thermoset type identified for use in Type P cable. All conductors shall be suitable for wet locations. The minimum wall thickness shall be 0.76 mm (30 mils).

Chapter 3
Article 342
Type IMC Conduit

ARTICLE 342
Intermediate Metal Conduit: Type IMC

342.10(E) Severe Physical Damage.

IMC shall be permitted to be installed where subject to severe physical damage.

Same wording added in 244.10(E) 2020 for Rigid Conduit

ARTICLE 342
Intermediate Metal Conduit: Type IMC

Galvanized

Stainless Steel

342.14 Dissimilar Metals.

Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action.

Stainless steel and aluminum fittings and enclosures shall be permitted to be used with galvanized steel IMC where not subject to severe corrosive influences.

Stainless steel IMC shall only be used with the following:

(1) Stainless steel fittings

(2) Stainless steel boxes and enclosures

(3) Steel (galvanized, painted, powder or PVC coated, and so forth) boxes and enclosures when not subject to severe corrosive influences

(4) Stainless steel, nonmetallic, or approved accessories

ARTICLE 342
Intermediate Metal Conduit: Type IMC

342.30 Securing and Supporting. IMC shall be installed as a complete system in accordance with 300.18 and shall be securely fastened in place and supported in accordance with 342.30(A) and (B).

(A) Securely Fastened. IMC shall be secured in accordance with one of the following:

(1) IMC shall be securely fastened within 900 mm **(3 ft)** of each outlet box, junction box, device box, cabinet, conduit body, or other conduit termination.

(2) Where structural members do not readily permit fastening within 900 mm (3 ft), fastening shall be permitted to be increased to a distance of 1.5 m **(5 ft).**

(3) Where approved, conduit shall not be required to be securely fastened within 900 mm (3 ft) of the service head for above-the-roof termination of a mast.

ARTICLE 342
Intermediate Metal Conduit: Type IMC

342.30 Securing and Supporting.

(B) Supports. IMC shall be supported in accordance with one of the following:

(1) Conduit shall be supported at intervals not exceeding 3 m **(10 ft).**

(2) The distance between supports for straight runs of conduit shall be permitted in accordance with Table 344.30(B)(2), provided the conduit is made up with threaded couplings and supports that prevent transmission of stresses to termination where conduit is deflected between supports.

Table 344.30(B)(2) Supports for Rigid Metal Conduit

Conduit Size		Maximum Distance Between Rigid Metal Conduit Supports	
Metric Designator	Trade Size	m	ft
16–21	½–¾	3.0	10
27	1	3.7	12
35–41	1¼–1½	4.3	14
53–63	2–2½	4.9	16
78 and larger	3 and larger	6.1	20

Rigid conduit has farther supports if threaded couplings

ARTICLE 342
Intermediate Metal Conduit: Type IMC

342.30 Securing and Supporting.

(B) Supports. IMC shall be supported in accordance with one of the following:

(3) Exposed vertical risers from industrial machinery or fixed equipment shall be permitted to be supported at intervals not exceeding 6 m **(20 ft)** if the conduit is made up with threaded couplings, the conduit is supported and securely fastened at the top and bottom of the riser, and no other means of intermediate support is readily available.

(4) Horizontal runs of IMC supported by openings through framing members at intervals not exceeding 3 m (10 ft) and securely fastened within 900 mm (3 ft) of termination points shall be permitted.

ARTICLE 342
Intermediate Metal Conduit: Type IMC

342.100 Construction. IMC shall be made of one of the following:

(1) Steel, with protective coatings

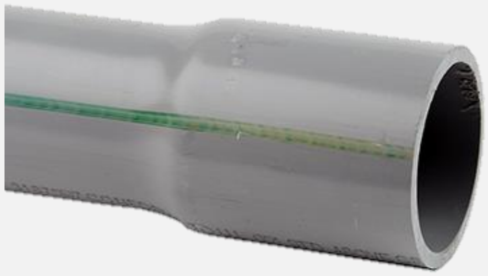
(2) Stainless steel

Aluminum conduit is Rigid

Chapter 3
Article 352
Type PVC Conduit

nec 2020

ARTICLE 352
Rigid Polyvinyl Chloride Conduit: Type PVC



358.10 Uses Permitted.

(A) Concealed. (In Walls, floors & Ceilings)

(B) In corrosive Locations

(C) In cinder fill

(D) In wet locations

(E) In dry and Damp locations

(F) Exposed PVC permitted (Physical Protection requires Schedule 80)

(G) Underground

(H) To support conduit bodies

(I) Permitted to contain higher rated temperature cables

ARTICLE 352
Rigid Polyvinyl Chloride Conduit: Type PVC

352.12 Uses Not Permitted.

(A) Hazardous Locations.

(B) Support of Luminaires or other equipment

(C) Where subject to physical damage unless identified for such use (Schedule 80).

(D) Ambient Temperatures. Where subject to ambient temperatures in excess of 50°C (122°F) unless listed otherwise.

(E) Theaters and Similar Locations.

ARTICLE 352
Rigid Polyvinyl Chloride Conduit: Type PVC

Table 352.30 Support of Rigid Polyvinyl Chloride Conduit (PVC)

Conduit Size		Maximum Spacing Between Supports	
Metric Designator	Trade Size	mm or m	ft
16–27	½–1	900 mm	3
35–53	1¼–2	1.5 m	5
63–78	2½–3	1.8 m	6
91–129	3½–5	2.1 m	7
155	6	2.5 m	8

352.30 Securing and Supporting.

(B) Supports. PVC conduit shall be supported as required in Table 352.30. Conduit listed for support at spacings other than as shown in Table 352.30 shall be permitted to be installed in accordance with the listing. Horizontal runs of PVC conduit supported by openings through framing members at intervals not exceeding those in Table 352.30 and securely fastened within 900 mm (3 ft) of termination points shall be permitted.

Chapter 3
Article 358
Type EMT Conduit

ARTICLE 358
Electrical Metallic Tubing: Type EMT

358.10 Uses Permitted.

(A) Exposed and Concealed. The use of EMT shall be permitted for both exposed and concealed work for the following:

(1) In concrete, in direct contact with the earth or in areas subject to severe corrosive influences where installed in accordance with 358.10(B)

(2) In dry, damp, and wet locations

(3) In any hazardous (classified) location as permitted by other articles in this Code

ARTICLE 358
Electrical Metallic Tubing: Type EMT

358.10 Uses Permitted.

(B) Corrosive Environments.

(1) Galvanized Steel and Stainless Steel EMT, Elbows, and Fittings. Galvanized steel and stainless steel EMT, elbows, and fittings shall be permitted to be installed in concrete, in direct contact with the earth, or in areas subject to severe corrosive influences where protected by corrosion protection and approved as suitable for the condition.

ARTICLE 358

Electrical Metallic Tubing: Type EMT

358.10 Uses Permitted.

(B) Corrosive Environments.

(2) Supplementary Protection of Aluminum EMT. Aluminum EMT shall be provided with approved supplementary corrosion protection where encased in concrete or in direct contact with the earth.

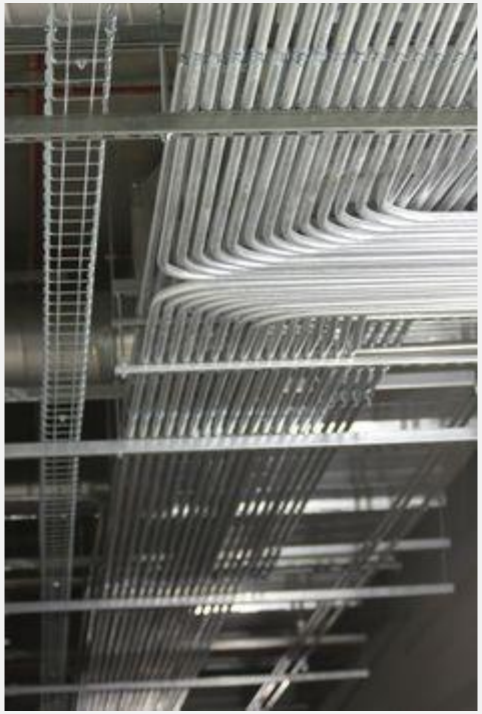
(C) Cinder Fill. Galvanized steel and stainless steel EMT shall be permitted to be installed in cinder concrete or cinder fill where subject to permanent moisture when protected on all sides by a layer of noncinder concrete at least 50 mm (2 in.) thick or when the tubing is installed at least 450 mm (18 in.) under the fill.

ARTICLE 358

Electrical Metallic Tubing: Type EMT

358.10(E) Physical Damage.

Steel and stainless steel EMT shall be permitted to be installed where subject to physical damage.



ARTICLE 358
Electrical Metallic Tubing: Type EMT

358.12 Uses Not Permitted. EMT shall not be used under the following conditions:

(1) Where subject to severe physical damage

(2) For the support of luminaires or other equipment except conduit bodies no larger than the largest trade size of the tubing

ARTICLE 358
Electrical Metallic Tubing: Type EMT

358.14 Dissimilar Metals. Where practicable, dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action.

Stainless Steel and Aluminum fittings and enclosures shall be permitted to be used with galvanized steel EMT, and galvanized steel fittings and enclosures shall be permitted to be used with aluminum EMT where not subject to severe corrosive influences.

ARTICLE 358
Electrical Metallic Tubing: Type EMT

358.20 Size.

(A) Minimum. EMT smaller than metric designator 16 (trade size 1⁄2) shall not be used.

Exception: For enclosing the leads of motors as permitted in 430.245(B).

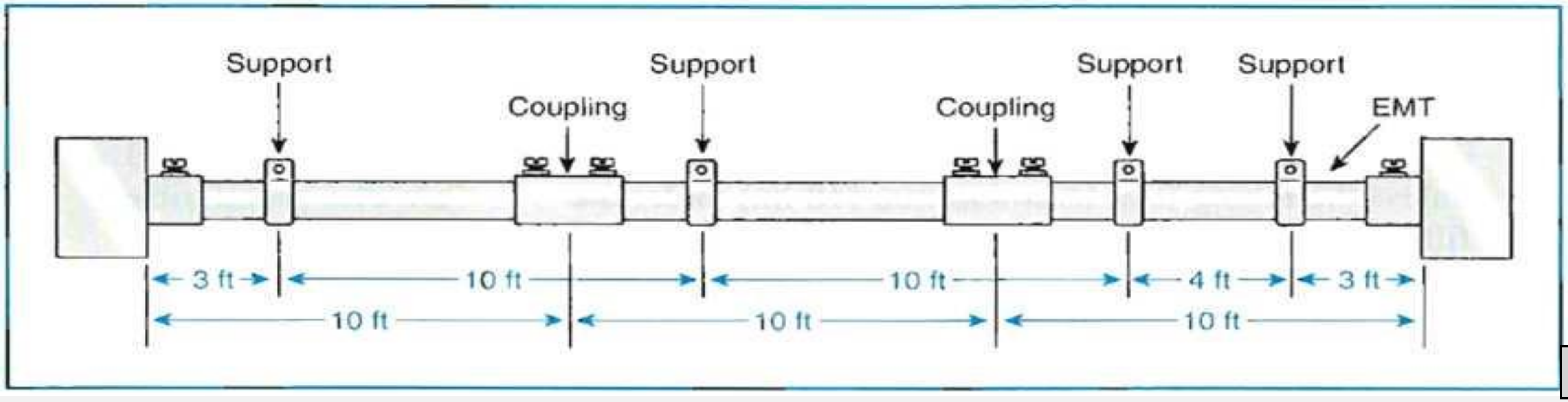
(B) Maximum. The maximum size of EMT shall be metric designator 103 (trade size 4).

Informational Note: See 300.1(C) for the metric designators and trade sizes. These are for identification purposes only and do not relate to actual dimensions.

ARTICLE 358
Electrical Metallic Tubing: Type EMT

358.30(A) Securely Fastened. EMT shall be securely fastened in place at intervals not to exceed 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.

Exception to 5' where structural members do not allow ready fastening



ARTICLE 358

Electrical Metallic Tubing: Type EMT

358.30 (B) Supports. Horizontal runs of EMT supported by openings through framing members at intervals not greater than 3 m (10 ft) and securely fastened within 900 mm (3 ft) of termination points shall be permitted.

ARTICLE 358
Electrical Metallic Tubing: Type EMT

358.60 Grounding. EMT shall be permitted as an equipment grounding conductor.

ARTICLE 358

Electrical Metallic Tubing: Type EMT

Part III. Construction Specifications

358.100 Construction. EMT shall be made of one of the following:

(1) Steel with protective coatings

(2) Aluminum

(3) Stainless steel

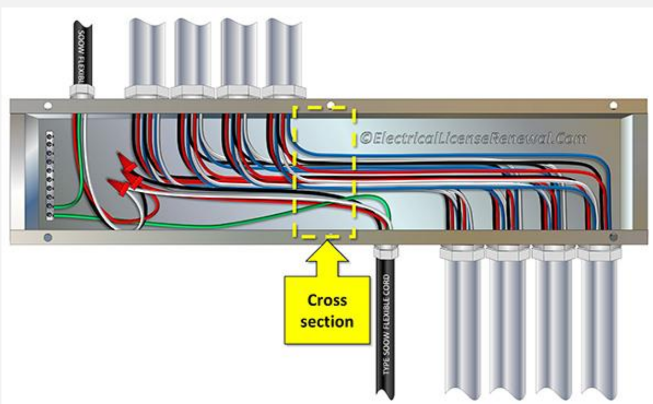
Chapter 3
Article 366
Auxiliary Gutters

ARTICLE 366.20
Auxiliary Gutters

366.20 Conductors Connected in Parallel. Where single conductor cables comprising each phase, neutral, or grounded conductor of an alternating-current circuit are connected in parallel as permitted in 310.10(H), the conductors shall be installed in groups consisting of not more than one conductor per phase, neutral, or grounded conductor to prevent current imbalance in the paralleled conductors due to inductive reactance.

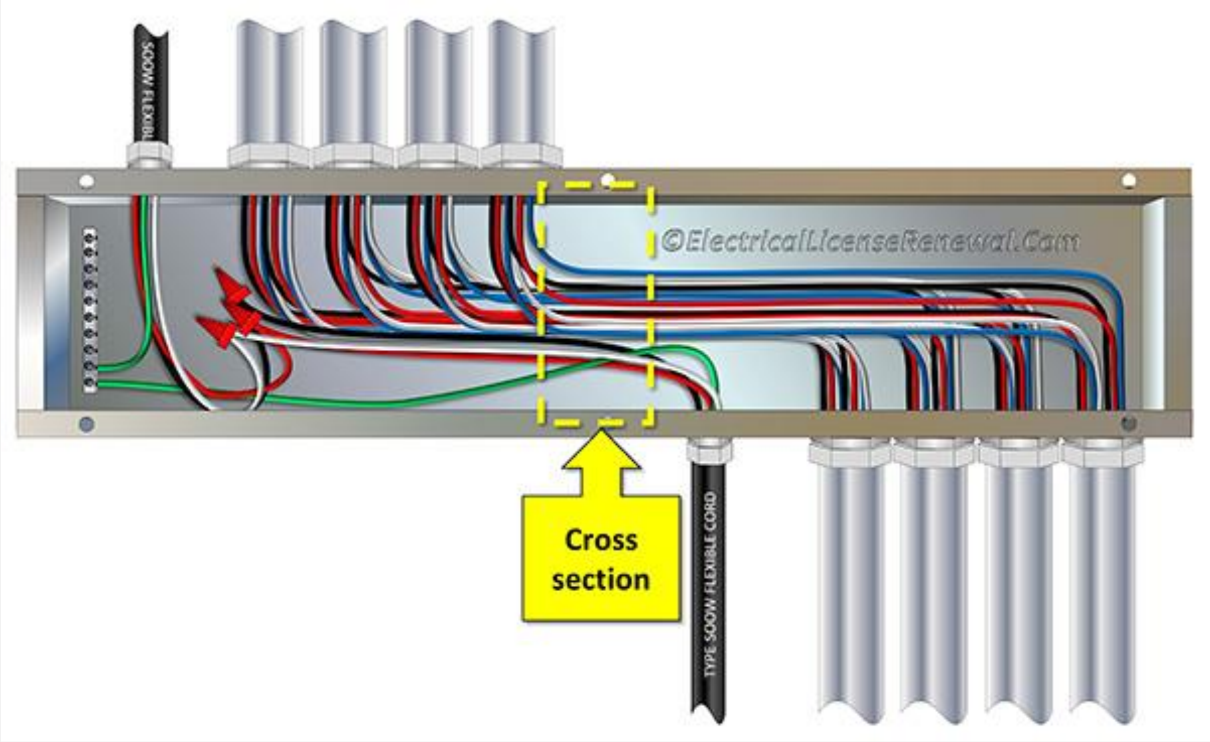
ARTICLE 366.20
Auxiliary Gutters

366.23(A) Sheet Metal Auxiliary Gutters.



The adjustment factors in 310.15(C)(1) shall be applied only where the number of current-carrying conductors, including neutral conductors classified as current-carrying under 310.15(E), **exceeds 30 at any cross section of the sheet metal auxiliary gutter.** Conductors for signaling circuits or controller conductors between a motor and its starter and used only for starting duty shall not be considered as current-carrying conductors. The current carried continuously in bare copper bars in sheet metal auxiliary gutters shall not exceed 1.55 amperes/mm^2 (1000 amperes/$in.^2$) of cross section of the conductor. For aluminum bars, the current carried continuously shall not exceed 1.09 amperes/mm^2 (700 amperes/$in.^2$) of cross section of the conductor.

ARTICLE 366.20
Auxiliary Gutters



366.23(B) Nonmetallic Auxiliary Gutters.

The adjustment factors specified in 310.15(C)(1) shall be applicable to the current-carrying conductors up to and including the 20 percent fill specified in 366.22(B).

End of Presentation
Thank-you

File Attachments for Item:

ER-14 NEC 2020 Electrical Systems for Health Care (Electrical League of Ohio)

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

Staff Notes: Recommend approval, add RPE.

ESIAC Recommendation: Recommend approval

Committee Recommendation:

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: Electrical League of Ohio

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: NEC 2020 Electrical Systems for Healthcare

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

Purpose and Objective: Healthcare has expanded into satellite locations with the advent of modern treatment centers, medical clinics, and urgent care centers. In addition, members of the baby boomer generation are moving toward assisted living and nursing homes. With so much happening in the field of medicine, it is important to know and understand the electrical requirements for installaitons in these types of Health Care facilitiies. Course will cover requirements and is tailored to those who design, manage or construct HCF, Nursing Homes, Laboratories and Medical Centers.

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

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

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: 20575 Corporate Drive ZOOM
Date(s) of ESI Course(s): April 14, 2021

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.

Form: 1526

BBS 81028110

Electrical League of Ohio
National Electrical Code Education Class
4-hour Course Outline

"Electrical Systems for Healthcare"
April 14, 2021

Presented By: Timothy G. Pool, PE, RCDD, ESI 7011

Executive Summary of course: Healthcare has expanded into satellite locations with the advent of modern treatment centers, medical clinics, and urgent care centers. In addition, members of the baby boomer generation are moving toward assisted living and nursing homes. With so much happening in the field of medicine, it is important to know and understand the electrical requirements for installations in these types of Health Care Facilities. This course will cover some of those requirements and is tailored for those who design, manage, or construct Health Care Facilities, Nursing Homes, Laboratories and Medical Centers.

Healthcare Facility Definition	**Class Time**
• Article 517.2 Definition of Medical Office, Patient Care and Category	20 min
• Article 517.2 Invasive Procedure Definition	10 min
• Article 517.2 Governing Body and AHJ	10 min

Special Grounding Requirements	**Class Time**
• Article 517.13 Receptacle Grounding in Patient Care Areas	30 min
• Article 517.17 GFP Protection	20 min
• Article 517.8 Number of Receptacles Required	20 min

Distribution System Layout	**Class Time**
• Article 517.25 Essential Electrical System (Type 1 and 2)	30 min
• Article 517.30 Generator and ATS Configuration for Essential System	20 min
• Article 517.31 Requirements for the Essential Electrical System	20 min

Nursing Home Requirements	**Class Time**
• Article 517.42 Essential Electrical Systems for Nursing Homes	20 min
• Article 517.44 Heating and Air Conditioning Backup Systems	20 min

Other Healthcare Facilities	**Class Time**
• Article 517.45 Essential Electrical System for Category 3 Patient Care	20 min

Total	4 hours

Tim Pool, PE, RCDD
Tec Inc. Engineering & Design

Executive Vice President, Engineering

Tim Pool is driven to produce fantastic finished projects for all of our clients. With nearly 30 years of experience working on electrical engineering projects with Tec Inc., Tim performs his work with the skills and precision necessary to perform at a high level on a wide variety of job types. During his time with the firm, Tim has assisted in many higher education and library projects, though his resume includes an ever-growing list of various spaces.

Interested in contributing to the engineering profession, Tim is a Registered Communication Distribution Designer (RCDD), a licensed Electrical Saftey Inspector with the State of Ohio, and frequently acts as an instructor for the Electric League of Ohio.

In his role as Executive Vice President, Tim devotes time to training the firm's electrical project team, providing the leadership and coordination needed to perform and generate great projects.

p. 440.953.8760 ext. 112

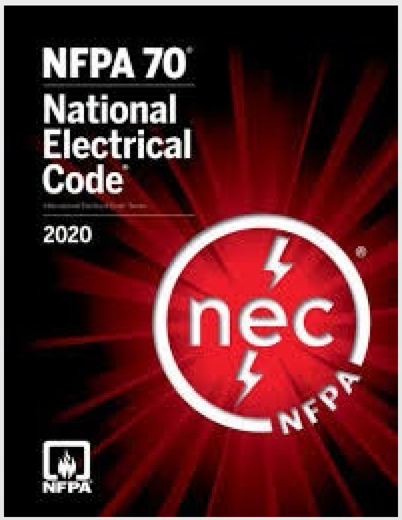
33851 Curtis Blvd, Suite 216, Eastlake, OH 44095

Electrical League of Ohio
April 14, 2021

Healthcare Electrical Systems

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

Introduction

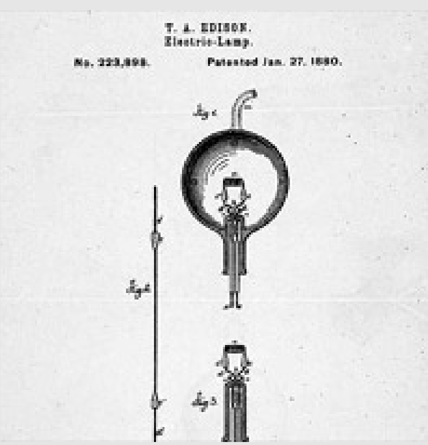


This class is a 4-hour review course covering ***Healthcare Electrical Systems*** based on Article 517. Special Wiring methods are needed in Healthcare facilities to ensure safety not only to patients undergoing treatments or procedures but also nursing staff working with sensitive instrumentation and life support equipment.

Information contained herein is presented with such copyright acknowledgement of the NFC and NFPA.

History of the Code and Currently Enforced Edition

History of the Code



Edison invented the light bulb in 1879.

By the late 1800's electricity and light was showing up in mainly higher-class households.

Five independent committees (insurance, electrical and architectural) convene in New York City in 1896.

The first code edition was published in 1897 by these committees.

History of the Code

The NFPA took control of publishing the NEC and has been sponsoring the updates since 1911.

The 2020 edition marks the 55th edition of the *National Electrical Code*.

The NEC is published on a three-year cycle. The next code is the 2023. Requests for changes are open for comment on the NFPA web site.

Closing date for comments on the 2023 NEC was September 10, 2020.

The projected 2023 NEC First Draft posting is April 2021.

History of the Code

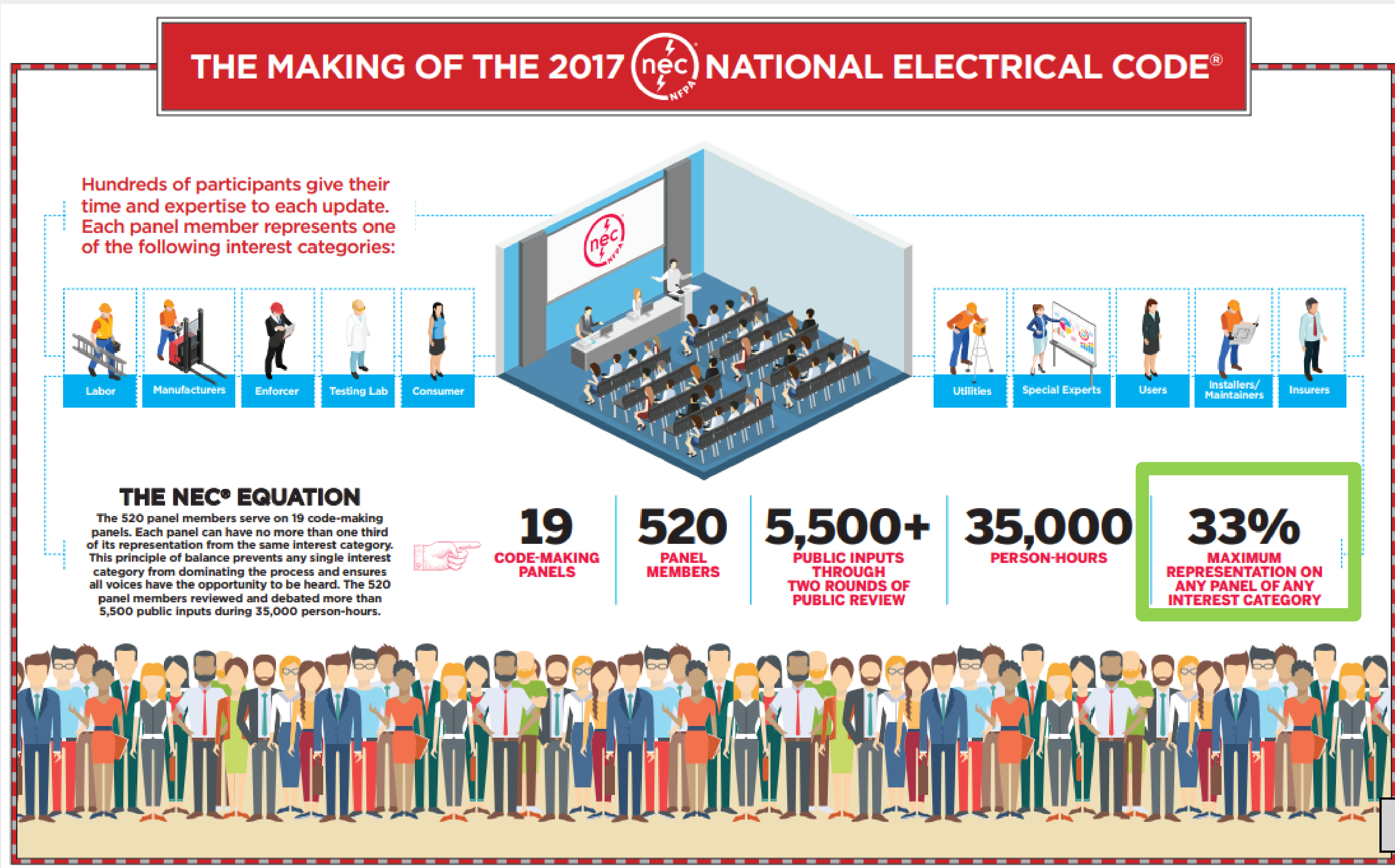
Falling behind on State Adoption

While 80% of U.S. residents expect up-to-date safety codes, nearly one-third of U.S. states have skipped one or more updates in the past 10 years and many have amended the code to remove safety regulations.

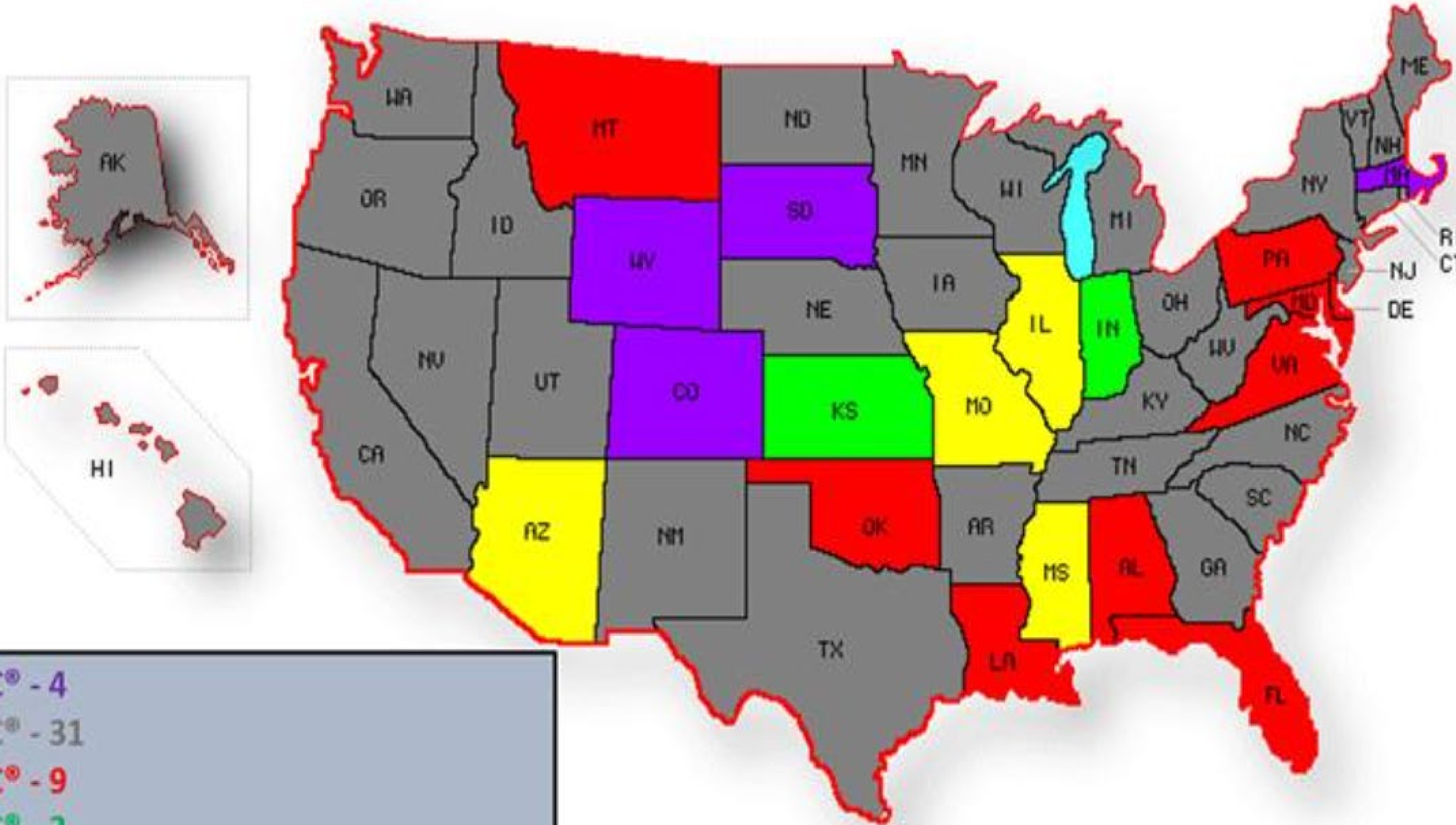
From NFPA:

Between 2010 and 2014 there was an average of 61,000 home and non-home fires each year due to electrical fires, claiming an average of 432 lives and responsible for $2.014 Billion Dollars.

ELECTRICAL LEAGUE of Ohio

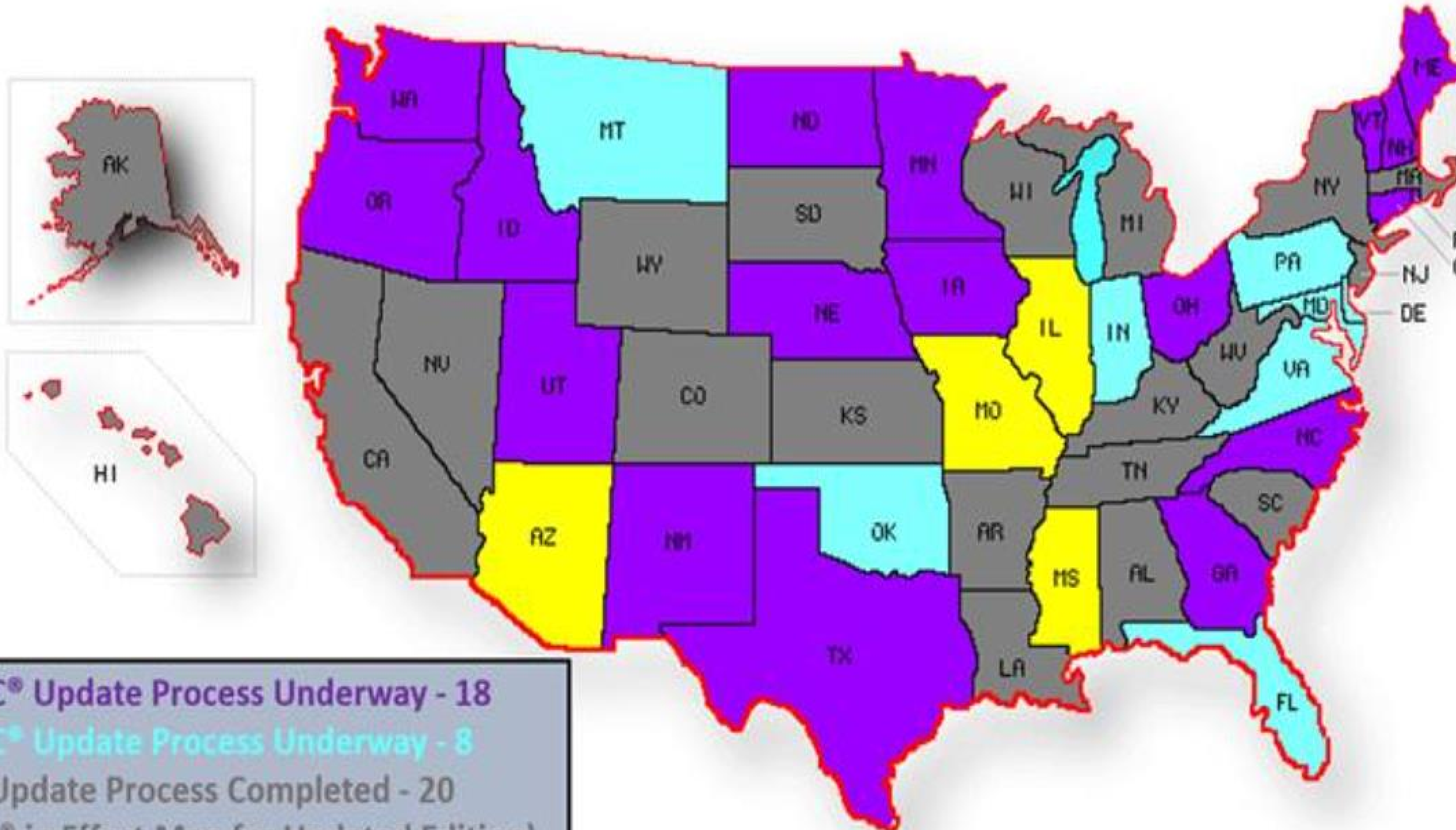


NEC® in Effect
10/1/2020



2020 NEC® - 4
2017 NEC® - 31
2014 NEC® - 9
2008 NEC® - 2
County/Municipality NEC® regulation only - 4

NEC® Update Process In Progress
10/1/2020



2020 NEC® Update Process Underway - 18
2017 NEC® Update Process Underway - 8
Current Update Process Completed - 20
(See NEC® in Effect Map for Updated Edition)
County/Municipality NEC® regulation only - 4

National Electrical Manufacturers Association (NEMA), the Ohio Board of Building Standards (OBBS) recently received Petition 20-01 from the Ohio Electrical Coalition

RECENT

State of Washington Adopts 2020 National Electrical Code
JUN 03, 2020
2020 National Electrical Code Changes

Dropping Your Only Insulated Screwdriver from 200 Feet Up
JUN 03, 2020
Safety

How Do You Deal with an Unsafe Operator?
JUN 03, 2020
Safety

benkrut/iStock/Getty Images Plus

NATIONAL ELECTRICAL CODE

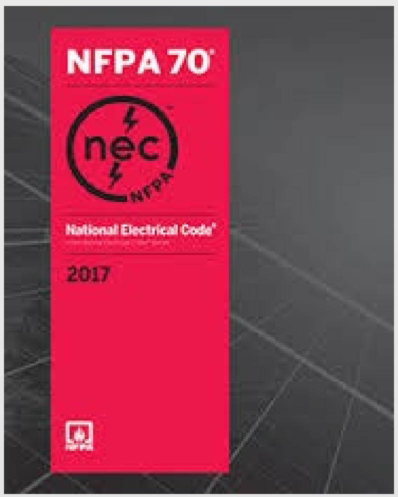
Ohio Looks to Adopt 2020 NEC

Stakeholder meeting to be held March 9, 2020

FEB 20, 2020

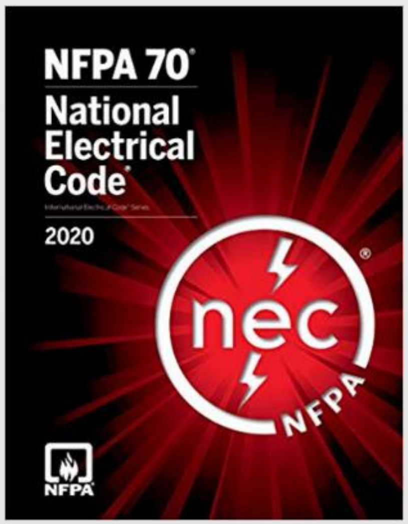
According to a recent update in *Code Alerts* from the National Electrical Manufacturers Association

Introduction



Ohio	2017 Commercial (11/1/2017) 2014 One-, two- and three-family dwellings (1/1/2016)	One-, two- and three-family dwellings (7/1/2019)
Oklahoma	2014 Commercial (11/1/2015) Residential 2015 IRC Electrical Chapters (11/1/2016)	Update process underway (effective date not established)
Oregon	2017 with Oregon amendments (10/1/2017)	
Pennsylvania	2014	
Rhode Island	2017 (8/1/2019)	
South Carolina	2014 (7/1/2016)	Update process underway (1/1/2020 projected)
South Dakota	2017 (7/1/2017)	

So Why Update at all?



The NFPA has two arguments why every state should adopt the latest edition of the NEC:

First and foremost, as electrical products and requirements change, safety standards must keep up. Therefore, the most up-to-date NEC is also the safest.

Second, stakeholders will save money on their electrical systems when the entire nation follows the same rules "economic efficiency through uniformity."

When every city has its own electrical codes, electricians have to spend time and effort to understand these rules which takes time and money. Also, if manufacturers can't be sure that their components can be used in certain states it limits growth.

Introduction

Changes to the 2020 edition are highlighted with gray shading and delta symbols. New figures or paragraphs are denoted with an *N* in the margin.

90.1 Purpose.

(A) Practical Safeguarding. The purpose of this *Code* is the practical safeguarding of persons and property from hazards arising from the use of electricity. This *Code* is not intended as a design specification or an instruction manual for untrained persons.

N

Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet (•) between the paragraphs that remain.

Δ **Table 430.72(B)**

Signaling Circuit. Any electrical circuit that energizes signaling equipment.

•

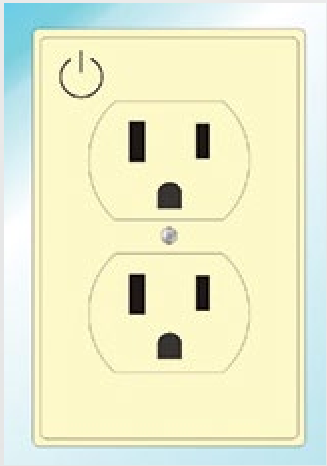
Special Permission. The written consent of the authority having jurisdiction.

Article 406
Receptacles

ARTICLE 406
Receptacles

406.3 Receptacle Rating and Type

(E) Controlled Receptacle Marking. All nonlocking-type, 125-volt, 15- and 20-ampere receptacles that are controlled by an automatic control device, or that incorporate control features that remove power from the receptacle for the purpose of energy management or building automation, shall be permanently marked with the symbol shown in Figure 406.3(E) and the word "controlled."



Added "Controlled" in 2017

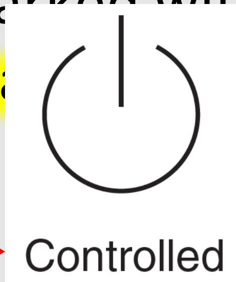


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Figure 406.3(E) Controlled Receptacle

ARTICLE 406
Receptacles

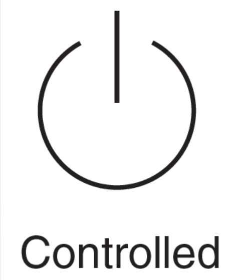
406.3 Receptacle Rating and Type

(E) Controlled Receptacle Marking.

For receptacles controlled by an automatic control device, the marking shall be located on the receptacle face and visible after installation.

In both cases where a multiple receptacle device is used, the required marking of the word "controlled" and symbol shall denote which contact device(s) are controlled.

Exception: The marking shall not be required for receptacles controlled by a wall switch that provide the required room lighting outlets as permitted by 210.70.



Added in 2017

ARTICLE 406
Receptacles

406.3 Receptacle Rating and Type

(F) Receptacle with USB Charger. A 125-volt 15- or 20-ampere receptacle that additionally provides Class 2 power shall be listed and constructed such that the Class 2 circuitry is integral with the receptacle.

Added in 2017

ARTICLE 406
Receptacles

406.6 Receptacle Faceplates (Cover Plates).

(D) Receptacle Faceplate (Cover Plates) with Integral Night Light and/or USB Charger. A flush device cover plate that additionally provides a night light and/or Class 2 output connector(s) shall be listed and constructed such that the night light and/or Class 2 circuitry is integral with the flush device cover plate.

ELECTRICAL LEAGUE of Ohio

ARTICLE 406
Receptacles

406.8 Receptacles in Damp or Wet Locations.

(B) Wet Locations.

(1) Receptacles of 15 and 20 Amperes in a Wet Location.

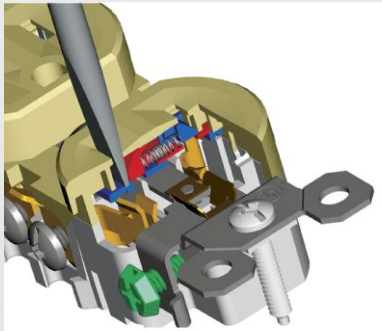
All 15- and 20-ampere, 125- and 250-volt nonlocking-type receptacles shall be listed and so identified as the weather resistant type.

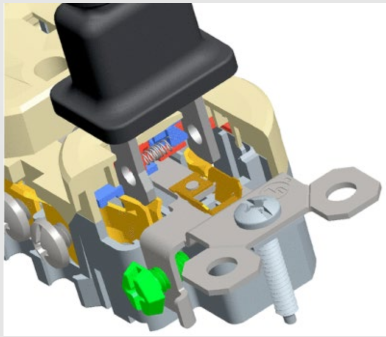
Are tamper resistant receptacles required in business offices of Hospitals, Clinics and Dental Offices?

1. Yes
2. No

ARTICLE 406
Receptacles

406.12 Tamper-Resistant Receptacles. All 15- and 20-ampere, 125- and 250-volt nonlocking-type receptacles in the areas specified in 406.12(1) through (7) shall be listed tamper resistant receptacles.





(1) Dwelling units in all areas specified in 210.52 & 550.13

(2) Guest rooms and guest suites of hotels and motels

(3) Child care facilities

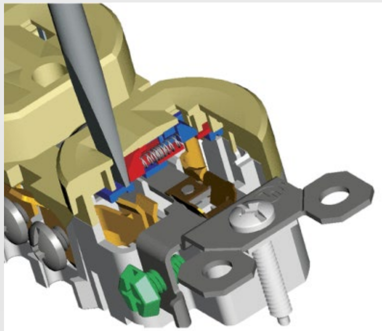
(4) Preschools and elementary education facilities

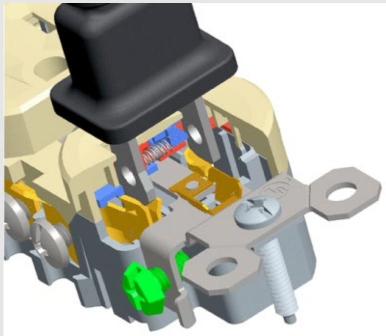
(5) Business offices, corridors, waiting rooms and the like in **clinics, medical and dental offices and outpatient facilities**

(6) Subset of assembly occupancies described in 518.2 to include places of waiting transportation, gymnasiums, skating rinks, and auditoriums

(7) Dormitories

ARTICLE 406
Receptacles





406.12 Tamper-Resistant Receptacles (Con't).

Exception to (1), (2), (3), (4), (5), (6), and (7): Receptacles in the following locations shall not be required to be tamper resistant:

(1) Receptacles located more than 1.7 m (5 1⁄2 ft) above the floor

(2) Receptacles that are part of a luminaire or appliance

(3) A single receptacle or a duplex receptacle for two appliances located within the dedicated space for each appliance that, in normal use, is not easily moved from one place to another and that is cord-and-plug-connected in accordance with 400.10(A)(6), (A)(7), or (A)(8)

ARTICLE 406
Receptacles

Tamper-Resistant vs. Tamper-Proof Receptacles

Tamper-Proof Receptacles are not required!

ARTICLE 430
Motors, Motor Circuits, and Controllers

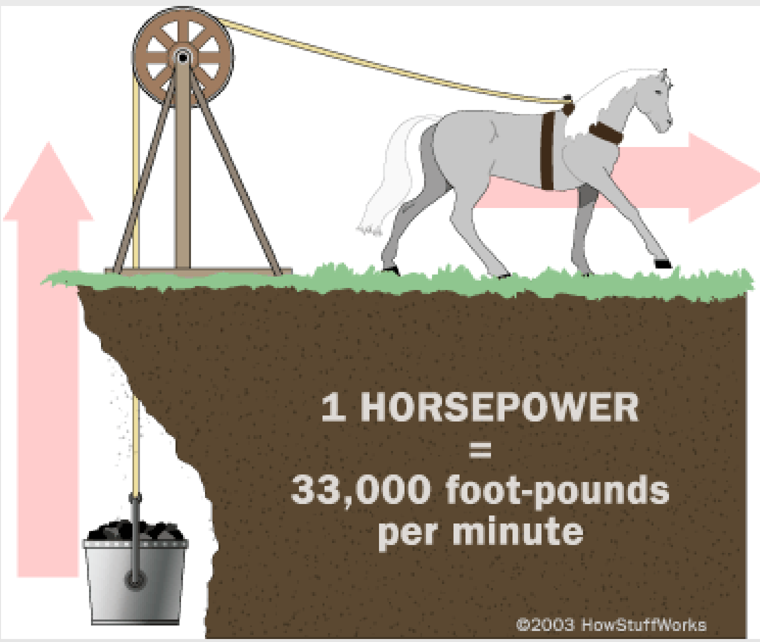
ARTICLE 430
Motors, Motor Circuits, and Controllers

Most electrical equipment is rated in volt-amperes (VA) or watt input.

Circuits supplying motors are sized according to the input to the motor. The input includes the motor losses and the power factor of the motor. The losses are not the type of information found on the nameplate of a motor.

Tables 430.249 and 430.250 contain accurate industry wide input ampere ratings for motors.

ARTICLE 430
Motors, Motor Circuits, and Controllers

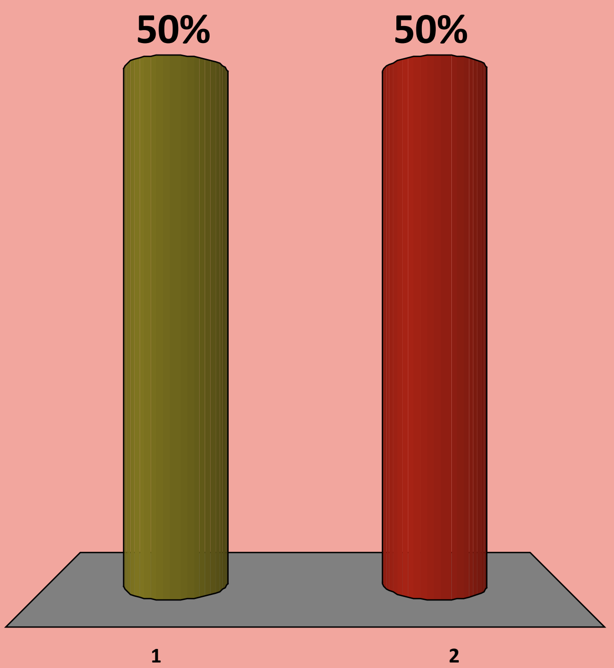


One horsepower equals approximately 746 watts without any losses or power factor considered.

It is important to understand that circuits that supply motors not rated in horsepower still must be sized according to the input of the motor, rated in amperes. Sizing circuits based solely on kilowatt output results in seriously undersized conductors (because the current requirements of the losses and the power factor ar[e] neglected) and the improper

When calculating the wire size to a motor, do you use the ampacity on the nameplate or the table in the NEC?

1. Motor Nameplate
2. The NEC Tables



ARTICLE 430
Motors, Motor Circuits, and Controllers

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 Circuits, and Controllers

430.6 Ampacity and Motor Rating Determination.

(1) Table Values. Where a motor is marked in amperes, but not horsepower, the horsepower rating shall be assumed to be that corresponding to the value given in Table 430.247, Table 430.248, Table 430.249, and Table 430.250, interpolated if necessary. Motors built for low speeds (less than 1200 RPM) or high torques may have higher full-load currents, and multispeed motors will have full-load current varying with speed, in which case the nameplate current ratings shall be used.

ARTICLE 430
Motors, Motor Circuits, and Controllers

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

The following values of full-load currents are typical for motors running a normal torque characteristics.

The voltages listed are rated motor voltages. The currents listed shall 120, 220 to 240, 440 to 480, and 550 to 1000 volts.

	Induction-Type Squirrel Cage and Wound Rotor (Ampere					
Horsepower	115 Volts	200 Volts	208 Volts	230 Volts	460 Volts	575 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

ARTICLE 430
Motors, Motor Circuits, and Controllers

430.6 Ampacity and Motor Rating Determination.

(2) Nameplate Values. Separate motor overload protection shall be based on the motor nameplate current rating.

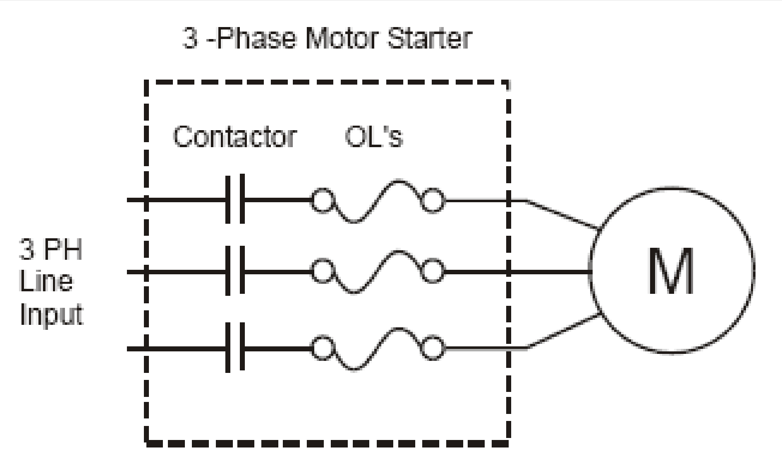


Figure 3-31. Line starting a motor

ELECTRICAL LEAGUE of Ohio

ARTICLE 430
Motors, Motor Circuits, and Controllers

430.6 Ampacity and Motor Rating Determination.

(C) Alternating-Current Adjustable Voltage Motors. For motors used in alternating-current, adjustable voltage, variable torque drive systems, the ampacity of conductors, or ampere ratings of switches, branch-circuit short-circuit and ground fault protection, and so forth, shall be based on the **maximum operating current marked on the motor or control nameplate, or both**. If the maximum operating current does not appear on the nameplate, the ampacity determination shall be based on 150 percent of the values given in Table 430.249 and Table 430.250.

ARTICLE 430
Motors, Motor Circuits, and Controllers

Table 430.7(B) Locked-Rotor Indicating Code Letters

Code Letter	Kilovolt-Amperes per Horsepower with Locked Rotor
A	0–3.14
B	3.15–3.54
C	3.55–3.99
D	4.0–4.49
E	4.5–4.99
F	5.0–5.59
G	5.6–6.29
H	6.3–7.09
J	7.1–7.99
K	8.0–8.99
L	9.0–9.99
M	10.0–11.19
N	11.2–12.49
P	12.5–13.99
R	14.0–15.99
S	16.0–17.99
T	18.0–19.99
U	20.0–22.39
V	22.4 and up

430.7 Marking on Motors and Multimotor Equipment.

(B) Locked-Rotor Indicating Code Letters. Code letters marked on motor nameplates to show motor input with locked rotor shall be in accordance with Table 430.7(B).

The code letter indicating motor input with locked rotor shall be in an individual block on the nameplate, properly designated.

20 HP type G Motor

$$\text{Locked-rotor kVA} = \text{motor hp} \times \text{maximum code letter value} = 20 \times 6.29 = 125.8$$

$$\text{Locked-rotor current} = \frac{\text{locked-rotor kVa}}{\sqrt{3} \times \text{KV}}$$

$$\text{for 460 volts} = \frac{125.8}{1.73 \times 0.46} = 158 \text{ amperes}$$

ARTICLE 430
Motors, Motor Circuits, and Controllers

Table 430.10(B) Minimum Wire-Bending Space at the Terminals of Enclosed Motor Controllers

Size of Wire (AWG or kcmil)	Wires per Terminal* 1 mm	1 in.	2 mm	2 in.
10 and smaller	Not specified		—	—
8–6	38	1½	—	—
4–3	50	2	—	—
2	65	2½	—	—
1	75	3	—	—
1/0	125	5	125	5
2/0	150	6	150	6
3/0–4/0	175	7	175	7
250	200	8	200	8
300	250	10	250	10
350–500	300	12	300	12
600–700	350	14	400	16
750–900	450	18	475	19

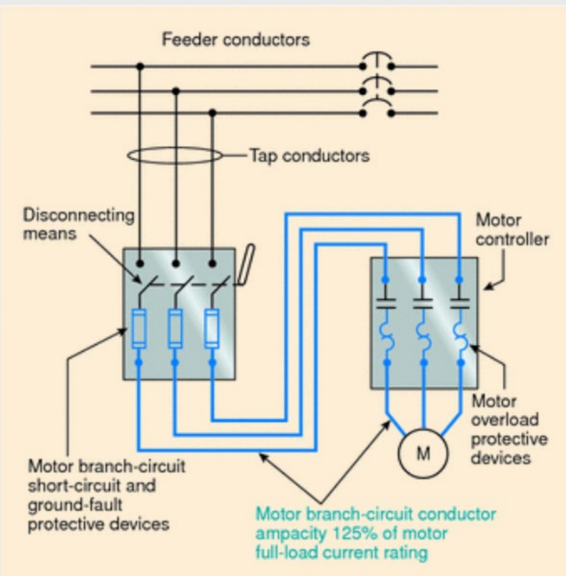
*Where provision for three or more wires per terminal exists, the minimum wire-bending space shall be in accordance with the requirements of Article 312.

430.9 Terminals.

(B) Wire-Bending Space in Enclosures. Minimum wire bending space within the enclosures for motor controllers shall be in accordance with Table 430.10(B) where measured in a straight line from the end of the lug or wire connector (in the direction the wire leaves the terminal) to the wall or barrier. Where alternate wire termination means are substituted for that supplied by the manufacturer of the controller, they shall be of a type identified by the manufacturer for use with the controlle

and shall not reduce the minimum wire-

ARTICLE 430
Motors, Motor Circuits, and Controllers



430.22 Single Motor. 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 full-load current rating, as determined by 430.6(A)(1), or not less than specified in 430.22(A) through (G).

(A) Direct-Current Motor-Rectifier Supplied.

(B) Multispeed Motor.

(C) Wye-Start, Delta-Run Motor.

(D) Part-Winding Motor.

(E) Other Than Continuous Duty. 430.22(E)

(F) Separate Terminal Enclosure

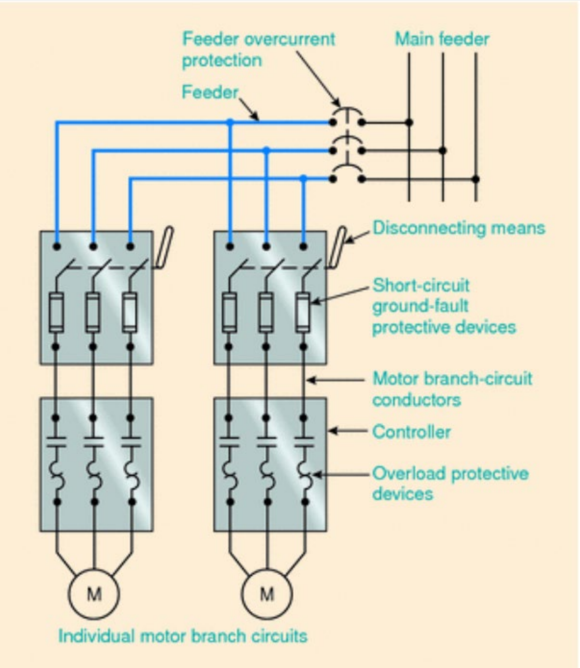
ARTICLE 430
Motors, Motor Circuits, and Controllers

Table 430.22(E) Duty-Cycle Service

	Nameplate Current Rating Percentages			
Classification of Service	**5-Minute Rated Motor**	**15-Minute Rated Motor**	**30- & 60-Minute Rated Motor**	**Contin-uous Rated Motor**
Short-time duty operating valves, raising or lowering rolls, etc.	110	120	150	—
Intermittent duty freight and passenger elevators, tool heads, pumps, drawbridges, turntables, etc. (for arc welders, see 630.11)	85	85	90	140
Periodic duty rolls, ore- and coal-handling machines, etc.	85	90	95	140
Varying duty	110	120	150	200

Note: Any motor application shall be considered as continuous duty unless the nature of the apparatus it drives is such that the motor will not operate continuously with load under any condition of use.

ARTICLE 430
Motors, Motor Circuits, and Controllers



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 the sum of each of the following:

(1) 125 percent of the full-load current rating of the highest rated motor, as determined by 430.6(A)

(2) Sum of the full-load current ratings of all the other motors in the group, as determined by 430.6(A)

(3) 100 percent of the non continuous non-motor load

(4) 125 percent of the continuous non motor

ARTICLE 430
Motors, Motor Circuits, and Controllers

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
DC (constant voltage)	150	150	250	150

IV. Motor Branch-Circuit Short-Circuit and Ground-Fault Protection

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.

Exception No. 1: …the next higher

ARTICLE 430
Motors, Motor Circuits, and Controllers

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

Type of Motor	Nontime Delay Fuse[1]	Dual Element (Time-Delay) Fuse[1]	Instantaneous Trip Breaker	Inverse Time Breaker[2]
	Percentage of Full-Load Current			
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
DC (constant voltage)	150	150	250	150

Note: For certain exceptions to the values specified, see 430.54.
[1]The values in the Nontime Delay Fuse column apply to time-delay Class CC fuses.
[2]The values given in the last column also cover the ratings of nonadjustable inverse time types of circuit breakers that may be modified as in 430.52(C)(1), Exceptions No. 1 and No. 2.

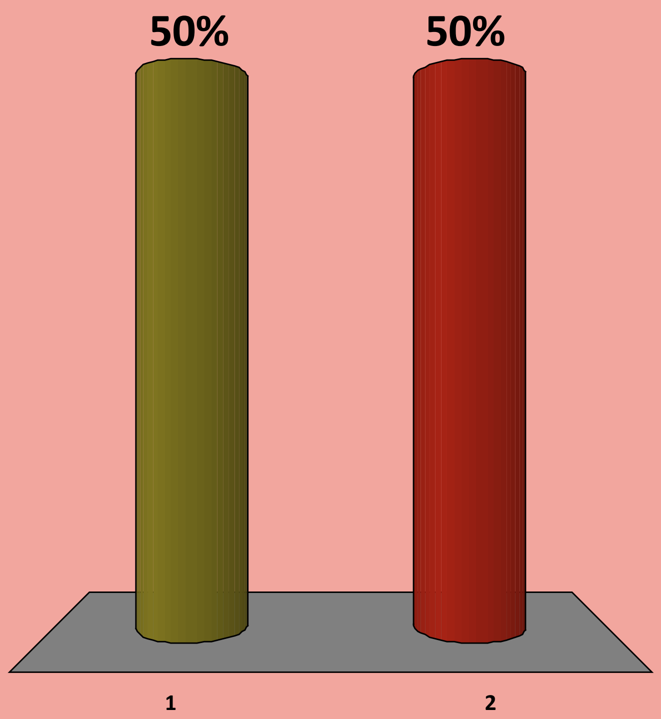
ARTICLE 430
Motors, Motor Circuits, and Controllers

Part VIII. Motor Control Centers

430.99 Available Fault Current. The available short circuit current at the motor control center and the date the short circuit current calculation was performed shall be documented and made available to those authorized to inspect the installation.

Under normal situations, is a disconnecting means required both at the motor and motor controller?

1. Yes
2. No



ARTICLE 430
Motors, Motor Circuits, and Controllers

IX. Disconnecting Means

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.

Exception No. 1: over 1000 volts

Exception No. 2: A single disconnecting means for a group of coordinated controllers on a single machine

Exception No. 3: not be required to be in sig

from valve actuator motor (VAM) assemblies

ARTICLE 430
Motors, Motor Circuits, and Controllers

430.102 Location (Con't).

(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

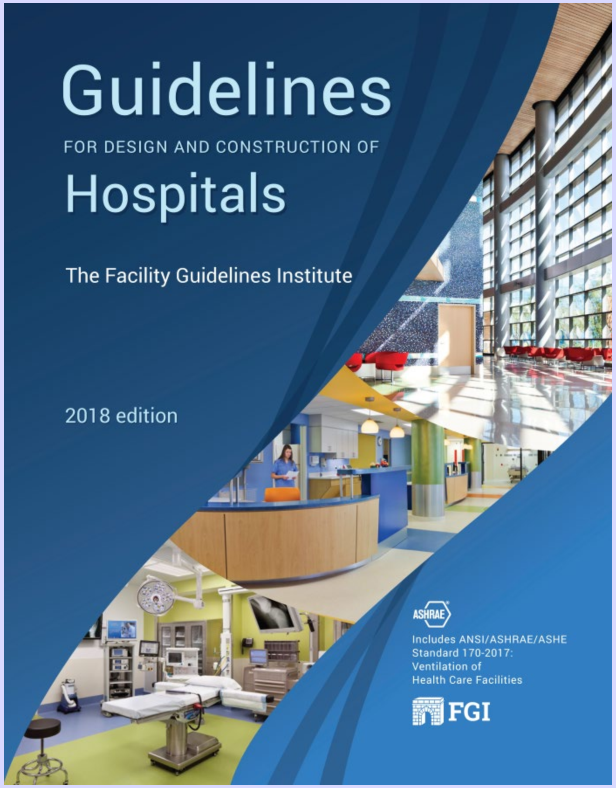
ARTICLE 430
Motors, Motor Circuits, and Controllers

430.103 Operation. The disconnecting means shall open all ungrounded supply conductors and shall be designed so that no pole can be operated independently. <u>**The disconnecting means shall be permitted in the same enclosure with the controller.**</u> The disconnecting means shall be designed so that it cannot be closed automatically.

ARTICLE 430
Motors, Motor Circuits, and Controllers

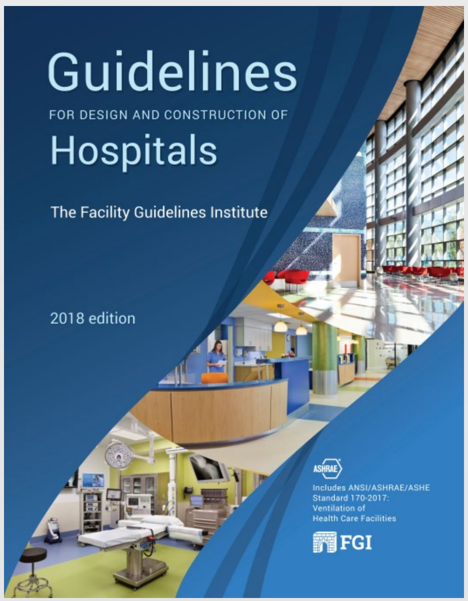
430.107 Readily Accessible. At least one of the disconnecting means shall be readily accessible.

Facility Guidelines Institute Requirements for Healthcare Facilities



Facility Guidelines Institute Requirements

Latest version is 2018.

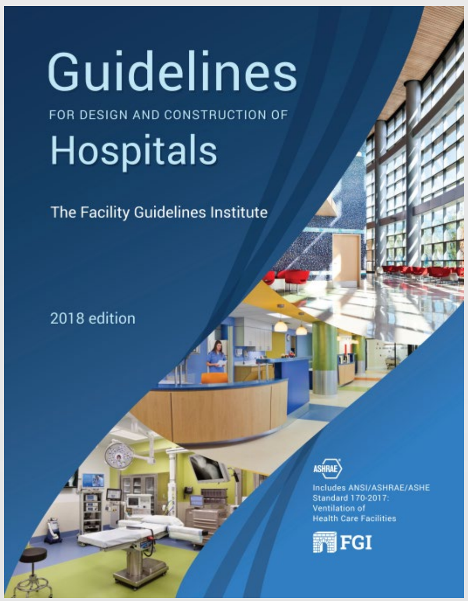


The most significant change to the 2018 edition is that the guideline is presented as three independent documents:

- Guidelines for Design and Construction of Hospitals
- Guidelines for Design and Construction of Outpatient Facilities
- Guidelines for Design and Construction of Residential Health, Care, and Support Facilities.

ELECTRICAL LEAGUE of Ohio

Facility Guidelines Institute Requirements



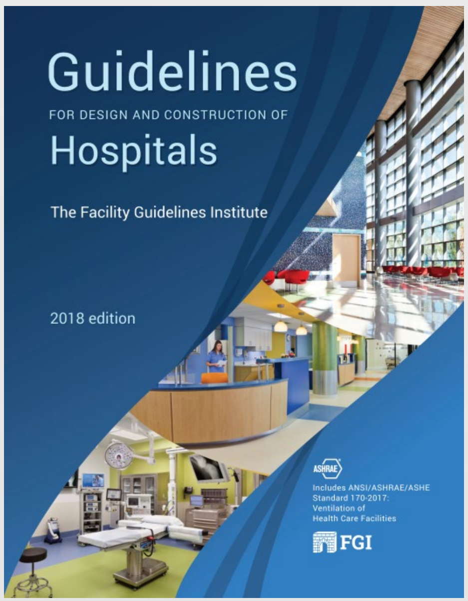
1.1-3.1.1.3 Conversion projects. When a building is converted from one occupancy type to another, it shall comply with the new construction requirements.

1.1-3.1.1.4 Building system projects

(1) Only the altered, renovated, or modernized portion of an existing building system or individual component shall be required to meet the installation and equipment requirements in the Guidelines.

Facility Guidelines Institute Requirements

1.1-3.1.2.2 Minor renovation or replacement work shall be permitted to be exempted from the requirements in Section 1.1-3.1.1



Facility Guidelines Institute Requirements

1.2-1.3.1.2 Outpatient facility planning, design, construction, and commissioning activities shall include—in addition to consideration of space and operational needs—consideration of components in the safety risk assessment as well as life safety and protection of occupants during construction.

Facility Guidelines Institute Requirements

A1.2-1.3.1.2 Facility construction, whether for freestanding buildings or expansion or renovation of existing buildings, can create conditions that are harmful to patients and staff. Thus, new outpatient buildings and renovation projects should be designed and constructed to facilitate ongoing cleanliness and mitigate infection control concerns.

Facility Guidelines Institute Requirements

1.2-4.3 Patient Handling and Movement Assessment (PHAMA)

A patient handling and movement assessment is a multidisciplinary, documented assessment process conducted to direct/assist the design team in incorporating appropriate patient handling and movement equipment into the health care environment. The purpose of this equipment is to increase or maintain patient mobility, independent functioning, and strength as well as to provide a safe environment for staff and patients during performance of high-risk patient handling tasks.

Facility Guidelines Institute Requirements

a. The PHAMA has two distinct yet interdependent phases:

Phase 1: A patient handling, movement, and mobility needs assessment is performed to identify appropriate patient handling and movement equipment for each patient care area.

Phase 2: The space, structural, and other design requirements needed to accommodate patient handling and movement equipment and to facilitate patients' weight-bearing and physical activity are determined.

Facility Guidelines Institute Requirements

A1.2-4.3.2.2 (2) Electrical and mechanical considerations

a. *For portable lifts.* Battery-charging areas with electrical services should be provided in storage rooms for portable, floor-based lifts and other assistive devices.

b. *For fixed lifts.* Access to both electrical power and emergency control features (often suspended from the motor housing) should be provided for fixed lifts.

Facility Guidelines Institute Requirements

1.2-5.4.1 Light

How the use and availability of natural light and illumination are to be considered in the design of the physical environment

A1.2-5.4.1 Light. Provision of natural light should be considered wherever possible in the design of the physical environment.

a. Access to natural light should be provided no farther than 50 feet from any patient activity area, visitor space, or staff work area. To the extent possible, the source of such natural light should also provide opportunities for exterior views.

Facility Guidelines Institute Requirements

1.2-5.4.1 Light

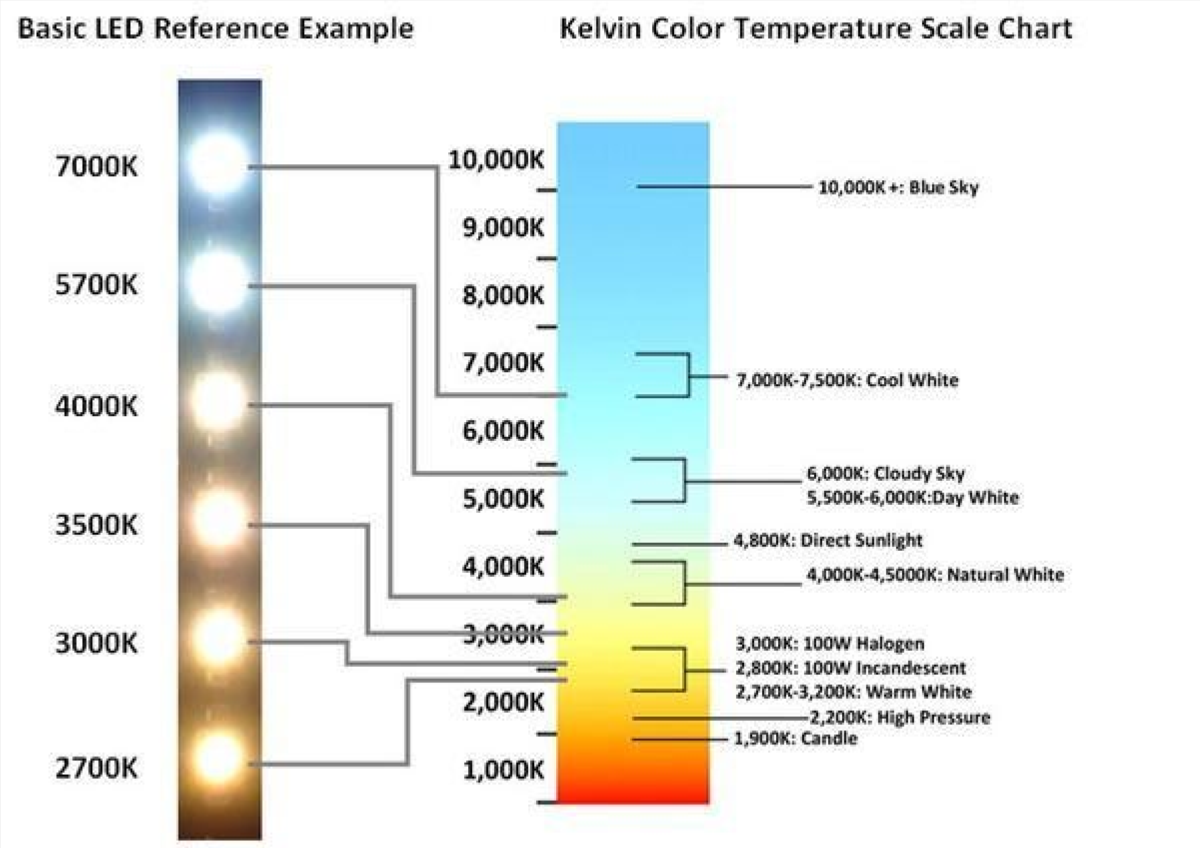
b. Access to natural light should be available without entering private spaces. Examples of such access include windows at the ends of corridors, skylights into deep areas of the building in highly traveled areas, transoms, and door sidelights.

Facility Guidelines Institute Requirements

1.2-5.4.1 Light

c. *Artificial lighting strategies.* The Illuminating Engineering Society (IES) has developed two publications that apply to health care facilities. ANSI/IES RP-29: *Recommended Practices for Lighting for Hospitals and Health Care Facilities* addresses lighting for the general population and special lighting for medical procedures. ANSI/IES RP-28: *Recommended Practices for Lighting and the Visual Environment for Seniors and the Low Vision Population* addresses the special lighting needs of older adults.

Facility Guidelines Institute Requirements



1.2-5.4.1 Light

d. Color rendering properties should be addressed in lamp selection.

e. Finish selection should address light reflectance values (LRV) in conjunction with lamp selection.

f. Indirect lighting should be considered to reduce glare.

Facility Guidelines Institute Requirements

Table 1.2-5: Maximum Design Criteria for Noise in Interior Spaces Caused by Buildin

Room Type	NC / RC(N) / RNC[2,3,4]	dBA
Patient Care and Diagnostic Areas		
Multiple-occupant patient care area	45	50
Examination/treatment room	40	45
Procedure room	40	45
Class 2 imaging room	40	45
Operating room[5]	50	55
Class 3 imaging room[5]	50	55
Support Areas		
Medication safety zone	40	45
Testing/research lab, minimal speech	55	60
Research lab, extensive speech	50	55
Group teaching lab	45	50
Public Areas		
Corridors and public areas	45	50
Conference room	35	40
Teleconferencing room	25	30
Auditorium, large lecture room	30	35
Administrative Areas		
Private office	40	45

1.2-6.1.4 Design Criteria for Room Noise Levels

1.2-6.1.4.1 Room noise levels caused by HVAC and other building systems shall not exceed the maximum values shown in Table 1.2-5 (Maximum Design Criteria for Noise in Interior Spaces Caused by Building Systems,

Facility Guidelines Institute Requirements

1.3-3.2 Lighting

Site lighting shall be provided for the patient path of travel.

Facility Guidelines Institute Requirements

2.1-7.2.2.14 Decorative water features

A2.1-7.2.2.14 Fountains and other open decorative water features can represent a reservoir for opportunistic human pathogens.

(1) Installation of indoor, unsealed (open) water features shall not be permitted in the confines of the licensed outpatient health care occupancy area.

(2) Covered fish tanks shall be permitted in public areas of the licensed outpatient health care occupancy area.

Not permitted in Hospitals!

Facility Guidelines Institute Requirements

2.1-8.3.2.1 Switchboards, Switchgear, and Automatic Transfer Switches

(1) Location. Switchboards, switchgear, and automatic transfer switches shall be:

(a) Located in a room that meets the requirements of NFPA 70: *National Electrical Code®*.

(b) Accessible to authorized persons only.

Facility Guidelines Institute Requirements

2.1-8.3.2.1 Switchboards, Switchgear, and Automatic Transfer Switches (Con't)

(c) Located in dry, ventilated spaces free of corrosive or explosive fumes or gases or any flammable material.

(2) Overload protective devices shall be listed for the ambient room temperature for the space in which they are installed.

Overcurrent devices are rated to operate in 40°C (104°F) ambient temp max

ELECTRICAL LEAGUE of Ohio

According to FGI does the panel serving critical loads in a hospital need to be on the same floor as those loads?

1. Yes
2. No

Facility Guidelines Institute Requirements

2.1-8.3.2.2 Panelboards

(1) All panelboards shall be accessible to the health care tenants they serve.

(2) Where panelboards serving critical branch circuits are required, they shall be located on each floor where services are provided.

(3) Where panelboards serving life safety branch circuits are required, they shall be permitted to serve floors immediately above and/or immediately below the level where the panel is located.

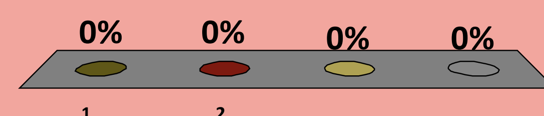
Facility Guidelines Institute Requirements

2.1-8.3.2.2 Panelboards

(4) New panelboards shall not be located in exit enclosures or exit passageways.

Where fuel is stored on site for the emergency power system (EPS) how many run hours are you required to store?

1. 8 hours
2. 12 hours
3. 24 hours
4. 40 hours



Facility Guidelines Institute Requirements

2.1-8.3.3.1 Emergency electrical service

(1) Emergency power shall be provided for in accordance with NFPA 99, NFPA 101, and NFPA 110: *Standard for Emergency and Standby Power Systems.*

(2) Where stored fuel is required, storage capacity shall permit continuous operation for **at least 24 hours.**

ELECTRICAL LEAGUE of Ohio

Facility Guidelines Institute Requirements

2.1-8.3.3.1 Emergency electrical service

(3) Acoustic considerations for emergency generators

(a) Generators shall meet the following criteria and be placed in a sound reduction enclosure if necessary to meet the criteria.

(i) Interior and exterior generators shall be designed to limit sound levels at nearest hospital building facades to a level not exceeding 70 dBA and not to exceed the applicable community noise code for the period of day when maintenance operations occur.

Facility Guidelines Institute Requirements

2.1-8.3.3.1 Emergency electrical service

(3) Acoustic considerations for emergency generators (Con't)

(ii) An engine exhaust muffler shall be provided for the emergency generator.

(b) Interior noise levels shall meet those specified in Table 1.2-5 (Maximum Design Criteria for Noise in Interior Spaces Caused by Building Systems).

Maximum noise level in a patient room is 45 dBA (See next slide)

Facility Guidelines Institute Requirements

Table 1.2-5

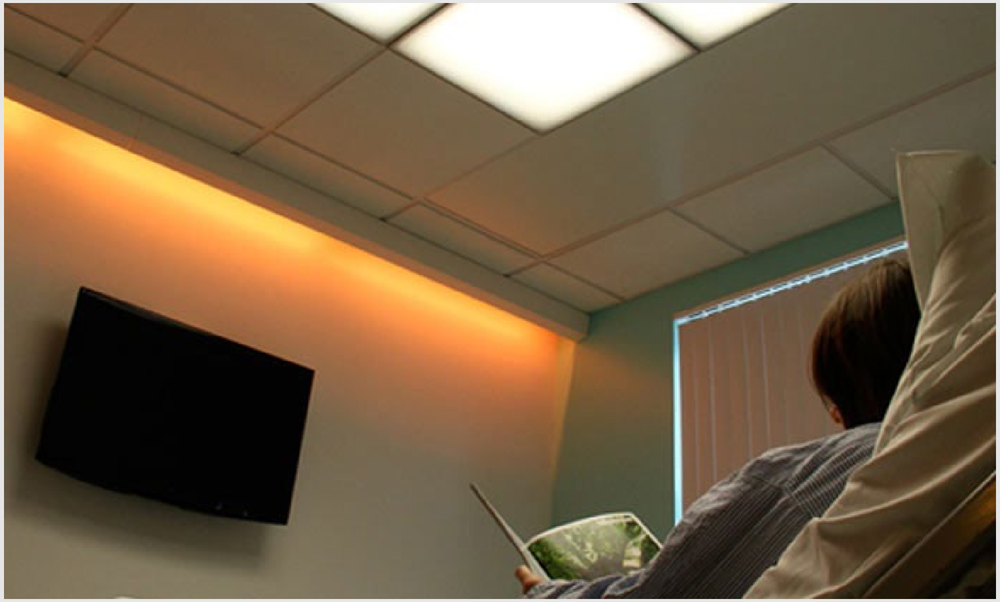
Maximum Design Criteria for Noise in Interior Spaces Caused by Building Systems[1]

Room Type	NC / RC(N) / RNC[3, 4, 5]	dBA
Patient rooms	40	45
Medication safety zones	40	45
Multiple occupant patient care areas	45	50
NICU sleep areas	30	35
NICU staff and family areas	35	40
Operating rooms[2]	50	55
Corridors and public spaces	45	50
Testing/research lab, minimal speech[2]	55	60
Research lab, extensive speech[2]	50	55
Group teaching lab	45	50
Private offices, exam rooms	40	45
Conference rooms	35	40
Teleconferencing rooms	25	30
Auditoriums, large lecture rooms	30	35

Facility Guidelines Institute Requirements

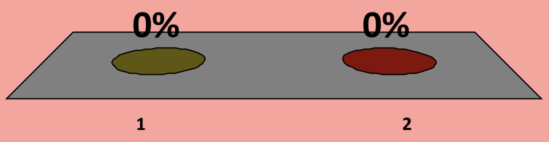
2.1-8.3.4.3 Lighting for specific locations in the hospital

(1) Patient rooms. Patient rooms shall have general lighting and night lighting.

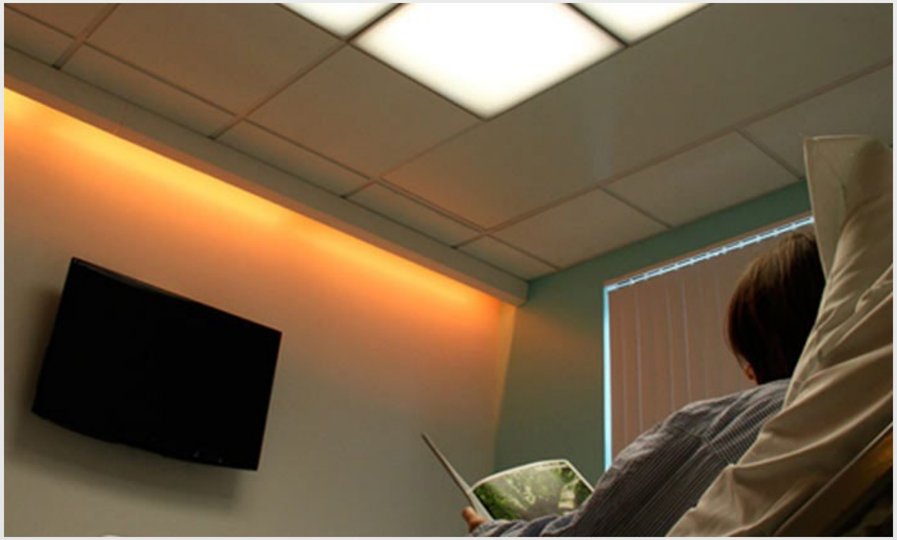


Is a reading light required in each patient room?

1. Yes
2. No



Facility Guidelines Institute Requirements



2.1-8.3.4.3 Lighting for specific locations in the hospital

(1) Patient rooms.

(a) A reading light shall be provided for each patient.

(i) Reading light controls shall be accessible to the patient(s) without the patient having to get out of bed.

Facility Guidelines Institute Requirements

2.1-8.3.4.3 Lighting for specific locations in the hospital

(1) Patient rooms. (Con't)

(iii) Unless the light source is specifically designed to protect the space below, the light source shall be covered by a diffuser or lens.

(iv) Flexible light arms, if used, shall be mechanically controlled to prevent the lamp from contacting the bed linen.

Can there be a central control of the night light required in each patient room?

1. Yes
2. No

Facility Guidelines Institute Requirements

2.1-8.3.4.3 Lighting for specific locations in the hospital

(1) Patient rooms.

(b) At least one night-light fixture shall be located in each patient room. This requirement does not apply to intensive care patient rooms where view panels are provided to the corridor.

(i) Central control of nightlights such as a common switch at the nurse station or time clock shall be prohibited.

Facility Guidelines Institute Requirements

2.1-8.3.4.3 Lighting for specific locations in the hospital

(1)Patient rooms. (Con't)

(ii) The night-light shall be located for staff and patient use to illuminate both the path from the room entrance to the bedside and the path between the bed and the toilet room.

Facility Guidelines Institute Requirements

2.1-8.3.4.3 Lighting for specific locations in the hospital

(1)Patient rooms.

(c) Lighting for coronary and intensive care bed areas shall permit staff observation of the patient while minimizing glare.

Facility Guidelines Institute Requirements

2.1-8.3.4.3 Lighting for specific locations in the hospital

(2) Nursing unit corridors. Corridors in nursing units shall have general illumination with provisions for reducing light levels at night.

Facility Guidelines Institute Requirements

2.1-8.3.4.3 Lighting for specific locations in the hospital

(3) Exam/ treatment/ trauma rooms. A portable or fixed examination light shall be provided for examination, treatment, and trauma rooms.

Facility Guidelines Institute Requirements

2.1-8.3.4.3 Lighting for specific locations in the hospital

(4) Operating and delivery rooms. Operating and delivery rooms shall have general lighting in addition to special lighting units provided at surgical and obstetrical tables. General lighting and special lighting shall be on separate circuits.

Facility Guidelines Institute Requirements

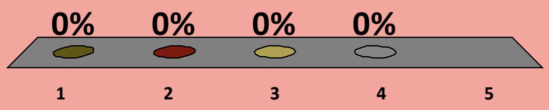
2.1-8.3.4.3 Lighting for specific locations in the hospital

(6) Food and nutrition areas. Kitchen and serving area lighting shall have a shatterproof or protective cover.

ELECTRICAL LEAGUE of Ohio

What is the maximum distance between receptacles in a hospital corridor?

1. 6’
2. 12’
3. 50’
4. 100’



Facility Guidelines Institute Requirements

2.1-8.3.6 Electrical Receptacles

2.1-8.3.6.1 Receptacles in corridors

(1) Duplex-grounded receptacles for general use shall be installed approximately **50 feet** (15.24 meters) apart in all corridors and within 25 feet (7.62 meters) of corridor ends.

(2) Receptacles in pediatric and psychiatric unit corridors shall be of the tamper-resistant type.

Facility Guidelines Institute Requirements

2.1-8.3.6 Electrical Receptacles

Receptacles in patient care areas shall be provided according to Table 2.1-1 (Electrical Receptacles for Patient Care Areas in Outpatient Facilities).

A2.1-8.3.6 Height of electrical receptacles. Potential high-use electrical receptacles in patient care areas (e.g., those areas proximal to gurneys and exam tables) should be positioned a minimum of 30 inches (76.2 centimeters) above finished floor (AFF) to the center of the electrical outlet. This height is recommended to minimize the need for staff to bend over to reach the receptacles.

ELECTRICAL LEAGUE of Ohio

Table 2.1-1: Electrical Receptacles for Patient Care Areas in Outpatient Facilities

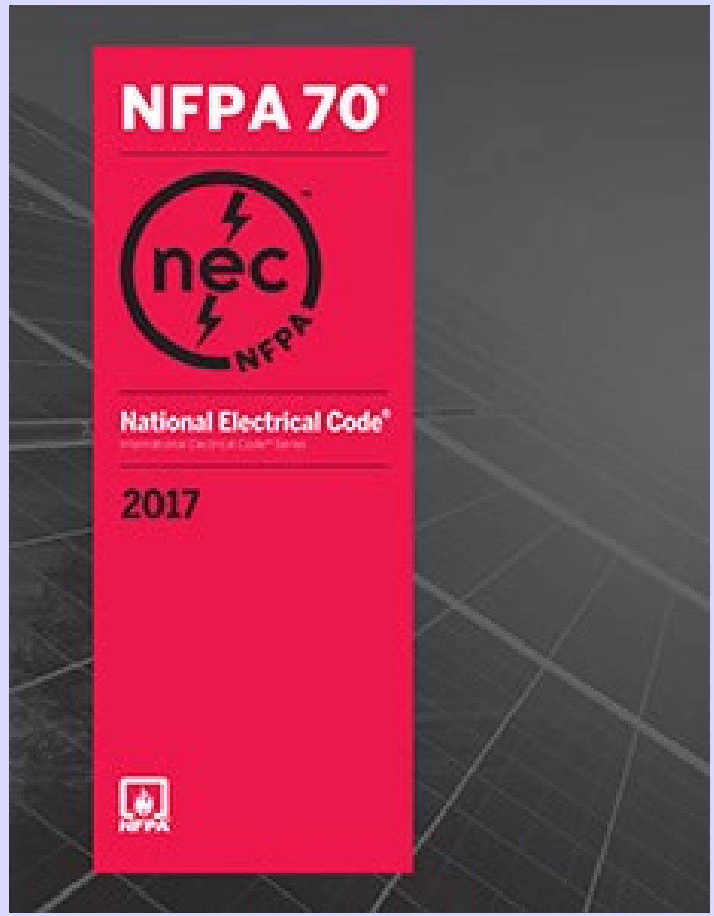
Section	Room Type	Number of Single Receptacles[1]	Receptacle Locations[2]
PATIENT CARE AND DIAGNOSTIC AREAS			
2.1-3.2.1 Table 2.1-4	Examination room/observation room Class 1 imaging room	8	4 convenient to head of exam table or gurney or on each lateral side of the imaging gantry
2.1-3.2.2 Table 2.1-4	Procedure room (including endoscopy) Class 2 imaging room	12[3]	8 convenient to table placement At least 1 on each wall
2.1-3.2.3 Table 2.1-4	Operating room Class 3 imaging room	36[3]	12 convenient to table placement 2 on each wall
2.1-3.7.3 2.1-3.7.5	Pre-procedure patient care station Phase II recovery patient care station	4	Convenient to gurney, lounge chair, or bed
2.1-3.7.4	Phase I post-anesthesia recovery (PACU) patient care station	8	Convenient to head of gurney or bed
2.4-2.2	Birthing room	8	4 convenient to head of the mother's bed
2.8-3.4.2	Treatment room (emergency facility)	12	4 convenient to head of exam table or gurney
2.8-3.4.4	Trauma/resuscitation room (emergency facility)	16	Convenient to head of gurney or bed
2.8-6.2.2	Triage area (emergency facility)	6	Convenient to head of gurney or bed (at least 3 outlets connected to emergency system power and so labeled)
2.10-3.2.2	Hemodialysis patient care station	8	4 on each side of a patient bed or lounge chair (2 on each side of the bed connected to emergency power)

More Specific areas than NEC

Facility Guidelines Institute Requirements

2.1-8.3.6.3 Emergency system receptacles. Electrical receptacle cover plates or electrical receptacles supplied from the emergency systems shall be distinctively colored or marked for identification. If color is used for identification purposes, the same color shall be used throughout the facility.

National Electrical Code
Article 517



ARTICLE 517
Health Care Facilities

517.2 Patient Care Spaces

Critical Care - Category 1 Failure likely to cause major injury or death (CCU, Cath Labs, Etc)

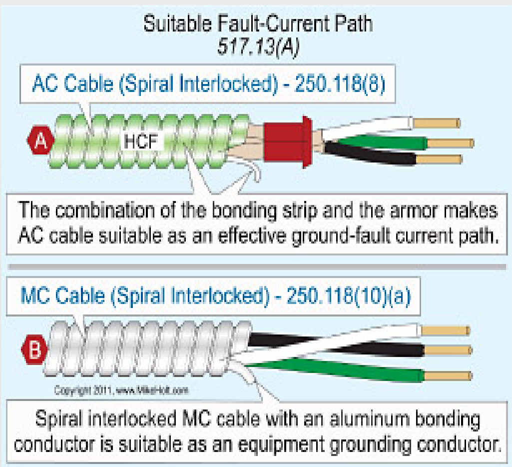
General Care - Category 2 Failure like to cause minor injury (inpatient bedroom, dialysis)

Basic Care - Category 3 Failure not likely to cause injury (Dental Offices)

Does the branch circuit wiring system installed to serve Patient Care Areas need to be installed in a metal raceway or metallic armor?

1. Yes
2. No

ARTICLE 517
Health Care Facilities



517.13 Grounding of Receptacles and Fixed Electrical Equipment in Patient Care Spaces. Wiring in patient care spaces shall comply with 517.13(A) and (B).

(A) Wiring Methods. All branch circuits serving patient care spaces shall be provided with an effective ground-fault current path 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 conductor in accordance with 250.118.

Is an insulated grounding conductor also required for patient care area branch circuits in addition to a metal raceway?

1. Yes
2. No

ARTICLE 517
Health Care Facilities

517.13 (B) Insulated Equipment Grounding Conductors and Insulated Equipment Bonding Jumpers.

(1) General. The following shall be directly connected to an insulated copper equipment grounding conductor that is clearly identified along its entire length by green insulation and installed with the branch circuit conductors in the wiring methods as provided in 517.13(A):

(1) The grounding terminals of all receptacles other than isolated ground receptacles

ARTICLE 517
Health Care Facilities

517.13 (B) Insulated Equipment Grounding Conductors and Insulated Equipment Bonding Jumpers (Con't).

(2) Metal outlet boxes, metal device boxes, or metal enclosures

(3) All non–current-carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts

Exceptions for isolated ground receptacles, metal faceplates and luminaires higher than 7 ½' above floor

ARTICLE 517
Health Care Facilities

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

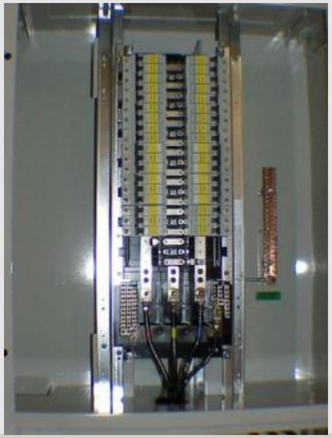
Rating or Setting of Automatic Overcurrent Device in Circuit Ahead of Equipment, Conduit, etc., Not Exceeding (Amperes)	Size (AWG or kcmil)	
	Copper	Aluminum or Copper-Clad Aluminum*
15	14	12
20	12	10
30	10	8
40	10	8
60	10	8
100	8	6

517.13(B)(2) Sizing. Equipment grounding conductors and equipment bonding jumpers shall be sized in accordance with 250.122.

Is a ground wire required to be installed between patient care area panel boards?

1. Yes
2. No

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 care vicinity shall be connected together with an insulated continuous copper conductor not smaller than 10 AWG. Where two or more panelboards serving the same individual patient care vicinity are served from separate transfer switches on the essential electrical system, the equipment grounding terminal buses of those panelboards shall be connected 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.

ARTICLE 517
Health Care Facilities

517.16 Use of Isolated Ground Receptacles.

(A) Inside of a Patient Care Vicinity. An isolated grounding receptacle shall not be installed within a patient care vicinity. [**99:**6.3.2.2.7.1(B)]

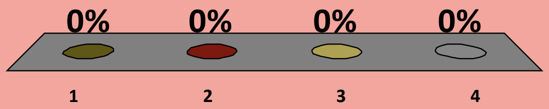
(B) Outside of a Patient Care Vicinity. Isolated ground receptacle(s) installed in patient care spaces outside of a patient care vicinity(s) shall comply with 517.16(B)(1) and (2).

Grounding terminal direct connection in patient care area.

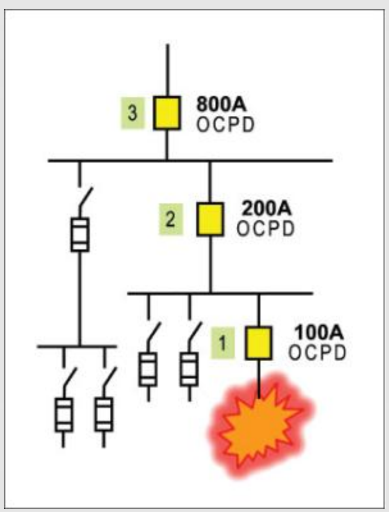
Insulated ground to metal back box.

How many levels of GFP protection are required in Category 1 hospital distribution system?

1. 1 Level
2. 2 levels
3. 3 levels
4. None Required



ARTICLE 517
Health Care Facilities

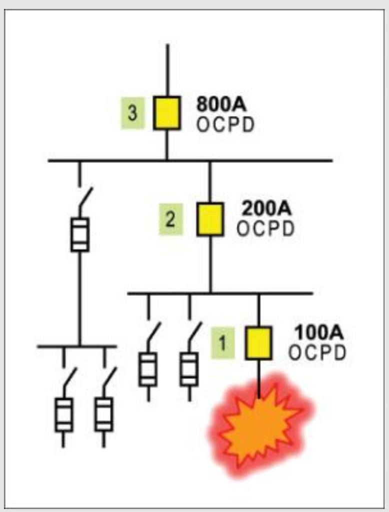


517.17 Ground-Fault Protection.

517.17 Ground-Fault Protection.

(A) Applicability. The requirements of 517.17 shall apply to hospitals, and other buildings (including multiple-occupancy buildings) with critical care (Category 1) spaces or utilizing electrical life-support equipment, and buildings that provide the required essential utilities or services for the operation of critical care (Category 1) spaces or electrical life-support equipment.

ARTICLE 517
Health Care Facilities



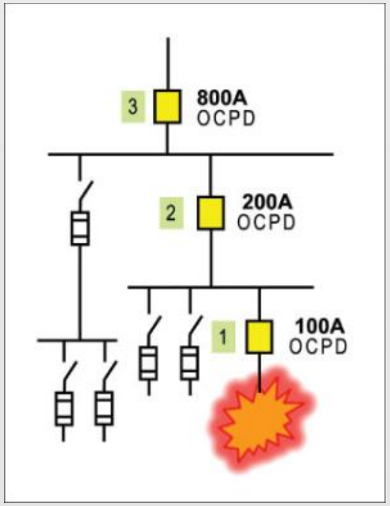
517.17 Ground-Fault Protection.

(B) Feeders. Where ground-fault protection is provided for operation of the service disconnecting means or feeder disconnecting means as specified by 230.95 or 215.10, **an additional step of ground-fault protection shall be provided in all next level feeder disconnecting means downstream toward the load**. Such protection shall consist of overcurrent devices and current transformers or other equivalent protective equipment that shall cause the feeder disconnecting means to open. The additional levels of ground-fault protection shall not be installed on the load side of an essential electrical system transfer

ARTICLE 517
Health Care Facilities

517.17 Ground-Fault Protection.

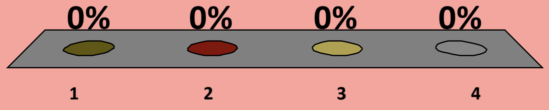
(C) Selectivity. Ground-fault protection for operation of the service and feeder disconnecting means shall be fully selective such that the feeder device, but not the service device, shall open on ground faults on the load side of the feeder device. Separation of ground-fault protection time-current characteristics shall conform to manufacturer's recommendations and shall consider all required tolerances and disconnect operating time to achieve **100 percent selectivity**.



6 cycle minimum was removed

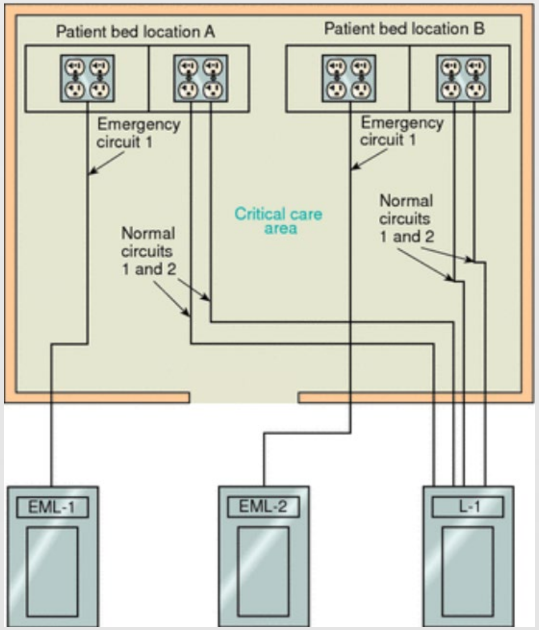
Unless fed from two separate transfer switches, how many branch circuits are required to serve a patient general care Category 2 spaces?

1. One normal
2. One normal and One Emergency
3. One Normal and Two Emergency
4. Two Normal and Two Emergency



ARTICLE 517
Health Care Facilities

517.18 General Care (Category 2) Spaces.

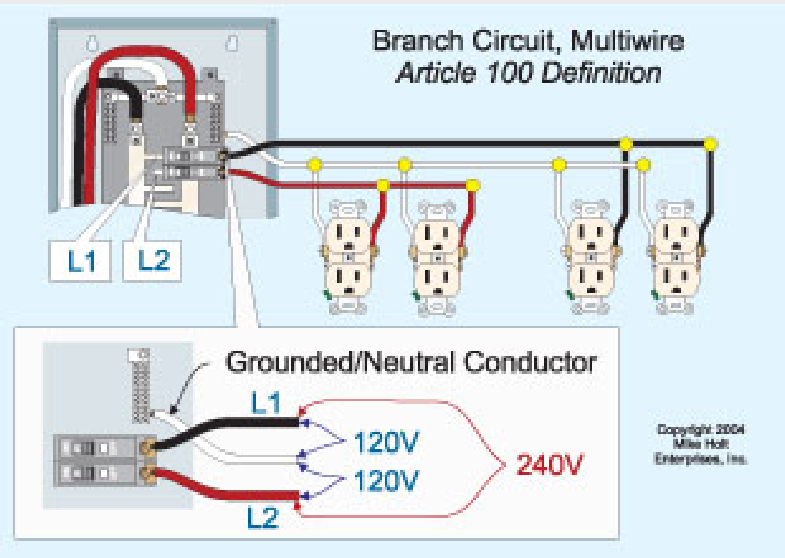


(A) Patient Bed Location. Each patient bed location shall be supplied by at **least two branch circuits, one from the critical branch and one from the normal system**. All branch circuits from the normal system shall originate in the same panelboard. The electrical receptacles or the cover plate for the electrical receptacles supplied from the critical branch shall have a distinctive color or marking so as to be readily identifiable and shall also indicate the panelboard and branch-circuit number supplying them.

Can branch circuits to patient general care (Category 2) bed areas in hospitals be multi-wire?

1. Yes
2. No

ARTICLE 517
Health Care Facilities



Would need to disconnect all ungrounded conductors per 210.4(B)

517.18 General Care Areas.

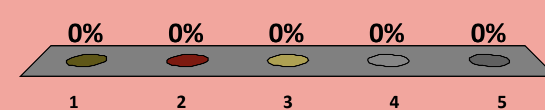
Branch circuits serving patient bed locations shall **not** be part of a multi-wire branch circuit.

Exception 1: Branch circuits serving only special purpose outlets or receptacles, such as portable X-ray outlets, shall not be required to be served from the same distribution panel or panels.

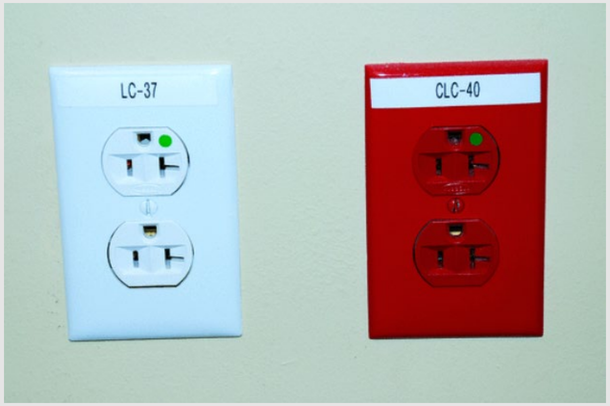
Exception 2: Multiwire permitted in dental, nursing homes, etc

How many receptacles are required at a general care (Category 2) patient bed area of a hospital?

1. 2
2. 4
3. 6
4. 8
5. 10



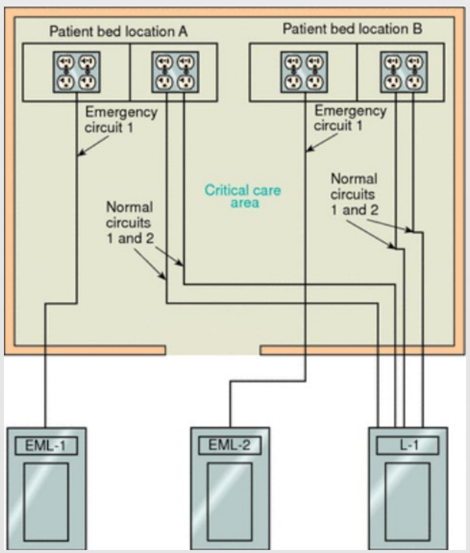
ARTICLE 517
Health Care Facilities



517.18 General Care Areas

(B) Patient Bed Location Receptacles. Each patient bed location shall be provided with a minimum of **8 (eight)** receptacles. They shall be permitted to be of the single, duplex, or quadruplex type, or any combination of the three. All receptacles shall be listed “hospital grade” and shall be so identified. The grounding terminal of each receptacle shall be connected to an insulated copper equipment grounding conductor sized in accordance with Table 250.122.

ARTICLE 517
Health Care Facilities



517.19 Critical Care (Category 1) Spaces.

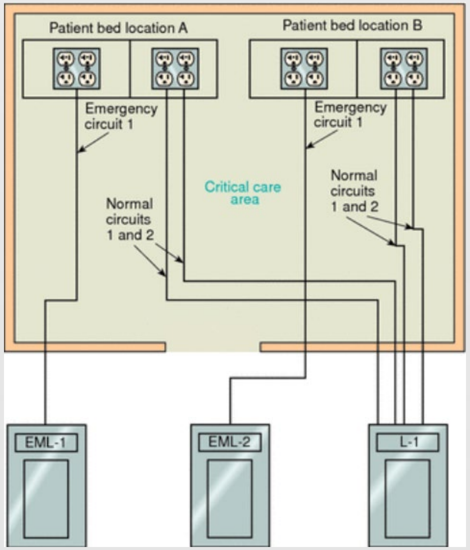
(A) Patient Bed Location Branch Circuits. Each patient bed location shall be supplied by at least two branch circuits, one or more from the critical branch and one or more circuits from the normal system. At least one branch circuit from the emergency system shall supply an outlet(s) only at that bed location.

The electrical receptacles or the cover plates for the electrical receptacles supplied from the life safety and critical branches shall have a distinctive color or marking so as to be readily identifiable. [99:6.4.2.2.6.2(C)]

ARTICLE 517
Health Care Facilities

517.19 Critical Care (Category 1) Spaces.

(A) Patient Bed Location Branch Circuits.

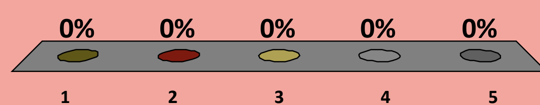


All branch circuits from the normal system shall be from a single panelboard. Critical branch receptacles shall be identified and shall also indicate the panelboard and circuit number supplying them.

The branch circuit serving patient bed locations shall not be part of a multi-wire branch circuit.

How many receptacles are required at a critical care (Category 1) patient bed area of a hospital?

1. 4
2. 8
3. 10
4. 12
5. 14



ARTICLE 517
Health Care Facilities

517.19(B) Patient Bed Location Receptacles.

(1) Minimum Number and Supply. Each patient bed location shall be provided with a minimum of **14 receptacles**, at least one of which shall be connected to either of the following:

(1) The normal system branch circuit required in 517.19(A)

(2) A critical branch circuit supplied by a different transfer switch than the other receptacles at the same patient bed location

ARTICLE 517
Health Care Facilities

517.19(B)(2) Receptacle Requirements. The receptacles required in 517.19(B)(1) shall be permitted to be single, duplex, or quadruplex type or any combination thereof. **All receptacles shall be listed "hospital grade"** and shall be so identified. The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor.

ELECTRICAL LEAGUE of Ohio

ARTICLE 517
Health Care Facilities

517.19 (C) Operating Room Receptacles.

(1) Minimum Number and Supply. Each operating room shall be provided with a minimum of 36 receptacles divided between at least two branch circuits. At least 12 receptacles, but not more than 24, shall be connected to either of the following:

(1) The normal system branch circuit required in 517.19(A)

(2) A critical branch circuit supplied by a different transfer switch than the other receptacles at the same location

ARTICLE 517
Health Care Facilities

517.20 Wet Procedure Locations.

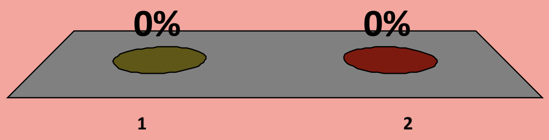
(A) Receptacles and Fixed Equipment. Wet procedure locations shall be provided with special protection against electric shock by one of the following means:

(1) Power distribution system that inherently limits the possible ground-fault current due to a first fault to a low value, without interrupting the power supply

(2) Power distribution system in which the power supply is interrupted if the ground-fault current does, in fact, exceed a value of 6 mA

Are GFCI receptacles required in a critical care area if installed within 6’ of the sink or toilet basin?

1. Yes
2. No

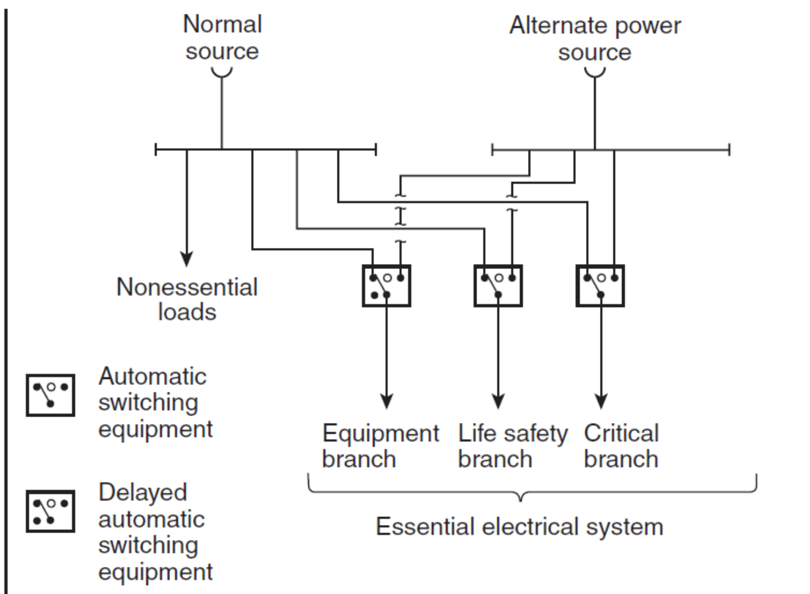


ELECTRICAL LEAGUE of Ohio

ARTICLE 517
Health Care Facilities

517.21 Ground-Fault Circuit-Interrupter Protection for Personnel. Ground-fault circuit-interrupter protection for personnel **shall not be** required for receptacles installed in those critical care areas (Category 1) spaces where the toilet and basin are installed within the patient room.

ARTICLE 517
Health Care Facilities

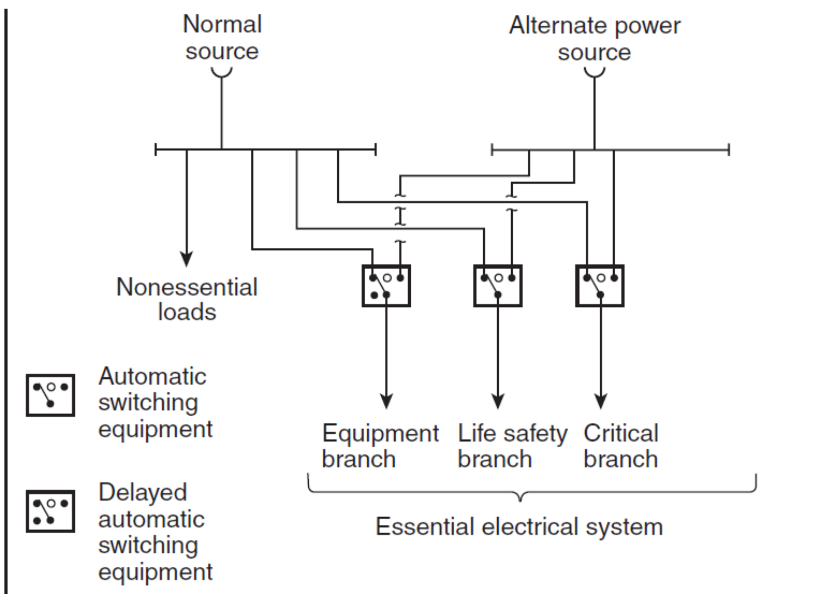


Informational Note Figure 517.30, No. 1 Hospital — Minimum Requirement (greater than 150 kVA) for Transfer Switch Arrangement.

517.29 Essential Electrical Systems for Hospitals and Other Health Care Facilities.

(A) Applicability. The requirements of Part III, 517.29 through 517.30, shall apply to critical care (Category 1) and general care (Category 2) hospitals and other health care facilities using Type 1 essential electrical systems where patients are sustained by electrical life-support equipment.

ARTICLE 517
Health Care Facilities

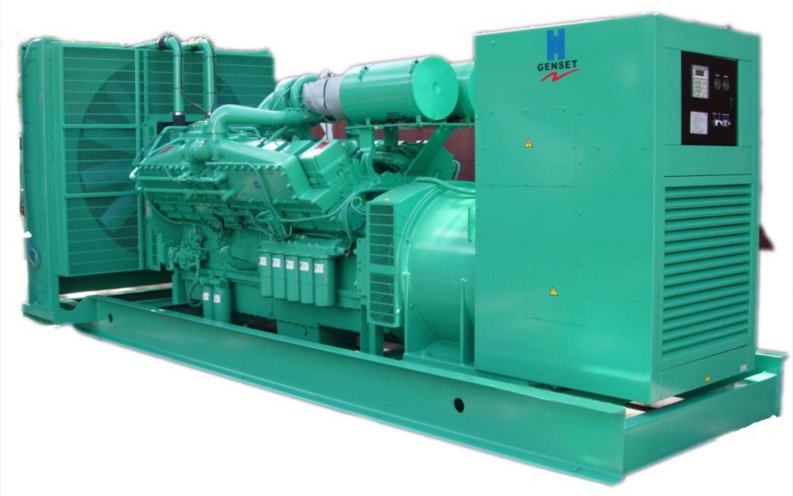


Informational Note Figure 517.30, No. 1 Hospital — Minimum Requirement (greater than 150 kVA) for Transfer Switch Arrangement.

517.29 Essential Electrical Systems for Hospitals and Other Health Care Facilities.

(B) Critical care (Category 1) spaces shall be served only by a Type 1 essential electrical system. [99:6.3.2.2.10.1]

ARTICLE 517
Health Care Facilities



517.30 Sources of Power.

(A) Two Independent Power Sources. **Essential electrical systems** shall have a minimum of the following two independent sources of power: a normal source generally supplying the entire electrical system and one or more alternate source(s) for use when the normal source is interrupted. [**99:**6.4.1.1.4]

ARTICLE 517
Health Care Facilities

517.30 Sources of Power.

(B) Types of Power Sources.

(1) Generating Units. Where the normal source consists of generating units on the premises, the alternate source shall be either another generating set or an external utility service.

(2) Fuel Cell Systems. Fuel cell systems shall be permitted to serve as the alternate source for all or part of an essential electrical system, provided the following conditions apply:

(1) Installation of fuel cells shall comply with Article 692 for 1000 volts or less and Part VI for over 1000 volts.

ARTICLE 517
Health Care Facilities

517.31 Requirements for the Essential Electrical System.

(C) Wiring Requirements (Con't).

Wiring of the life safety branch and the critical branch shall be permitted to occupy the same raceways, boxes, or cabinets of other circuits not part of the branch where such wiring complies with one of the following:

(1) Is in transfer equipment enclosures

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

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

(4) Is for two or more circuits supplied from the same branch and same transfer switch

ARTICLE 517
Health Care Facilities

517.31 Requirements for the Essential Electrical System.

(C) Wiring Requirements (Con’t).

The wiring of the equipment branch shall be permitted to occupy the same raceways, boxes, or cabinets of other circuits that are not part of the essential electrical system.

Is it permitted to install wiring of the hospital essential distribution system in PVC schedule 80 conduit if mechanically protected and not a branch circuit?

1. Yes
2. No

ARTICLE 517
Health Care Facilities

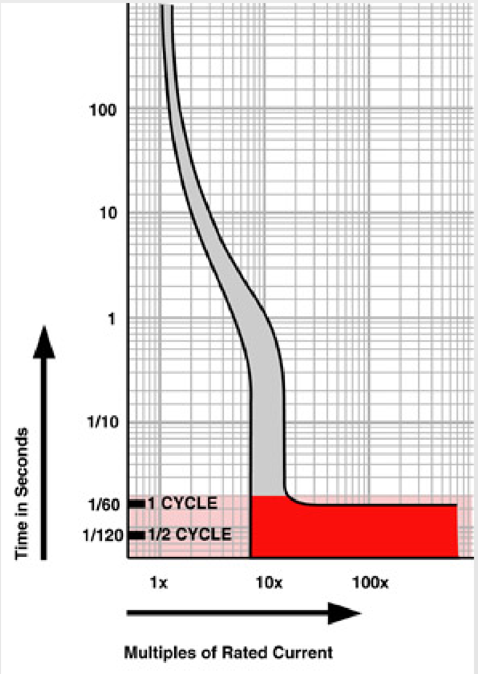
517.31 Requirements for the Essential Electrical System.

(3) Mechanical Protection of the Essential Electrical System.

The wiring of the life safety and critical branches shall be mechanically protected. Where installed as branch circuits in patient care spaces, the installation shall comply with the requirements of 517.13(A) and (B). Only the following wiring methods shall be permitted:

(1) Nonflexible metal raceways, Type MI cable, Type RTRC marked with the suffix –XW, **or Schedule 80 PVC conduit**. Nonmetallic raceways shall not be used for branch circuits

ARTICLE 517
Health Care Facilities



517.31(G) Coordination. Overcurrent protective devices serving the essential electrical system shall be coordinated for the period of time that a fault's duration extends beyond 0.1 second.

Exception No. 1: Between transformer primary and secondary overcurrent protective devices, where only one overcurrent protective device or set of overcurrent protective devices exists on the transformer secondary.

Exception No. 2: Between overcurrent protective devices of the same size (ampere rating) in series.

ARTICLE 517
Health Care Facilities

517.32 Branches Requiring Automatic Connection.

(A) Those functions of patient care depending on lighting or appliances that are connected to the essential electrical system shall be divided into the life safety branch and the critical branch, as described in 517.33 and 517.34 .

(B) The life safety and critical branches shall be installed and connected to the alternate power source specified in 517.30(A) and (B) so that all functions specified herein for the life safety and critical branches are automatically restored to operation within 10 seconds after interruption of the normal source.

[99:6.4.3.1]

Article 700.3(F)
Temporary Source of Power for Maintenance of the Emergency Alternate Power Source

ARTICLE 700.3
Tests and Maintenance

700.3 Tests and Maintenance.

(F) Temporary Source of Power for Maintenance or Repair of the Alternate Source of Power. If the emergency system relies on a single alternate source of power, which will be disabled for maintenance or repair, the emergency system shall include permanent switching means to connect a portable or temporary alternate source of power, which shall be available for the duration of the maintenance or repair. The permanent switching means to connect a portable or temporary alternate source of power shall comply with the following:

ARTICLE 700.3
Tests and Maintenance

700.3 Tests and Maintenance. (F) (Con’t)

(1) Connection to the portable or temporary alternate source of power shall not require modification of the permanent system wiring.

(2) Transfer of power between the normal power source and the emergency power source shall be in accordance with 700.12.

(3) The connection point for the portable or temporary alternate source shall be marked with the phase rotation and system bonding requirements.

(4) Mechanical or electrical interlocking shall prevent inadvertent interconnection of power

ARTICLE 700.3
Tests and Maintenance

700.3 Tests and Maintenance. (F) (Con't)

(5) The switching means shall include a contact point that shall annunciate at a location remote from the generator or at another facility monitoring system to indicate that the permanent emergency source is disconnected from the emergency system.

See figure 700.3(F)

It shall be permissible to utilize manual switching to switch from the permanent source of power to the portable or temporary alternate source of power and to utilize the switching means for connection of a load bank.

ARTICLE 700.3
Tests and Maintenance

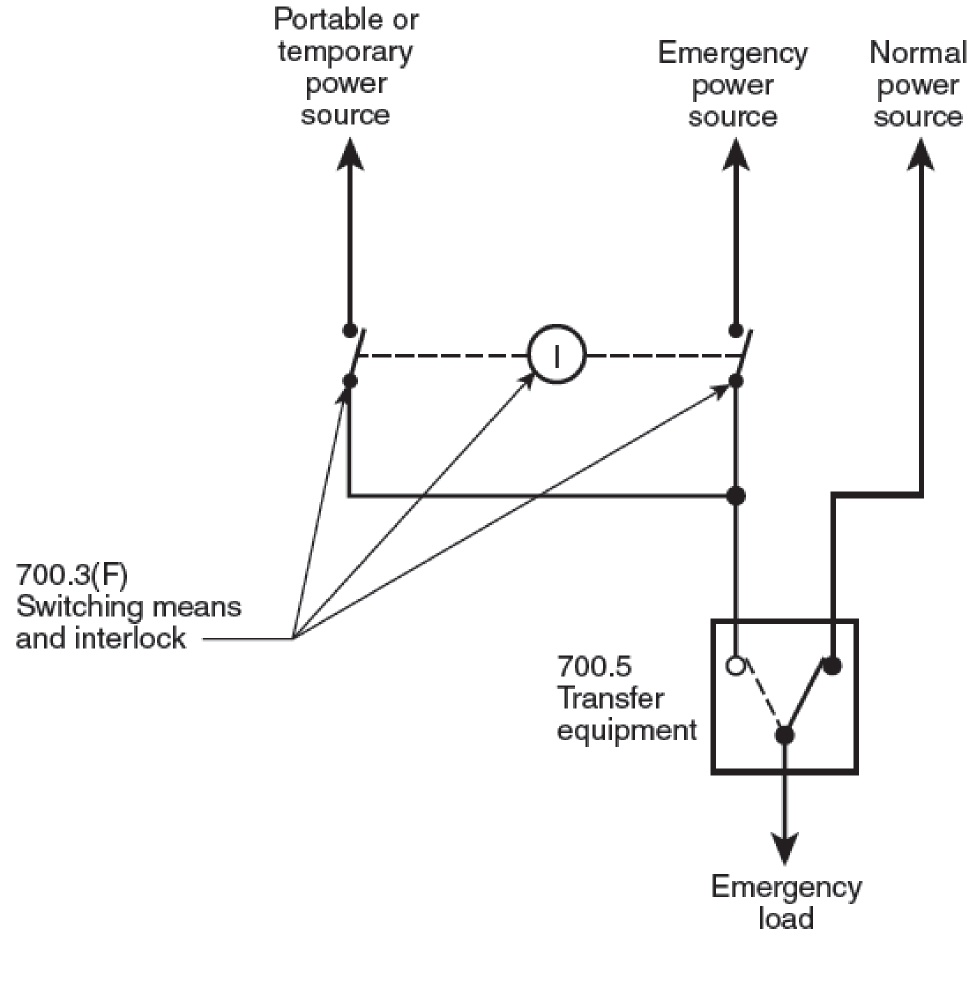


FIGURE 700.3(F)

Article 700.10
Emergency System Identification

Article 700.10
Emergency System Wiring

700.10 Wiring, Emergency System.

(A) Identification. Emergency circuits shall be permanently marked so they will be readily identified as a component of an emergency circuit or system by the following methods:

(1) All boxes and enclosures (including transfer switches, generators, and power panels) for emergency circuits shall be permanently marked as a component of an emergency circuit or system.

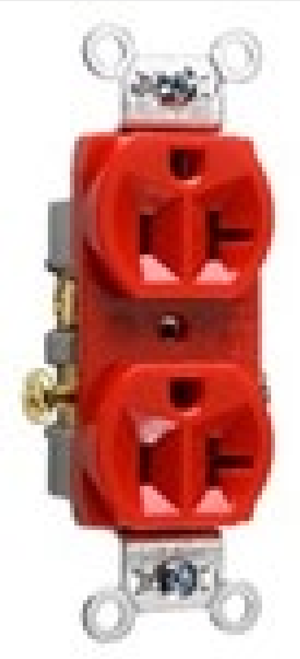
(2) Where boxes or enclosures are not encountered, exposed cable or raceway systems shall be permanently marked to be identified as a component of an emergency

Article 700.10
Emergency System Wiring

700.10 Wiring, Emergency System.

Identification. (Con't)

Receptacles supplied from the emergency system shall have a distinctive color or marking on the receptacle cover plates or the receptacles.



Article 725.144 Transmission of Power and Data

Article 725.144 Transmission of Power and Data

725.144 Transmission of Power and Data. The requirements of 725.144(A) and (B) shall apply to Class 2 and Class 3 circuits that transmit power and data to a powered device. The requirements of Parts I and III of Article 725 and 300.11 shall apply to Class 2 and Class 3 circuits that transmit power and data. The conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the cur

Cables must have a suffix

-LP

Table 725.144 Ampacities of Each Conductor in Amperes in 4-Pair Class 2 or Class 3 Data Cables Based on Copper Conductors at an Ambient Temperature of 30°C (86°F) with All Conductors in All Cables Carrying Current, 60°C (140°F), 75°C (167°F), and 90°C (194°F) Rated Cables

AWG	Number of 4-Pair Cables in a Bundle																				
	1			2–7			8–19			20–37			38–61			62–91			92–192		
	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1	1	1	1	1	1	0.7	0.8	1	0.5	0.6	0.7	0.4	0.5	0.6	0.4	0.5	0.6	NA	NA	NA
24	2	2	2	1	1.4	1.6	0.8	1	1.1	0.6	0.7	0.9	0.5	0.6	0.7	0.4	0.5	0.6	0.3	0.4	0.5
23	2.5	2.5	2.5	1.2	1.5	1.7	0.8	1.1	1.2	0.6	0.8	0.9	0.5	0.7	0.8	0.5	0.7	0.8	0.4	0.5	0.6
22	3	3	3	1.4	1.8	2.1	1	1.2	1.4	0.7	0.9	1.1	0.6	0.8	0.9	0.6	0.8	0.9	0.5	0.6	0.7

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.

Note 2: Where only half of the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a factor of 1.4.

Informational Note: The conductor sizes in data cables in wide-spread use are typically 22–26 AWG.

Chapter 8
Communications

Article 840.48 Unlisted Wires and Cables Entering Buildings

Outdoor cable cannot exceed 50’ inside a building

840.48 Unlisted Wires and Cables Entering Buildings. Installations of unlisted cables entering buildings shall comply with 840.48(A), (B), or (C), as applicable.

(A) Optical Fiber Cables. Installations of unlisted optical fiber cables entering buildings shall comply with 770.48.

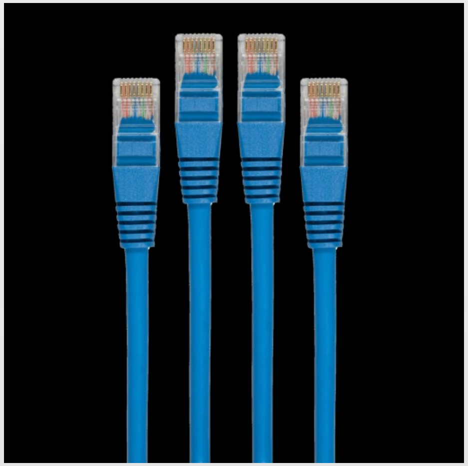
(B) Communications Wires and Cables. Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 800.48.

(C) Coaxial Cables. Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

Article 840.160
Powering Circuits

Part VI. Premises Powering of Communications Equipment over Communications Cables

840.160 Powering Circuits. Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. Where the power supplied over a communications cable to communications equipment is greater than **60 watts**, communication cables and the power circuit shall comply with 725.144 where communications cables are used in place of Class 2 and Class 3 cables.



Power Limited
Cable type -LP

End of Class

Questions?

Thank-you
Timothy Pool

File Attachments for Item:

ER-15 Pools, Fountains, Natural and Artificial Bodies of Water: 2020 NEC Articles 680 and 682 (Independent Electrical Contractors)

ESI, EPE (2 hours)

Staff Notes: This course does have slides (attached). Recommend approval, add BO, MPE, RBO, RPE.

ESIAC Recommendation: Recommend approval

Committee Recommendation:

[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: Barbara A. Tipton (Contact Name)

Organization: IEC Central Ohio-AEC-IEC (Organization/Company)

Address: 3128-H East 17th Ave. (Include Room Number, Suite, etc.)

City: Columbus State: OH Zip: 43219

E-Mail: btipton@ieccentraloh.org

Telephone: 614-473-1050 Fax 614-473-1359

Course Sponsor: IEC Central Ohio-AEC-IEC

COURSE INFORMATION:

Course Title: Pools, Fountains, Natural and Artificial bodies of Water

New Course Submittal: ☒ Update Course: ☐ Prior Approval Number: NEC Articles 680, 682

Purpose and Objective: Requirements of 2020 NEC Article 680 and 682 covering Pools, Fountains, Natural and Artificial bodies of Water.

Objective: Various required components of Pools and Bodies of Water

Number of Instructional Contact Hours that can be obtained upon completion: 2.0

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: IEC Central Ohio-AEC-IEC Date(s) of ESI Course(s): May 18, 2021 - 5-7pm

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:		na
Completed Application:		✓

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

IEC Central Ohio
Independent Electrical Contractors

INSTRUCTOR BIO

Clay Carroll
614-557-1147

Clay has been in the electrical field for over 45 years serving in many capacities including apprentice, journeyman, service tech, estimator, business owner, even Safety Director.

He has held a state of Ohio Contractors Certification since its inception as well as a Master Electricians certification in 12 other states and a General Contractors Certification for the State of Florida
State of Ohio Fire Alarm Installers Certificate.

Credentials:
Conducted Continuing Education Classes on the NEC since 1988
Has taught apprenticeship classes for the past 16 years
Is a certified trainer of OSHA 10 and 30
Certified First Aid/ CPR/ AED instructor
Mobile Elevated Work Platform Operator Instructor
Forklift Operator Instructor

Beyond the Electrical Industry Clay has served his local community in the following capacities:

Mayor of the Village of Buckeye Lake
Village Council member
Planning and Zoning Commission
Tree and Landscape Commission
Member of the Masonic Lodge

OCILB License # 12911

3128-H E. 17th Ave. Columbus, OH 43219
Phone: 614-473-1050 Fax: 614-473-1359 Website: www.IECCentralOH.org

IEC Central Ohio
Independent Electrical Contractors

COURSE OUTLINE:

Pools, Fountains, Natural and Artificial bodies of water

NEC Article 680 and 682

Scope:
This course will review the requirements of 2020 NEC Art. 680 and 682.

- Definitions
- Wiring Methods
- Grounding and bonding
- Equipotential Bonding
- Establishing an Electrical Datum Plane

Course will review the various components of a pool that are required to be bonded together as well as the methods used to complete this. A long with grounding and bonding we will discuss wiring methods and installation for pool equipment, lighting and convenience receptacles.

3128-H E. 17th Ave. Columbus, OH 43219
Phone: 614-473-1050 Fax: 614-473-1359 Website: www.IECCentralOH.org

1

SWIMMING POOLS

Natural and Artificial Bodies of Water

2

NEC Art. 680 Swimming Pools

- Permanent
- Portable
- Indoor
- Outdoor
- Therapeutic
- Fountains
- Spa's

3

680.6 Grounding.
Electrical equipment shall be grounded in accordance with Parts V, VI, and VII of Article 250 and connected by wiring methods of Chapter 3, except as modified by this article. The following equipment shall be grounded:

(1) Through-wall lighting assemblies and underwater luminaires, other than those low-voltage lighting products listed for the application without a grounding conductor

(2) All electrical equipment located within 1.5 m (5 ft) of the inside wall of the specified body of water

(3) All electrical equipment associated with the recirculating system of the specified body of water

(4) Junction boxes

(5) Transformer enclosures

(6) Ground-fault circuit interrupters

(7) Panelboards that are not part of the service equipment and that supply any electrical equipment associated with the specified body of water

4

General Rules

- 680.7 Cord connected
- 680.8 Overhead Clear.
- 680.9 Heaters limited to 48 amps.
- 680.10 Undergrd. Clearance
- 680.12 Disconnects (attached)

5

680.12 Maintenance Disconnecting Means.

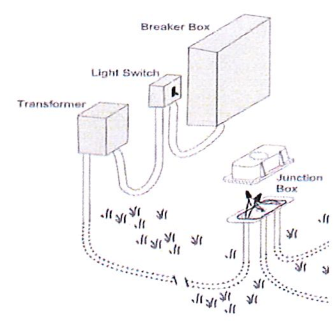
One or more means to simultaneously disconnect all ungrounded conductors shall be provided for all utilization equipment other than lighting. Each means shall be readily accessible and within sight from its equipment and shall be located at least 1.5 m (5 ft) horizontally from the inside walls of a pool, spa, or hot tub unless separated from the open water by a permanently installed barrier that provides a 1.5 m (5 ft) reach path or greater. This horizontal distance is to be measured from the water's edge along the shortest path required to reach the disconnect.

6

Part 2 Permanently Installed

- 680.22 Receptacles
- 680.23 Underwater Lighting
- 680.24 Junction Box
- 680.25 Feeder

7



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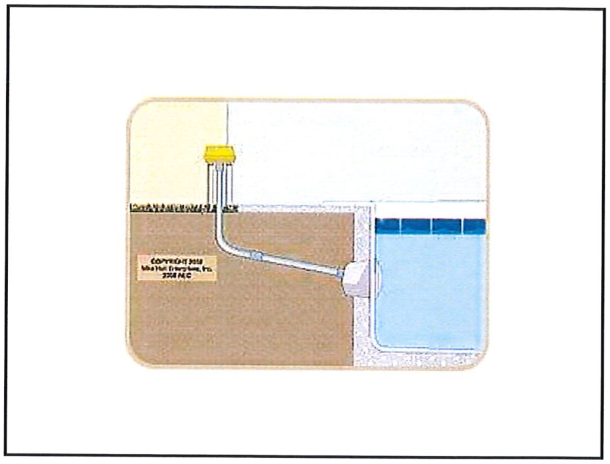

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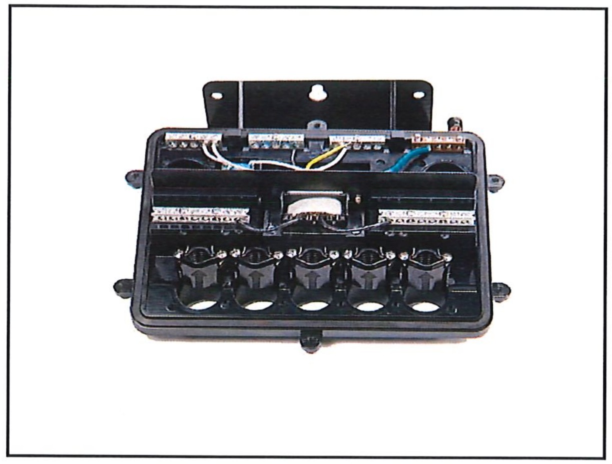

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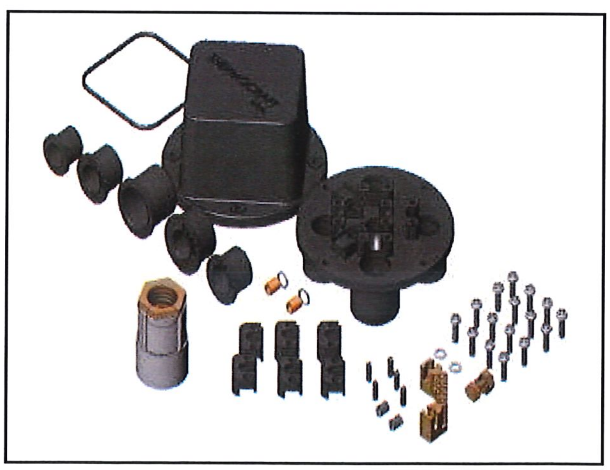

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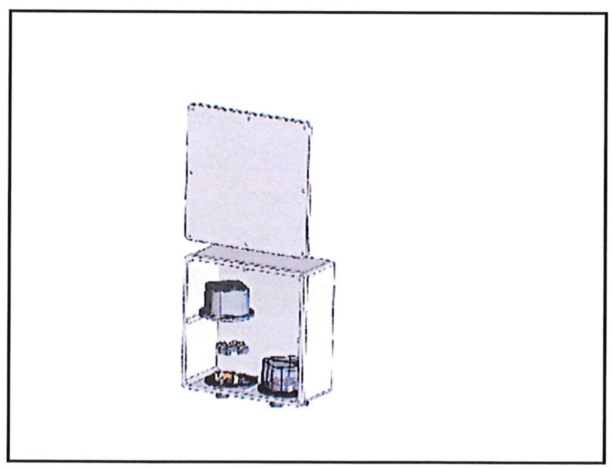
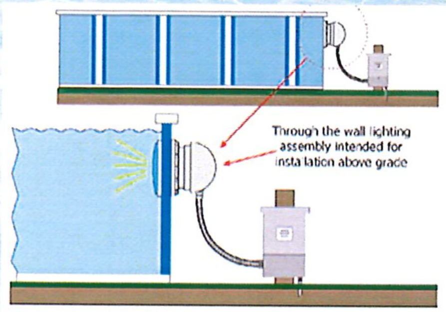


12

Through-Wall Lighting Assembly



30

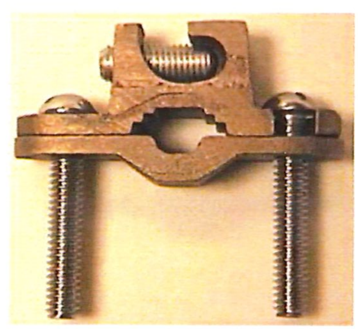
13

680.26 Equipotential Bonding.

- Conductive Pool Shell
- Perimeter Surfaces
- Metallic Components
- Underwater Lighting.
- Metal Fittings
- Electrical Equipment
- Metal Wiring Methods and Equipment
- Pool Water.

14

15



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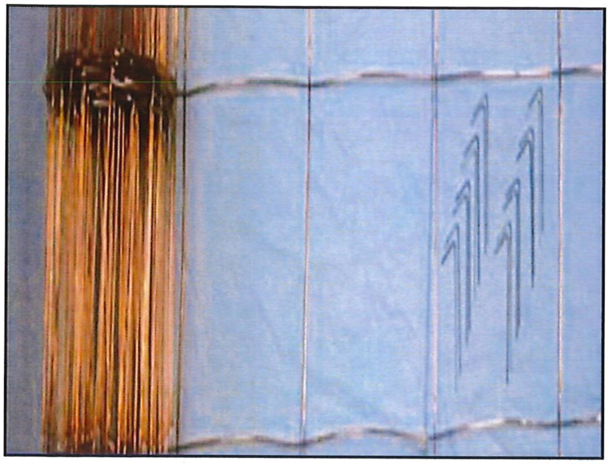

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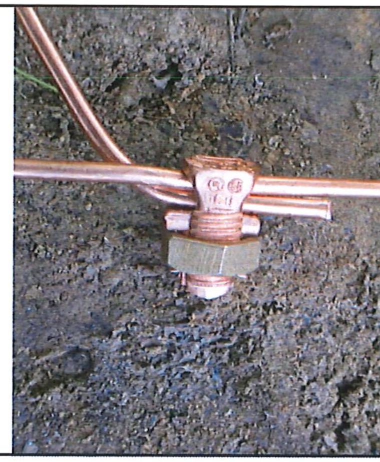

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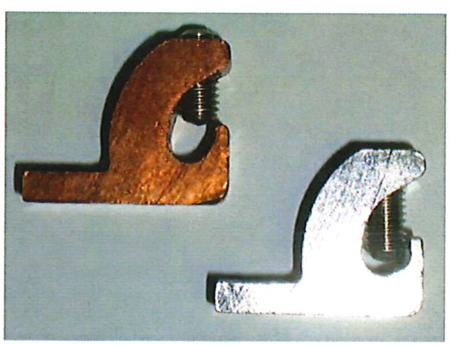
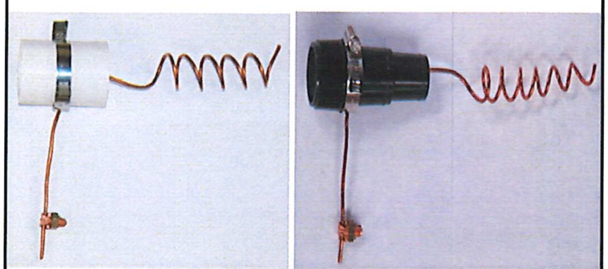


19

Pursuant to section 680.26(C) of the 2008 National Electrical Code®, there must be an intentional bond to the water from the rest of the bonded system of the pool, such as the bonding grid under the deck, equipment, electrical panel, metal handrails and all other metal objects within 5' of the water. The bond must provide at least 9 square inches of surface to the water.

20



21

682 Natural and Artificially Made Bodies of Water

- Electrical Datum Plane
- Equipotential Plane

22

Electrical Datum Plane. The electrical datum plane as used in this article is defined as follows:
(1) In land areas subject to tidal fluctuation, the electrical datum plane is a horizontal plane 600 mm (2 ft) above the highest tide level for the area occurring under normal circumstances, that is, highest high tide.
(2) In land areas not subject to tidal fluctuation, the electrical datum plane is a horizontal plane 600 mm (2 ft) above the highest water level for the area occurring under normal circumstances.
(3) In land areas subject to flooding, the electrical datum plane based on (1) or (2) above is a horizontal plane 600 mm (2 ft) above the point identified as the prevailing high water mark or an equivalent benchmark based on seasonal or storm-driven flooding from the authority having jurisdiction.

23

Equipotential Plane. An area where wire mesh or other conductive elements are on, embedded in, or placed under the walk surface within 75 mm (3 in.), bonded to all metal structures and fixed nonelectrical equipment that may become energized, and connected to the electrical grounding system to prevent a difference in voltage from developing within the plane.

24

- 682.11 Equipment
- 682.14 Disconnecting means
- 682.15 GFCI
- 682.33

25

682.11 Location of Service Equipment.
On land, the service equipment for floating structures and submersible electrical equipment shall be located no closer than 1.5 m (5 ft) horizontally from the shoreline and live parts shall be elevated a minimum of 300 mm (12 in.) above the electrical datum plane. Service equipment shall disconnect when the water level reaches the height of the established electrical datum plane.

26

682.14 Disconnecting Means for Floating Structures or Submersible Electrical Equipment.
(A) Type. The disconnecting means shall be permitted to consist of a circuit breaker, switch, or both, and shall be properly identified as to which structure or equipment it controls.
(B) Location. The disconnecting means shall be readily accessible on land and shall be located in the supply circuit ahead of the structure or equipment connection. The disconnecting means shall be within sight of, but not closer than 1.5 m (5 ft) horizontally from, the edge of the shoreline and live parts elevated a minimum of 300 m (12 in.) above the electrical datum plane.

27

682.15 Ground-Fault Circuit-Interrupter (GFCI) Protection.
Fifteen- and 20-ampere single-phase, 125-volt through 250-volt receptacles installed outdoors and in or on floating buildings or structures within the electrical datum plane area that are used for storage, maintenance, or repair where portable electric hand tools, electrical diagnostic equipment, or portable lighting equipment are to be used shall be provided with GFCI protection. The GFCI protection device shall be located not less than 300 mm (12 in.) above the established electrical datum plane.

28

682.33 Equipotential Planes and Bonding of Equipotential Planes.
An equipotential plane shall be installed where required in this section to mitigate step and touch voltages at electrical equipment.
(A) Areas Requiring Equipotential Planes. Equipotential planes shall be installed adjacent to all outdoor service equipment or disconnecting means that control equipment in or on water, that have a metallic enclosure and controls accessible to personnel, and that are likely to become energized. The equipotential plane shall encompass the area around the equipment and shall extend from the area directly below the equipment out not less than 900 mm (36 in.) in all directions from which a person would be able to stand and come in contact with the equipment.

29

30

(C) Bonding. Equipotential planes shall be bonded to the electrical grounding system. The bonding conductor shall be solid copper, insulated, covered or bare, and not smaller than 8 AWG. Connections shall be made by exothermic welding or by listed pressure connectors or clamps that are labeled as being suitable for the purpose and are of stainless steel, brass, copper, or copper alloy.

31

File Attachments for Item:

ER-16 Significant Changes to the 2020 NEC, Part A (Electrical Trades Center)

ESI, BI (10 hours in 3 sessions)

Staff Notes: Recommend approval, add BO, MPE, EPE, RBO, RPE

ESIAC Recommendation: Recommend approval

Committee Recommendation:

[redacted]

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: Trent Parker
(Contact Name)

Organization: The Electrical Trades Center
(Organization/Company)

Address: 947 Goodale Blvd.
(Include Room Number, Suite, etc.)

City: Columbus State: Ohio Zip: 43212

E-Mail: parker@electricaltrades.org

Telephone: 614-463-5282 Fax: 614-463-5252

Course Sponsor: The Electrical Trades Center

COURSE INFORMATION:

Course Title: Significant Changes to the 2020 NEC; Part A

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

Purpose and Objective: This course will focus on teh code wide changes tot he 2020 NEC and specifically those found in Chapters 1-3.

Number of Instructional Contact Hours that can be obtained upon completion: 10

If Multi-Session, Number of Instructional Contact Hours Per Session: 3.5, 3.5, 3

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: 947 Goodale Blvd. Columbus, OH 43212 Date(s) of ESI Course(s): April 15, 20, 22 of 2021

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.

10 hour Code Update A

Syllabus

Course Description: This extensive and popular program analyzes the major changes to the *NEC*. Members of the twenty code-making panels contributed to the development of the authoritative text, which covers more than 400 of the most significant changes and includes interpretations by the group that enforces the *NEC*. This comprehensive course will provide users a solid understanding and application of the requirements contained in the 2020 NEC.

The course is presented using PowerPoint presentations and interactive group discussions. The course explores the most important changes to the first 3 chapters of the NEC.

.

Prerequisite: None

Required Material: 2020 NEC
Significant Changes to the NEC-2020 PPT

Course Outline:

Significant Changes to the NEC 2020 Part A

Day 1

Entire Code, Code Wide Changes
Chapter 1: General, Articles 90 - 110

90 Introduction
100 Definitions
110 Requirements for Electrical Installations

Day 2

Chapter 2: Wiring and Protection, Articles 200 – 280

200 Use and Identification of Grounded Conductors
210 Branch Circuits
215 Feeders
220 Branch- Circuit, Feeder, Service Calculations
225 Outside Branch Circuits and Feeders
230 Services
240 Overcurrent Protection
242 Surge Protection
250 Grounding

Day 3

Chapter 3: Wiring Methods and Materials, Articles 300 - 399

300 Wiring Methods
310 Conductors for General Wiring
311 Medium Voltage Conductors
312 Cabinets, Cutout Boxes, and Meter Socket Enclosures
314 Outlet, Device, Pull, and Junction Boxes; Conduit Boxes; Fittings; and Manholes
320 Armored Cable: Type AC
330 MC Cable
334 NM Cable
336 Tray Cable
337 Type P Cable
338 Service-Entrance Cable: Types SE and USE
342 Intermediate Metal Conduit Type IMC
344 Rigid Metal Conduit Type RMC
358 EMT
392 Multiconductor Cables

Significant Changes

TO THE *NEC*® 2020

Code-Wide Revisions and Chapter 1

electrical training ALLIANCE IBEW - NECA IN COLLABORATION WITH NECA NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

Code-Wide Revisions

Reconditioned Equipment

Change Summary

- There are now several reconditioned equipment requirements in the *NEC*.
- See a new definition of *Reconditioned* added in Article 100.
- See 110.21(A)(2), where reconditioned equipment must be identified as reconditioned, and the original listing mark be removed.
- Other examples of requirements include a prohibition to recondition molded case circuit breakers and transfer switches.
- Low voltage power circuit breakers, and more, are permitted to be reconditioned.

GFCI Requirements

Change Summary

- The *NEC* now globally provides clarity in Chapters 5, 6, and 7 with respect to the general GFCI requirements in 210.8.
- Revisions provide clarity that 210.8 applies unless specifically modified in a Chapter 5, 6, or 7 article.
- Sections 210.8 and 422.5 are correlated to clarify the application of GFCI requirements for appliances.

Code-Wide Revisions

Definitions

Change Summary

- Article 100 now has a new Part III, which contains hazardous (classified) location definitions.
- Generally, where a word or term is defined and is used in more than one article, the definition is located in Article 100.
- Generally, where used only in a single article, a definition is located in the XXX.2 section of that article.
- Note that a number of definitions exist in the XXX.2 section of an article but apply throughout the Code (e.g., cable assemblies, raceways, and systems).
- Text in each XXX.2 section explain which definitions apply only within that article, and those that apply beyond that article.

Code-Wide Revisions

Fault Current

Change Summary

- Definitions were added for *Fault Current* and *Available Fault Current*.
- The use of the terms *short circuit current*, *fault current*, and *available fault current* were correlated throughout the *NEC*.
- Equipment has a *short circuit current* rating.
- *Available fault current* must not exceed the *short circuit current* rating.

Disconnects for Emergency Responders

Change Summary

- There is a need for a means to remove power quickly and safely for one- and two-family dwelling units during a fire or other emergency.
- A means to disconnect power (and signage) on the outside of the dwelling unit requirements is added.
- Examples include requirements for services, generators, energy storage systems, and alternative energy sources.

Code-Wide Revisions

Outside Feeders and Service Disconnects

Change Summary

- Revisions allow for easier establishment of an ESWC and reducing the likelihood and level of exposure where ESWC is not established.
- Section 230.71 no longer permits a panelboard to contain six disconnecting means.
- Generally, each service enclosure must contain only one disconnecting means.
- Switchboards, switchgear, and metering centers with separate compartments and barriers may contain up to six disconnects.
- New 225.30(B) now allows six feeders instead of a single large feeder under prescribed conditions to facilitate ESWC on a part of the building supply and smaller conductors and a reduction in available fault current.
- This requirement mandates that (not more than six) feeders originate in the same equipment and terminate in the same location.

Code-Wide Revisions

Chapter 8

Change Summary

- Reorganization and clarification of the application of Chapter 8 requirements has begun.
- A new Article 800, *General Requirements for Communications Systems*, is added.
- Redundancies that existed throughout Chapter 8 have been eliminated.
- Existing Article 800 for *Communications Circuits* is editorially renumbered as Article 805.

New Articles

Article 242 Overvoltage Protection

Change Summary

- Articles 280 and 285 from the 2017 *NEC* have been combined into a single article titled “Overvoltage Protection.”
- The article has three parts, General, Surge Protective Devices (SPDs) 1000 Volts or Less, and Surge Arresters Over 1000 Volts.

New Articles

Article 311 Medium Voltage Conductors and Cables

Change Summary

- Article 328 in the 2017 *NEC* has been deleted, and its content has been relocated to a new Article 311 titled Medium Voltage Conductors and Cables.
- Requirements for medium voltage cables and conductors rated over 2000 volts and located formerly in Article 310 have also been incorporated into this new article.
- This new article covers the use, installation, construction specifications, and ampacities for Type MV medium voltage conductors and cable.

New Articles

Article 337 Type P Cable

Change Summary

- A new article titled “Type P Cable” has been added to *NEC* Chapter 3.
- Article 337 addresses the use and installation of Type P cable (marine shipboard cable).
- Type P cable has been commonly used in land-based oil and gas rigs for over four decades, but the *NEC* has never addressed its permitted use.
- Type P cable is limited to industrial installations and hazardous locations.

New Articles

Article 800 General Requirements for Communications Systems and Article 805 Communications Circuits

Change Summary

- Article 800 has been revised to include all the common general requirements from all the Chapter 8 communications articles into a single article.
- The remaining specific rules in former Article 800 have been included in a new Article 805 titled "Communications Circuits."
- This revision eliminates redundancy.

90.2(A)(5) & (6)

REVISION

Expanded Scope Electric Vehicles and Marinas

Change Summary

- The words "in marinas and boatyards" have been added to 90.2(A)(5).
- 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.

90.2(A)(5) & (6)

REVISION

Article 100

REVISION

Article 100 Scope (.2)

Change Summary

- The scope of Article 100 has been revised to indicate that definitions are also provided in the .2 section of some articles.
- The second (.2) section of various articles have been revised to address when the defined terms apply only within that article.
- The second (.2) section in some cases will indicate that the defined term applies within that article and throughout the *NEC*.

Article 100

REVISION

Article 100 Definitions

Scope. This article contains only those definitions essential to the application of this *Code*. It is not intended to include commonly defined general terms or commonly defined technical terms from related codes and standards. In general, only those terms that are used in two or more articles are defined in Article 100. Definitions are also found in XXX.2 sections of other articles…(See *NEC* Text)…

An example of Definitions provided in XXX.2 of an *NEC* article:

240.2 Definitions. The definitions in this section shall apply only in this article.

Current-Limiting Overcurrent Protective Device. A device that, when interrupting currents in its current-limiting range, reduces the current flowing in the faulted circuit to a magnitude substantially less than that obtainable in the same circuit if the device were replaced with a solid conductor having comparable impedance.

Supervised Industrial Installation. For the purposes of Part VIII, the industrial portions of a facility where all of the following conditions are met:

(1) Conditions of maintenance and engineering supervision ensure that only qualified persons monitor and service the system.
(2) The premises wiring system has 2500 kVA or greater of load used in industrial process(es), manufacturing activities,
or both, as calculated in accordance with Article 220.
(3) The premises has at least one service or feeder that is more than 150 volts to ground and more than 300 volts phase-to-phase.

(…See *NEC* text…)

Article 100

REVISION

Article 100 Scope (Parts I, II, and III)

Change Summary

- The scope of Article 100 has been revised to indicate that definitions are also provided in the .2 section of some articles.
- The second paragraph of the scope now indicates that Part III of Article 100 includes definitions applicable to Hazardous (Classified) Locations.
- Both changes revise the scope to align with the representation contained in Article 100.

Article 100

REVISION

Article 100 Definitions

Scope. This article contains only those definitions essential to the application of this *Code*. …(See *NEC* text)…

Part I of this article contains definitions intended to apply wherever the terms are used throughout this *Code*. Part II contains definitions applicable to installations and equipment operating at over 1000 volts, nominal. Part III contains definitions applicable to Hazardous (Classified) Locations.

Part I. General

Accessible (as applied to equipment) Capable of being reached for operation, renewal, and inspection. (CMP-1)

Accessible (as applied to wiring methods) Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in by the structure or finish of the building. (CMP-1) …(See *NEC* text)…

Part II. Over 1000 Volts, Nominal

Electronically Actuated Fuse. An overcurrent protective device that generally consists of a control module that provides current sensing, electronically derived time–current characteristics, energy to initiate tripping, and an interrupting module that interrupts current when an overcurrent occurs. Electronically actuated fuses may or may not operate in a current limiting fashion, depending on the type of control selected. (CMP-10)

Fuse. An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it. (CMP-10) …(See *NEC* text)…

Part III. Hazardous (Classified) Locations (CMP-14).

Aircraft Painting Hangar. An aircraft hangar constructed for the express purpose of spray/coating/dipping applications and provided with dedicated ventilation supply and exhaust. (CMP-14) …(See *NEC* text)…

Article 100

REVISION

Definition of Accessible (as applied to equipment)

Change Summary

- The definition of the term *Accessible (as applied to equipment)* has been revised and simplified.
- The revision provides a clearer differentiation from the definition of the term *readily accessible*.
- Rules containing this term have a more accurate meaning by definition.

Article 100

REVISION

Article 100

DELETION / RELOCATE

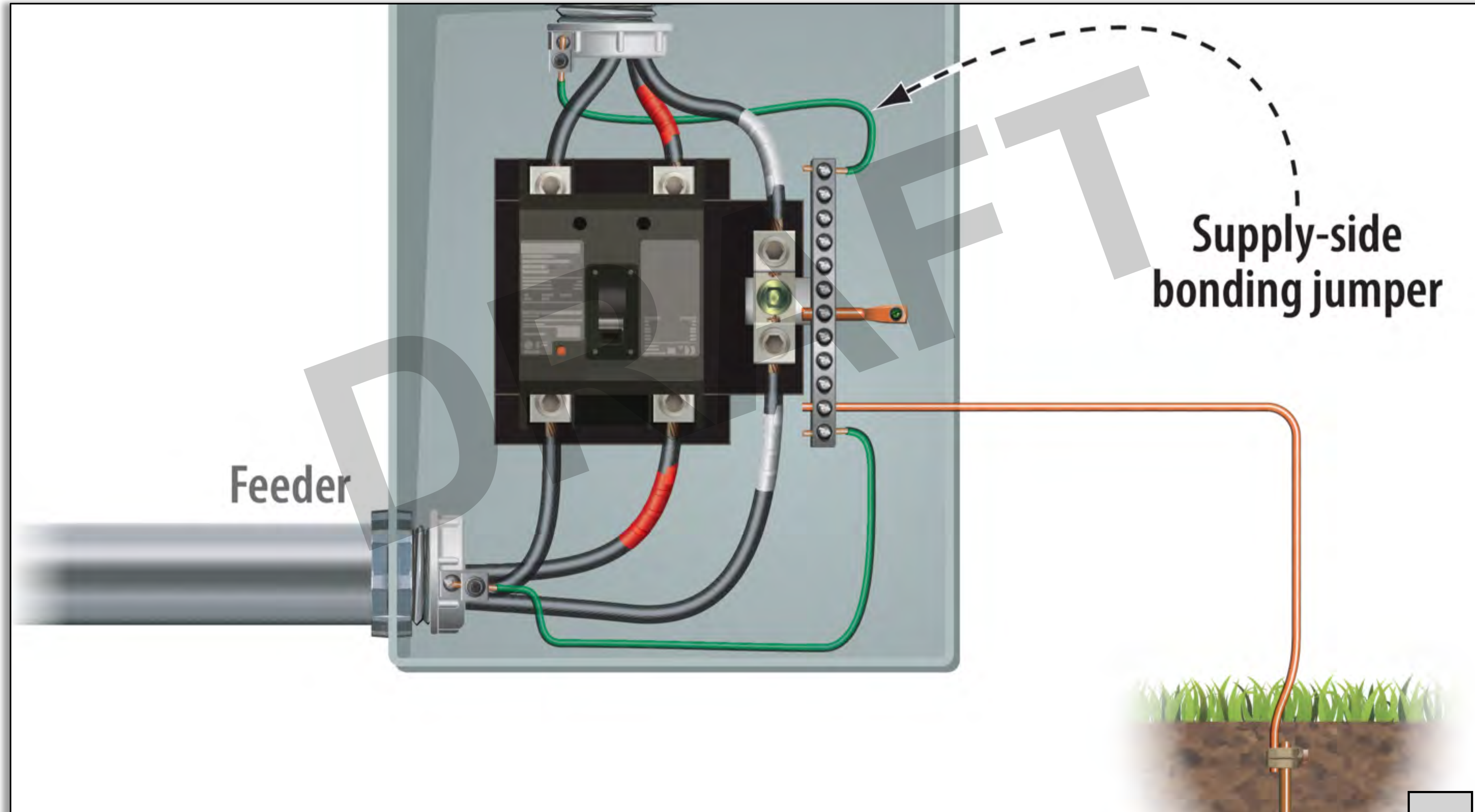
Definition of Bonding Jumper, Supply-Side

Change Summary

- The definition of the term *Bonding Jumper, Supply-Side* has been deleted from 250.2.
- The definition, without revision, has been located into Part I of Article 100.
- This relocation aligns with the requirements of Section 2.2.2.1 of the *NEC Style Manual*.

Article 100

DELETION / RELOCATE



Article 100

REVISION

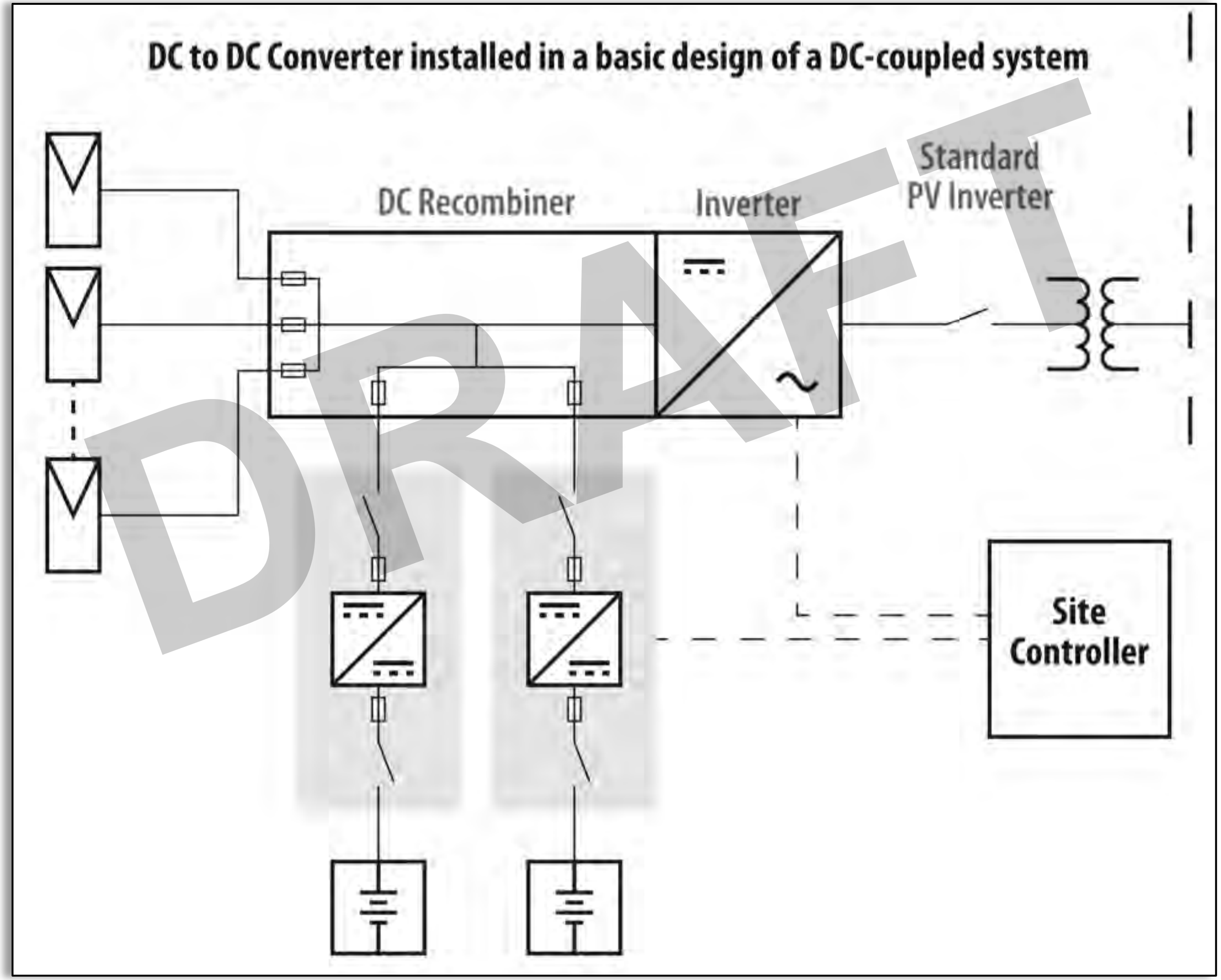
Definition of DC-to-DC Converter

Change Summary

- The varying versions of the term *DC-to-DC Converter* have been removed from Articles 690, 606, and 712.
- One common definition of the term has been incorporated into Article 100.
- CMP-4 retains technical responsibility of the term in the 2020 *NEC*.

Article 100

REVISION



Article 100

REVISION / RELOCATE

Definition of Equipotential Plane

Change Summary

- The definition of the term *equipotential plane* has been simplified and relocated in Article 100.
- This definition applies to Articles 680 and 682.
- The definition of "equipotential plane" in Section 547.2 remains in that section and applies only to agricultural facilities.

Article 100

REVISION / RELOCATE

Article 100

NEW

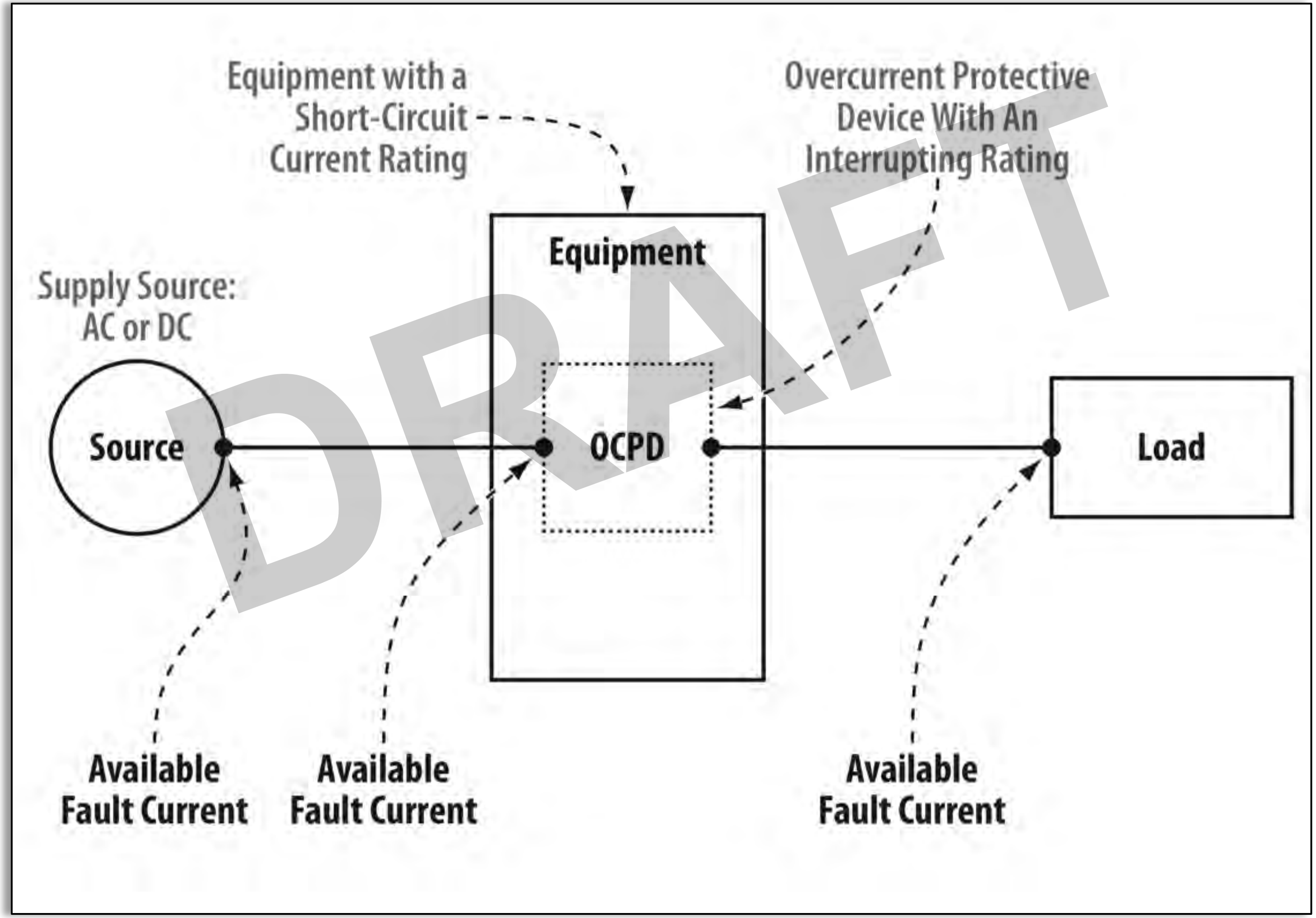
Definition of Fault Current and Available Fault Current

Change Summary

- 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*.

Article 100

NEW



Article 100

NEW

Definition of Habitable Room

Change Summary

- A new definition of the term *habitable room* has been added to Article 100.
- The new definition describes what constitutes a habitable room and differentiates it from one that is not.
- The new definitions align with the same defined term that is included in *NFPA 5000* with similar context to the defined term in the IRC and IBC.

Article 100

NEW

Article 100

REVISION

Definition of Interactive Inverter

Change Summary

- The definition of the term *interactive inverter* has been revised and clarified.
- The term *interactive inverter* is no longer limited in use within *NEC* rules addressing interaction with a utility.
- Interactive inverters are capable of delivering power to the utility where identified for that use in accordance with Section 705.6.

Article 100

REVISION

Courtesy of Eaton

Article 100

REVISION / RELOCATE

Definition of Inverter

Change Summary

- The definition of the term *Inverter* has been revised and simplified.
- The definition has been relocated to Article 100 to comply with the *NEC Style Manual*.
- The term *inverter* is applicable to multiple types of systems and not limited in application to just photovoltaic (PV) systems.

Article 100

REVISION / RELOCATE

Article 100

NEW

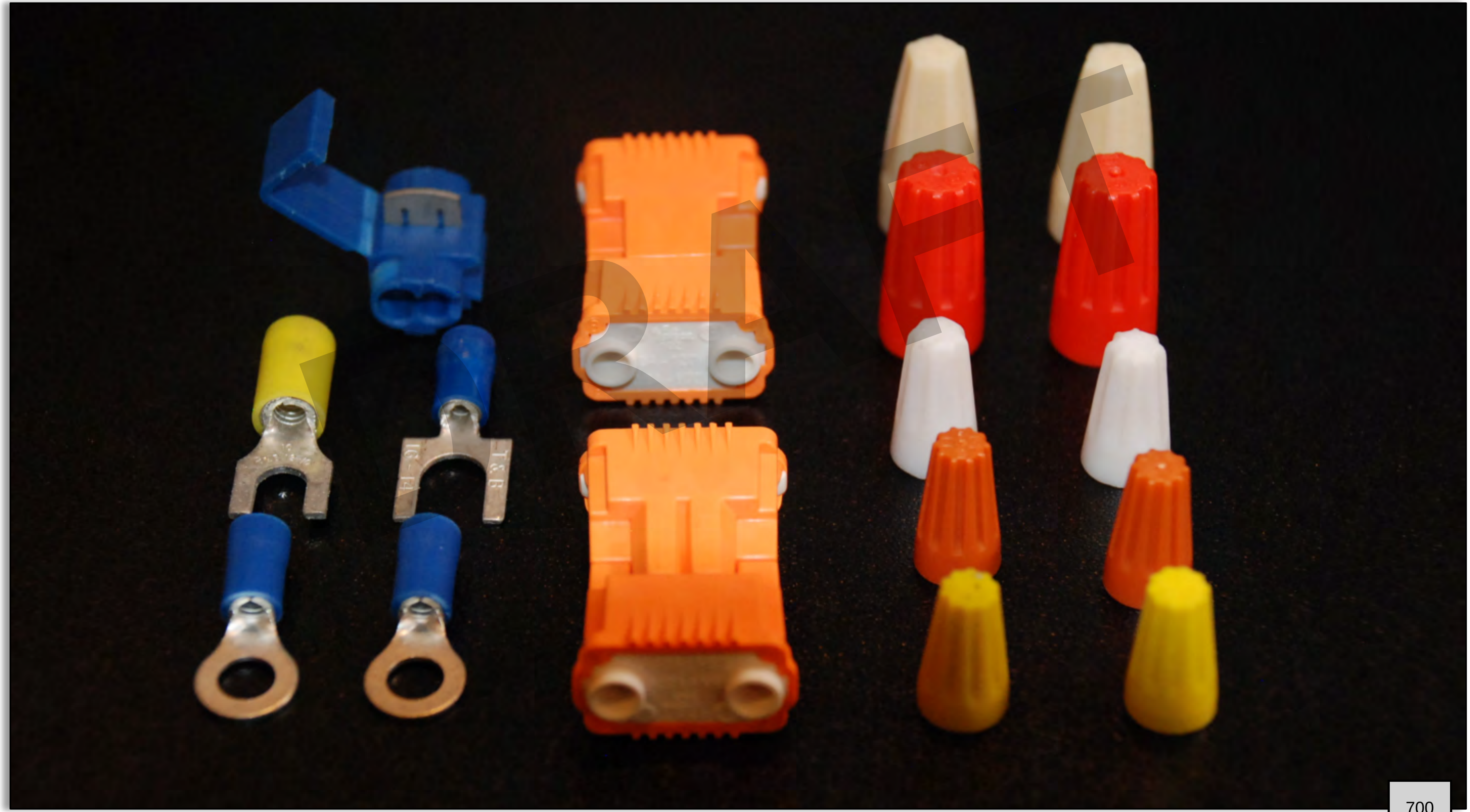
Definition of Labeled – New Informational Note

Change Summary

- A new informational note has been added following the definition of the term *Labeled*.
- Clarification has been provided about what constitutes labeling as defined in the *NEC*.
- The labeling can appear on the smallest package of the product in cases where the equipment is small or installed in a harsh environment.

Article 100

NEW



Article 100

NEW

Definition of Laundry Area

Change Summary

- A new definition of the term *Laundry Area* has been added to Article 100.
- This is an area containing or designed to contain a laundry tray, clothes washer, or clothes dryer.
- The definition of laundry area in Section 550.2 is no longer necessary and has been deleted.

Article 100

NEW

Article 100

NEW

Definition of Messenger or Messenger Wire

Change Summary

- A definition of the term(s) *messenger* and *messenger wire* have been added to Article 100.
- This unique definition applies to either term used within the *NEC*.
- A messenger can be current carrying or be dead-ended on both ends and used only for support.

Article 100

NEW

Article 100

REVISION

Definition of Photovoltaic (PV) System

Change Summary

- The definition of the term *Photovoltaic (PV) System* has been revised.
- As revised, the system includes all components, circuits, and equipment up to and including the PV system disconnecting means.
- The text about connecting to a utilization load has been deleted.

Article 100

REVISION

Article 100

NEW

Definition of Prime Mover

Change Summary

- A definition of the term *Prime Mover* has been added to Article 100.
- It is defined as the machine that supplies mechanical horsepower to a generator.
- CMP-13 has been assigned technical responsibility of this term.

Article 100

NEW

Article 100

REVISION NEW

Definition of Receptacle – New Informational Note

Change Summary

- The words “or strap” have been added following the word “yoke” in two instances within this definition.
- This revision aligns with *NEC* requirements that use the phrase mounting yoke or strap, such as in 314.16(B)(4), 404.10(B), and 406.5.
- The informational note clarifies that a duplex receptacle is two receptacles on a single mounting yoke or strap.

Article 100

REVISION NEW

Article 100

NEW

Definition of Reconditioned

Change Summary

- The term *reconditioned* has been added in multiple articles of the *NEC* and is now defined in Article 100.
- The process of reconditioning equipment differs from normal servicing of equipment that remains in place.
- Reconditioned equipment is often referred to as rebuilt, refurbished, or remanufactured.

Article 100

NEW

Article 100

REVISION

Definition of Service Equipment

Change Summary

- The definition of the term *Service Equipment* has been revised.
- The word "usually" has been removed to reduce ambiguity and the word "cutoff" has been replaced by the *NEC* term *disconnecting means*.
- Technical responsibility of this definition has been reassigned from CMP-4 to CMP-10.

Article 100

REVISION

Article 100

REVISION

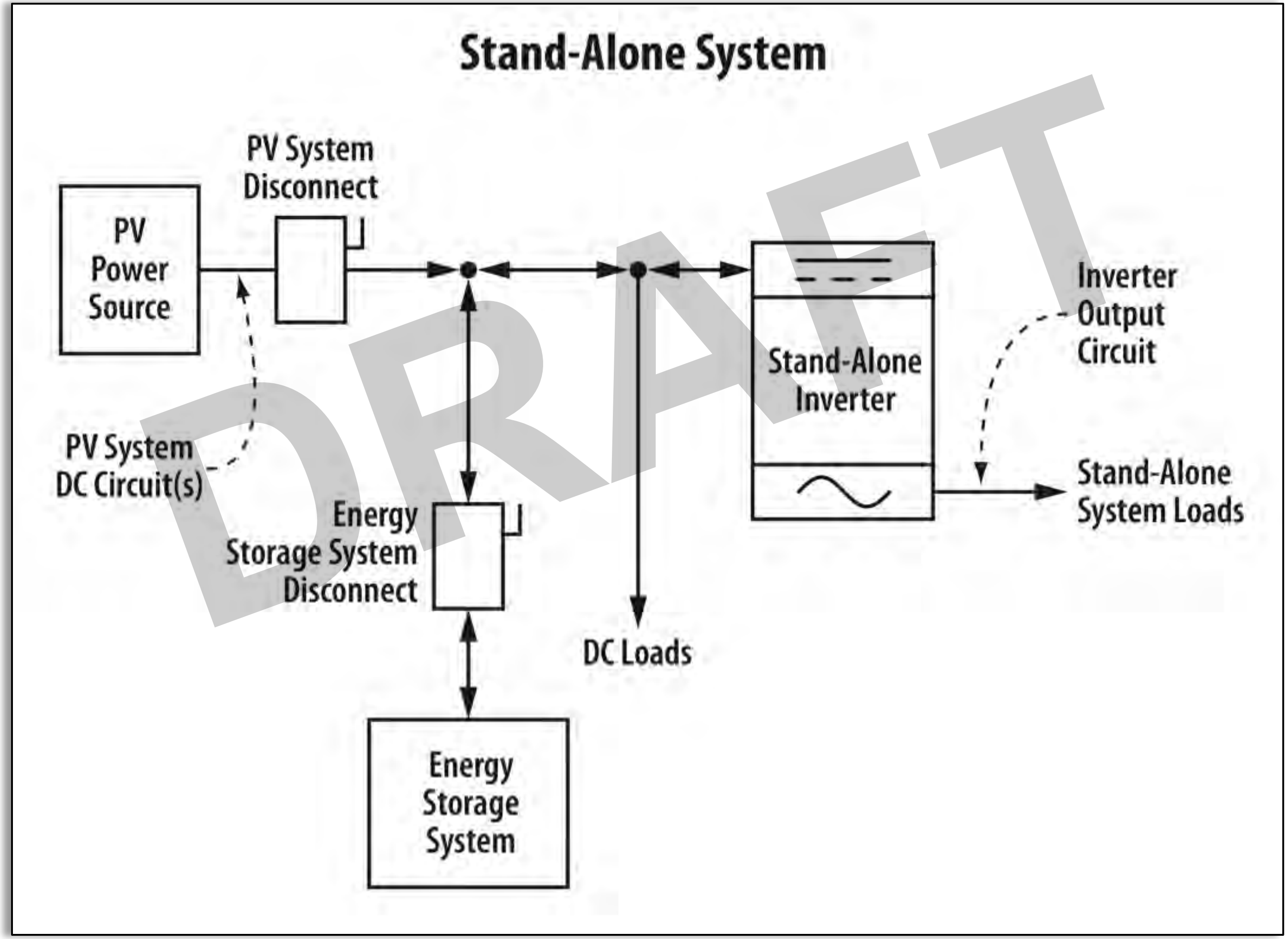
Definition of Stand-Alone System

Change Summary

- The definition of the term *Stand-Alone System* has been revised.
- The revision clarifies that a stand-alone system is capable of supplying power and is independent of an electric power production and distribution network.
- Examples of stand-alone systems are those powered solely by photovoltaic (PV), wind electric systems, fuel cell systems, all of which are often combined with energy storage systems.

Article 100

REVISION



Article 100

NEW

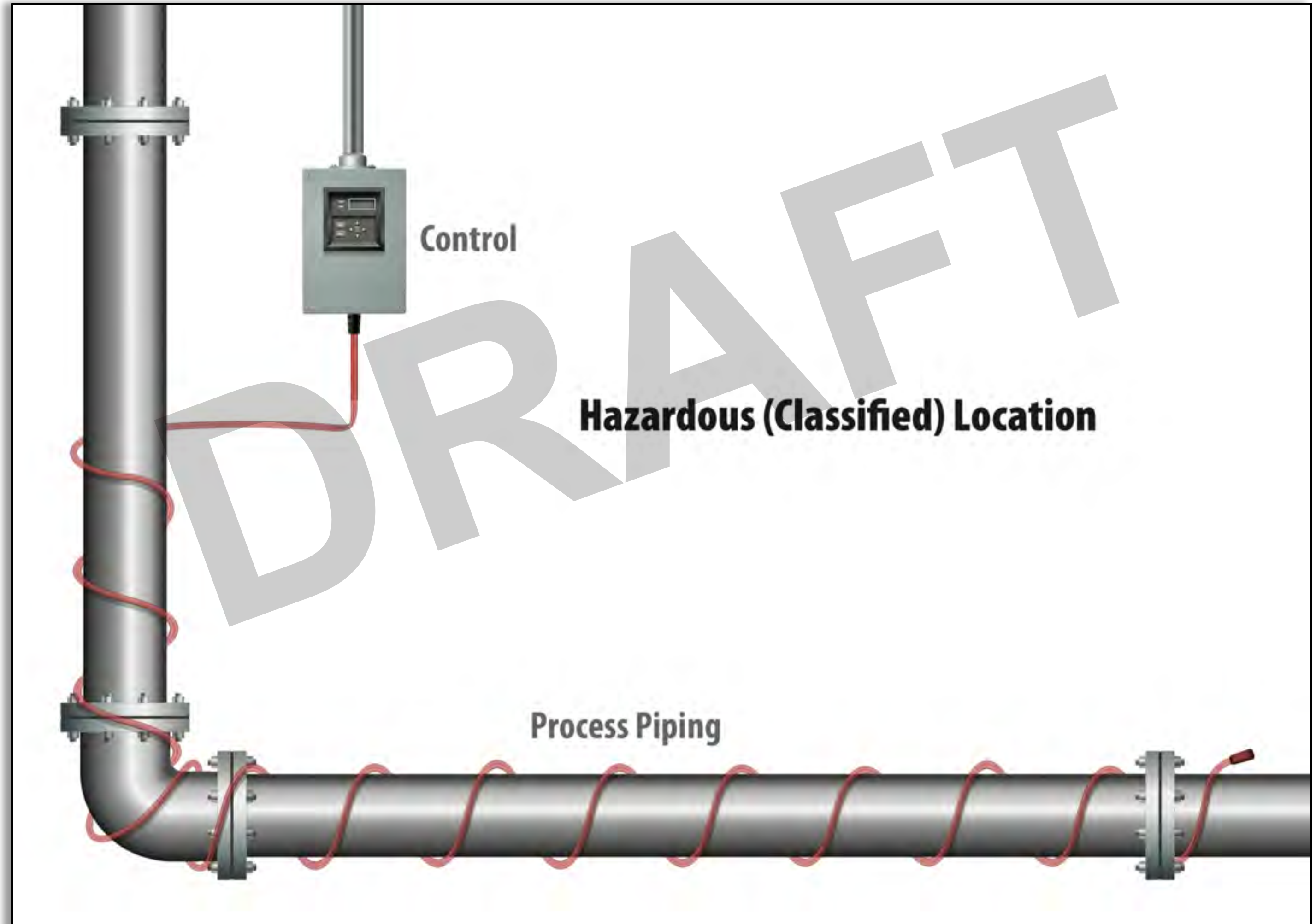
Definition of Electrical Resistance Trace Heating

Change Summary

- A new definition of the term *electrical resistance trace heating* has been incorporated into Part III of Article 100.
- Part III of Article 100 now includes all definitions of words and terms related to hazardous (classified) locations.
- A new informational note refers to the applicable standard (ANSI/*UL 60079-30-1*) for electrical resistance trace heating general and testing requirements.

Article 100

NEW



Article 100

NEW

Definition of Inherently Safe Optical Radiation "op is"

Change Summary

- A new definition of the term *inherently safe optical radiation "op is"* has been added to Article 100.
- Part III of Article 100 has been designated specifically for the defined terms associated with hazardous (classified) locations.
- The new informational note provides an important reference to ANSI/*UL 60079* containing information related to explosive atmosphere ignition concerns.

Article 100

NEW

Article 100

NEW

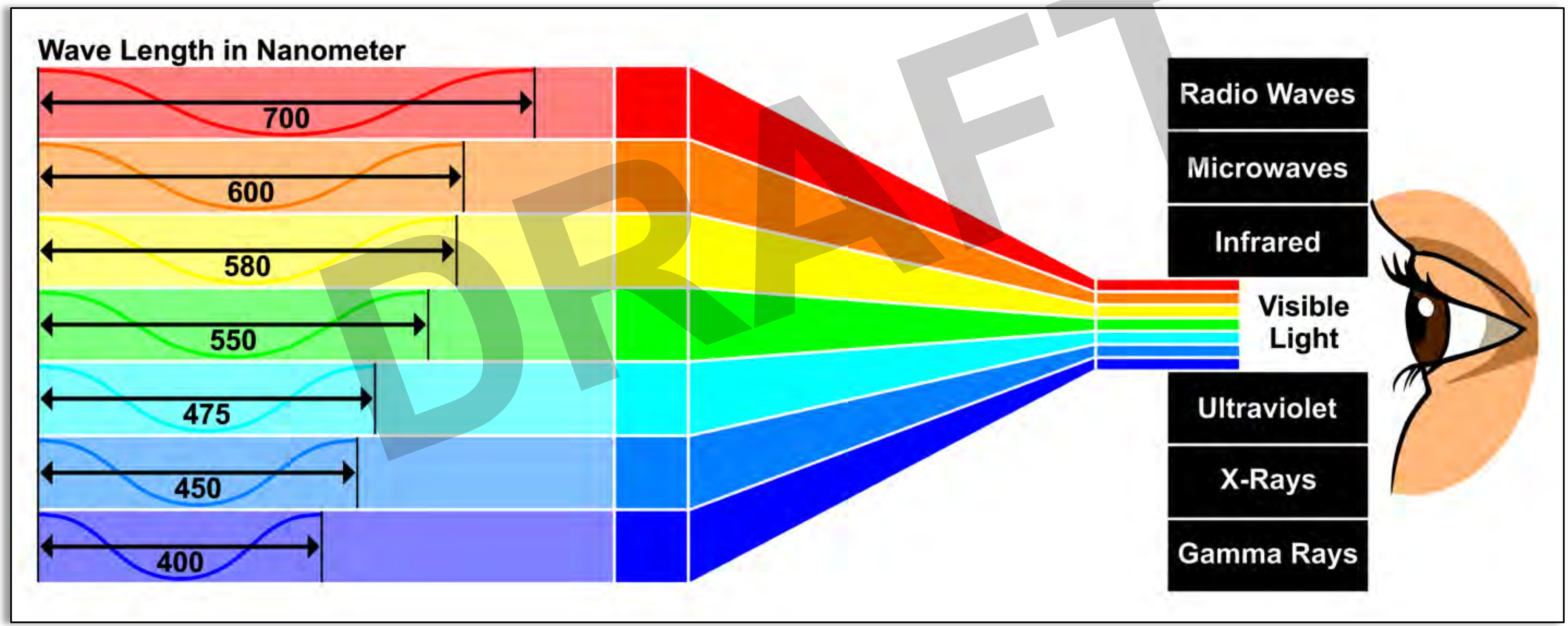
Definition of Optical Radiation

Change Summary

- A new definition of the term *optical radiation* has been added to Part III of Article 100.
- Part III of Article 100 is now designated for defined terms used in *NEC* rules that address hazardous (classified) locations.
- The new informational note provides an important reference to ANSI/*UL 60079* containing information related to explosive atmosphere ignition concerns.

Article 100

NEW



Article 100

NEW

Definition of Protected Optical Fiber Cable

Change Summary

- A new definition of the term *Protected Optical Fiber Cable* has been added to Article 100.
- Part III of Article 100 has been designated specifically for the defined terms associated with hazardous (classified) locations.
- The new informational note provides an important reference to ANSI/*UL 60079* containing information related to explosive atmosphere ignition concerns and protection techniques that can be used.

Article 100

NEW

Article 100

NEW

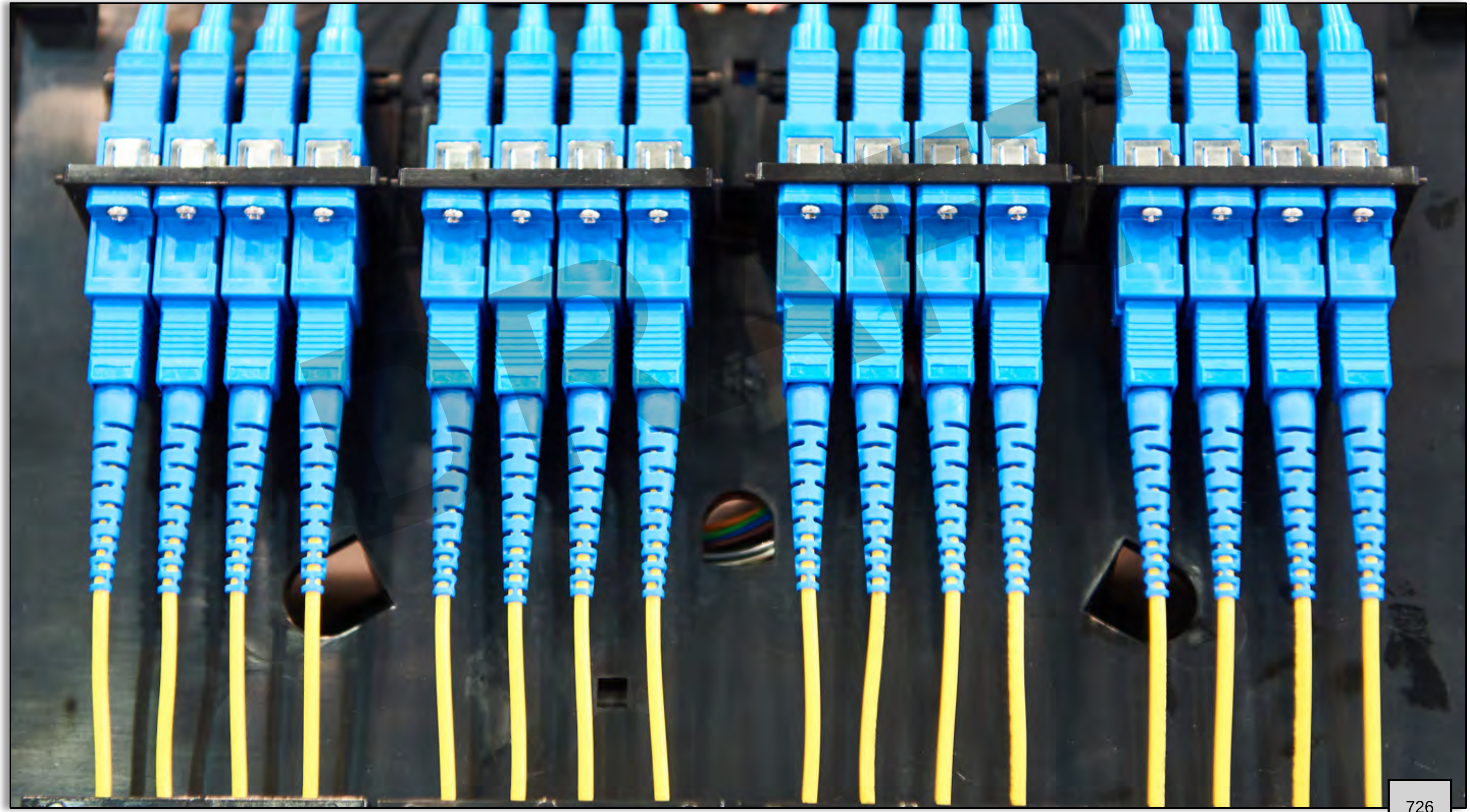
Definition of Protected Optical Fiber Radiation

Change Summary

- A new definition of the term *Protected Optical Fiber Radiation* has been added to Article 100.
- Part III of Article 100 has been designated specifically for the defined terms associated with hazardous (classified) locations.
- The new informational note provides an important reference to ANSI/*UL 60079* containing information related to explosive atmosphere ignition concerns and protection techniques.

Article 100

NEW



110.3(B)

NEW

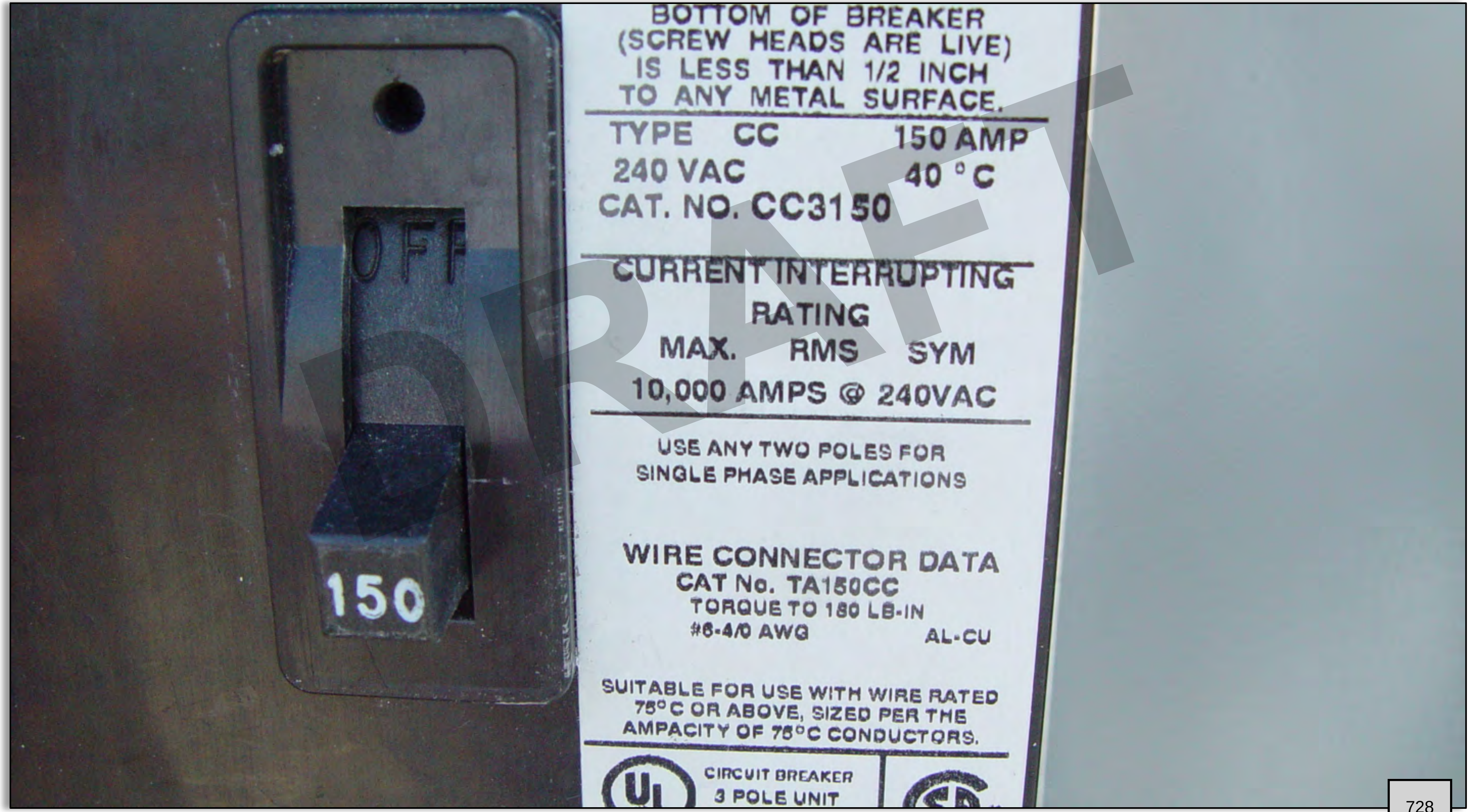
Installation and Use

Change Summary

- Section 110.3(B) was revised and reworded to include the words "or both" in the rule.
- Equipment that is listed (certified), either bears the listing mark, bears a label, or both, often in combination.
- The revision aligns with the fact that most but not all listed (certified) equipment is labeled.

110.3(B)

NEW


BOTTOM OF BREAKER
(SCREW HEADS ARE LIVE)
IS LESS THAN 1/2 INCH
TO ANY METAL SURFACE.
TYPE CC 150 AMP
240 VAC 40 °C
CAT. NO. CC3150
CURRENT INTERRUPTING
RATING
MAX. RMS SYM
10,000 AMPS @ 240VAC
USE ANY TWO POLES FOR
SINGLE PHASE APPLICATIONS
WIRE CONNECTOR DATA
CAT No. TA150CC
TORQUE TO 180 LB-IN
#6-4/0 AWG AL-CU
SUITABLE FOR USE WITH WIRE RATED
75°C OR ABOVE, SIZED PER THE
AMPACITY OF 75°C CONDUCTORS.
CIRCUIT BREAKER
3 POLE UNIT
OFF
150

110.12(C)

NEW

Cables and Conductors – Workmanship

Change Summary

- A new subdivision (C) titled *Cables and Conductors* has been added in Section 110.12 which is titled *Mechanical Execution of Work*.
- It 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.

110.12(C)

NEW

110.14(D)

REVISION

Terminal Connection Torque

Change Summary

- The title of subdivision (D) has been changed from “Installation” to “Terminal Connection Torque.”
- The term *calibrated* has been deleted from this section.
- Three new informational notes provide practical guidance for installers and inspectors.

110.14(D)

REVISION

110.21(A)(2)

REVISION

Reconditioned Equipment Exception

Change Summary

- The exception has been revised to provide clarification as to when this exception can be applied.
- New Informational Note No. 2 explains that terms such as *refurbished*, *rebuilt*, or *remanufactured* are often used interchangeably with the term *reconditioned*.
- New Informational Note No. 3 explains that the original listing mark could include the mark of the certifying body, and not an entire label.

110.21(A)(2)

REVISION

110.22(A)

REVISION

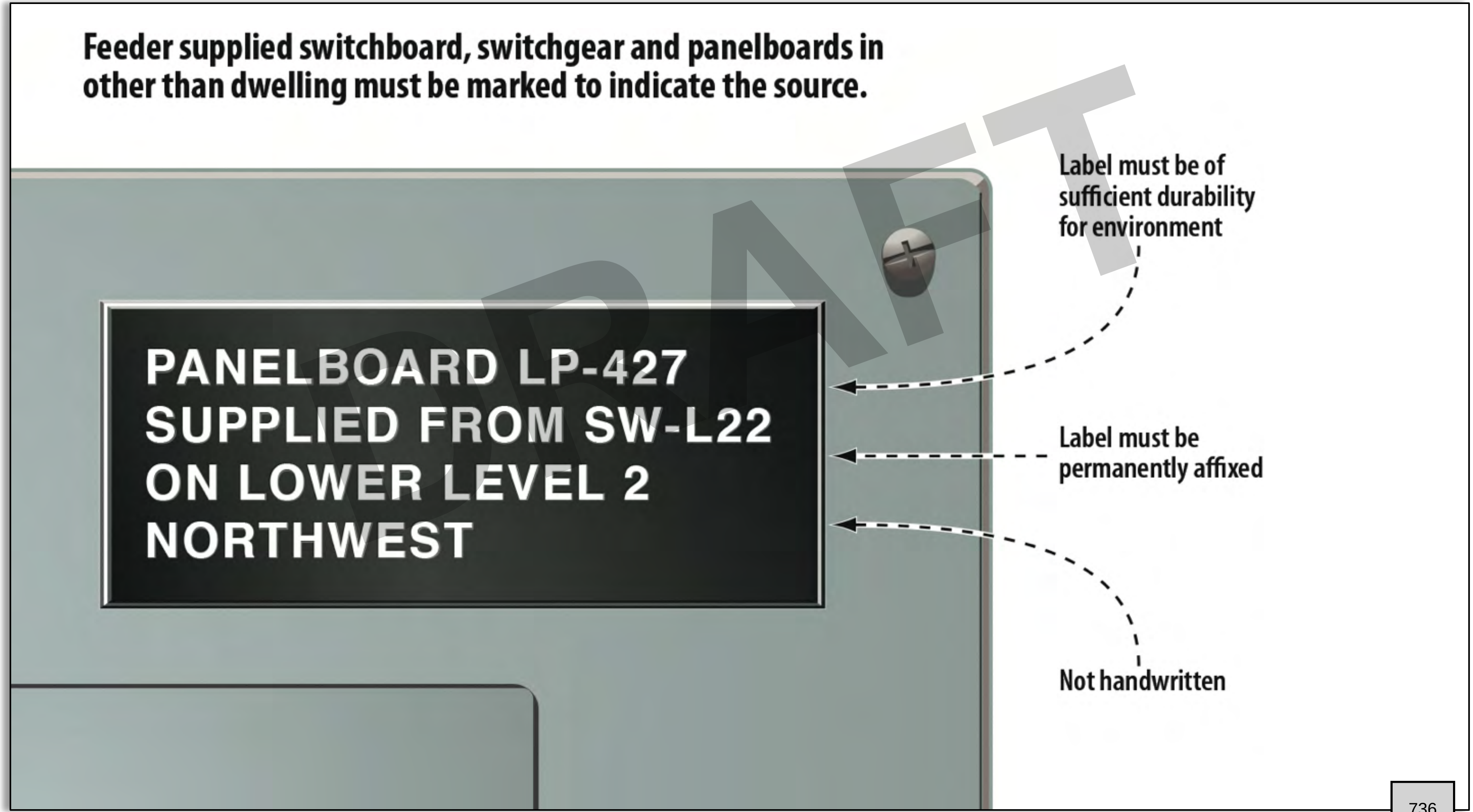
Disconnect Marking

Change Summary

- A new second sentence has been added to Section 110.22(A).
- Identification of the source circuit supplying the disconnecting means is now required for other than one- and two-family dwelling installations.
- The revision enhances the ability to establish an electrically safe work condition as addressed in *NFPA 70E*.

110.22(A)

REVISION



110.24(A)

NEW

Published Values of Available Fault Current

Change Summary

- Section 110.24(A) has been revised for accuracy and clarification.
- The word “maximum” has been deleted in front of “available fault current” because it is not necessary.
- New Informational Note No. 2 explains that available fault current values are typically provided and published by utilities.

110.24(A)

NEW

SES#	1 PH 120/240 POLE/PAD XFMR		3 PH 120/240 Closed Delta POLE TOP XFMR		3 PH 120/240 Open Delta POLE TOP XFMR		3 PH 120/240 Open Delta PAD XFMR (based upon a 167/75kva transformer)		3 PH 120/208 POLE TOP XFMR		3 PH 120/208 PAD XFMR		3 PH 277/480 POLE TOP XFMR		3 PH 277/480 PAD XFMR	
AMPS	**kVA**	**Isc**	**kVA**	**Isc**	**kVA**	**ISC**	**kVA**	**Isc**	**kVA**	**Isc**	**kVA**	**Isc**	**kVA**	**Isc**	**kVA**	**Isc**
100	50	8,890	3-25	9,948	75-75	19,953	167-75	23,971	3-25	8,895	112.5	12,684	75	5,192	112.5	8,688
125	50	8,890	3-25	9,948	75-75	19,953	167-75	23,971	3-25	8,895	112.5	12,684	150	9,613	112.5	8,688
150	50	8,890	3-25	9,948	75-75	19,953	167-75	23,971	3-25	8,895	112.5	12,684	150	9,613	112.5	8,688
200	75	14,318	3-25	10,478	75-75	25,625	167-75	33,705	3-25	10,483	112.5	16,178	150	10,347	150	12,076
***400**	100	20,955	3-50	20,034	75-75	28,369	167-75	39,681	3-50	21,553	150	27,478	300	20,938	300	25,573
600	167	32,755	3-75	28,369	100-75	35,297	167-75	44,187	3-75	33,789	225	39,066	500	31,615	500	25,773
800	167	36,451	3-100	33,208	167-75	44,186	167-75	44,187	**3-100	43,106	300	49,505			750	25,773
1,000									**3-100	45,740	300	53,011			750	25,773
1,200											500	53,011			1,000	25,773
1,600											500	56,194			1,500	32,990
2,000											750	56,194			1,500	33,207
2,500											750	56,194			2,000	44,250
3,000											1,000	56,194			2,000	44,346

Sample Published Available Fault Current Levels for Utility Service

110.26(A)

REVISION

Planning for an Electrically Safe Work Condition

Change Summary

- The informational note to Section 110.26(A) has been revised and expanded.
- The date of *NFPA 70E* has been changed from 2015 to 2018 to reference the current edition.
- The phrase “including establishing an electrically safe work condition” has been incorporated.

110.26(A)

REVISION

110.26(C)(2)

REVISION

Sum of Service Disconnect Ratings Added

Change Summary

- Section 110.26(C)(2) has been revised and restructured into a list format.
- Two entrances and egress paths from the work space are required if the sum of the two-to-six service disconnects is 1200 amperes or more.
- Open equipment doors on large equipment shall not impede the entry to or egress from the required working space.

110.26(C)(2)

REVISION

110.26(C)(3)

REVISION NEW

Listed Fire Exit Hardware

Change Summary

- 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.
- The revision differentiates listed panic hardware from listed fire exit hardware.

110.26(C)(3)

REVISION NEW

110.28

NEW

Dusttight Enclosure Use and Application

Change Summary

- Two new informational notes have been added to Section 110.28.
- Informational Note No. 3 references the specific “uses permitted” sections with Articles 502, 503, and 506.
- Informational Note No. 4 indicates that these types of enclosures are permitted in any unclassified location and limited to Class II, Division 2; Class III, and Zone 22 hazardous (classified) locations.

110.28

NEW

746

Courtesy of Eaton

110.31(A)(4)

REVISION

Listed Panic and Fire Exit Hardware

Change Summary

- Section 110.31(A)(4) has been revised to clarify the personnel door opening must be in the direction of egress.
- The terms *listed panic hardware* and *listed fire exit hardware* have been incorporated in this section.
- The informational note to Section 110.26(C)(3) provides references to two UL standards that address listed panic hardware and listed fire exit hardware.

110.31(A)(4)

REVISION

110.32

REVISION

Work Space About Equipment

Change Summary

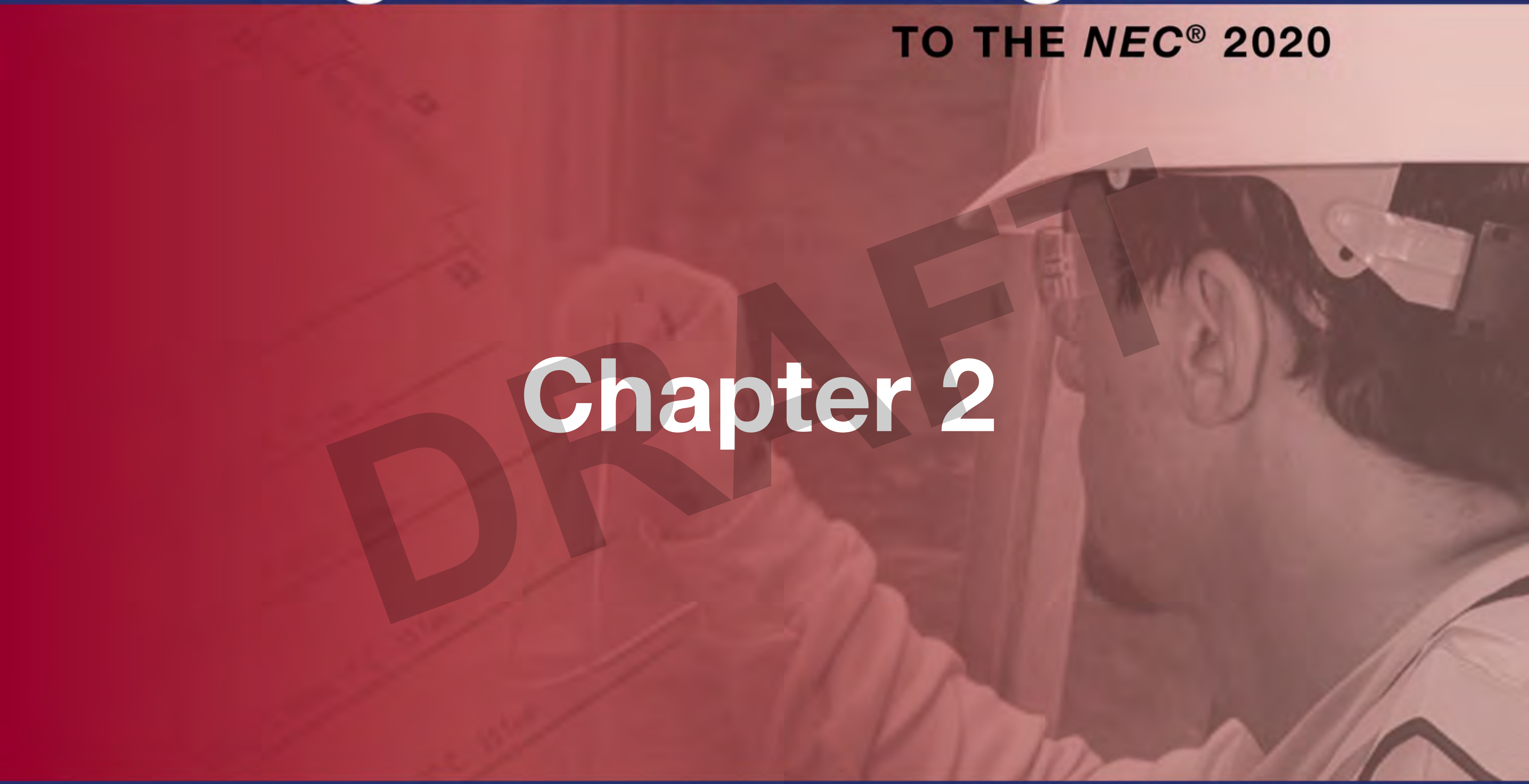
- This section has been revised and expanded to align with similar requirements in 110.26(A) and (B).
- The work space shall not be used for storage.
- Live parts that are exposed for inspection or servicing must be suitably guarded.

110.32

REVISION

Significant Changes

TO THE *NEC*® 2020



Chapter 2

electrical training ALLIANCE IBEW - NECA IN COLLABORATION WITH NECA NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

200.3

REVISION

Connection to Grounded System

Change Summary

- Section 200.3 has been revised for improved clarity and usability.
- The word *utility* has been deleted from this section as it was redundant and implied by definition of premises wiring.
- The term *direct electrical connection* provides a clear distinction from a connection through electromagnetic induction.

200.3

REVISION

200.10(B)

REVISION

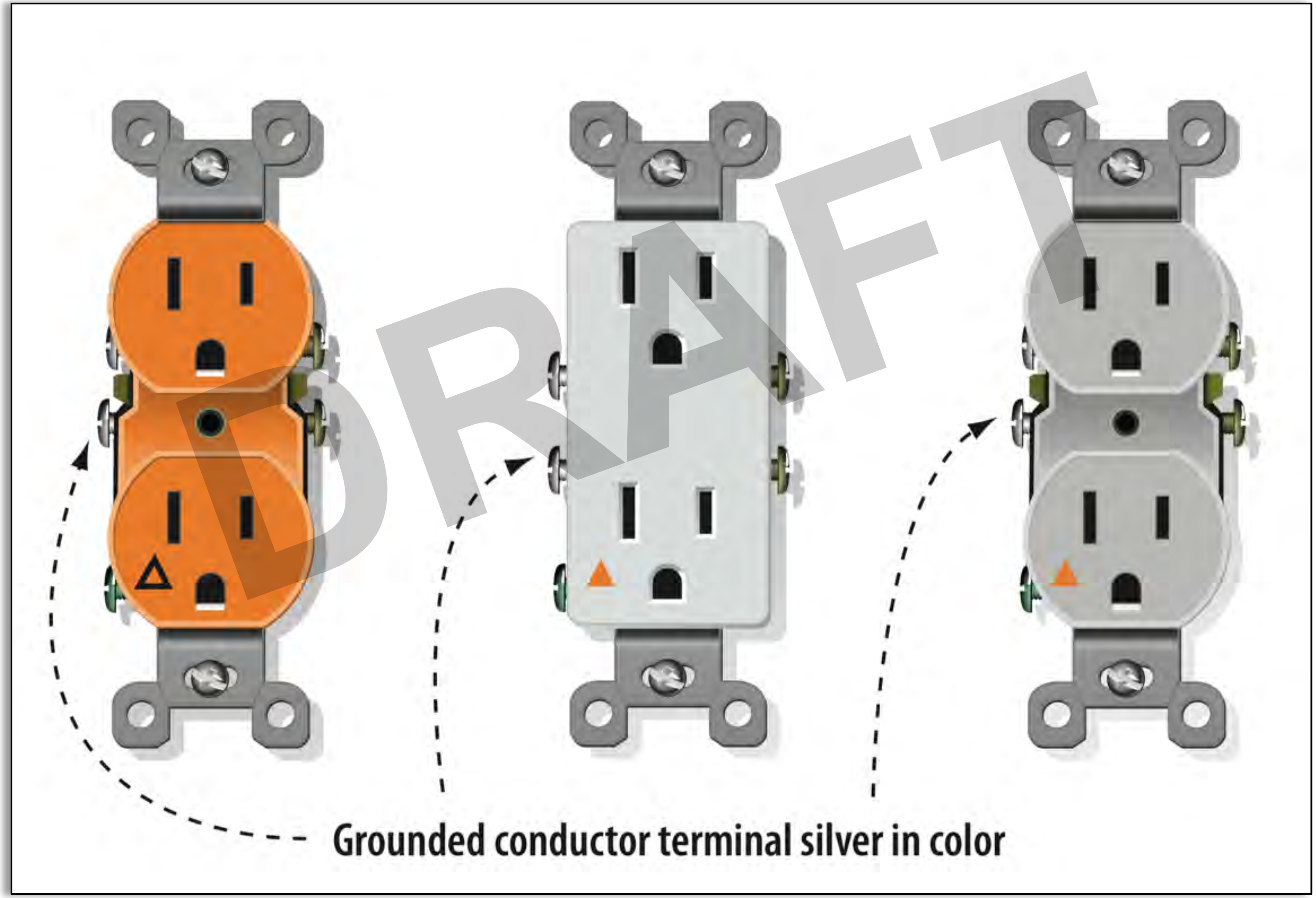
Identification of Grounded Conductor Terminals

Change Summary

- The words “or silver” have been added to second level subdivision (1).
- Receptacles, polarized attachment plugs, and cord connectors for plugs and polarized plugs typically include a terminal that is silver or chrome in color, as compared to brass or gold color.
- The revision reflects the common identification means employed by product manufacturers.

200.10(B)

REVISION



210.5(C)(1)

REVISION

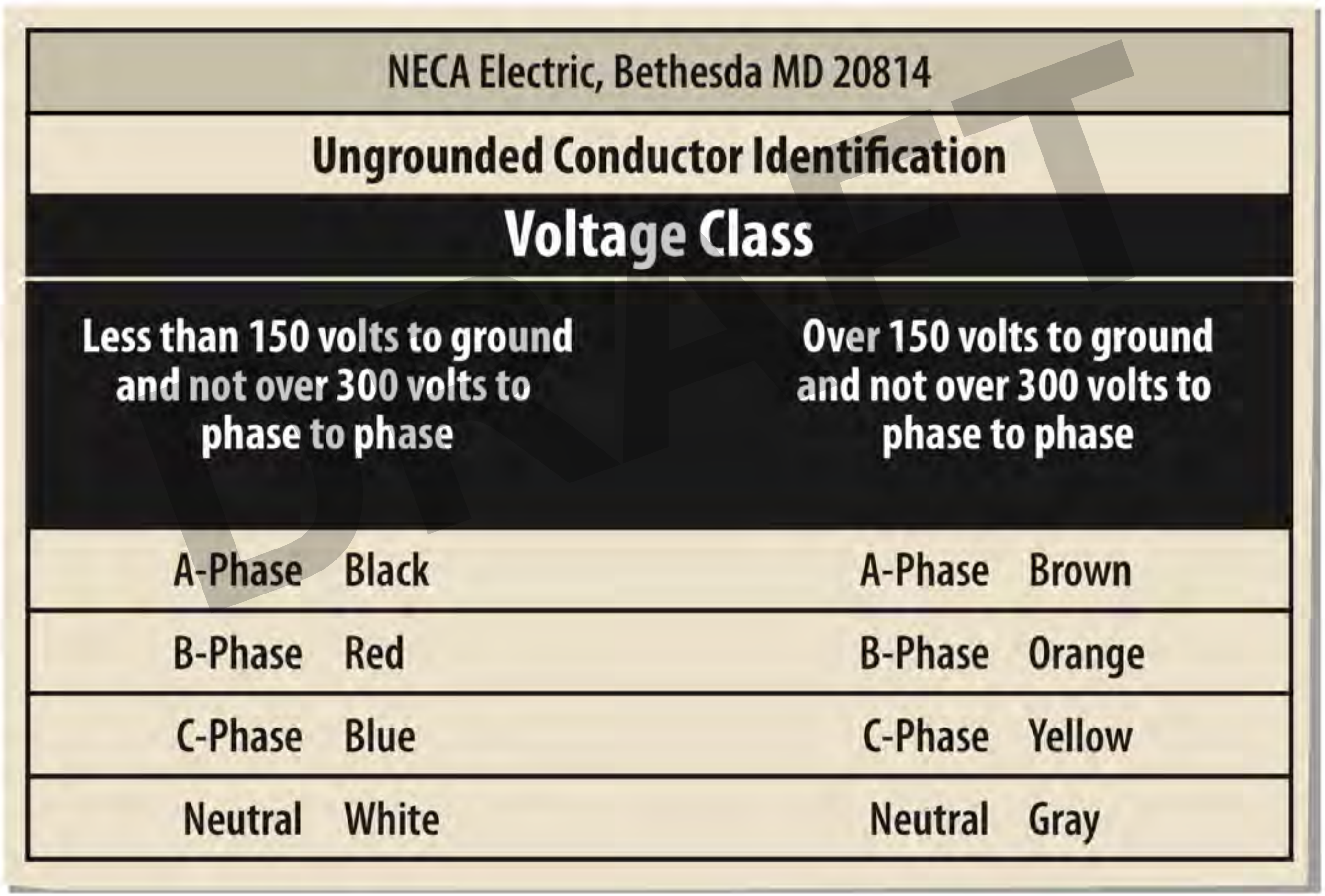
Identification of Ungrounded Conductors

Change Summary

- 210.5(C)(1) now requires ungrounded conductors be identified by phase or line and *by system voltage class*.
- Clarification is provided to permit different voltage systems within the same premises with the same *system voltage class* to use the same means of identification.

210.5(C)(1)

REVISION



NECA Electric, Bethesda MD 20814			
Ungrounded Conductor Identification			
Voltage Class			
Less than 150 volts to ground and not over 300 volts to phase to phase		Over 150 volts to ground and not over 300 volts to phase to phase	
A-Phase	Black	A-Phase	Brown
B-Phase	Red	B-Phase	Orange
C-Phase	Blue	C-Phase	Yellow
Neutral	White	Neutral	Gray

210.8

REVISION

GFCI Protection for Personnel

Change Summary

- Measuring distance from receptacles is modified. Doors or doorways do not eliminate GFCI requirements.
- 210.8(C) for boat hoists is relocated into 555.9. An informational note is added.
- In 210.8 two first level subdivisions are deleted and three are added.

210.8

REVISION

210.8(A)

REVISION

GFCI, Dwelling Units

Change Summary

- The parent text in 210.8(A) is expanded to include all 125-volt through 250-volt receptacles rated 150 volts or less to ground.
- List item 210.8(A)(5) is no longer limited to unfinished areas and applies to all receptacles in basements.
- New list item 11 requires GFCI protection for indoor damp and wet locations.

210.8(A)

REVISION

210.8(B)

REVISION

GFCI, Other Than Dwelling Units

Change Summary

- Parent text in 210.8(B) is revised for clarity. Accessory buildings are added in 210.8(B)(8).
- 210.8(B)(2) Kitchens include areas with a sink and permanent provisions for either food preparation or cooking.
- Two new list items are added to include laundry areas, bathtubs and shower stalls.

210.8(B)

REVISION

210.8(D), (E), & (F)

NEW DELETION

GFCI Protection for Personnel

Change Summary

- Existing 210.8(D) is deleted and GFCI requirements for dishwashers are expanded and relocated to 422.5.
- New 210.8(D) references 422.5 to coordinate GFCI protection.
- New 210.8(E) references 210.63 requiring GFCI protection and new (F) includes general GFCI requirements for outdoor outlets other than those in 210.8(A)(3) Exception.

210.8(D), (E), & (F)

NEW DELETION

210.11(C)(3) & (C)(4)

REVISION

Bathroom and Garage Branch Circuits

Change Summary

- Requirements for branch circuits in 210.11 are modified for clarity.
- The required receptacle outlet(s) in 210.52(D) and any other countertop or similar work surface receptacle outlets in bathrooms must be supplied by one or more 120-volt, 20-amp branch circuits.
- The required 120-volt, 20-amp branch circuit in 210.11(C)(4) is intended to supply the required receptacle outlet(s) in 210.52(G)(1).

210.11(C)(3) & (C)(4)

REVISION

210.12(A)

REVISION

AFCI Protection, Dwelling Units

Change Summary

- The exception for an individual branch circuit supplying a fire alarm system is modified to permit any metal raceway, metal auxiliary gutter, steel armored cable, Type MC or Type AC cable.
- The IN reference to UL Subject 1699C, *Outline of Investigation for System Combination Arc-Fault Circuit Interrupters* is retained.

210.12(A)

REVISION

Courtesy of Eaton

210.12(C)

REVISION

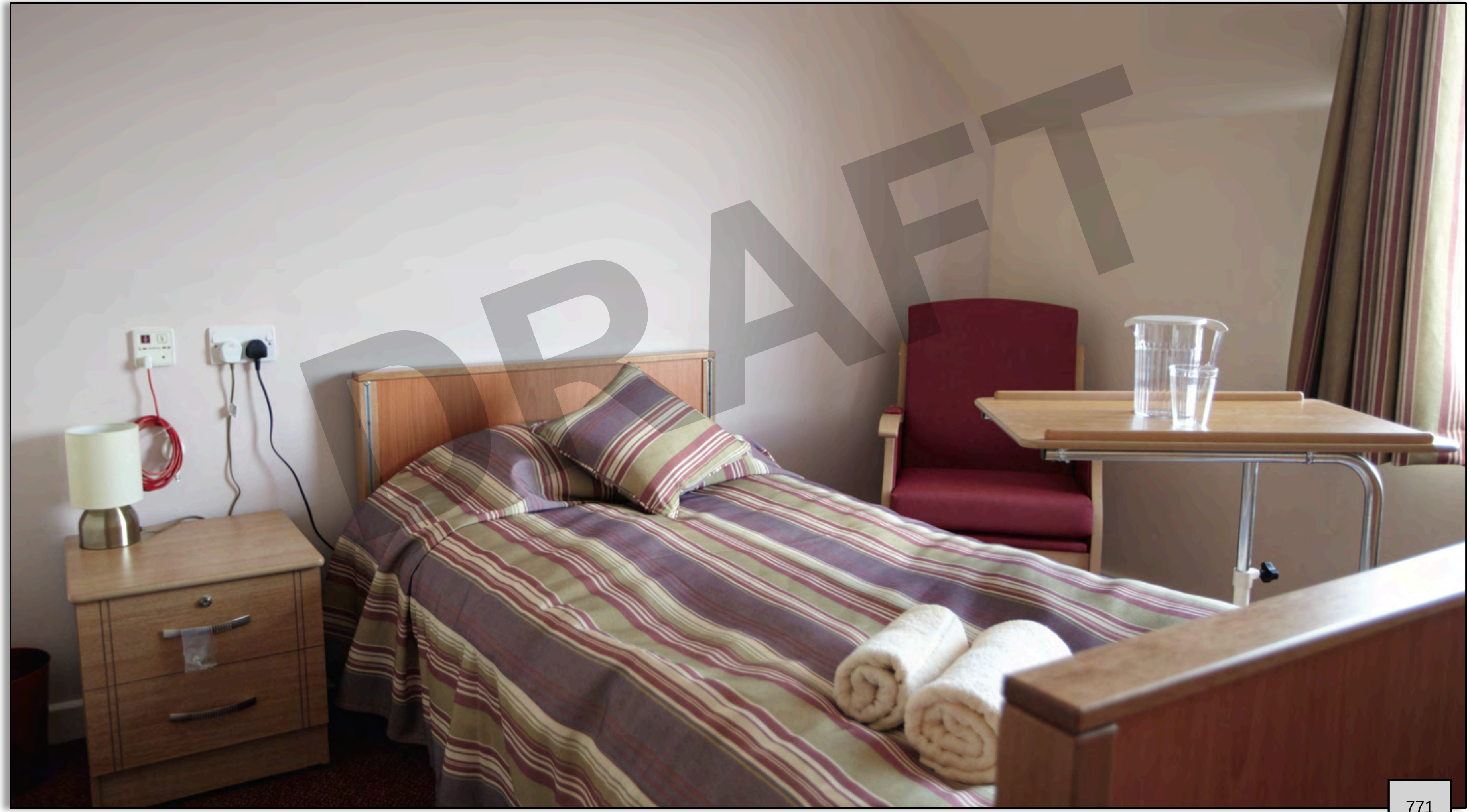
…Sleeping Rooms, Nursing, Limited-Care Facilities

Change Summary

- The AFCI requirements of 210.12 are expanded to include patient sleeping rooms in nursing homes and limited care facilities.
- These sleeping rooms are very similar in nature to those found in dwelling units, guest rooms, guest suites, and dormitory units.

210.12(C)

REVISION



210.12(D)

REVISION

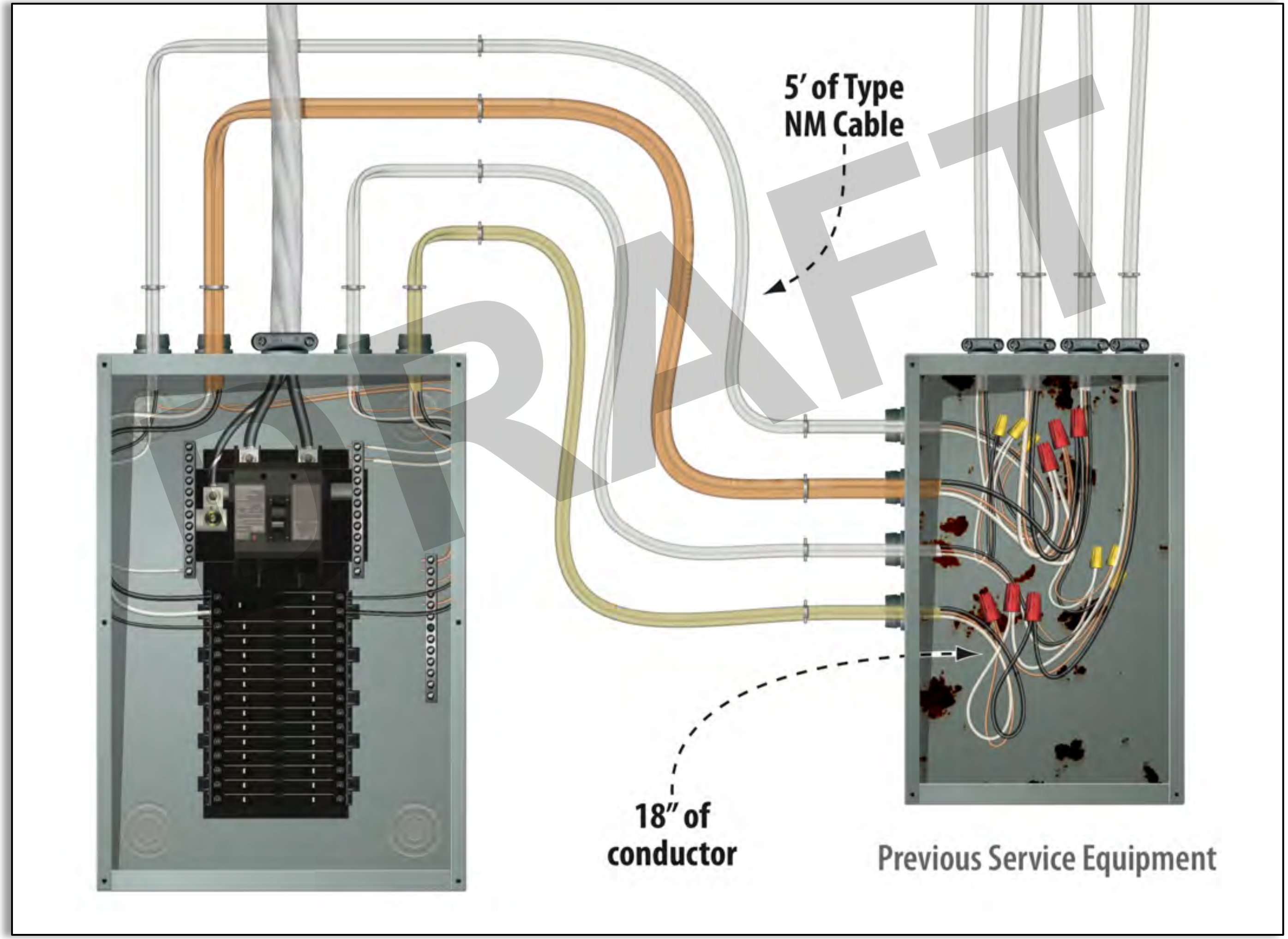
BC Extensions/Modifications, Guest Rooms/Suites

Change Summary

- 210.12(D) is expanded to include guest rooms and guest suites.
- New text is added to clarify the exception for branch circuit conductor extensions not more than 6 feet.
- Splicing devices are permitted. The 6-foot measurement does not include conductors inside an enclosure, cabinet, or junction box.

210.12(D)

REVISION



210.19(A)(1)

REVISION

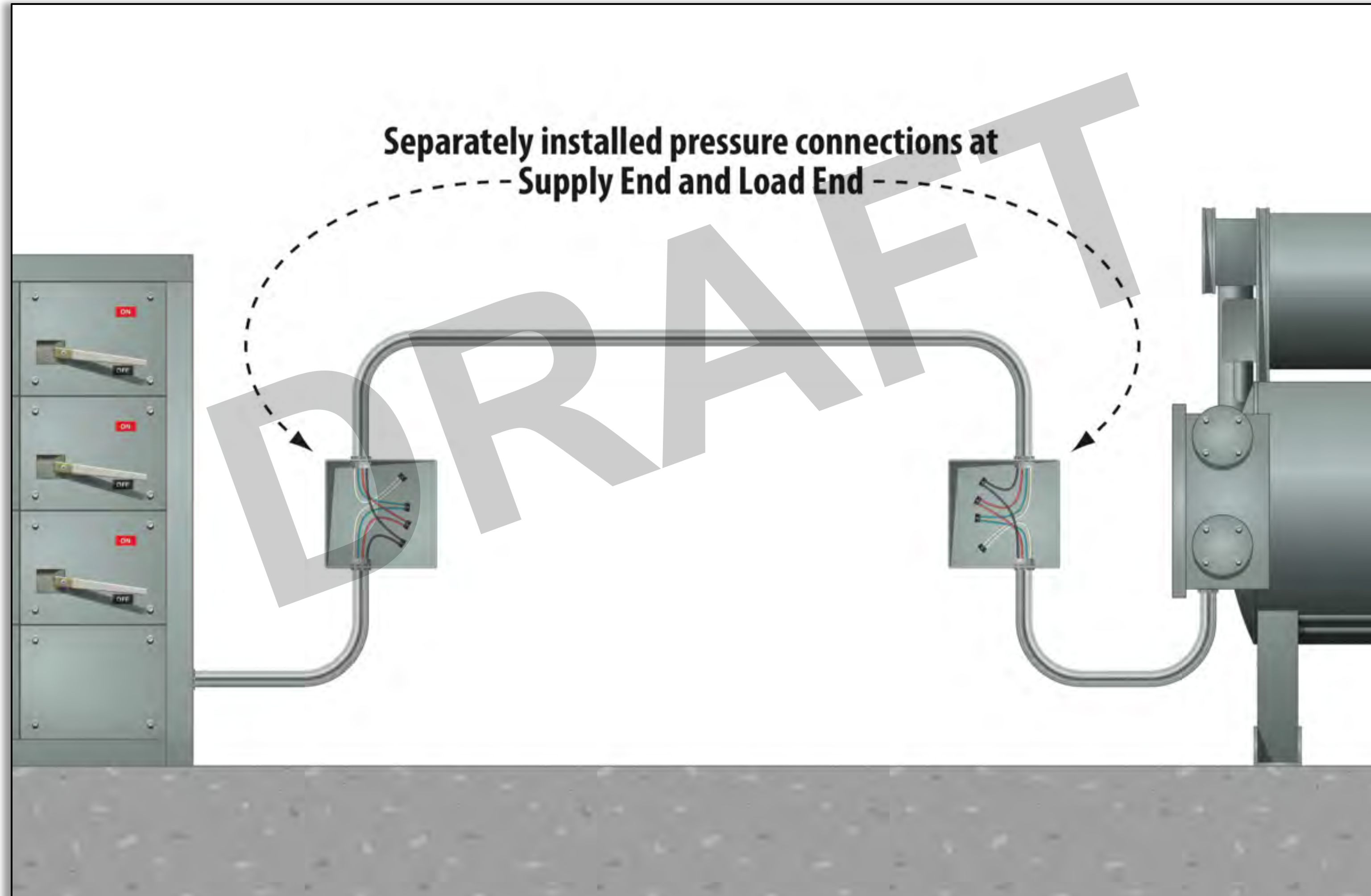
Conductors, Minimum Ampacity and Size

Change Summary

- The minimum ampacity and size of branch circuit conductors must also comply with 110.14(C) for equipment terminations.
- The existing exception is clarified to apply to only 210.19(A)(1)(a).
- A new Exception No. 2 is added to permit portions of the branch circuit (not the full length) to have an allowable ampacity of not less than the sum of the continuous load plus the noncontinuous load.

210.19(A)(1)

REVISION



210.25(B)

REVISION

Common Area Branch Circuits

Change Summary

- A new informational note is added in 210.25(B) to provide examples of common areas or public spaces.
- These areas include, but are not limited to, lobbies, corridors, stairways, laundry rooms, roofs, elevators, washrooms, storerooms, driveways (parking), and mechanical rooms.

210.25(B)

REVISION

210.52(C)

REORGANIZE

Receptacle Outlets, Countertops and Work Surfaces

Change Summary

- Requirements for island and peninsular countertops are combined.
- 9 $ft.^2$ of space or any fraction will require a receptacle and one more for every 18 $ft.^2$ or any fraction thereof.
- A peninsular countertop work surface must have a receptacle outlet within 2 feet of the end of the countertop or work surface.

210.52(C)

REORGANIZE

210.52(E) & (G)

REVISION

Outdoor Outlets and Basements, Garages, ...

Change Summary

- New text modifies receptacle outlet requirements for decks and porches; accessibility from inside an attachment is no longer required.
- Multifamily dwellings must now comply with 210.52(G).
- Garage spaces not attached in multifamily dwellings are not required to have a receptacle outlet in each vehicle bay.

210.52(E) & (G)

REVISION

210.63

REVISION

Equipment Requiring Servicing

Change Summary

- 210.63 and 210.64 are revised and combined into a single section.
- The exceptions to 210.64 are deleted.
- A new requirement now mandates a receptacle outlet for all indoor equipment requiring dedicated equipment space.

210.63

REVISION

210.65

REVISION

Meeting Rooms

Change Summary

- Meeting room receptacle requirements are relocated from 210.71 to 210.65.
- Clarity is provided for the number of, and location of, receptacle outlets in fixed walls.
- Revisions also address non-rectangular meeting rooms and floor outlets to supply receptacles that could be in hardwired furniture.

210.65

REVISION

210.70

REVISION

Lighting Outlets Required

Change Summary

- 210.70 is modified to require lighting outlets “controlled by a listed wall-mounted control device.”
- Listed snap switches are permitted.
- This revision recognizes technology that utilizes remote devices that wirelessly communicate to control a lighting outlet or receptacle.

210.70

REVISION

215.10

NEW

Ground Fault Protection of Equipment

Change Summary

- New Exception No. 3 now permits temporary feeders to be installed without ground-fault protection for the time necessary to repair and maintain equipment.
- This permission is limited to the time period necessary, but not more than 90 days.
- Editorial revisions were made in the remainder of this section.

215.10

NEW

CATERPILLAR
D379 CATERPILLAR
DOW CORNING
732
Multi-Purpose Sealant
TRACEY

220.11, 220.12(A) & (B)

NEW / REVISION

Floor Area, Lighting Load Non-Dwelling Occupancies

Change Summary

- The parent text of 220.12 is modified editorially and relocates requirements to determine floor area to a new section 220.11.
- Energy Code requirements are added in 220.12(B) and Exception No. 1 is deleted.
- Exception No. 2 is deleted as the values in Table 220.12 are revised.

220.11, 220.12(A) & (B)

NEW / **REVISION**

Courtesy of Koninklijke Philips Electronics N. V-Lightolier

Table 220.12

REVISION

General Lighting Loads by Non-Dwelling Occupancy

Change Summary

- Table 220.12 is now limited to non-dwelling occupancies.
- Significant revisions are included for types of occupancies to correlate with ASHRAE 90.1.
- The unit load for most occupancies has been significantly reduced.

Table 220.12

REVISION

220.14(J), (K), & (M)

NEW / REVISION

Dwelling Units, Office Buildings, Hotels, and Motels

Change Summary

- General lighting load requirements for dwelling units are relocated to 220.14(J).
- 220.14(K) now clarifies that the value in (K) has demand factors applied.
- New 220.14(M) clarifies that the minimum unit load in table 220.12 includes the lighting at receptacle outlets specified.

220.14(J), (K), & (M)

NEW REVISION

220.42

REVISION

General Lighting

Change Summary

- Demand factors for derating feeder and service conductors in hospitals are deleted.
- Demand factors for feeder and service conductors in hotels, motels, and apartment houses without provision for cooking, are increased to correlate with revisions in Table 220.12.

220.42

REVISION

220.87

REVISION

Determining Existing Loads

Change Summary

- 220.87 permits actual maximum demand values to determine existing loads.
- Where feeder or service conductors have a renewable energy system, or any form of peak load shaving, actual maximum demand is not obtainable and Section 220.87 cannot be applied.

220.87

REVISION

225.10, 230.43, & 230.44

NEW REVISION

Wiring on Buildings (or Other Structures)

Change Summary

- Type TC-ER cable is now a permitted wiring method for outside feeders and branch circuits and services.
- Type TC-ER cable complies with the crush and impact requirements of Type MC cable.
- Type SE cable is now specifically identified as permitted in 225.10, 230.43, and 230.44.

225.10, 230.43, & 230.44

NEW REVISION

225.15

REVISION

Supports Over Buildings

Change Summary

- Section 225.15 is revised by removing the reference to 230.29.
- The requirement for outside branch-circuits and feeders supported over a building is that they be "securely supported."
- Applying the requirements of 230.29 in Article 225, and bonding the grounded conductor to metal support structures violates 250.142(B).

225.15

REVISION

225.19

REVISION

Overhead Spans Open/Multiconductor Cable

Change Summary

- Parent text is added to clarify that this section applies only to overhead spans of open conductors and open multiconductor cables.
- Cable assemblies, such as Type SE or UF are not “open multiconductor cables.”
- The requirements of 225.19 do not apply to raceways or cable assemblies.

225.19

REVISION

225.30(A)

NEW

Special Conditions (Number of Supplies)

Change Summary

- 225.30(A) is modified to permit additional feeders or branch circuits for docking facilities and piers.
- This revision recognizes the need for increased levels of ground fault protection in marinas and similar installations.
- Section 555.35 requires shore power receptacles to have GFPE not exceeding 30 mA. Feeders and branch circuits must have GFPE set to open at not more than 100 mA.

225.30(A)

NEW

225.30(B)

NEW

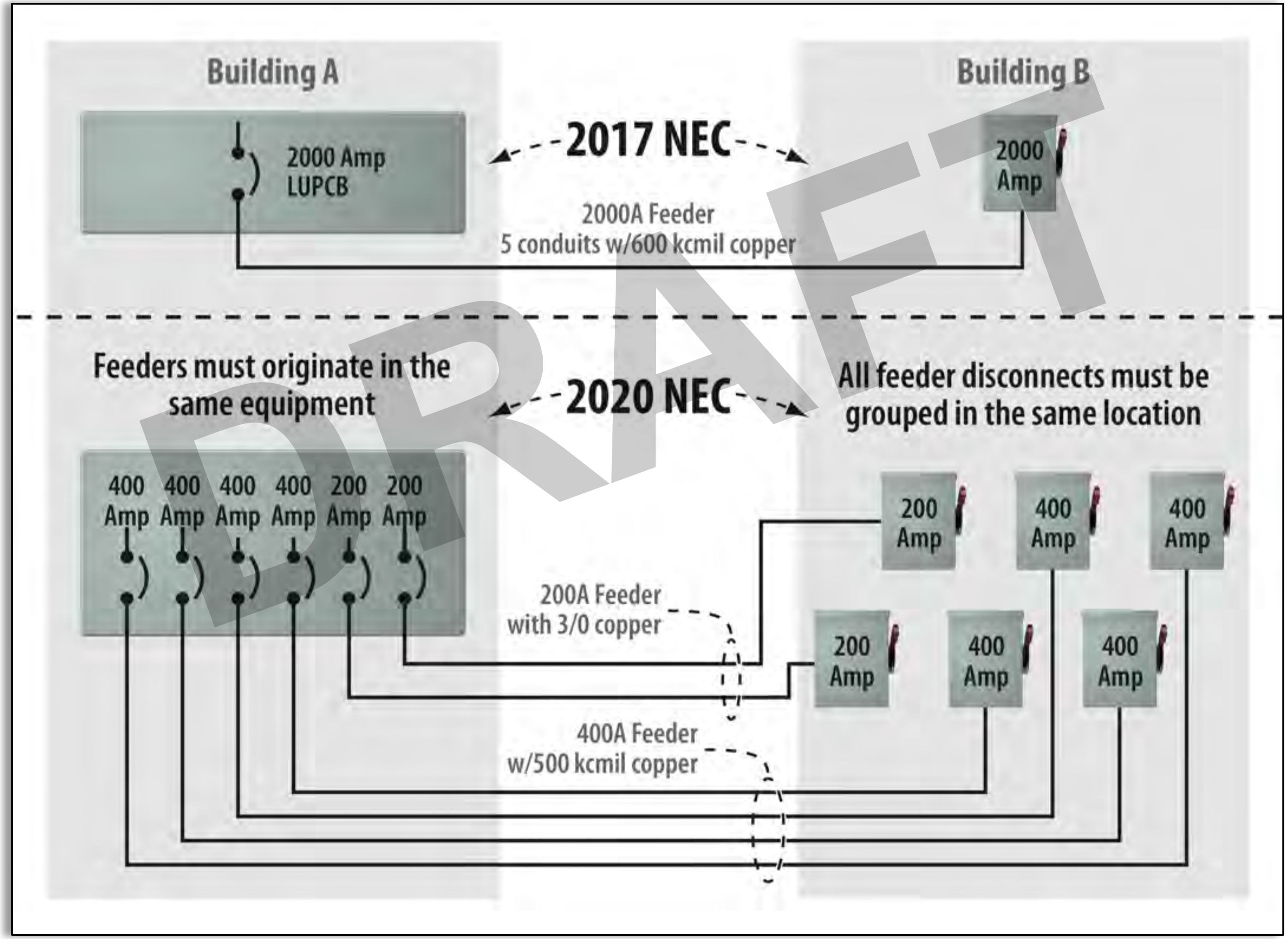
Common Supply Equipment

Change Summary

- 225.30(B) now permits up to six feeders to supply a separate building or structure.
- All of the feeder conductors must originate in the same panelboard, switchboard, or other distribution equipment.
- Each feeder must terminate in a single disconnecting means, and all of the feeder disconnects in the building or structure supplied, must be grouped in the same location.

225.30(B)

NEW



809

230.46

REVISION

Spliced and Tapped Conductors

Change Summary

- The requirement for marking power distribution blocks used on service conductors is moved from 314.28(E)(1) to 230.46.
- All power distribution blocks, pressure connectors, and devices for splices and taps of service conductors must be listed.
- Effective January 1, 2023, pressure connectors and devices for splices and taps on service conductors must be marked as suitable.

230.46

REVISION

230.62(C)

NEW

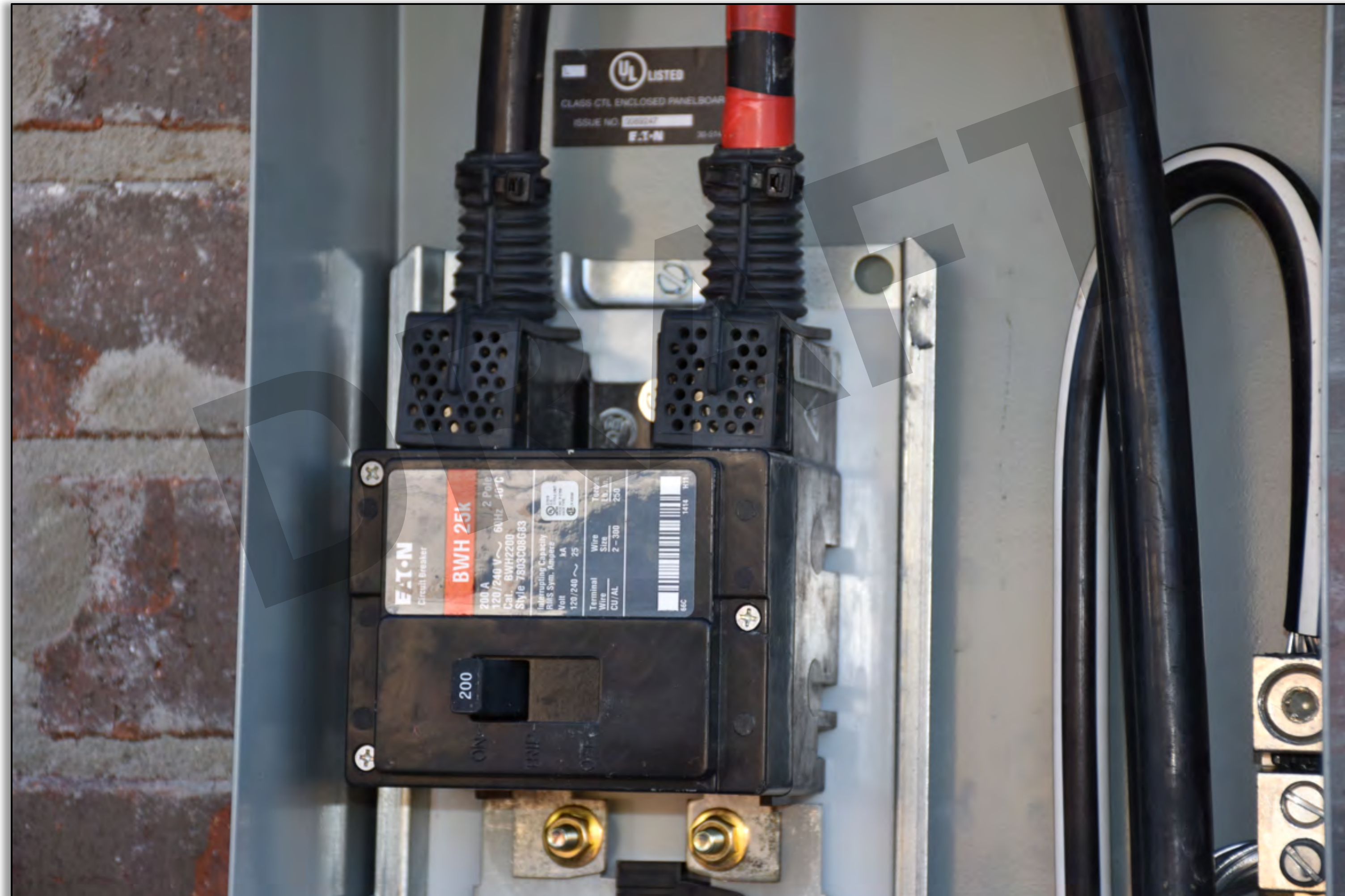
Barriers

Change Summary

- The requirements of 408.3(A)(2) are relocated and expanded into new 230.62(C).
- All service equipment is now required to be provided with barriers to prevent line side inadvertent contact.
- This includes, but is not limited to panelboards, switchboards, switchgear, motor control centers, individual circuit breaker enclosures, SUSE rated transfer switches, and fused disconnects.

230.62(C)

NEW



230.67

NEW

Surge Protection, Dwelling Units

Change Summary

- New 230.67 requires services supplying dwelling units to be provided with an SPD.
- The SPD must be located in or next to the service equipment. An exception permits an alternate location, provided an SPD is located at each next level distribution equipment downstream toward the load.
- All of the requirements in this new section apply where service equipment is replaced.

230.67

NEW

230.71

REVISION

Maximum Number of Disconnects, Two to Six

Change Summary

- The requirements in 230.71(B) permitting up to six service disconnects are significantly revised.
- Panelboards, for example, must be provided with a single main in each enclosure.
- 230.71(B)(1) through (4) outline the permitted methods for two to six service disconnects.

230.71

REVISION

230.75

REVISION

Disconnection of Grounded Conductor

Change Summary

- A new informational note is added in 230.75, to explain how this requirement is typically met.
- In order to performance test GFPE, there must be a means to disconnect the grounded conductor from premises wiring.
- A short section of bus is typically installed so that it can be easily removed, and it is typically identified as a *neutral disconnect link.*

230.75

REVISION

230.82 (1), (3), (5), & (6)

REVISION

Equipment…Supply Side of Service Disconnect

Change Summary

- Other current-limiting devices are not permitted to act as a "cable limiter."
- Where service conductors are spliced, the rules of 240.21 do not apply.
- 230.82(6) now requires PV systems, fuel cells, and wind energy, etc. connected on the supply side of the service disconnect to be provided with service rated disconnecting means and overcurrent protection.

230.82 (1), (3), (5), & (6)

REVISION

230.82 (10) & (11)

REVISION

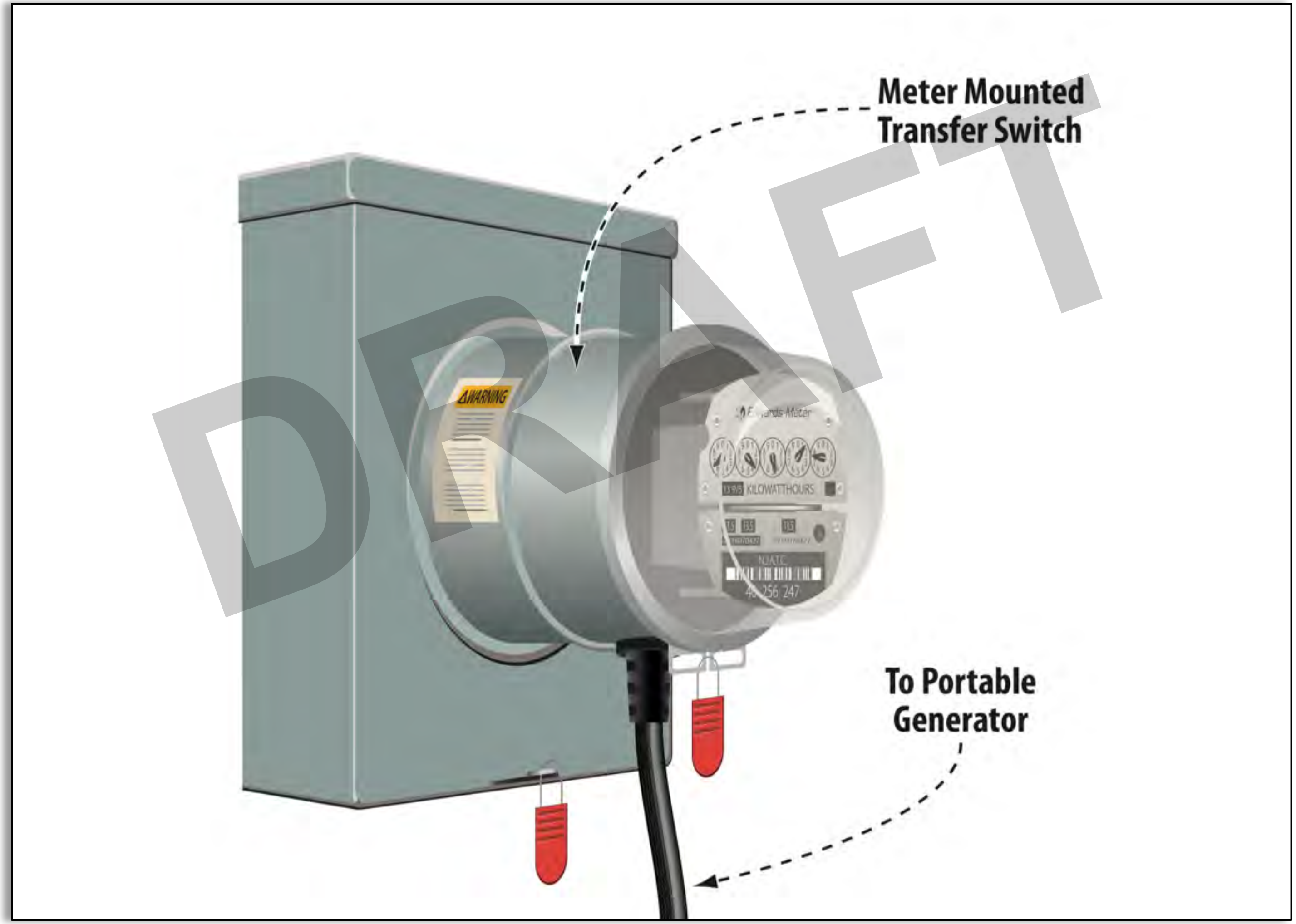
Equipment…Supply Side of Service Disconnect

Change Summary

- Emergency disconnects required by 230.85 are permitted to be connected on the supply side of the service disconnect.
- Meter mounted transfer switches are added in list item (11) and are permitted for optional standby use.

230.82 (10) & (11)

REVISION



230.85

NEW

Emergency Disconnects

Change Summary

- All services for one and two family dwellings are now required to have emergency disconnects installed in a readily accessible outdoor location.
- These disconnects are necessary for first responders in a fire or other emergency.
- Similar requirements are added in this *NEC* cycle for energy storage systems and permanently mounted generators.

230.85

NEW

240.6(C)

REVISION

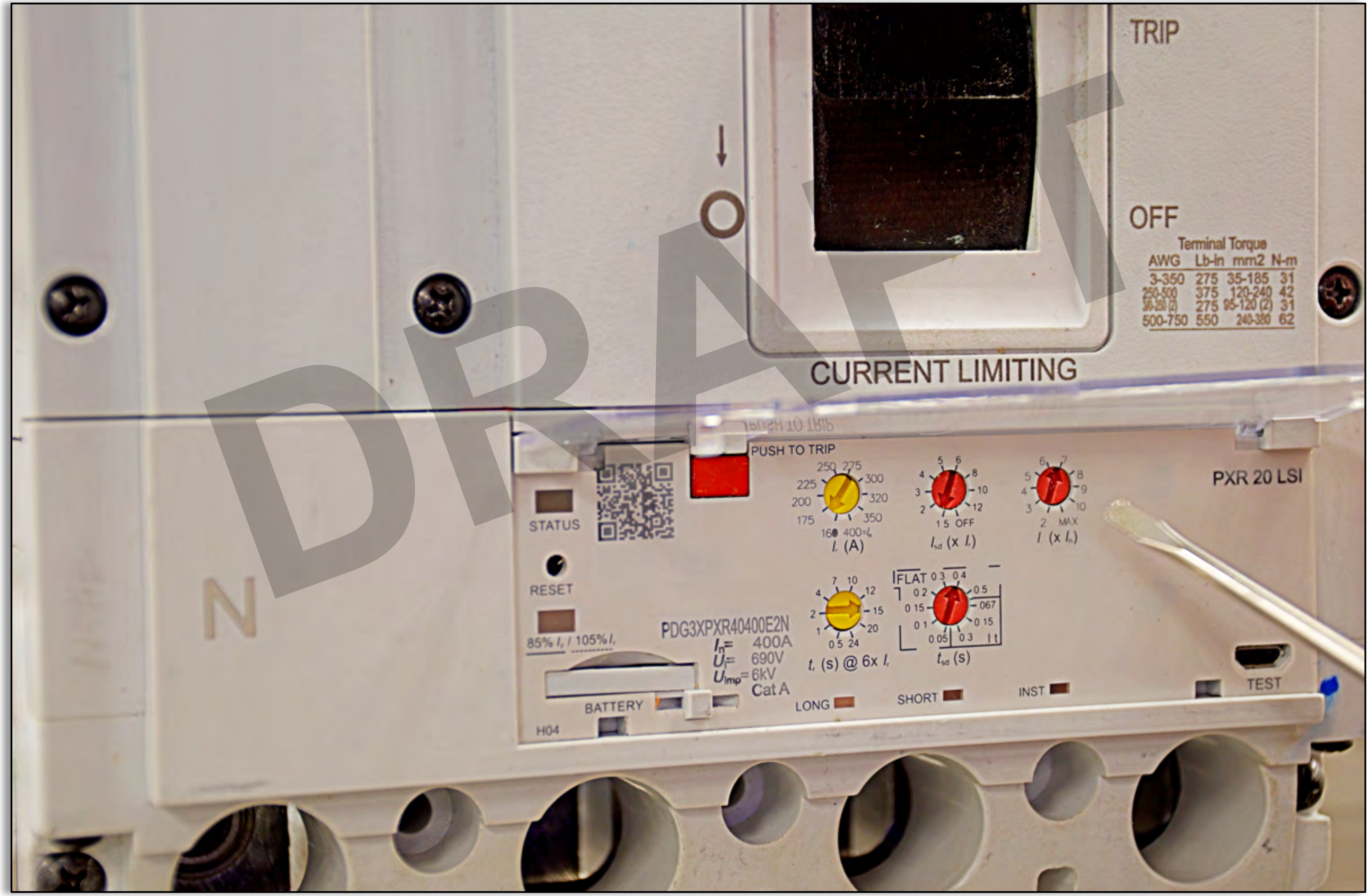
Restricted Access Adjustable-Trip Circuit Breakers

Change Summary

- Adjustable trip circuit breakers may be rated at the adjusted current setting, provided there is restricted access to the device.
- 240.6(C) list items (1) through (3) are editorially modified for clarity.
- New list item (4) permits an adjustable trip circuit breaker that is password-protected with the password accessible only to qualified personnel to be considered as having restricted access.

240.6(C)

REVISION



240.21(B)

REVISION

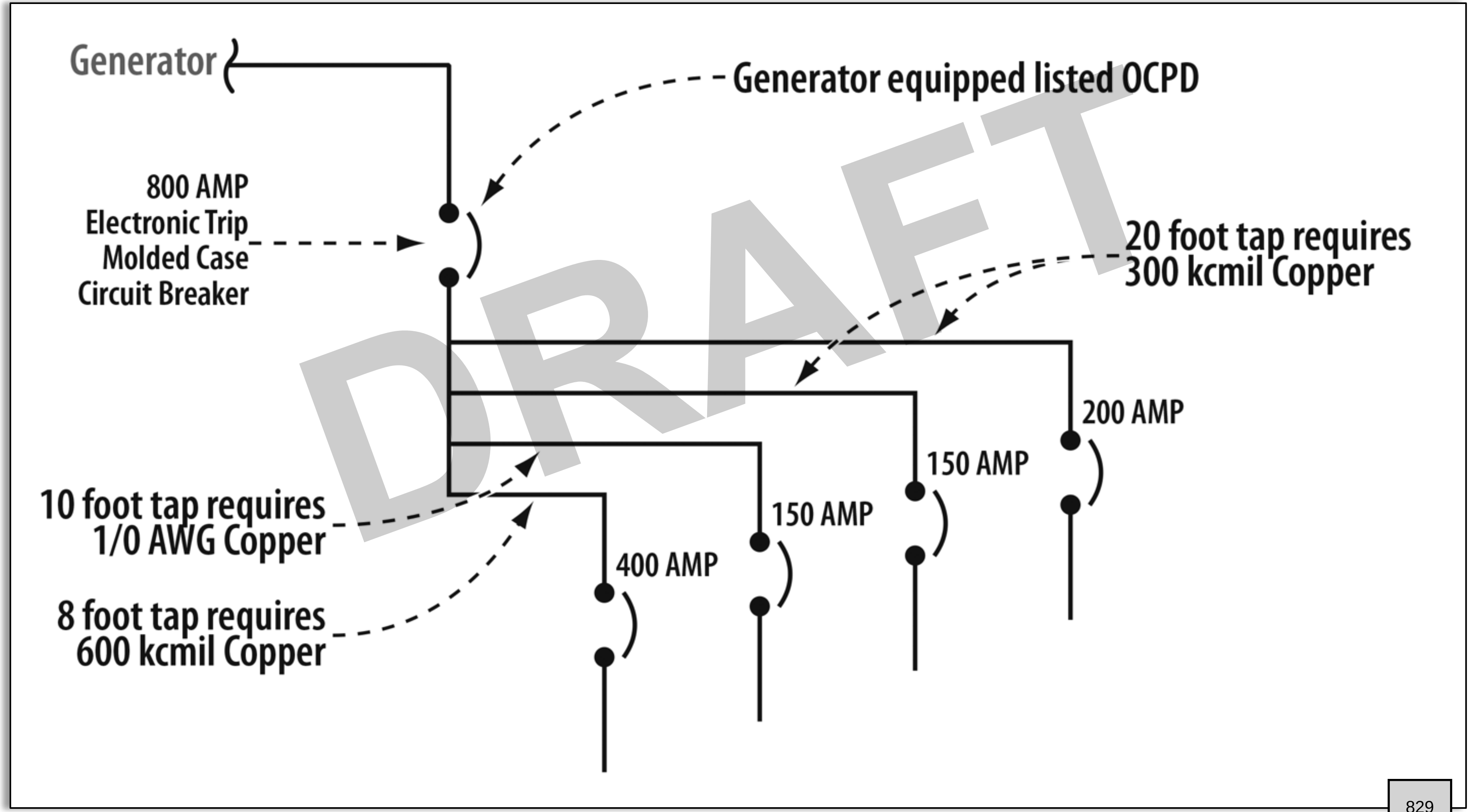
Feeder Taps

Change Summary

- The parent text 240.21(B) is modified for clarity.
- Feeders are permitted to be tapped at any point on the load side of the feeder overcurrent protective device.
- Generator supplied feeder tap conductors are often installed in this manner. See 445.13(B).

240.21(B)

REVISION



240.62, 240.88, & 240.102

NEW

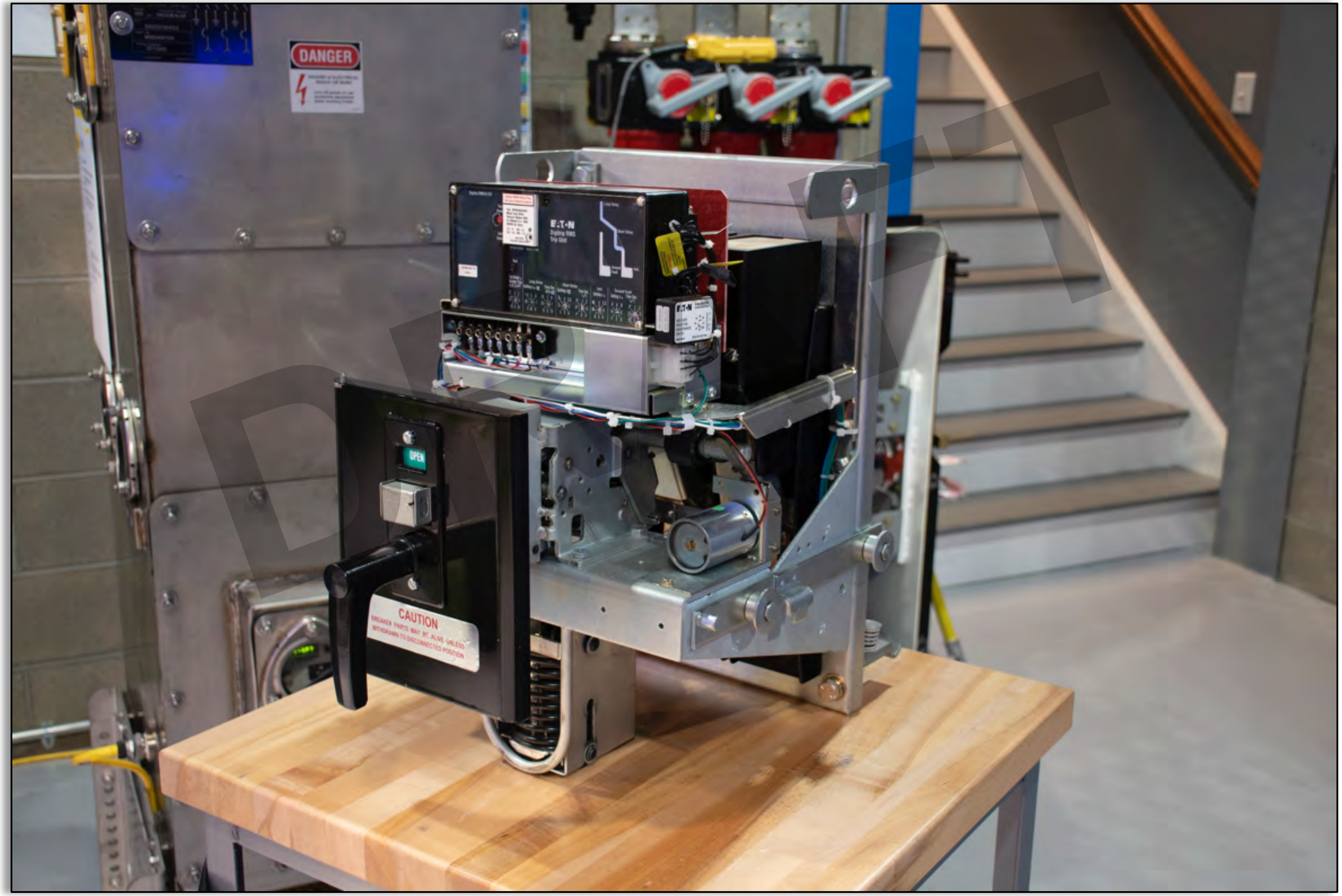
Reconditioned Equipment

Change Summary

- Low and medium voltage fuse holders/non-renewable fuses are not permitted to be reconditioned.
- Molded case circuit breakers and low voltage power circuit breaker electronic trip units are not permitted to be reconditioned.
- Low, medium voltage power CBs, high voltage CBs, electromechanical protective relays, and current transformers are permitted to be reconditioned.

240.62, 240.88, & 240.102

NEW



Courtesy of Eaton

240.67

REVISION

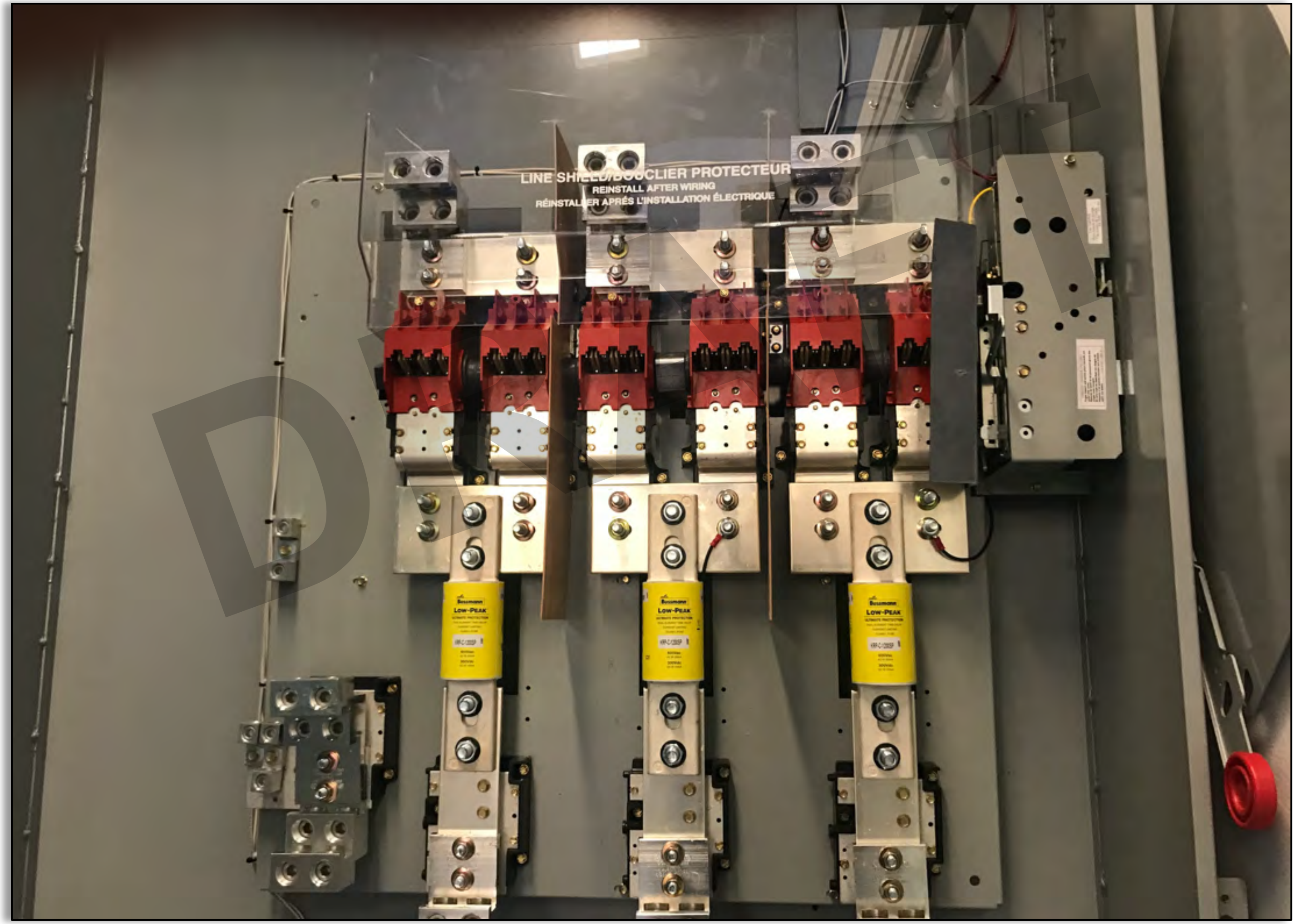
Arc Energy Reduction

Change Summary

- Documentation is now required to demonstrate that the method chosen to reduce clearing time will operate at a value below the arcing current.
- 240.67(B) requires that the method chosen to reduce clearing time operates at a value below the arcing current.
- Current limiting electronically actuated fuses are now a permitted arc energy reduction method in 240.67.

240.67

REVISION



Courtesy of Eaton

240.67(C) & 240.87(C)

NEW

Performance Testing

Change Summary

- Arc energy reduction methods must be performance tested when first installed onsite.
- Testing must be performed by qualified persons in accordance with the manufacturers' instructions.
- A written record of this testing must be made available to the AHJ.

240.67(C) & 240.87(C)

NEW

Courtesy of Eaton

240.87

REVISION

Arc Energy Reduction

Change Summary

- Temporary adjustment of the instantaneous trip setting to achieve arc energy reduction is prohibited.
- All arc energy reduction methods chosen, must operate at less than the available arcing current. This must be documented.

240.87

REVISION

Courtesy of Eaton

Article 242

NEW RELOCATE

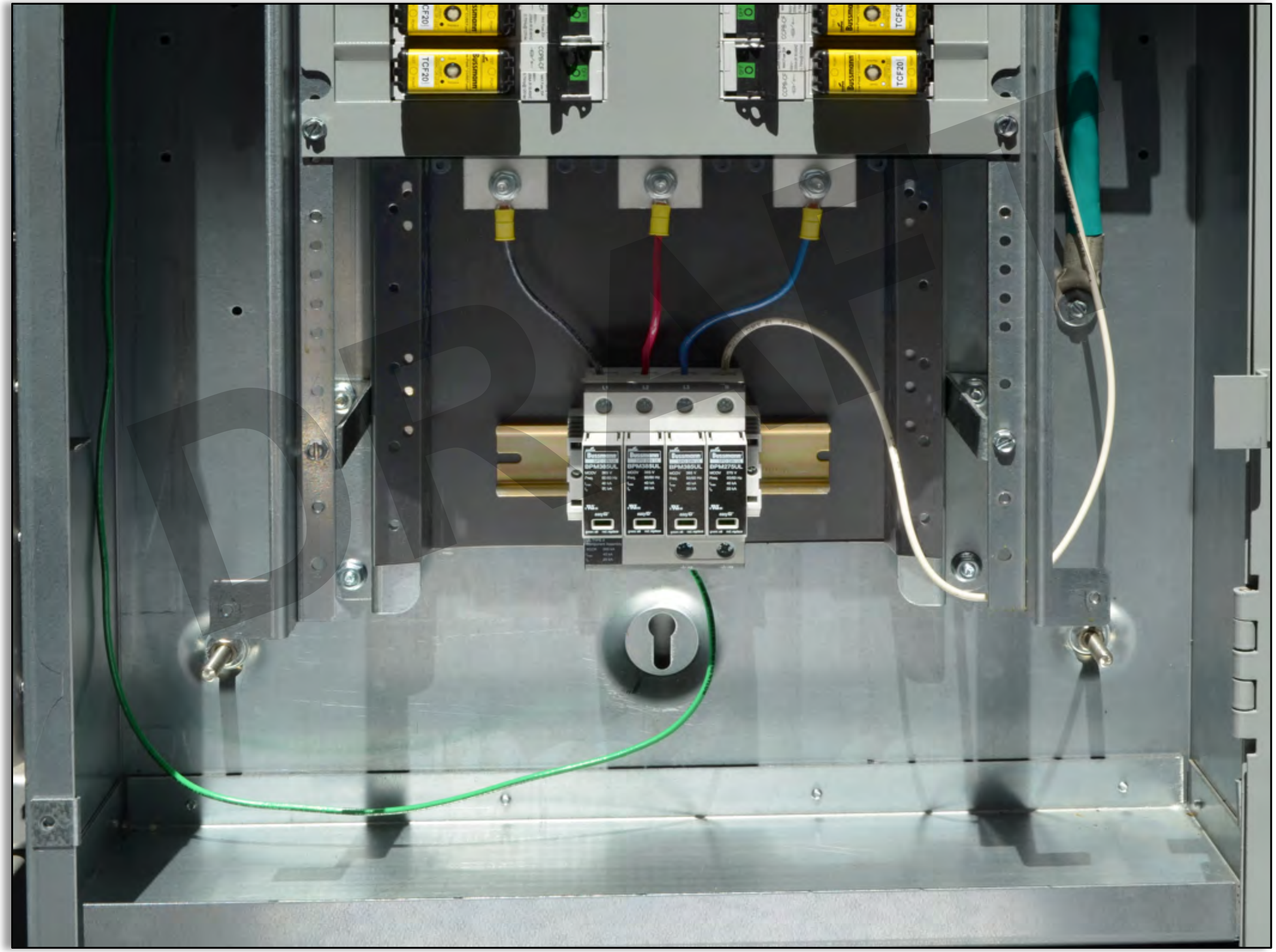
Overvoltage Protection

Change Summary

- Articles 280 and 285 have been combined to form a new Article 242 titled Overvoltage Protection.
- The article has three parts, General, Surge Protective Devices (SPDs) 1000 Volts or Less, and Surge Arresters Over 1000 Volts.
- Technical responsibility for Article 242 and its associated definitions in Article 100 has been shifted from CMP-5 to CMP-10.

Article 242

NEW RELOCATE



250.2

DELETION / RELOCATE

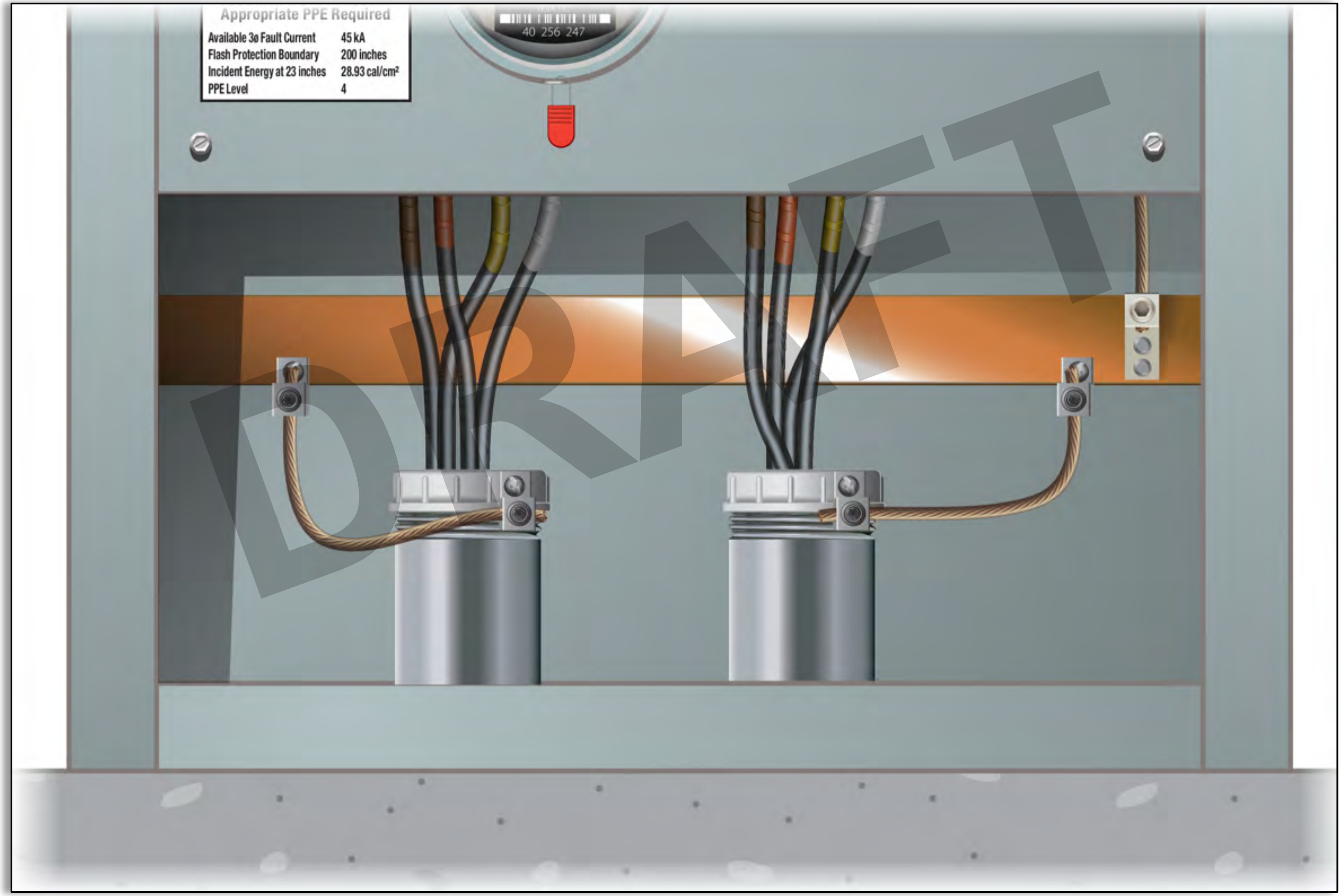
Definition of Bonding Jumper, Supply-Side

Change Summary

- The definition of the term *Bonding Jumper, Supply-Side* has been deleted from 250.2.
- The definition, without revision has been located into Part I of Article 100.
- This relocation aligns with the requirements of Section 2.2.2.1 of the *NEC Style Manual*.

250.2

DELETION / RELOCATE



250.20(B) & 250.36 Informational Note

NEW

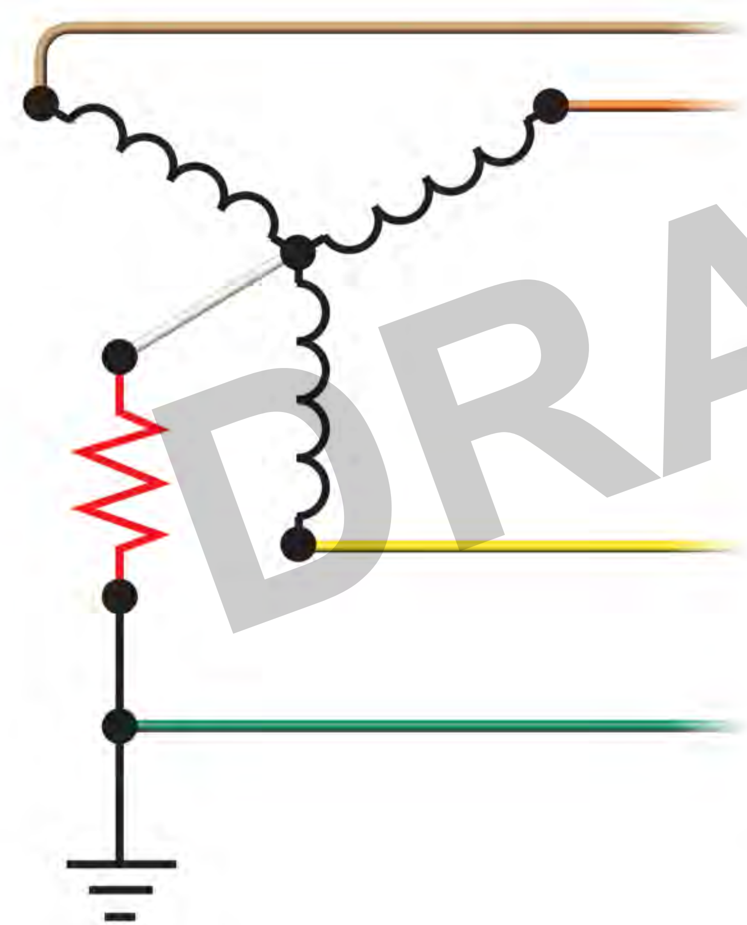
Informational Note References *NFPA 70E*

Change Summary

- A new informational note has been added following Section 250.20(B) and 250.36.
- The informational note references *NFPA 70E Standard for Electrical Safety in the Workplace, Annex O.*
- High-impedance grounded systems limit arc energy in a first phase-to-ground fault event that occurs in a high impedance grounded system.

250.20(B) & 250.36 Informational Note

NEW



Grounding location is between the grounding electrode conductor and the neutral grounding point.

Neutral conductor has to be fully insulated.

Neutral conductor must have an ampacity no less than the maximum current rating of the grounding impedance.

Grounding connection can only be made through the grounding impedance device.

250.25

NEW

Grounding on Supply Side of Disconnect

Change Summary

- A new section 250.25 titled “Grounding Systems Permitted to Be Connected on the Supply Side of the Disconnect” has been added in Part II of Article 250.
- The new section provides rules for grounding of systems connected to the supply side of the service disconnect as permitted in 230.82.
- The new section addresses systems supplied by grounded and ungrounded utility sources.

250.25

NEW

PHOTOVOLTAIC SYSTEM DEDICATED KWH METER
DANGER
E:T·N
INVERTERS LOCATED IN GARAGE
AC DISCONNECT SWITCH
RAIN DIAL
WARNING
WARNING
PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN

250.28

REVISION

Main Bonding Jumper and System Bonding Jumper

Change Summary

- The words "aluminum, copper-clad aluminum" have been added to Section 250.28(A).
- This clarifies the conductive materials permitted to be used as main and system bonding jumpers.
- This revision also aligns with the permitted materials listed in 250.102(C)(1), and with materials that manufacturers sometimes use for main and system bonding jumpers within listed equipment.

250.28

REVISION

250.30

REVISION

Grounding Separately Derived AC Systems

Change Summary

- Multiple separately derived systems connected in parallel are considered a single separately derived system, only where the systems are of the same type.
- Section 250.30(A)(2) was revised to clarify that the system bonding jumper is connected to the enclosure, not the disconnecting means.
- Exceptions were relocated to follow the rule to which they apply to comply with the *NEC Style Manual*.

250.28

REVISION

250.34(A) & (B)

REVISION

Trailer-Mounted Generators

Change Summary

- The term *trailer-mounted* has been incorporated into Section 250.34(B).
- The requirements apply to portable, vehicle, and trailer-mounted generators.
- Subdivision (C) remains as in the 2017 *NEC* due to Second Revision 7793 failing ballot.

250.34(A) & (B)

REVISION

250.64(A)

REVISION

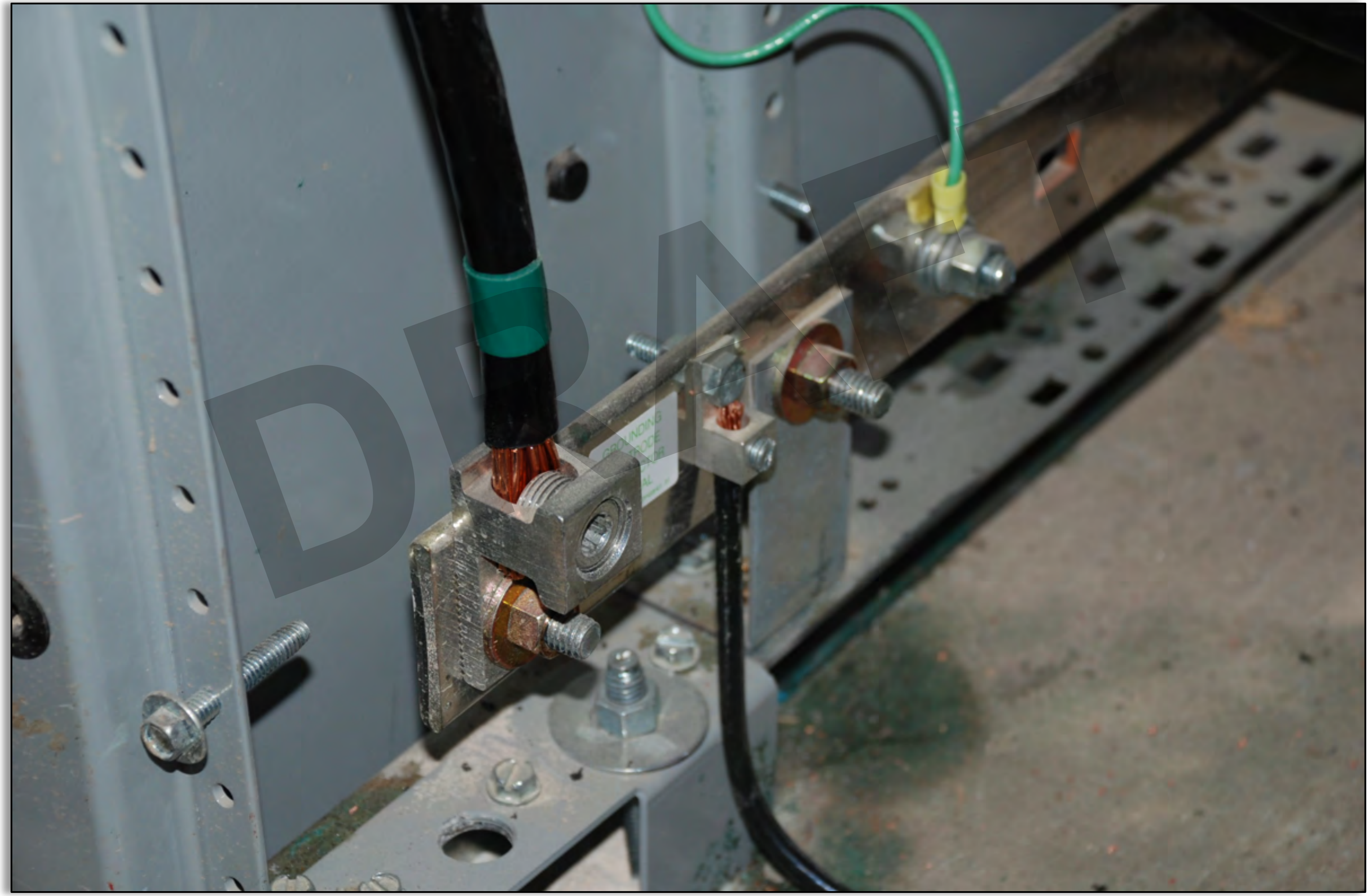
Aluminum and Copper-Clad Aluminum Conductors

Change Summary

- This section was restructured into a list format to meet the *NEC Style Manual* requirements.
- The revision in (1) prohibits direct contact with concrete.
- (2) has been revised to permit terminations of aluminum and copper-clad aluminum conductors connections within 18 inches of the earth where within enclosures listed for the environment.

250.64(A)

REVISION



250.64(B)(2) & (B)(3)

REVISION

Securing and Protection Against Physical Damage

Change Summary

- The term *Schedule 80* has been added to second-level subdivisions (2) and (3).
- The revision clarifies the type of PVC conduit that is suitable to provide protection against physical damage.
- Schedule 80 PVC conduit provides impact and crush resistant characteristics, while schedule 40 does not.

250.64(B)(2) & (B)(3)

REVISION

250.64(E)(1) & (E)(3)

REVISION

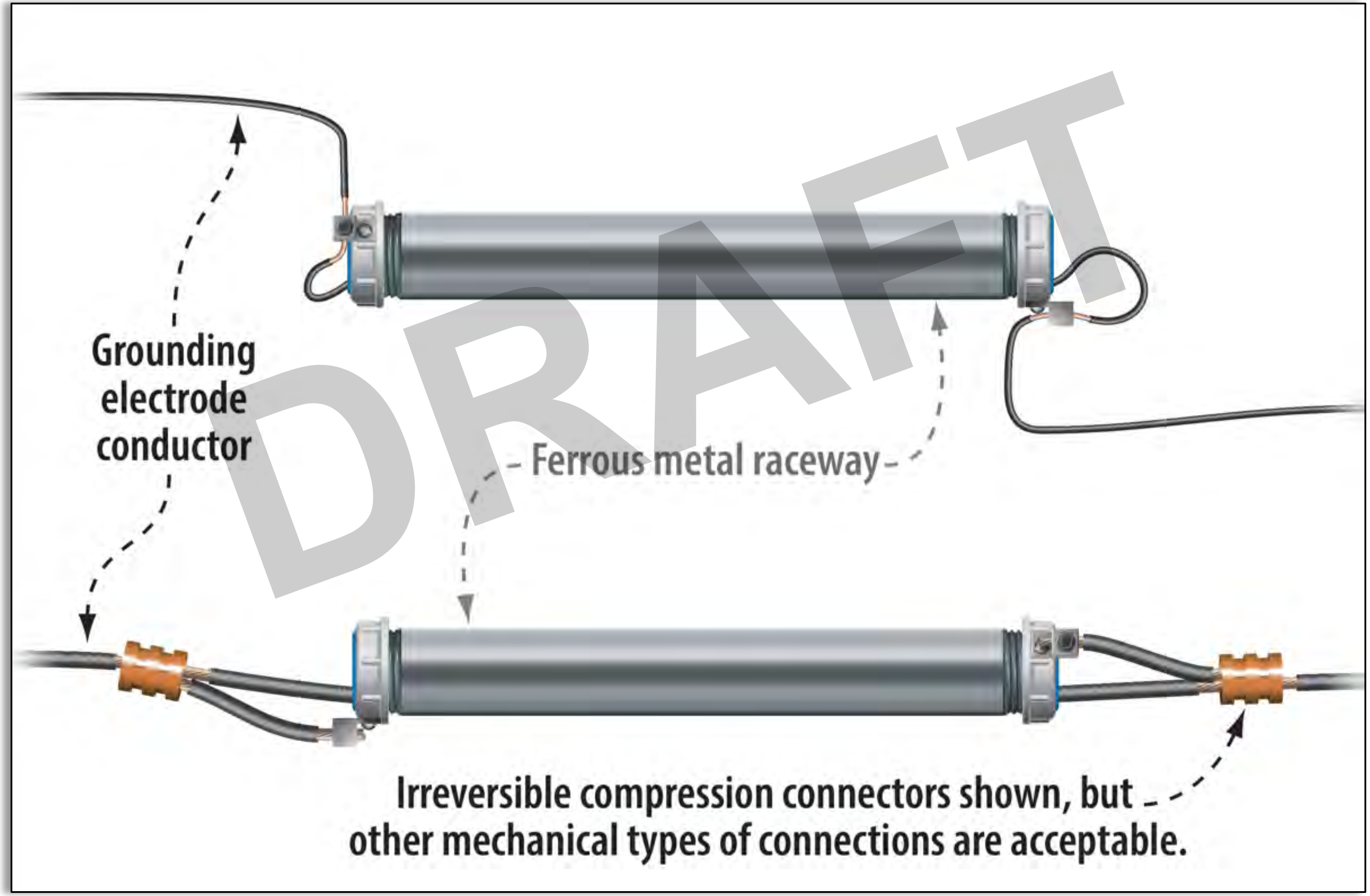
Raceways and Enclosures for GECs

Change Summary

- The term *cable armor* has been added to second-level subdivision (1).
- (3) has been revised to clarify minimum sizing requirements for bonding jumpers that are connected to ferrous metal raceways, or cable armor that encloses a GEC.
- The minimum size must not be smaller than the largest contained GEC in the same enclosure.

250.64(E)(1) & (E)(3)

REVISION



250.68(C)(3)

NEW / REVISION

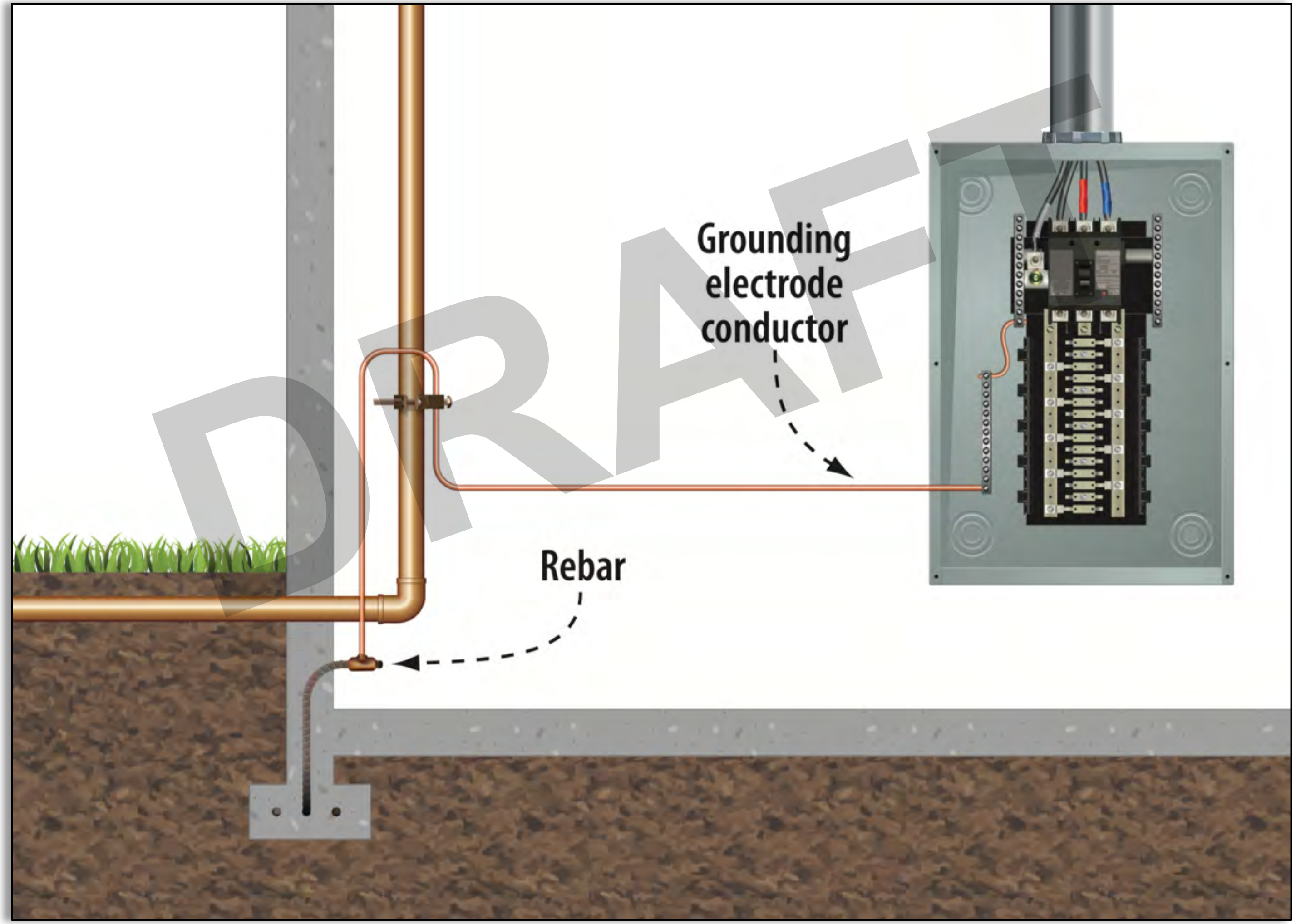
Grounding Electrode Conductor Connections

Change Summary

- The rebar extension must be connected to the rebar in the foundation or footing.
- The rebar extension shall not be exposed to earth contact without corrosion protection.
- The rebar extension shall not be used to interconnect electrodes of the grounding electrode system.

250.68(C)(3)

NEW REVISION



250.92(B)

REVISION

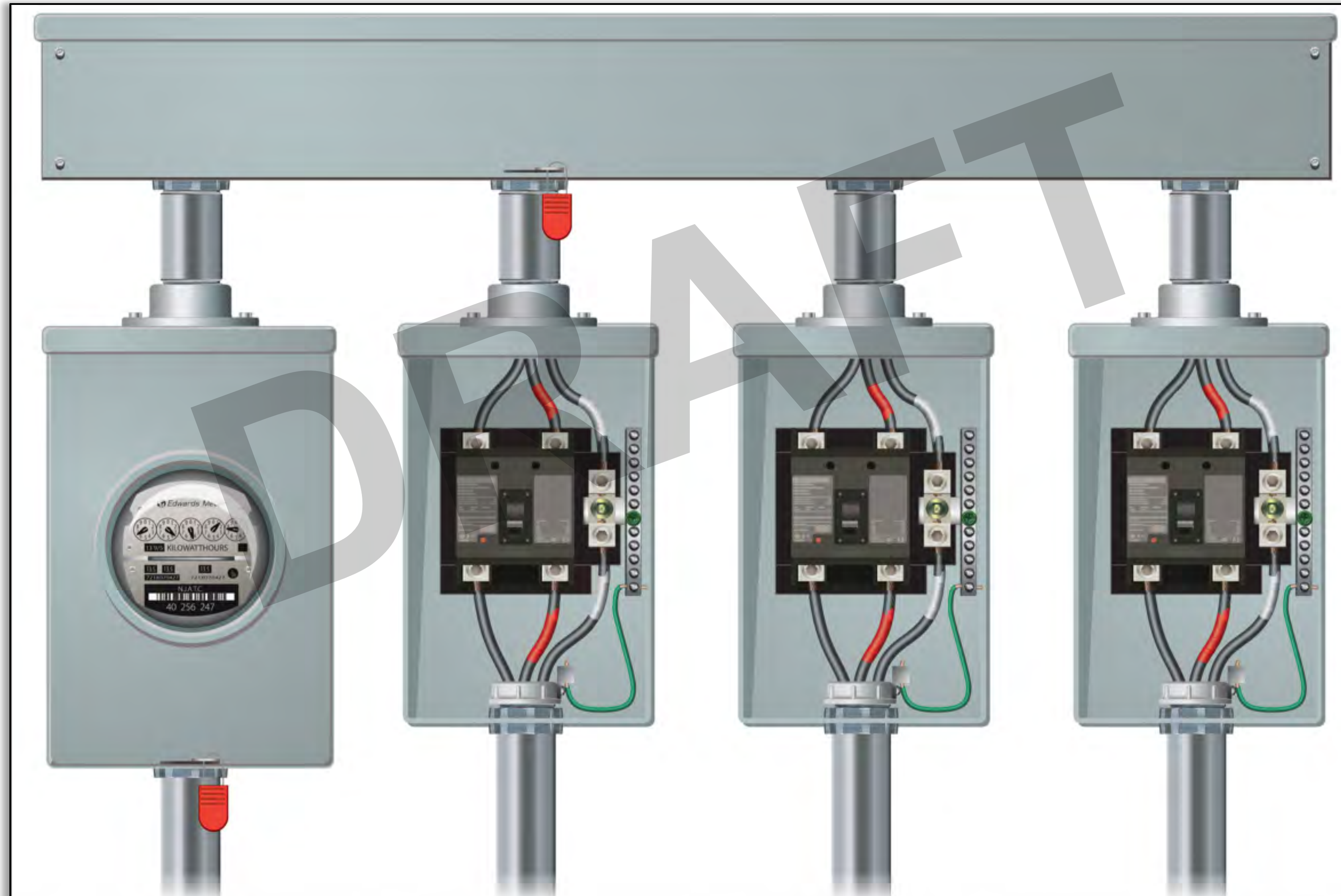
Method of Bonding at the Service

Change Summary

- The words “listed threaded hubs” have been incorporated into list item (2) of this section.
- Standard hubs that have not been evaluated and listed for use in service bonding applications are not permitted.
- Listed products are identified for the uses for which they are permitted.

250.92(B)

REVISION



250.98

REVISION

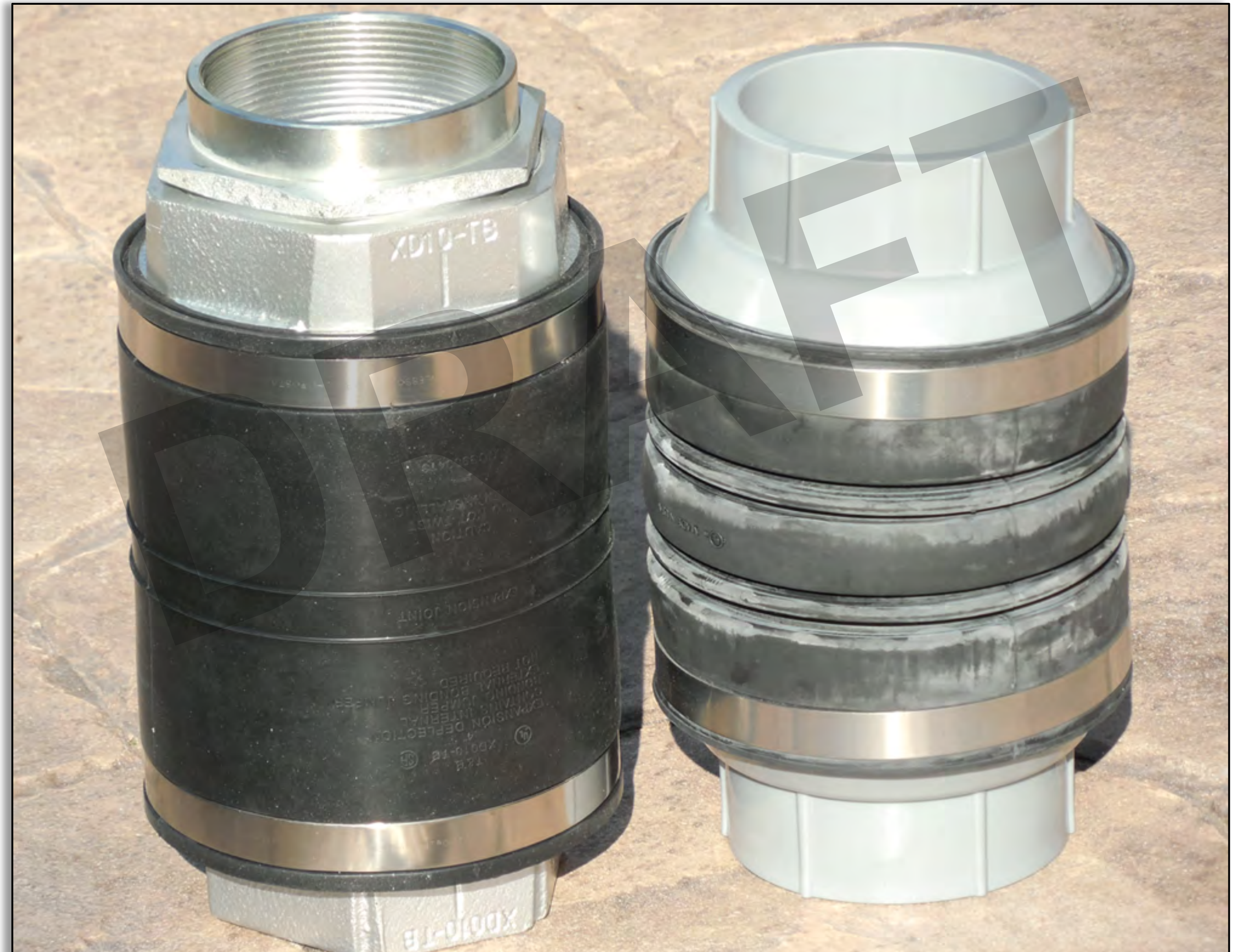
Bonding Loosely Joined Metal Raceways

Change Summary

- The words "expansion-deflection, or deflection" have been incorporated into this section.
- Bonding requirements in this section now apply to expansion deflection, and deflection fittings, as well as telescoping expansion fittings.
- Some fittings have integral bonding jumpers, others do not, and bonding jumpers must be installed.

250.98

REVISION



Courtesy of ABB

250.104(A)(B)(C)(D)

REVISION

Bonding of Piping Systems and Exposed Structural Metal

Change Summary

- The words “except that it shall not be required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum” have been restored within this section.
- Bonding jumper sizes do not have to exceed 3/0 copper or 250 aluminum as appeared in the 2014 *NEC* and prior.
- Informational note references to *NFPA 54* and *NFPA 780* have been updated.

250.104(A)(B)(C)(D)

REVISION

250.119(B)

REVISION

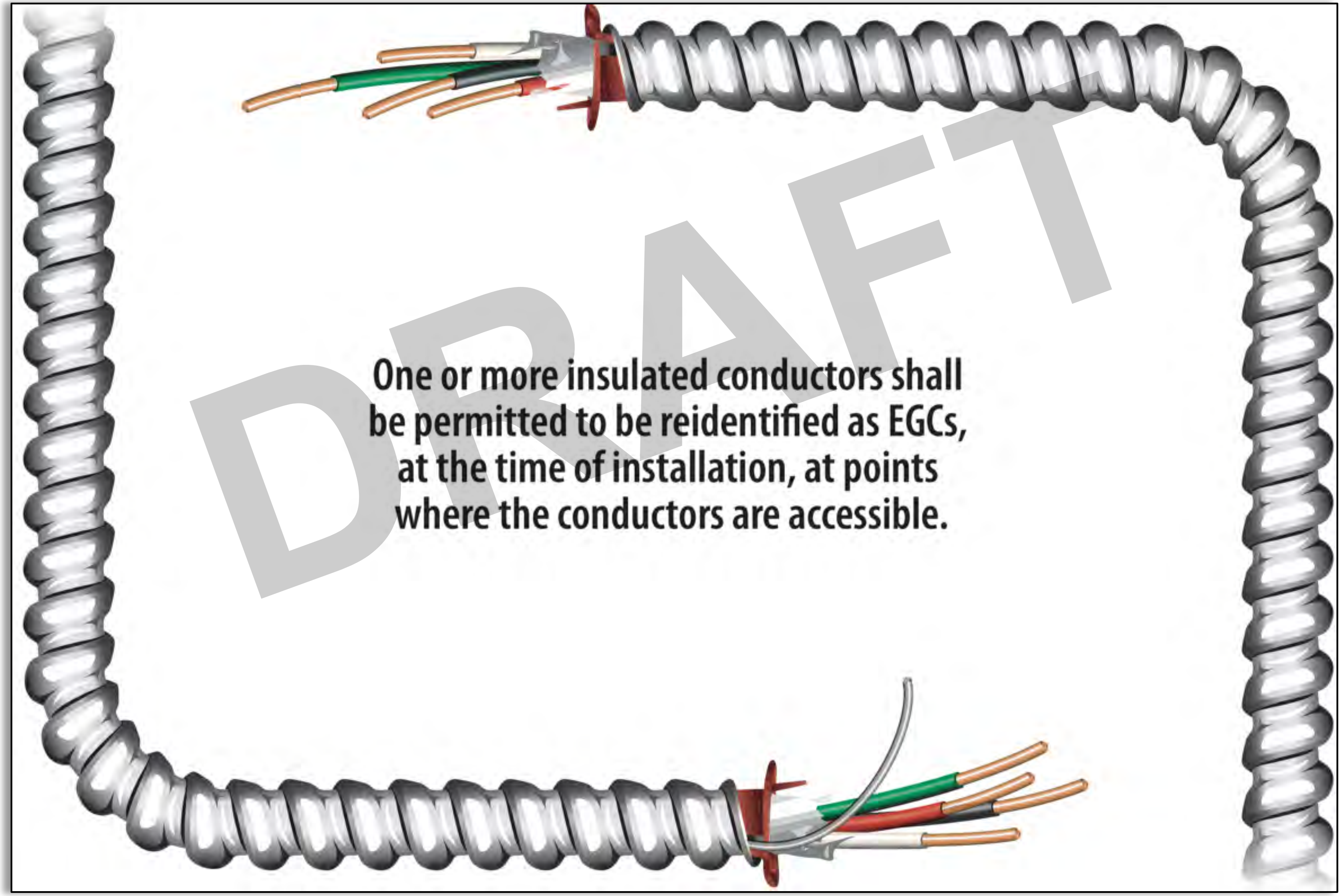
Multiconductor Cable Reidentified

Change Summary

- This section provides allowances for reidentifying equipment grounding conductors.
- The words “Where the conditions of maintenance and supervision ensure that only qualified persons service the installation” have been removed from this section.
- No other such restrictions exist that deal with reidentification of conductors.

250.119(B)

REVISION



250.121(B)

NEW

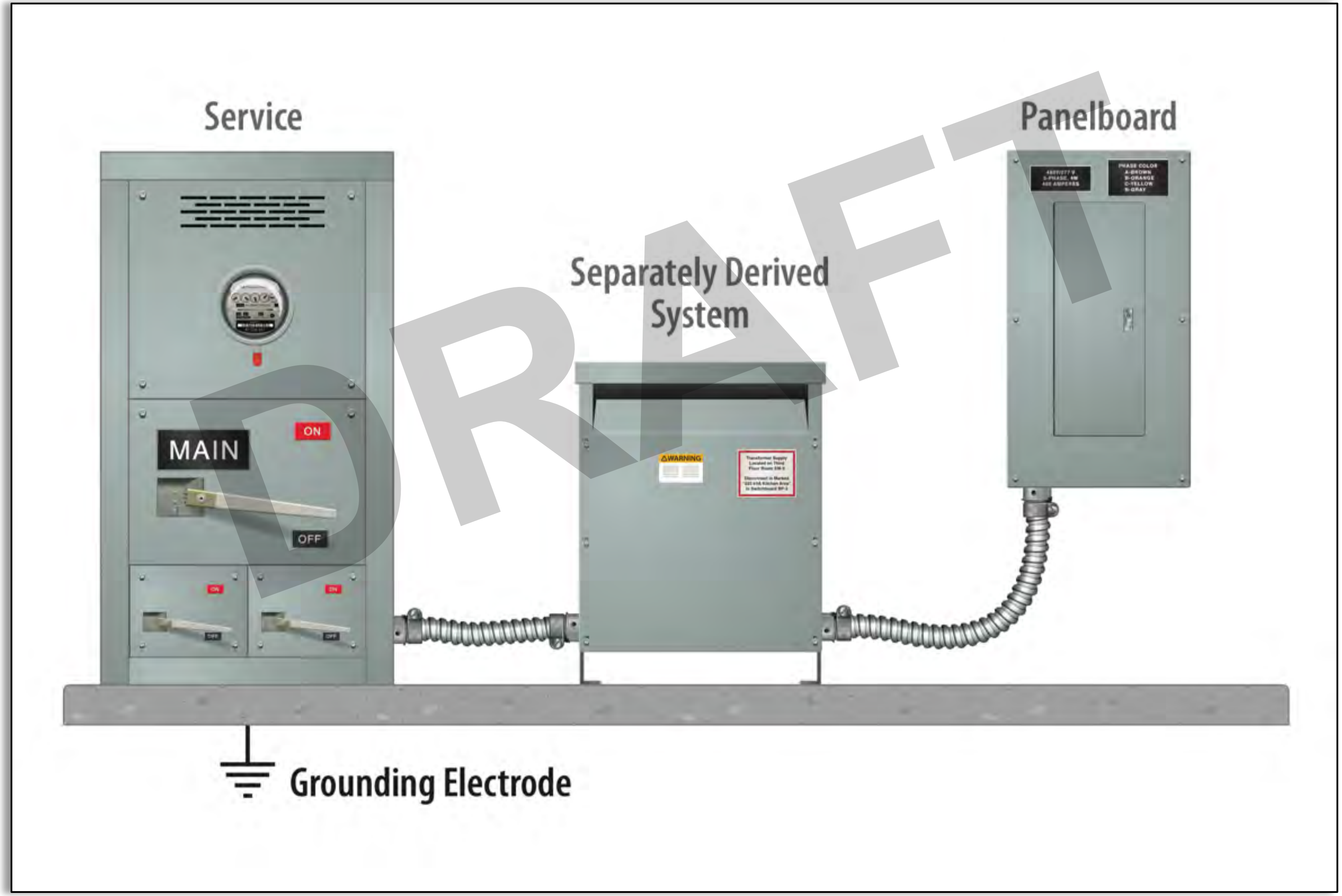
Metal Frame of Building or Structure

Change Summary

- The word “restricted” has been added to the title of this section.
- Added text in (B) restricts structural metal building frames from use as equipment grounding conductors.
- The revision provides consistency with the provisions of 250.136(A).

250.121(B)

NEW



Service
MAIN
ON
OFF
Separately Derived System
Panelboard
Grounding Electrode
DRAFT

250.122

REVISION

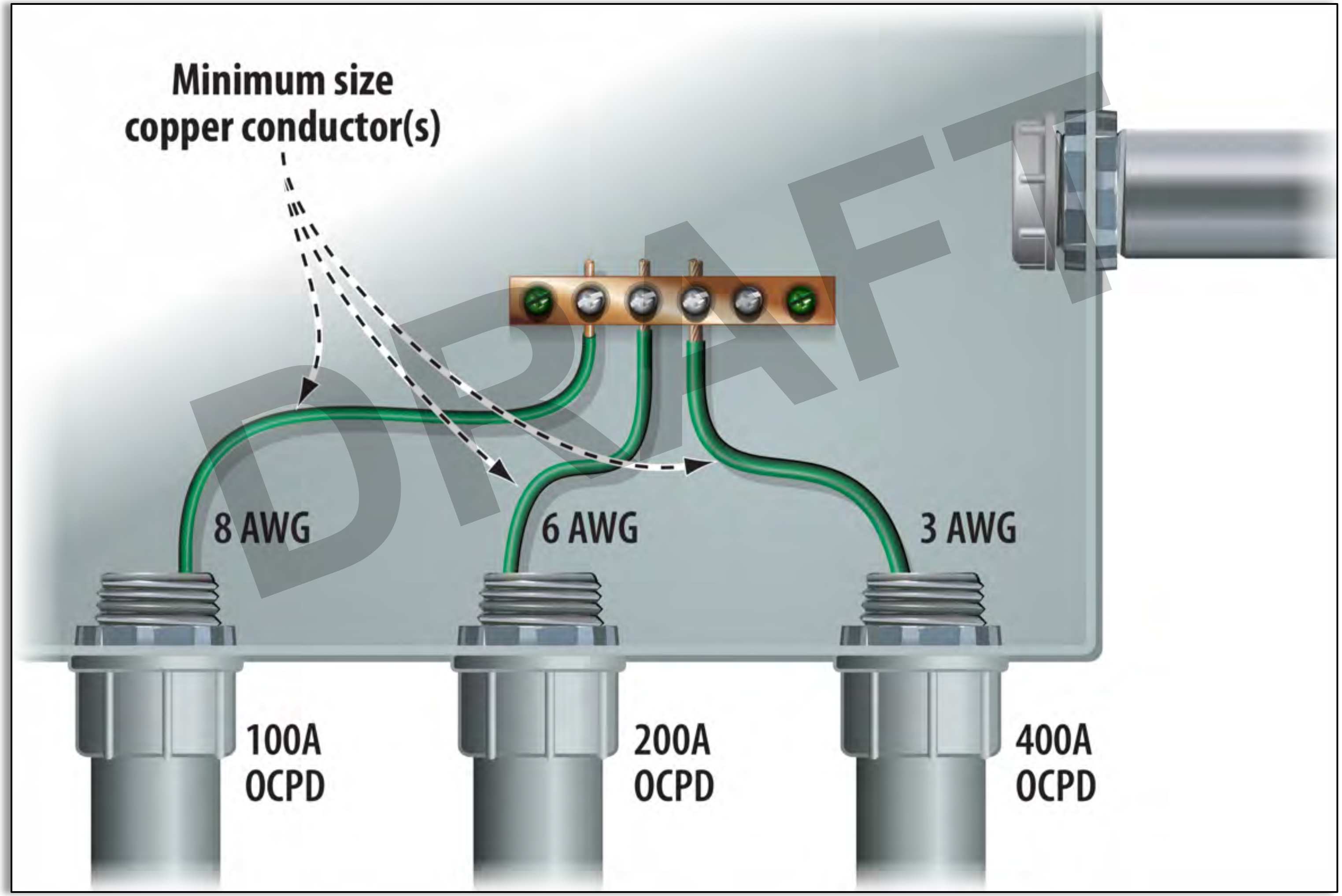
Size of Equipment Grounding Conductors

Change Summary

- Subdivision (B) is revised to clarify that adjustment and/or correction factors do not require an increase in the size of the EGC.
- The new exception to (B) indicates qualified persons shall be permitted to size equipment grounding conductors to provide an effective ground-fault current path.
- EGC sizes for 5000 and 6000 amperes are revised to correlate with Table 8, Chapter 9.

250.122

REVISION



250.134

REVISION

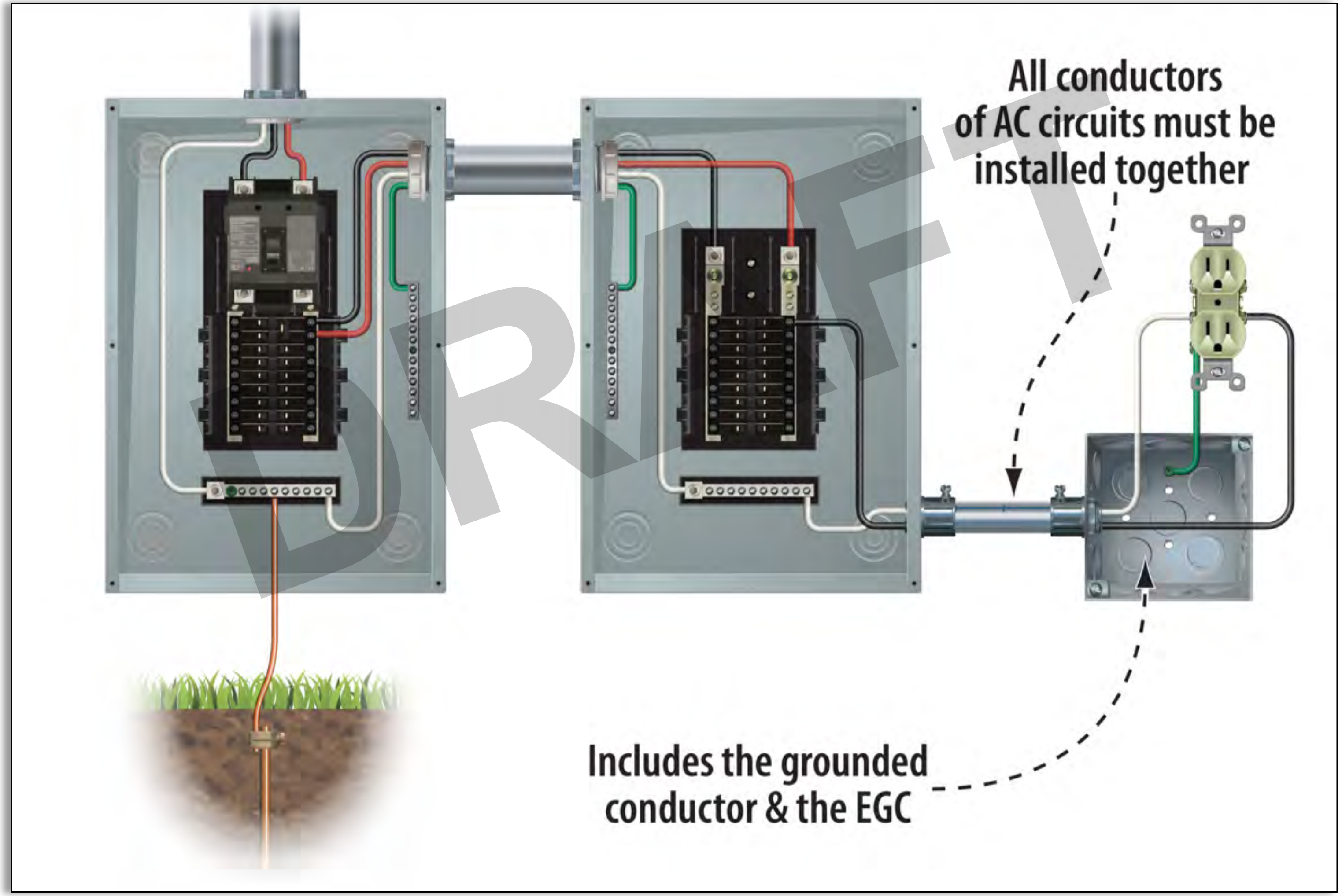
Connections to an Equipment Grounding Conductor

Change Summary

- This section has been rearranged into a list format in accordance with the *NEC Style Manual*.
- Revisions in (2) include the words “of the wire type” and “contained within the same” for clarification.
- Informational Note No. 2 now includes both flexible cords and flexible cables.

250.134

REVISION



250.136

REVISION

Equipment Secured to Grounded Metal Supports

Change Summary

- The title of this section has been revised to “Equipment Secured to Grounded Metal Supports.”
- Text was added to clarify that the metal rack or structure must be connected to an equipment grounding conductor of the circuit.
- Former Subdivision (B) has been deleted as it is redundant to the equipment grounding conductor requirements in Part IX of Article 620 covering elevators.

250.136

REVISION

250.142

REVISION / DELETION

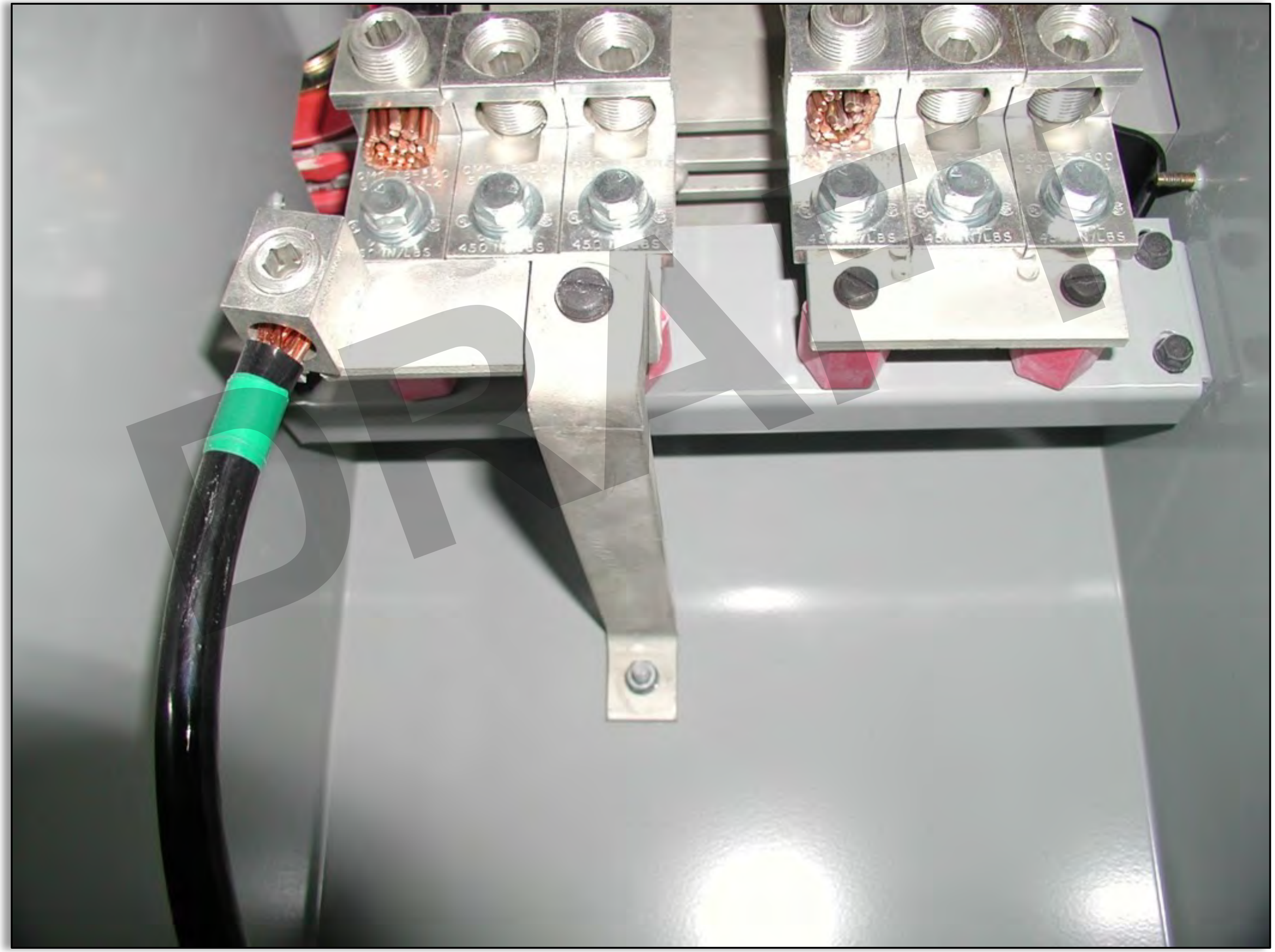
Line- and Load-Side Equipment Grounding

Change Summary

- This section has been revised to be consistent with the use of defined *grounding* and *bonding* terms.
- A new item has been added to (A), which recognizes the grounded conductor for grounding in a supply-side disconnect application that is not at the service.
- Exception No. 3 to 250.142(B) has been removed.

250.142

REVISION / DELETION



250.146

REVISION

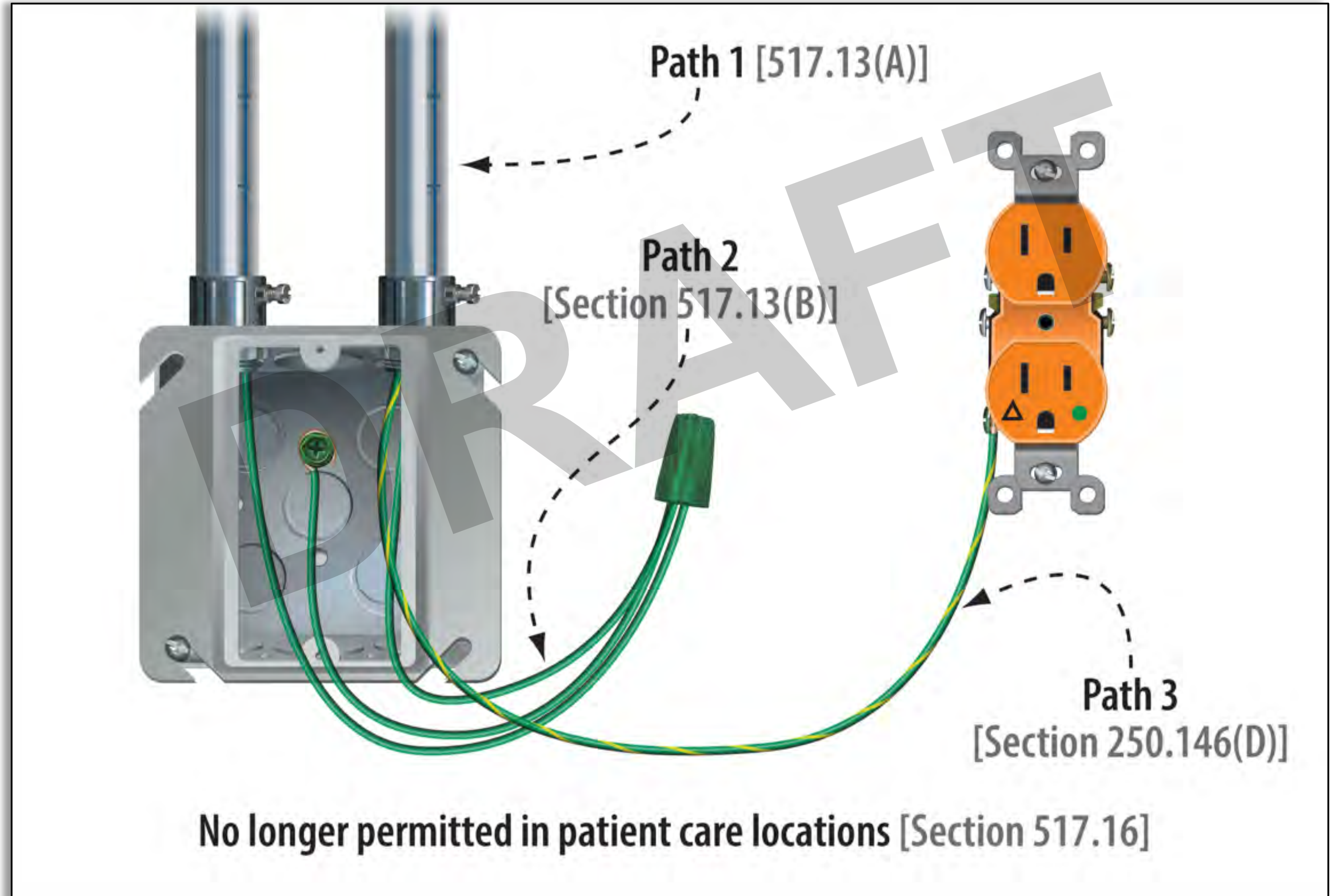
Receptacle Grounding Connections to Grounded Boxes

Change Summary

- The phrase “the provisions of” has been removed as part of a global revision in the NEC.
- The title of Section 250.146 has been changed to remove the word “box” and replace it with the term *equipment grounding conductor*.
- The revised text provides clarification about the metal box that is connected to an EGC.

250.146

REVISION



250.148

REVISION

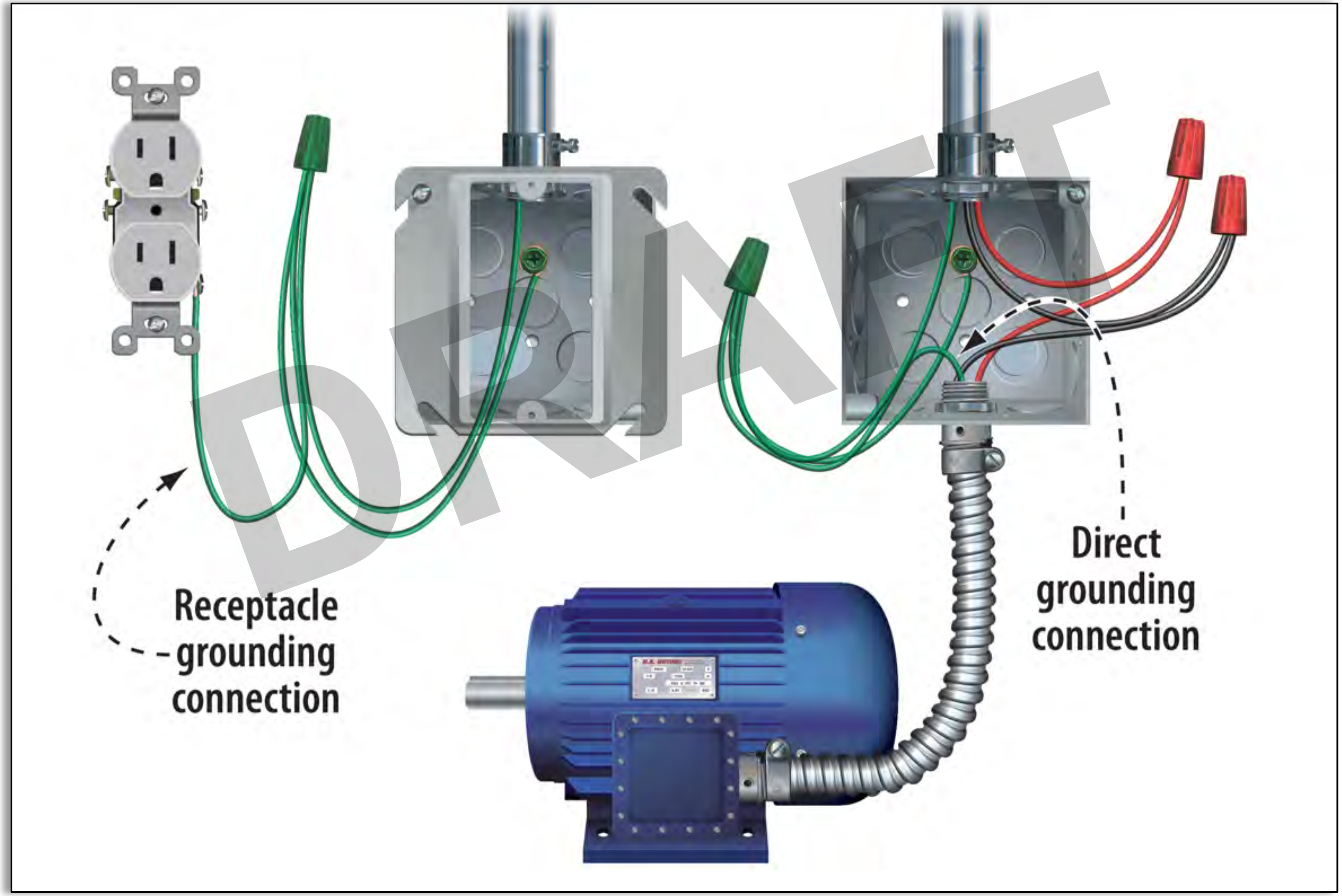
Continuity of EGCs and Attachment in Metal Boxes

Change Summary

- The title of this section has been revised by replacing the word “to” with the word “in.”
- This section has been revised to restore the words “associated with any of those circuit conductors” that appeared in the 2014 *NEC*.
- Subdivision (E) has been deleted as the restrictions related to soldered connections is covered in 250.8.

250.148

REVISION



250.184(A)(1) & (C) Exception

REVISION

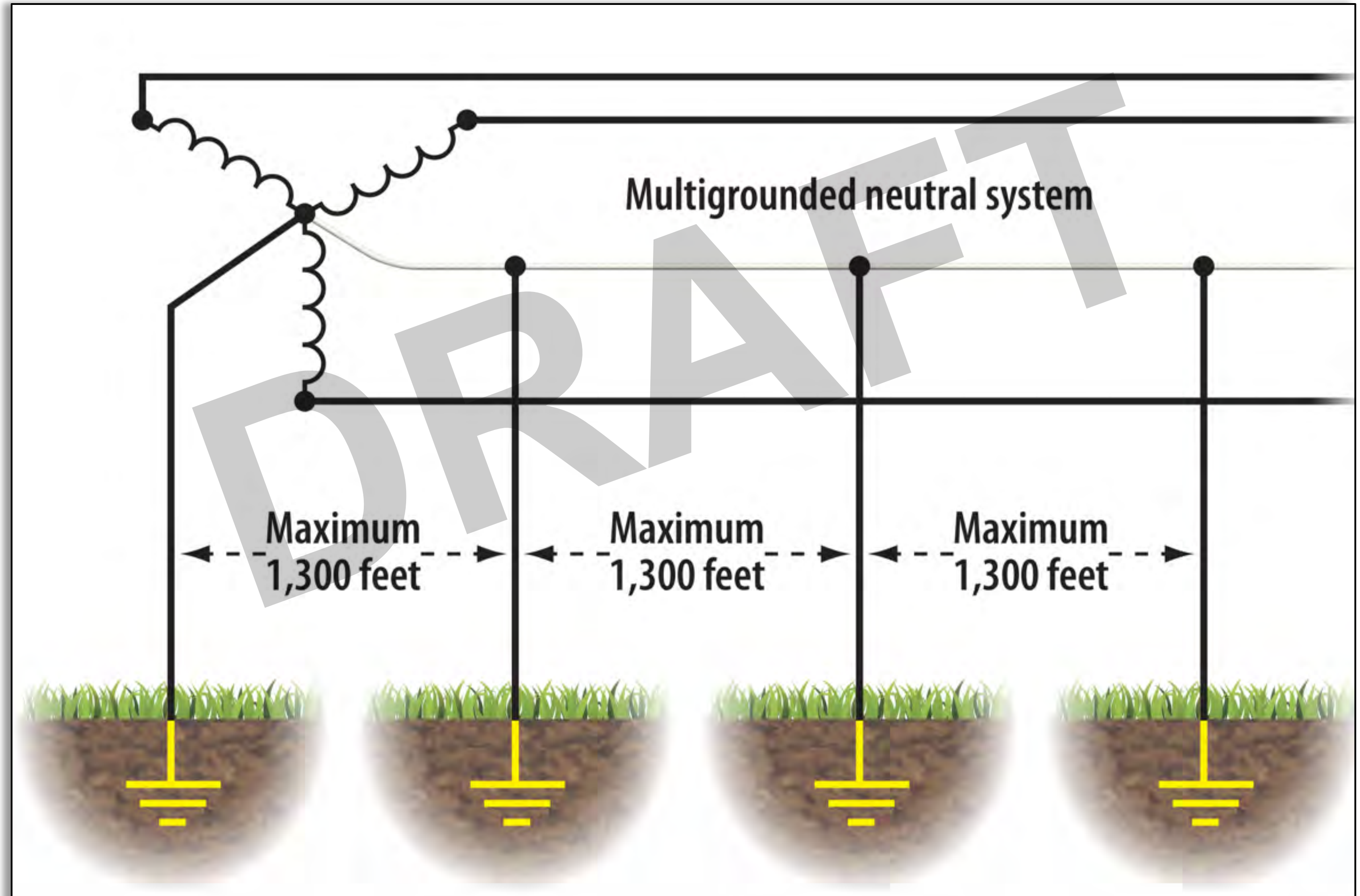
Multipoint Grounded Neutral Systems

Change Summary

- Exception No. 1 to 250.184(A)(1) has been revised to remove the word “bare” and add the text “For multigrounded neutral systems as permitted in 250.184(C), bare…” (See NEC text).
- A new exception to 250.184(C) relaxes the distance requirement if the only purpose is to remove the cable sheath to make a grounding electrode connection.

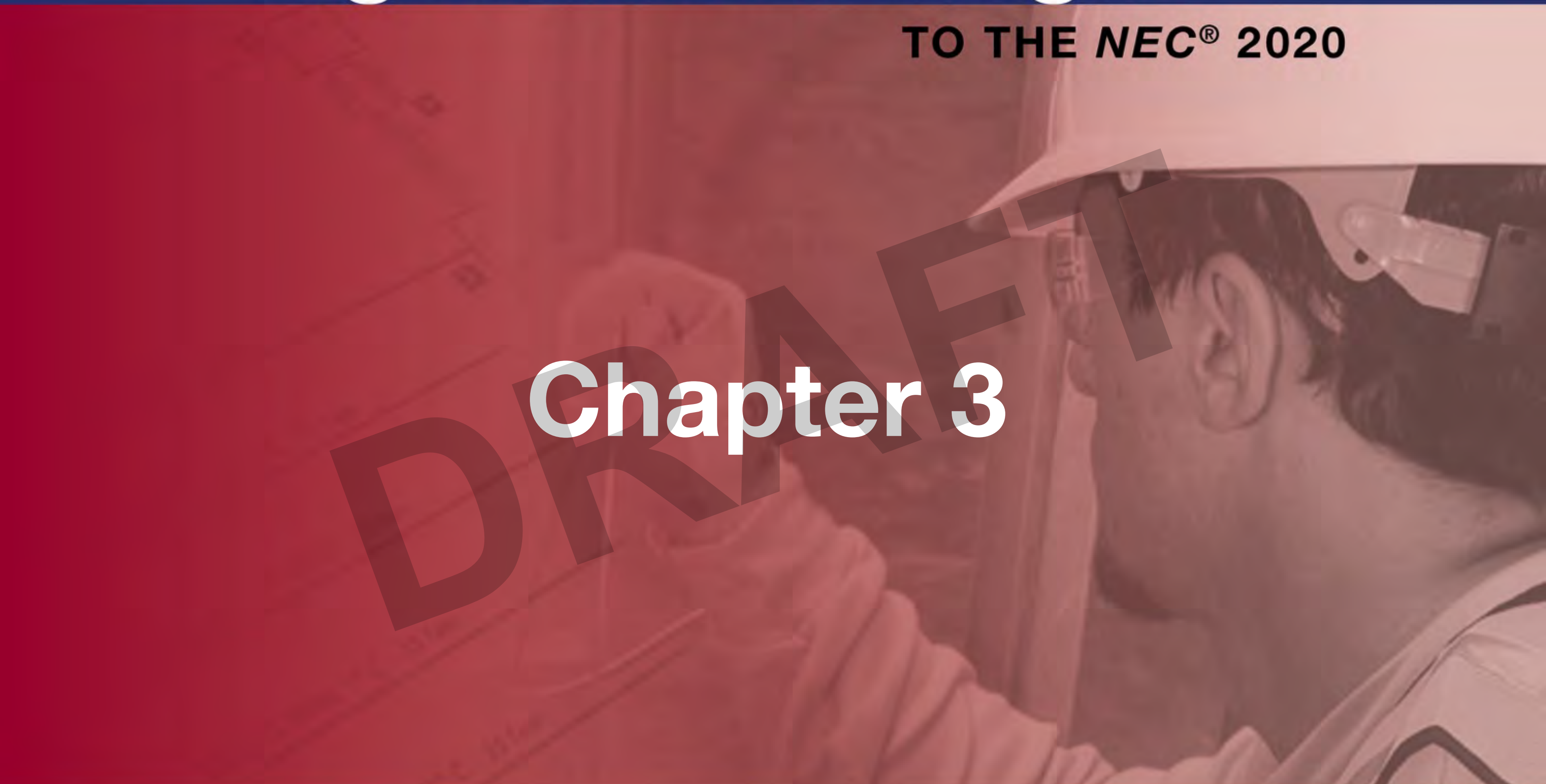
250.184(A)(1) & (C) Exception

REVISION



Significant Changes

TO THE *NEC*® 2020



Chapter 3

electrical training ALLIANCE IBEW - NECA IN COLLABORATION WITH NECA NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

300.3(B)(1)

REVISION

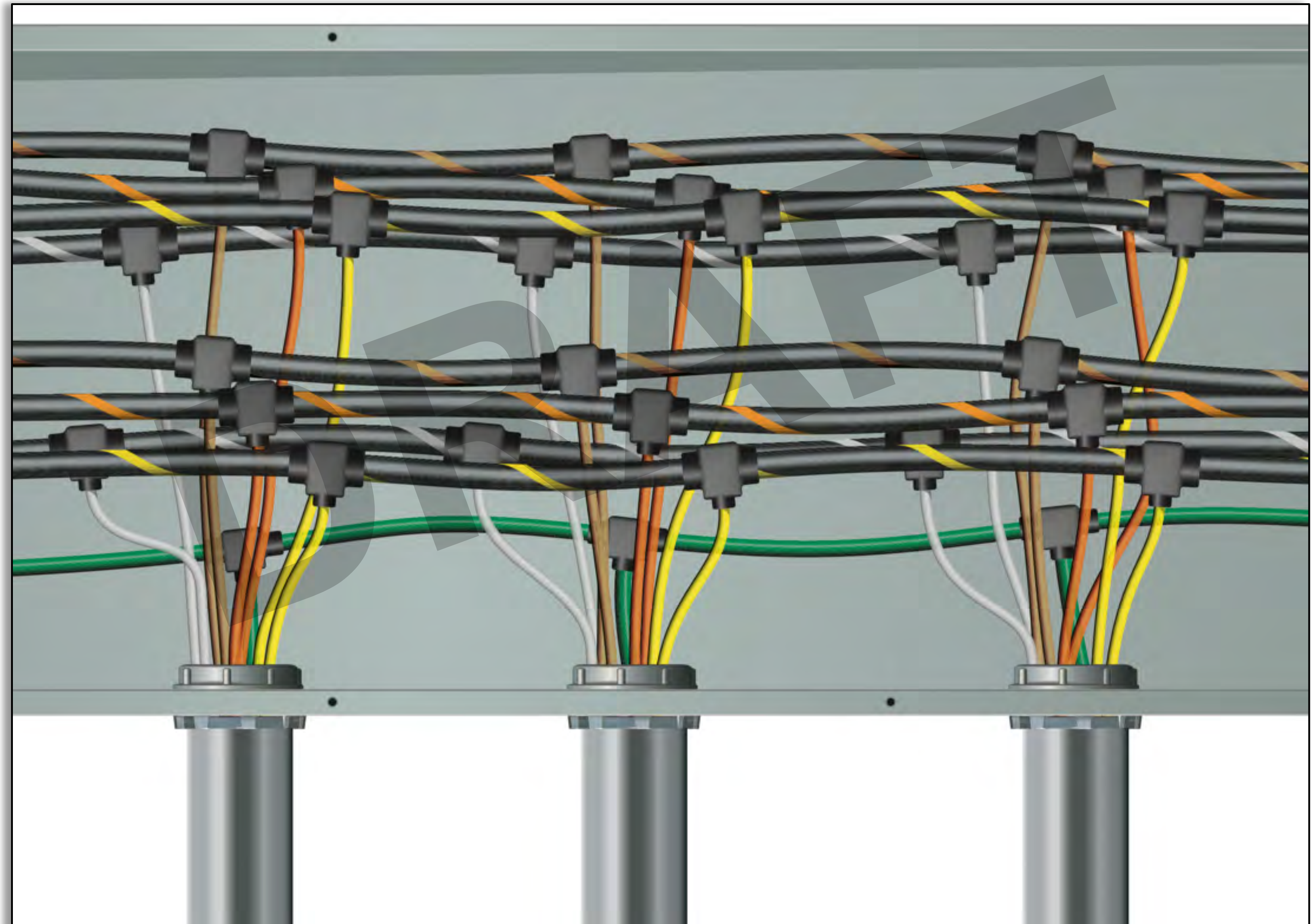
Conductors, Paralleled Installations

Change Summary

- 300.3(B)(1) is modified to require connections, taps or extensions from paralleled conductors be made in a manner to equalize the current.
- This revision attempts to provide additional clarity for the termination of and tapping from paralleled conductors.
- 310.10(H) does not address potential misapplication of connections to paralleled conductors.

300.3(B)(1)

REVISION



300.4(G)

REVISION

Protection Against Physical Damage, Fittings

Change Summary

- 300.4(G) is modified to recognize multiple methods for fittings to provide protection in positive text.
- Physical protection is required, not insulation. New list items are added.
- The exception is deleted and rolled into new list item (3).

300.4(G)

REVISION

300.7(A)

REVISION

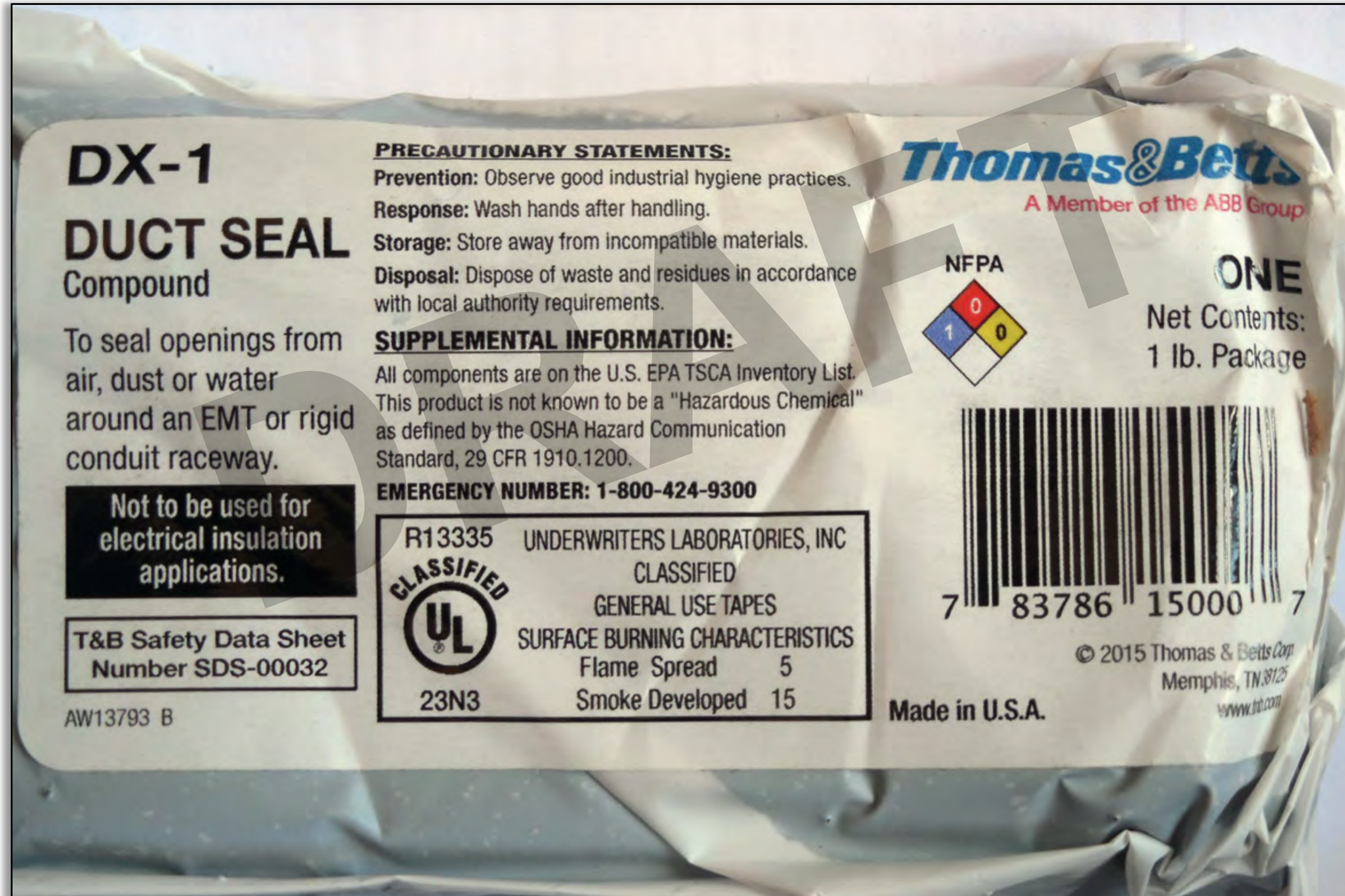
Raceways Exposed… Temperatures, Sealing

Change Summary

- 300.7(A) is revised to correlate with 225.27.
- Products used to seal raceways or sleeves must be identified for the use.
- Compatibility with the cable/conductor insulation, bare conductor, shield or other component is required.

300.7(A)

REVISION



Courtesy of ABB

300.25

NEW

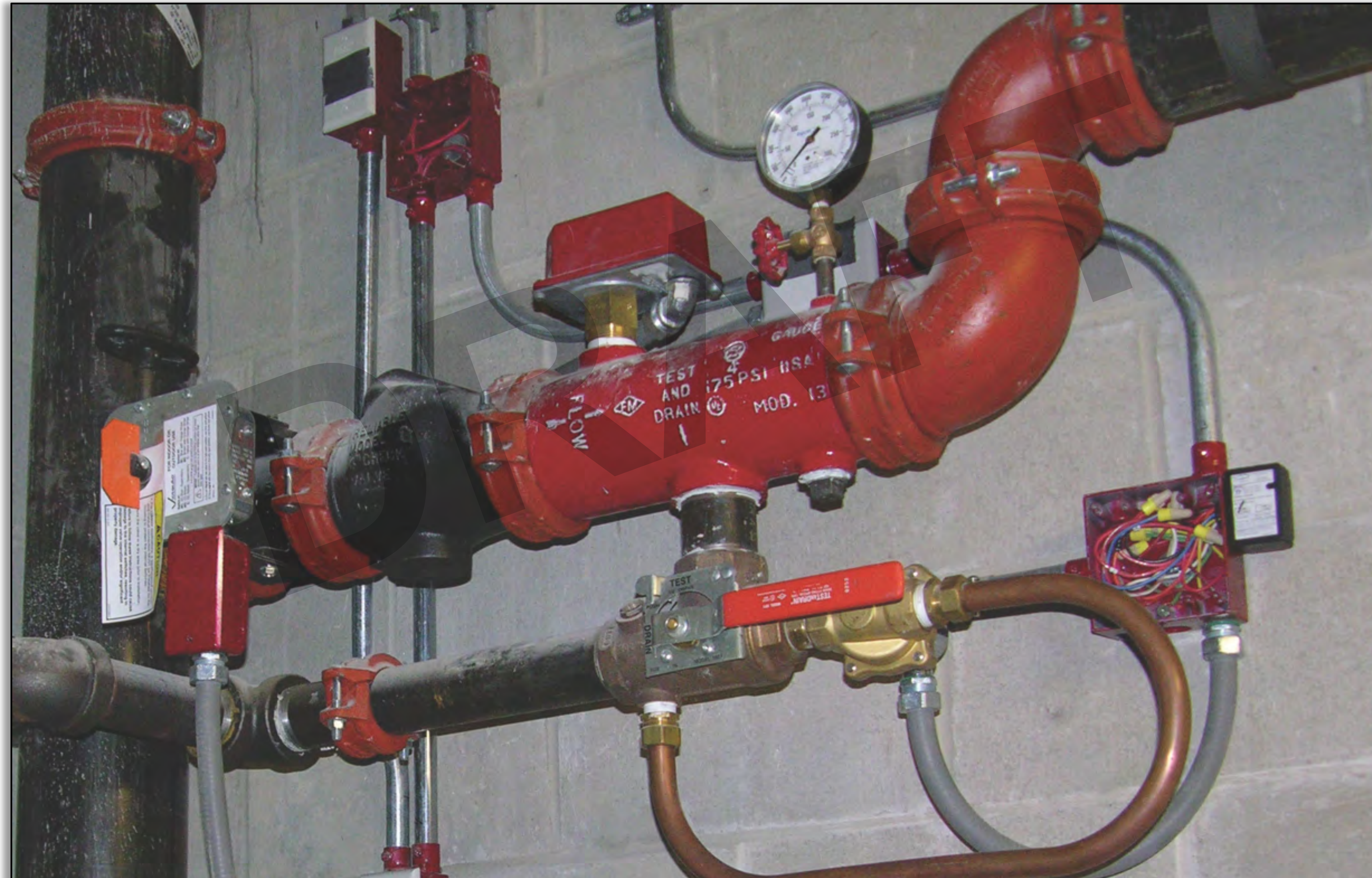
Exit Enclosures (Stair Towers)

Change Summary

- New section 300.25 addresses the installation of wiring methods in stair towers.
- Only wiring methods serving equipment permitted by the AHJ are permitted.
- This new section correlates with existing requirements in *NFPA 101, the Life Safety Code.*

300.25

NEW



310.1 & 310.3

NEW

Article Scope and Conductors

Change Summary

- The scope of article 310 is now limited to not more than 2000 volts.
- Requirements and ampacity tables for conductors over 2000 volts are relocated into new Article 311.
- Copper clad aluminum (CCA) conductors must meet the material requirements of the definition in Article 100.

310.1 & 310.3

NEW

310.12

RELOCATE

Single-Phase Dwelling Services and Feeders

Change Summary

- Previous requirements of 310.15(B)(7) are relocated into new section 310.12.
- The existing table in Annex D, previously located in 310.15(B)(7) is reinserted as Table 310.12.
- Table 310.12 is permitted to be applied where no ampacity adjustment or correction factors are required.

310.12

RELOCATE

310.14 & 310.15

RELOCATE NEW

Ampacity Tables

Change Summary

- Previous requirements in 310.15(A)(1) through (A)(3) are relocated into new 310.14.
- Under engineering supervision interpolation of the conductor, ampacities are permitted.
- 310.15(A) is modified to require that conductor ampacity complies with 310.15(A) through (F) and 310.12.

310.14 & 310.15

RELOCATE NEW

310.15(B) & (C)

NEW / REVISION / RELOCATE

Ambient Temperature Correction/Adjustment Factors

Change Summary

- Requirements for ambient temperature correction factors are completely reorganized.
- Six new sections are added to correlate with remaining ampacity tables.
- Revised structure increases clarity and usability.

310.15(B) & (C)

NEW / REVISION / RELOCATE

Article 311

NEW

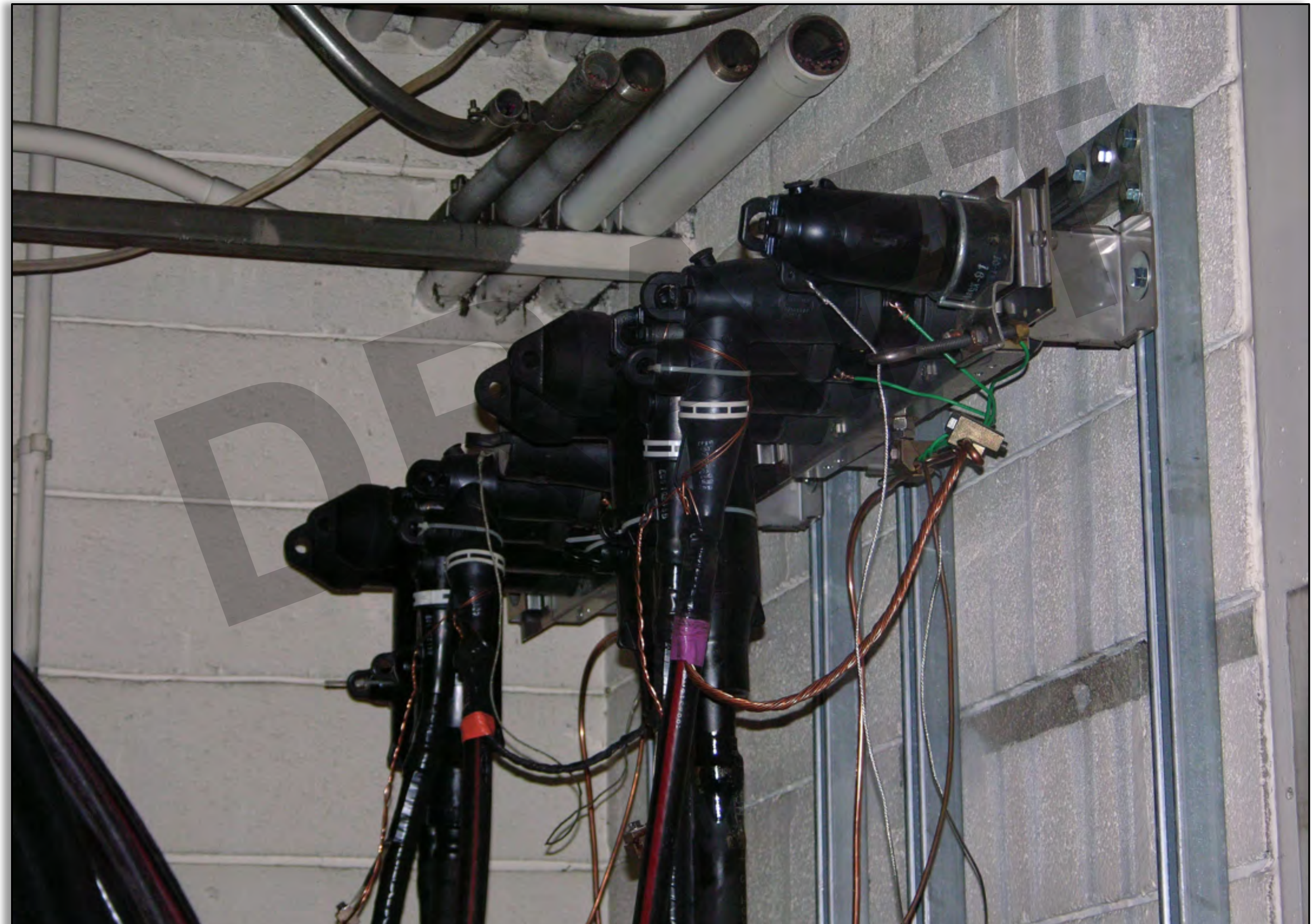
Article 311 Medium Voltage Conductors and Cable

Change Summary

- New Article 311 is added to cover the use, installation, construction specifications, and ampacities for Type MV medium voltage conductors and cable.
- Article 328 for MV cable is deleted.
- Requirements for conductors rated over 2000 volts are removed from Article 310 into 311.

Article 311

NEW



312.8(B)

REVISION

Power Monitoring or Energy Management Equipment

Change Summary

- 312.8(B) now addresses both power monitoring and energy management systems.
- New requirements are added for conductors used exclusively for control or instrumentation circuits.
- Existing requirements are separated into subdivisions for clarity.

312.8(B)

REVISION

Courtesy of Eaton

314.16

REVISION

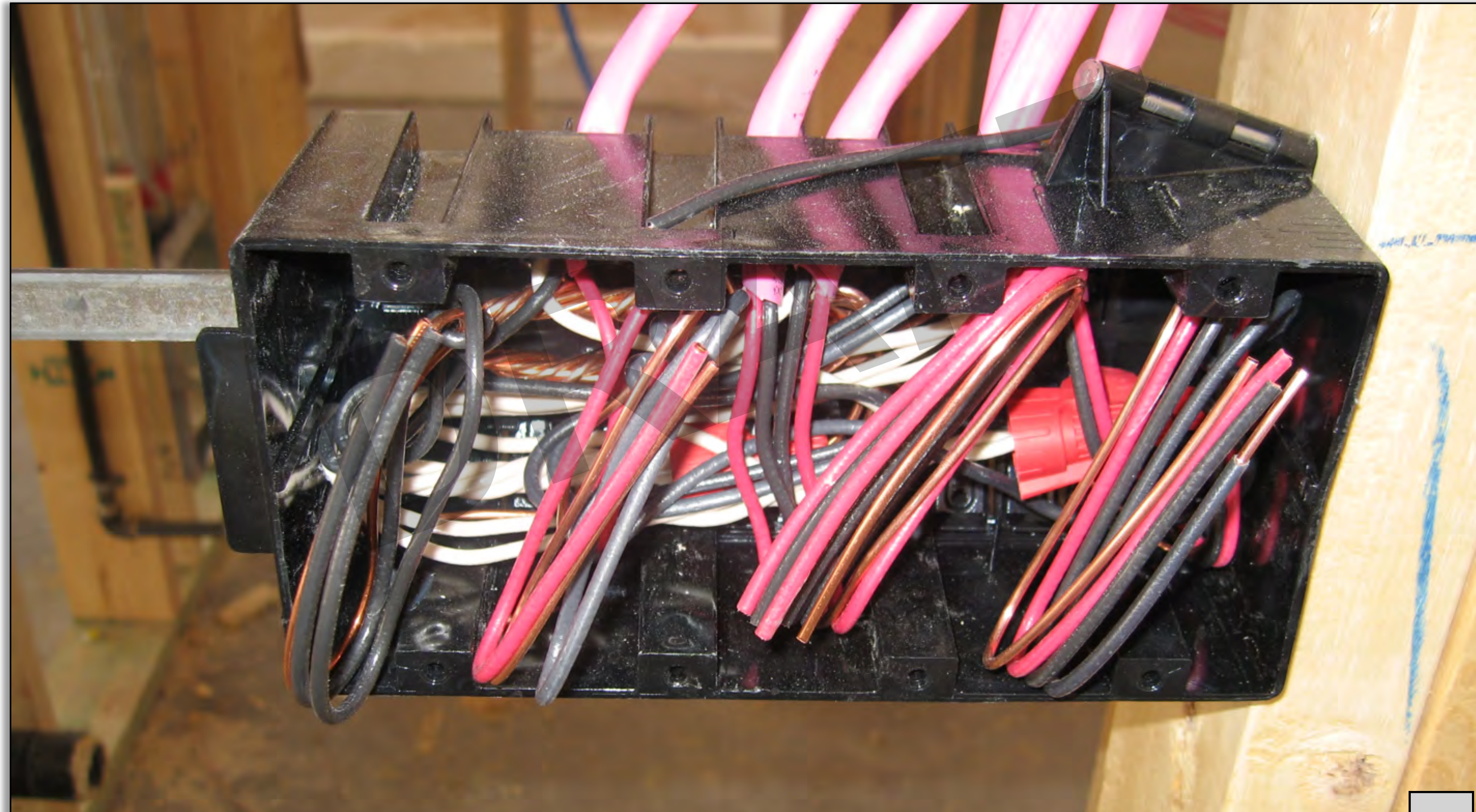
Number of Conductors...Box Volume/Fill

Change Summary

- The single volume allowance for EGCs and EBJs is limited to four of these conductors.
- A ¼ volume allowance based upon the largest EGC or EBJ in the box is added for each EGC or EBJ over four.
- Editorial revisions are made in the parent text and Table 314.16(A).

314.16

REVISION



314.17

REVISION

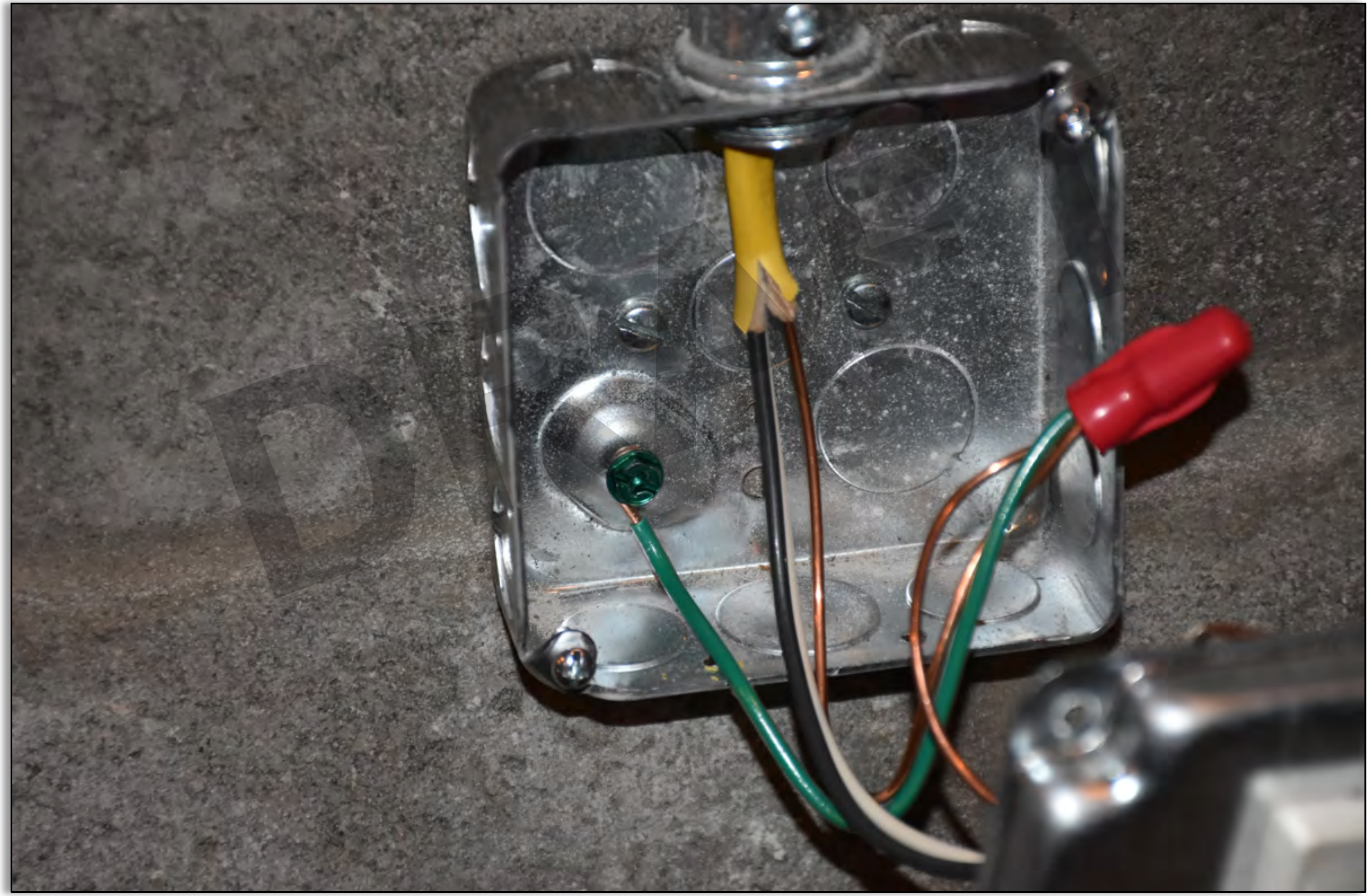
Conductors Entering Boxes, Conduit Bodies, or Fittings

Change Summary

- Openings through which conductors enter must now be closed in a manner *identified* for the application.
- 314.17(B) is retitled as *Boxes and Conduit Bodies* and is separated into four second-level subdivisions.
- 314.17(B)(4) *Temperature Limitation* requires nonmetallic boxes/conduit bodies to be suitable for the lowest temperature rated conductor.

314.17

REVISION



314.27

REVISION

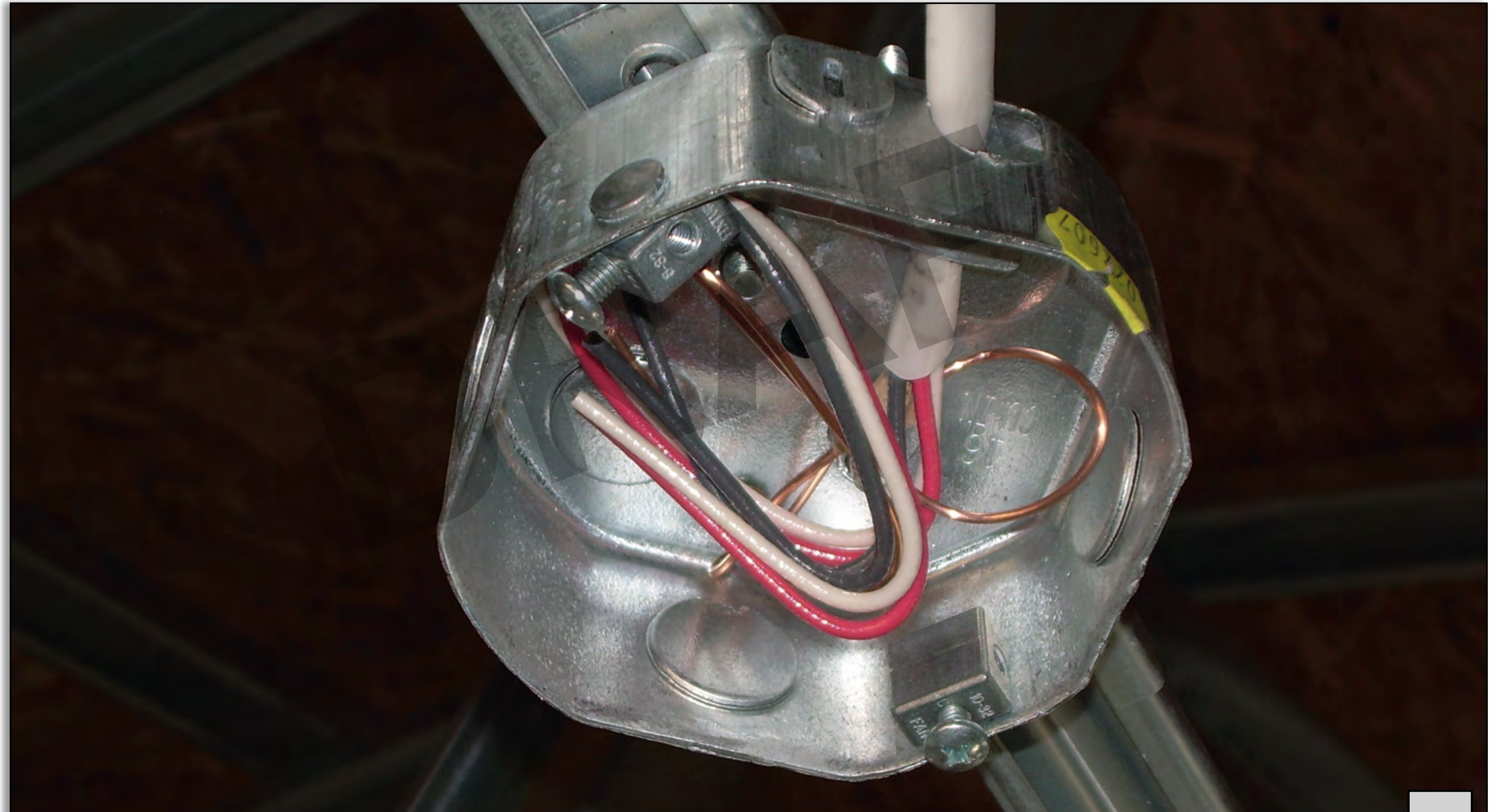
Boxes at Ceiling-Suspended (Paddle) Fan Outlets

Change Summary

- The limitation of this requirement to “where spare, separately switched, ungrounded conductors, are provided to a ceiling-mounted outlet box” is deleted.
- Boxes listed for the sole support of ceiling suspended fans and those providing access to structural framing capable of supporting a ceiling-suspended fan bracket, or equivalent are permitted.

314.27

REVISION



320.80(A), 330.80(C), & 338.10(B)(4)

NEW / REVISION

Ampacity

Change Summary

- New text in 320.80(A), 330.80(C) and 338.10(B)(4) are added to address the installation of more than two cables in thermal insulation.
- Where space is not maintained between cables that are in contact with thermal insulation, caulk, or sealing that foam, capacity must be adjusted in accordance with Table 310.15(C)(1).
- Editorial revisions are made in 330.80(B) to reference tables in new Article 311 MV Conductors and Cables.

320.80(A), 330.80(C), & 338.10(B)(4)

NEW REVISION

330.130

NEW

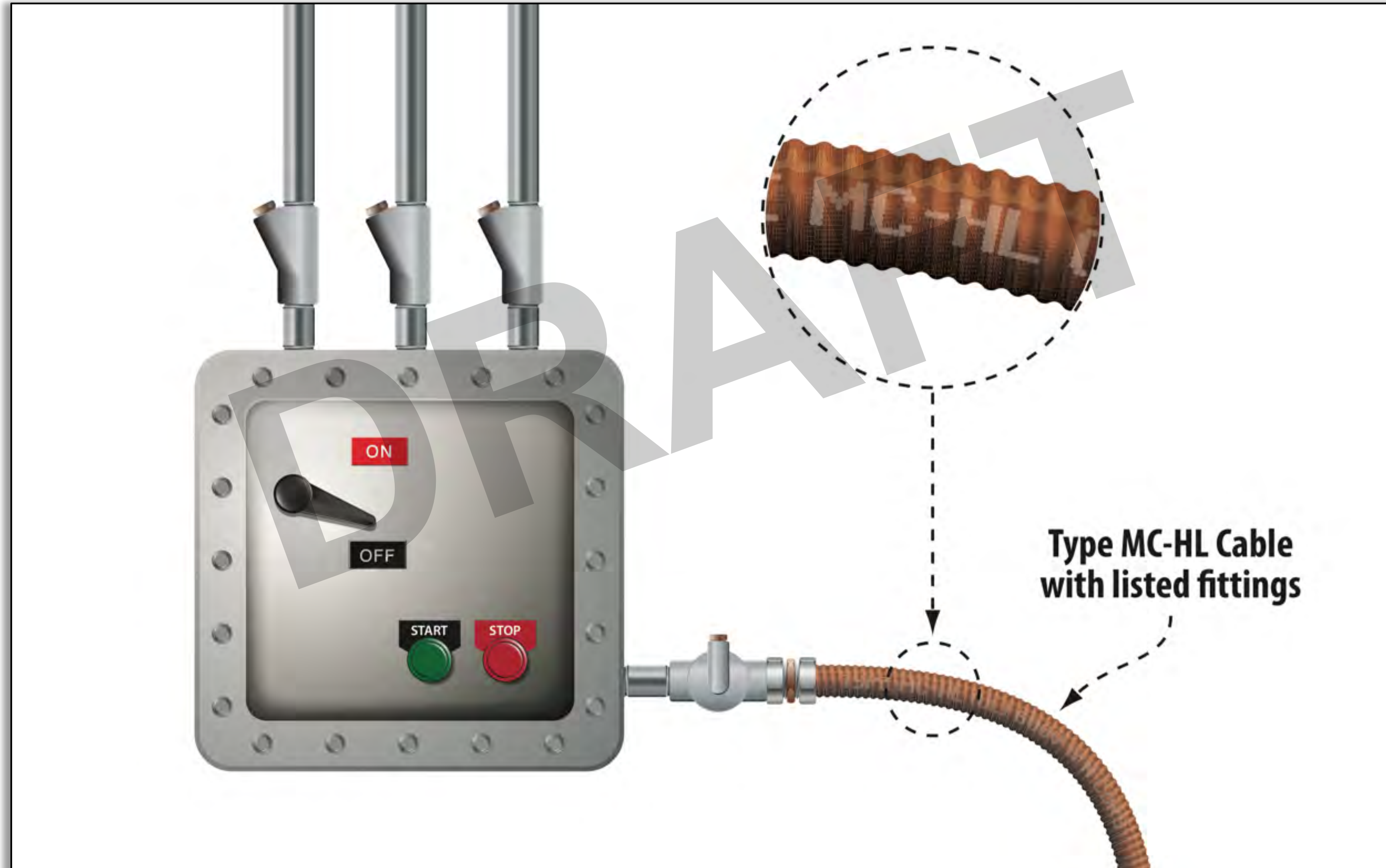
Hazardous (Classified) Locations

Change Summary

- New 330.130 provides construction requirements for Type MC-HL cable.
- Type MC-HL cable is built to the UL Product Category, *Cable for Use in Hazardous Locations, PJPP*.
- Type MC-HL cable is recognized for use in some hazardous location applications.

330.130

NEW


ON
OFF
START
STOP
MC-HL
Type MC-HL Cable
with listed fittings
DRAFT

330.104 & 336.104

REVISION

Conductors

Change Summary

- To address minimum conductor sizes for control and signal conductors, the following revisions are implemented.
- 18 AWG copper, nickel, or nickel-coated copper, 14 AWG copper clad aluminum, and 12 AWG aluminum.
- 14 AWG copper clad aluminum is permitted for only controlling signal conductors.

330.104 & 336.104

REVISION

Courtesy of Copperweld Bimetallics LLC

334.30

REVISION

Securing and Supporting

Change Summary

- New text in 334.30 mandates that the cable length between the cable entry and the closest cable support shall not exceed 18 inches.
- This is necessary where loops are left for future modifications.
- All references to, and requirements for, Type NMS cable are deleted throughout Article 334.

334.30

REVISION

336.10

REVISION

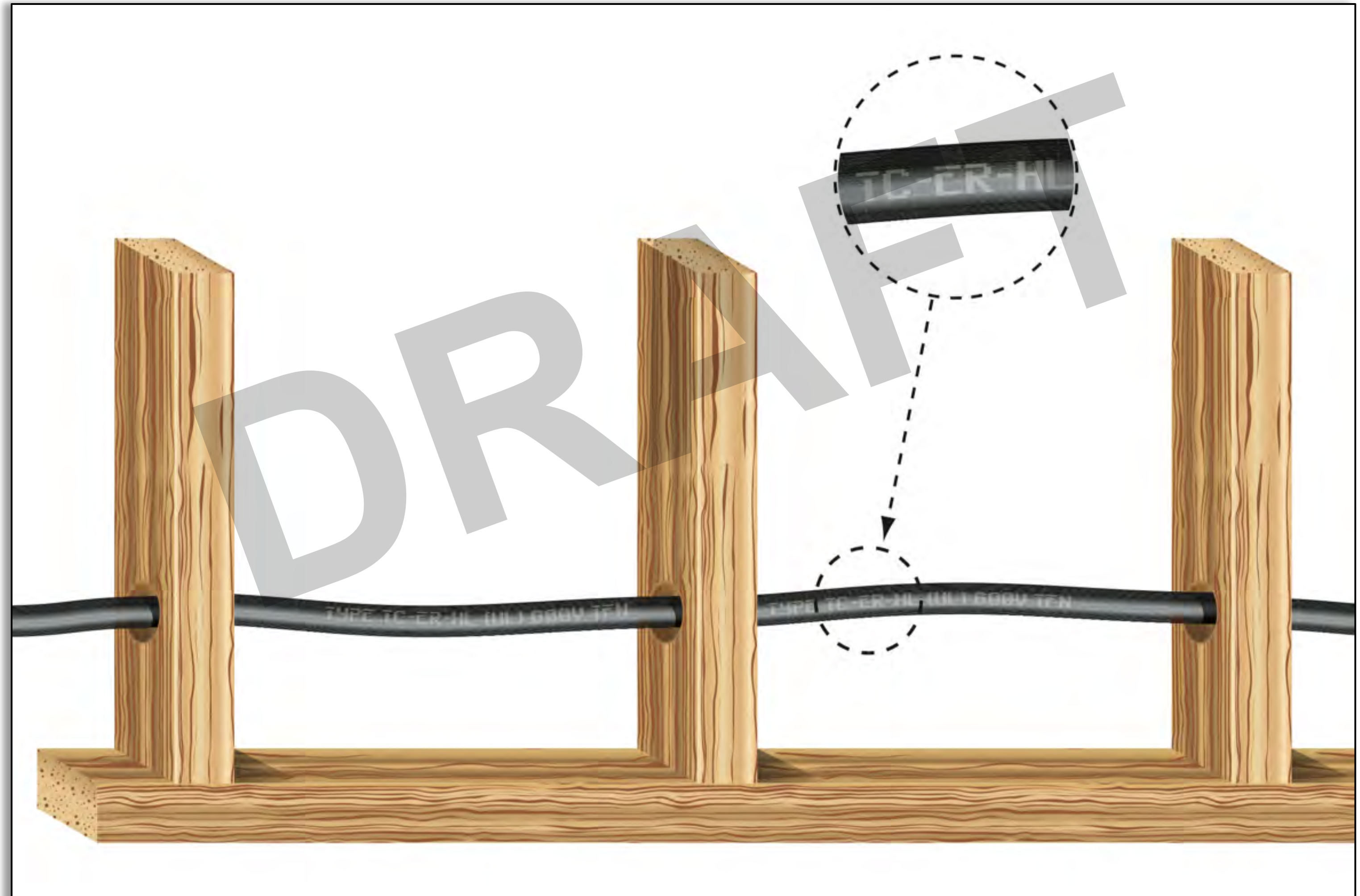
Type TC Cable, Uses Permitted

Change Summary

- Only Type TC-ER-JP cable containing both power and control conductors is permitted in one- and two-family dwelling units.
- Type TC-ER-JP cable installed on the exterior of a dwelling unit must comply with Part II of Article 340.
- Type TC cable is now permitted in hazardous locations where specifically referenced elsewhere in the *Code*.

336.10

REVISION



336.130

REVISION

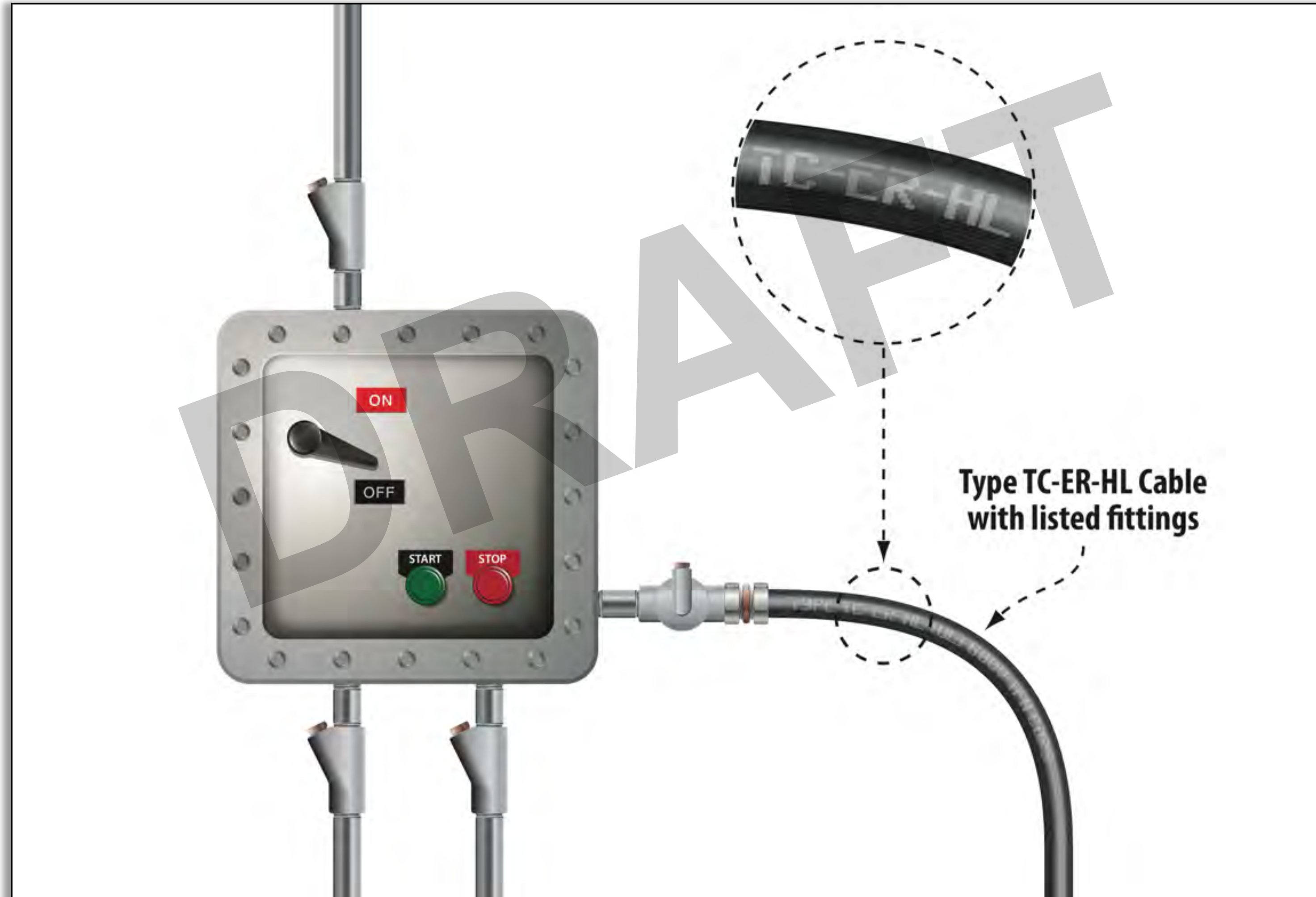
Hazardous (Classified) Location Cable

Change Summary

- New construction requirements for Type TC-ER-HL are added to correlate with 336.10(11).
- The use of Type TC-ER-HL in hazardous locations has been expanded.
- TC-ER-HL cable larger than 1 inch in diameter must meet additional requirements.

336.130

REVISION



Article 337

NEW

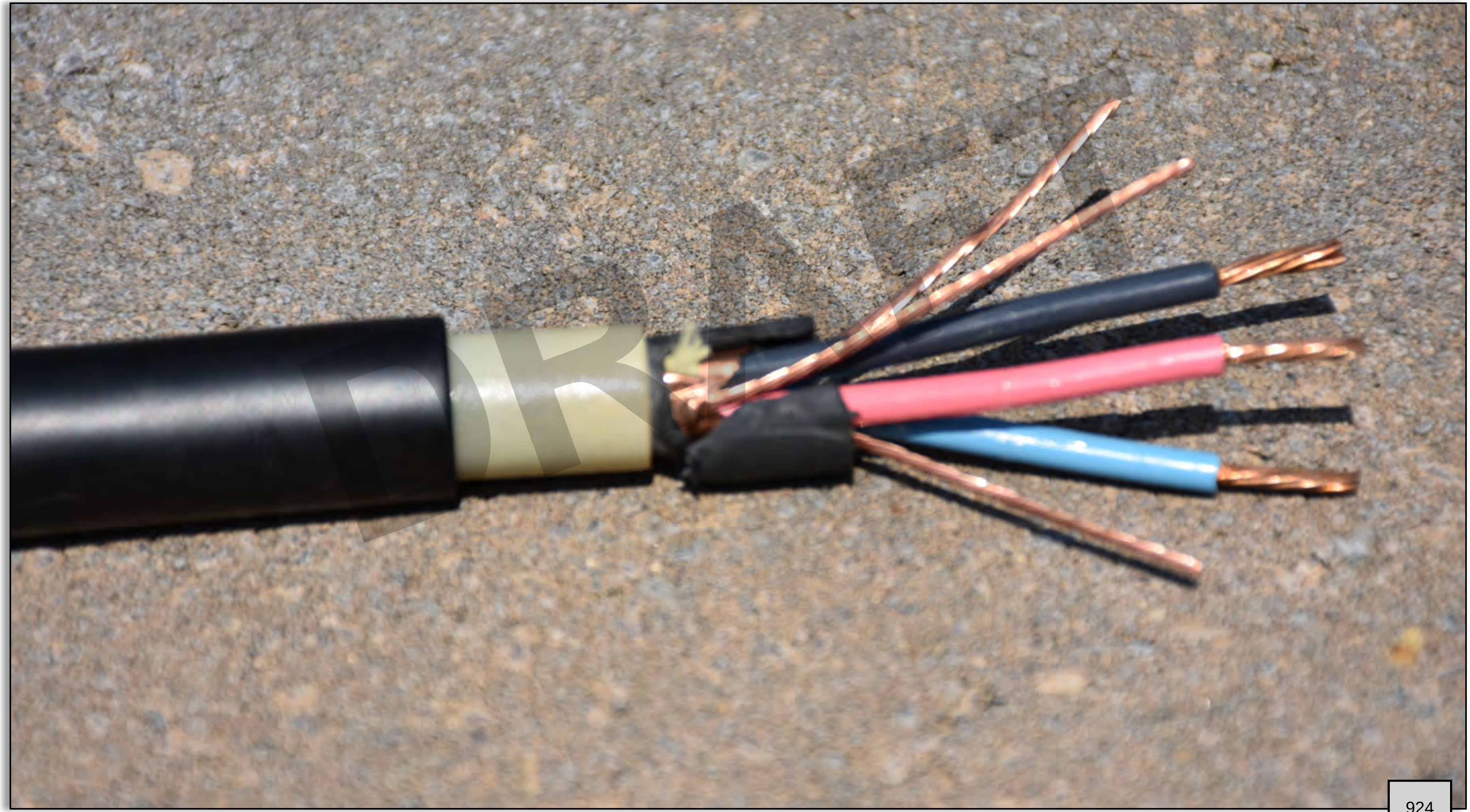
Type P Cable

Change Summary

- New Article 337 now permits the installation of Type P cable (marine shipboard cable).
- Type P cable has been used in land-based oil and gas rigs for over four decades.
- Type P cable is limited to industrial installations and hazardous locations.

Article 337

NEW



338.2 & 338.100

NEW / **REVISION**

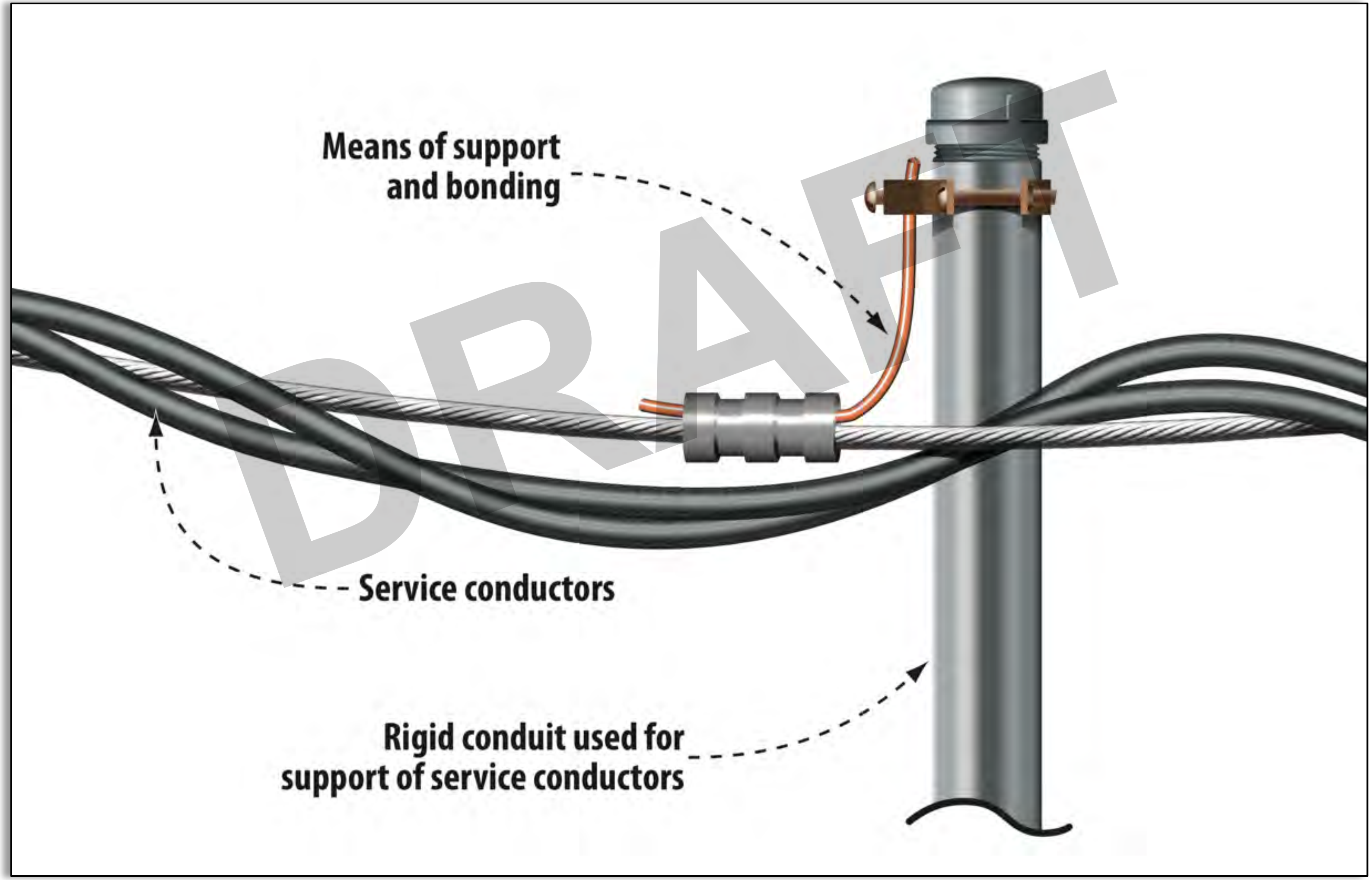
Service Entrance Conductor Assembly

Change Summary

- A new definition of "Service Entrance Conductor Assembly" is added to 338.2.
- This definition is necessary to address assemblies of single insulated USE conductors.
- Construction requirements are modified to recognize service entrance conductor assemblies.

338.2 & 338.100

NEW / REVISION



342.10(E), 344.10(E), & 358.10(E)

NEW

Physical Damage and Severe Physical Damage

Change Summary

- Physical damage is now specifically addressed in the XXX.10(E) sections for IMC, RMC, and EMT.
- IMC and RMC are permitted to be installed in areas subject to severe physical damage.
- EMT is permitted to be installed in areas subject to physical damage.

342.10(E), 344.10(E), & 358.10(E)

NEW

342.14, 344.14, & 358.14

REVISION

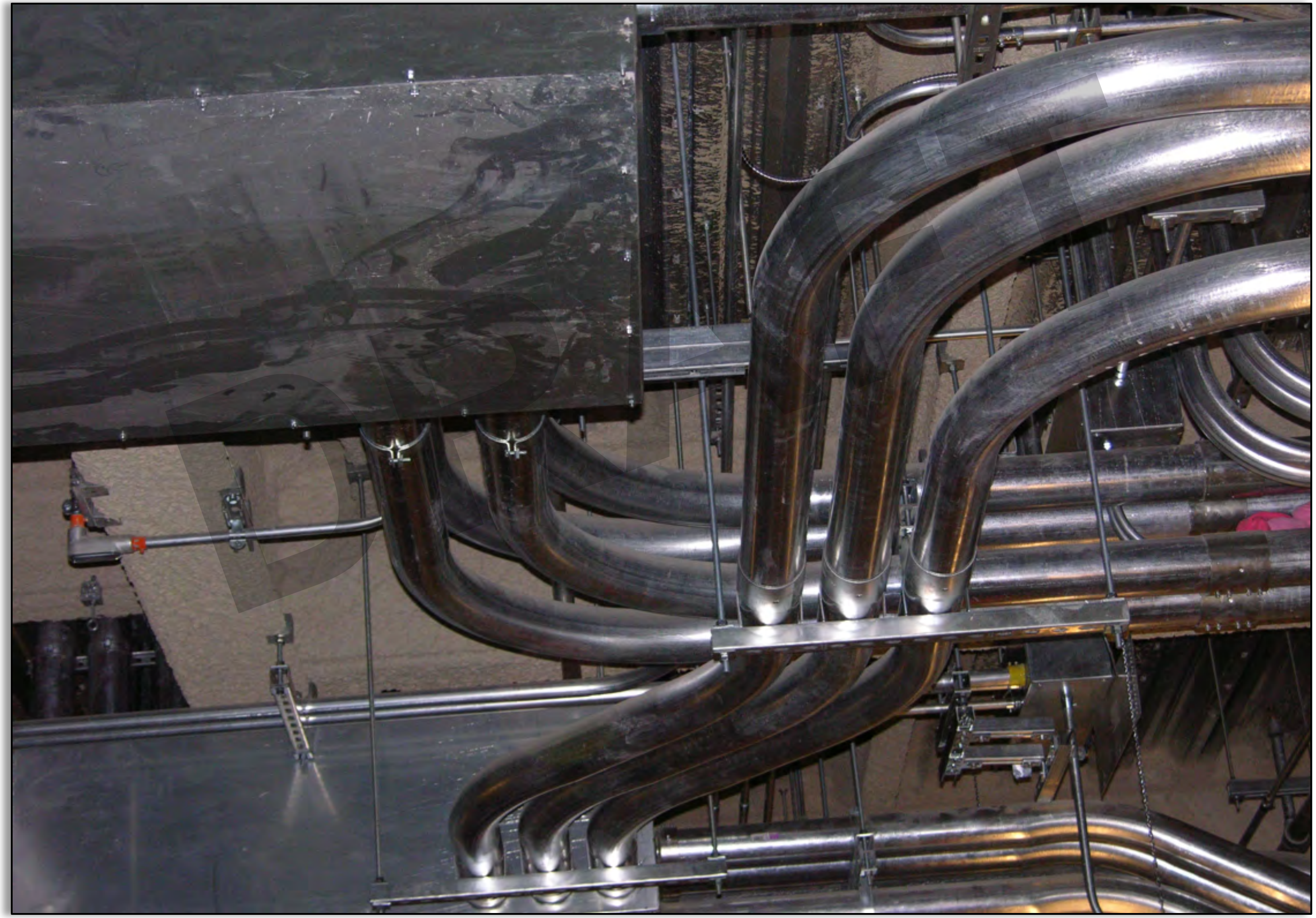
Dissimilar Metals

Change Summary

- Galvanized IMC/RMC/EMT are permitted to be used with stainless steel and aluminum fittings where not subject to severe corrosive influences.
- Stainless steel IMC/RMC/EMT must be installed with stainless fittings, boxes and enclosures.
- Steel boxes and enclosures are permitted where not subject to corrosive influences.

342.14, 344.14, & 358.14

REVISION



930

392.30(B) & 392.44

NEW REVISION

Securing/Supporting and Expansion Splice Plates

Change Summary

- Cable ties used in cable tray must be listed and identified for the application and for securement and support.
- Cable ties for securement and support must have the suffix S, 2S or 21S.
- Expansion splice plates for cable trays are required where necessary, to compensate for thermal expansion and contraction.

392.30(B) & 392.44

NEW REVISION

Courtesy of ABB

392.46

REVISION

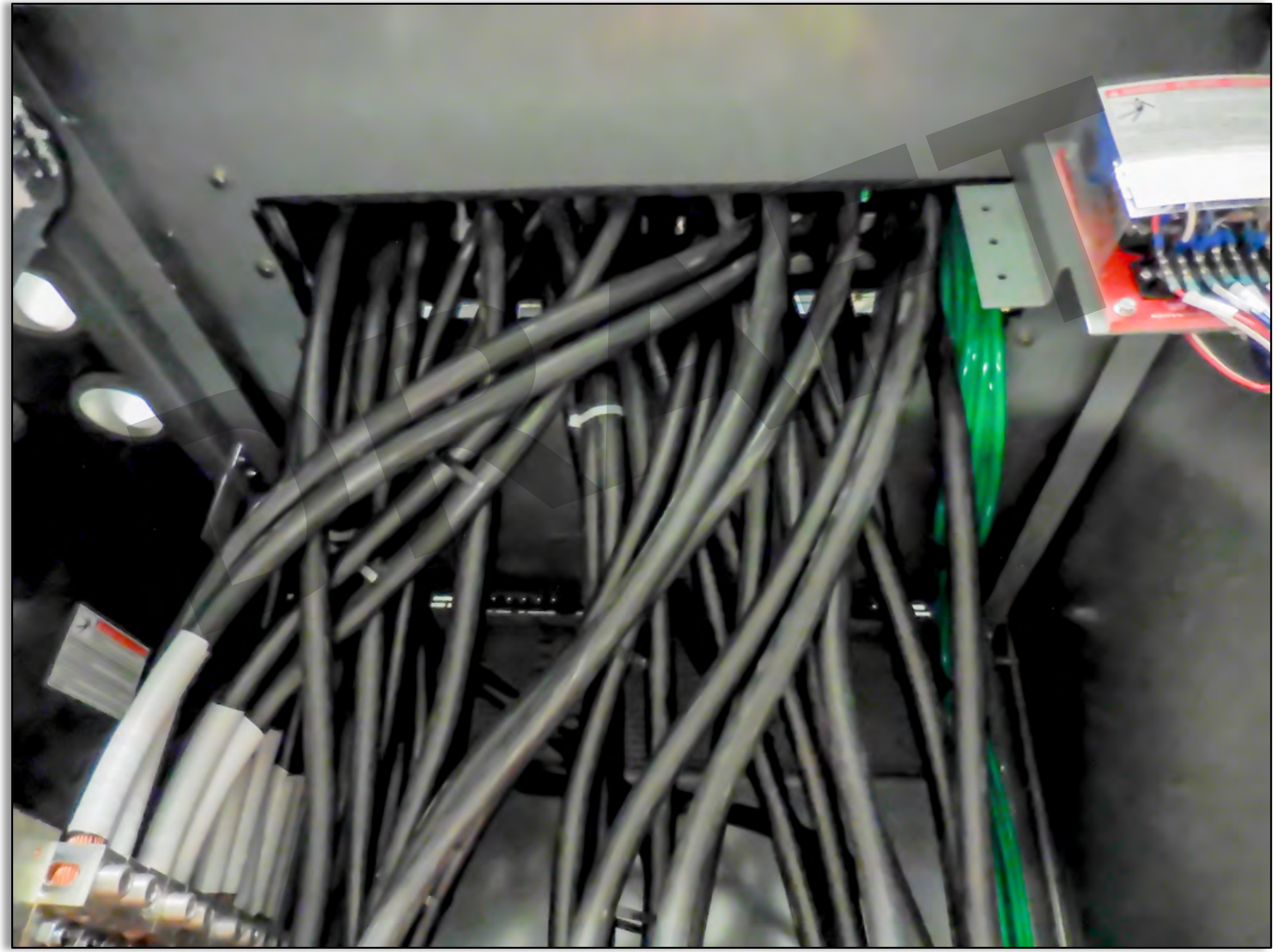
Bushed Conduit and Tubing, Flanged Connections

Change Summary

- 392.46 is separated into first-level subdivisions for clarity.
- Only nonmetallic cables or conductors are permitted to transition through bushed conduit, tubing or flanged connections.
- Conduits, tubing, and flanged connections must be protected from the abrasion and sealed to prevent debris from entering.

392.46

REVISION



Courtesy of Mark Hilbert

Resume of
John K Brown

Purpose:

1) To certify as an OCIEB training instructor for the continuing education requirements for electrical certificate holders in the fields of National Electrical Code, Business, and Technology.

2) To certify as an Ohio Department of Commerce Board of Building Standards training instructor for the continuing education requirements for Electrical Safety Inspector recertification requirements of The National Electrical Code.

Experience :(field related work History)

1) Journeyman Electrician for 38 Years
2) 2007-2013: Foreman/Service Truck/Bucket Truck/Derrick Truck Operator with Roberts Electrical/Service Group. Traveled in Ohio and Penn., W.V., Kentucky, Indiana, Michigan, South Carolina, Texas, N.M., Arizona, Nevada working on Generator, Fire Alarm, Temp. Control Projects @ ATT facilities and for Fed Ex @ airport ramp facilities.
3) 1997-2006: Foreman/Service Truck/Various Projects with Century Electric, Inc. Supervised upgrades @ Cooper Stadium, Musco Lighting @ Marysville High School Stadium.
4) 1992-1996: Foreman/Service Truck/Bucket Truck Operator with MGM Electric Supervised installation of Electrical Projects @ Timken Railroad Bearing Plant
5) 1986-1991: Foreman/Service Truck/Bucket Truck/Digger Derrick Truck Operator with American Line Construction Supervised installation of Electrical Projects @ Timken Railroad Bearing Plant, Tornado Siren upgrades for Franklin County EMA.
6) 1976 – 1985: Worked on and was job Foreman on numerous electrical projects in the Columbus Ohio area

Experience: (educational instructor)

Education

1) 1976-1980: Electrical Apprenticeship program for International Brotherhood of Electrical workers
2) 1984- Present: Numerous National Electrical Code, Business, and technology courses that were needed to maintain Electrical Safety Inspector certification, and City of Columbus and State Contractor license
3) 1970-1972: Columbus Technical Institute-Associate Degree-Accounting

Licenses:

1) Electrical Safety Inspector (Ohio Certificate # 2362)
2) OCIEB Electrical Contractor License (State ID#21522)
3) Fire Alarms / Detection certification(Ohio State Fire Marshall Certificate #54.25.0227)
4) Electrician-West Virginia (WV #J447957REOH1208)

Professional Organizations :

1) International Brotherhood of Electrical Workers
2) Columbus Joint Apprenticeship and Training for the Electrical Industry.

John K. Brown

File Attachments for Item:

ER-17 Significant Changes to the 2020 NEC, Part B (Electrical Trades Center)

ESI, BI (10 hours in 3 sessions)

Staff Notes: Recommend approval, add BO, MPE, EPE, RBO, RPE

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: Trent Parker
(Contact Name)

Organization: The Electrical Trades Center
(Organization/Company)

Address: 947 Goodale Blvd.
(Include Room Number, Suite, etc.)

City: Columbus State: Ohio Zip: 43212

E-Mail: parker@electricaltrades.org

Telephone: 614-463-5282 Fax: 614-463-5252

Course Sponsor: The Electrical Trades Center

COURSE INFORMATION:

Course Title: Significant Changes to the 2020 NEC; Part B

New Course Submittal: [x] Update Course: [ ] Prior Approval Number:

Purpose and Objective: This course will focus on the code wide changes to the 2020 NEC and specifically the changes in Chapters 4-5.

Number of Instructional Contact Hours that can be obtained upon completion: 10

If Multi-Session, Number of Instructional Contact Hours Per Session: 3.5, 3.5, 3

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 [x]
- 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: 947 Goodale Blvd. Columbus, OH 43212 Date(s) of ESI Course(s): NOV 9,11, and 16 of 2020

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.

10 hour Code Update A

Syllabus

Course Description: This extensive and popular program analyzes the major changes to the *NEC*. Members of the twenty code-making panels contributed to the development of the authoritative text, which covers more than 400 of the most significant changes and includes interpretations by the group that enforces the *NEC*. This comprehensive course will provide users a solid understanding and application of the requirements contained in the 2020 NEC.

The course is presented using PowerPoint presentations and interactive group discussions. The course explores the most important changes to the first 3 chapters of the NEC.

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Prerequisite: None

Required Material: 2020 NEC
Significant Changes to the NEC-2020 PPT

Course Outline:

Significant Changes to the NEC 2020 Part A

Day 1

Entire Code, Code Wide Changes
Chapter 1: General, Articles 90 - 110

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Significant Changes

TO THE *NEC*® 2020

Code-Wide Revisions and Chapter 1

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Code-Wide Revisions

Reconditioned Equipment

Change Summary

- There are now several reconditioned equipment requirements in the *NEC*.
- See a new definition of *Reconditioned* added in Article 100.
- See 110.21(A)(2), where reconditioned equipment must be identified as reconditioned, and the original listing mark be removed.
- Other examples of requirements include a prohibition to recondition molded case circuit breakers and transfer switches.
- Low voltage power circuit breakers, and more, are permitted to be reconditioned.

Code-Wide Revisions

GFCI Requirements

Change Summary

- The *NEC* now globally provides clarity in Chapters 5, 6, and 7 with respect to the general GFCI requirements in 210.8.
- Revisions provide clarity that 210.8 applies unless specifically modified in a Chapter 5, 6, or 7 article.
- Sections 210.8 and 422.5 are correlated to clarify the application of GFCI requirements for appliances.

Code-Wide Revisions

Definitions

Change Summary

- Article 100 now has a new Part III, which contains hazardous (classified) location definitions.
- Generally, where a word or term is defined and is used in more than one article, the definition is located in Article 100.
- Generally, where used only in a single article, a definition is located in the XXX.2 section of that article.
- Note that a number of definitions exist in the XXX.2 section of an article but apply throughout the Code (e.g., cable assemblies, raceways, and systems).
- Text in each XXX.2 section explain which definitions apply only within that article, and those that apply beyond that article.

Code-Wide Revisions

Fault Current

Change Summary

- Definitions were added for *Fault Current* and *Available Fault Current*.
- The use of the terms *short circuit current*, *fault current*, and *available fault current* were correlated throughout the *NEC*.
- Equipment has a *short circuit current* rating.
- *Available fault current* must not exceed the *short circuit current* rating.

Code-Wide Revisions

Disconnects for Emergency Responders

Change Summary

- There is a need for a means to remove power quickly and safely for one- and two-family dwelling units during a fire or other emergency.
- A means to disconnect power (and signage) on the outside of the dwelling unit requirements is added.
- Examples include requirements for services, generators, energy storage systems, and alternative energy sources.

Code-Wide Revisions

Outside Feeders and Service Disconnects

Change Summary

- Revisions allow for easier establishment of an ESWC and reducing the likelihood and level of exposure where ESWC is not established.
- Section 230.71 no longer permits a panelboard to contain six disconnecting means.
- Generally, each service enclosure must contain only one disconnecting means.
- Switchboards, switchgear, and metering centers with separate compartments and barriers may contain up to six disconnects.
- New 225.30(B) now allows six feeders instead of a single large feeder under prescribed conditions to facilitate ESWC on a part of the building supply and smaller conductors and a reduction in available fault current.
- This requirement mandates that (not more than six) feeders originate in the same equipment and terminate in the same location.

Chapter 8

Change Summary

- Reorganization and clarification of the application of Chapter 8 requirements has begun.
- A new Article 800, *General Requirements for Communications Systems*, is added.
- Redundancies that existed throughout Chapter 8 have been eliminated.
- Existing Article 800 for *Communications Circuits* is editorially renumbered as Article 805.

New Articles

Article 242 Overvoltage Protection

Change Summary

- Articles 280 and 285 from the 2017 *NEC* have been combined into a single article titled "Overvoltage Protection."
- The article has three parts, General, Surge Protective Devices (SPDs) 1000 Volts or Less, and Surge Arresters Over 1000 Volts.

New Articles

Article 311 Medium Voltage Conductors and Cables

Change Summary

- Article 328 in the 2017 *NEC* has been deleted, and its content has been relocated to a new Article 311 titled Medium Voltage Conductors and Cables.
- Requirements for medium voltage cables and conductors rated over 2000 volts and located formerly in Article 310 have also been incorporated into this new article.
- This new article covers the use, installation, construction specifications, and ampacities for Type MV medium voltage conductors and cable.

New Articles

Article 337 Type P Cable

Change Summary

- A new article titled “Type P Cable” has been added to *NEC* Chapter 3.
- Article 337 addresses the use and installation of Type P cable (marine shipboard cable).
- Type P cable has been commonly used in land-based oil and gas rigs for over four decades, but the *NEC* has never addressed its permitted use.
- Type P cable is limited to industrial installations and hazardous locations.

New Articles

Article 800 General Requirements for Communications Systems and Article 805 Communications Circuits

Change Summary

- Article 800 has been revised to include all the common general requirements from all the Chapter 8 communications articles into a single article.
- The remaining specific rules in former Article 800 have been included in a new Article 805 titled "Communications Circuits."
- This revision eliminates redundancy.

90.2(A)(5) & (6)

REVISION

Expanded Scope Electric Vehicles and Marinas

Change Summary

- The words “in marinas and boatyards” have been added to 90.2(A)(5).
- 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.

90.2(A)(5) & (6)

REVISION

Article 100

REVISION

Article 100 Scope (.2)

Change Summary

- The scope of Article 100 has been revised to indicate that definitions are also provided in the .2 section of some articles.
- The second (.2) section of various articles have been revised to address when the defined terms apply only within that article.
- The second (.2) section in some cases will indicate that the defined term applies within that article and throughout the *NEC*.

Article 100

REVISION

Article 100 Definitions

Scope. This article contains only those definitions essential to the application of this *Code*. It is not intended to include commonly defined general terms or commonly defined technical terms from related codes and standards. In general, only those terms that are used in two or more articles are defined in Article 100. Definitions are also found in XXX.2 sections of other articles…(See *NEC* Text)…

An example of Definitions provided in XXX.2 of an *NEC* article:

240.2 Definitions. The definitions in this section shall apply only in this article.

Current-Limiting Overcurrent Protective Device. A device that, when interrupting currents in its current-limiting range, reduces the current flowing in the faulted circuit to a magnitude substantially less than that obtainable in the same circuit if the device were replaced with a solid conductor having comparable impedance.

Supervised Industrial Installation. For the purposes of Part VIII, the industrial portions of a facility where all of the following conditions are met:

(1) Conditions of maintenance and engineering supervision ensure that only qualified persons monitor and service the system.
(2) The premises wiring system has 2500 kVA or greater of load used in industrial process(es), manufacturing activities,
or both, as calculated in accordance with Article 220.
(3) The premises has at least one service or feeder that is more than 150 volts to ground and more than 300 volts phase-to-phase.

(…See *NEC* text…)

Article 100

REVISION

Article 100 Scope (Parts I, II, and III)

Change Summary

- The scope of Article 100 has been revised to indicate that definitions are also provided in the .2 section of some articles.
- The second paragraph of the scope now indicates that Part III of Article 100 includes definitions applicable to Hazardous (Classified) Locations.
- Both changes revise the scope to align with the representation contained in Article 100.

Article 100

REVISION

Article 100 Definitions

Scope. This article contains only those definitions essential to the application of this *Code*. …(See *NEC* text)…

Part I of this article contains definitions intended to apply wherever the terms are used throughout this *Code*. Part II contains definitions applicable to installations and equipment operating at over 1000 volts, nominal. Part III contains definitions applicable to Hazardous (Classified) Locations.

Part I. General

Accessible (as applied to equipment) Capable of being reached for operation, renewal, and inspection. (CMP-1)

Accessible (as applied to wiring methods) Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in by the structure or finish of the building. (CMP-1) …(See *NEC* text)…

Part II. Over 1000 Volts, Nominal

Electronically Actuated Fuse. An overcurrent protective device that generally consists of a control module that provides current sensing, electronically derived time–current characteristics, energy to initiate tripping, and an interrupting module that interrupts current when an overcurrent occurs. Electronically actuated fuses may or may not operate in a current limiting fashion, depending on the type of control selected. (CMP-10)

Fuse. An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it. (CMP-10) …(See *NEC* text)…

Part III. Hazardous (Classified) Locations (CMP-14).

Aircraft Painting Hangar. An aircraft hangar constructed for the express purpose of spray/coating/dipping applications and provided with dedicated ventilation supply and exhaust. (CMP-14) …(See *NEC* text)…

Article 100

REVISION

Definition of Accessible (as applied to equipment)

Change Summary

- The definition of the term *Accessible (as applied to equipment)* has been revised and simplified.
- The revision provides a clearer differentiation from the definition of the term *readily accessible*.
- Rules containing this term have a more accurate meaning by definition.

Article 100

REVISION

Article 100

DELETION / RELOCATE

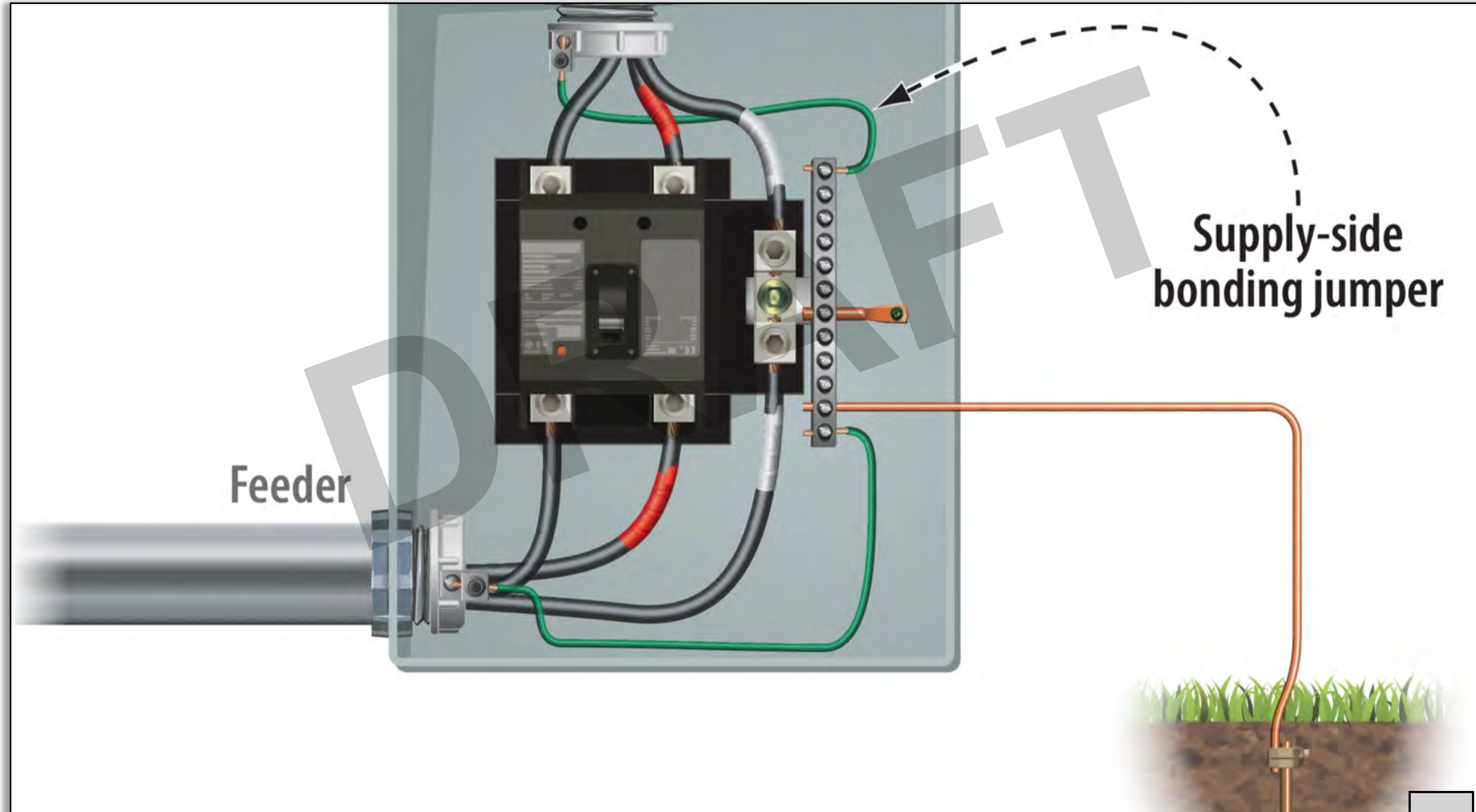
Definition of Bonding Jumper, Supply-Side

Change Summary

- The definition of the term *Bonding Jumper, Supply-Side* has been deleted from 250.2.
- The definition, without revision, has been located into Part I of Article 100.
- This relocation aligns with the requirements of Section 2.2.2.1 of the *NEC Style Manual*.

Article 100

DELETION / RELOCATE



Article 100

REVISION

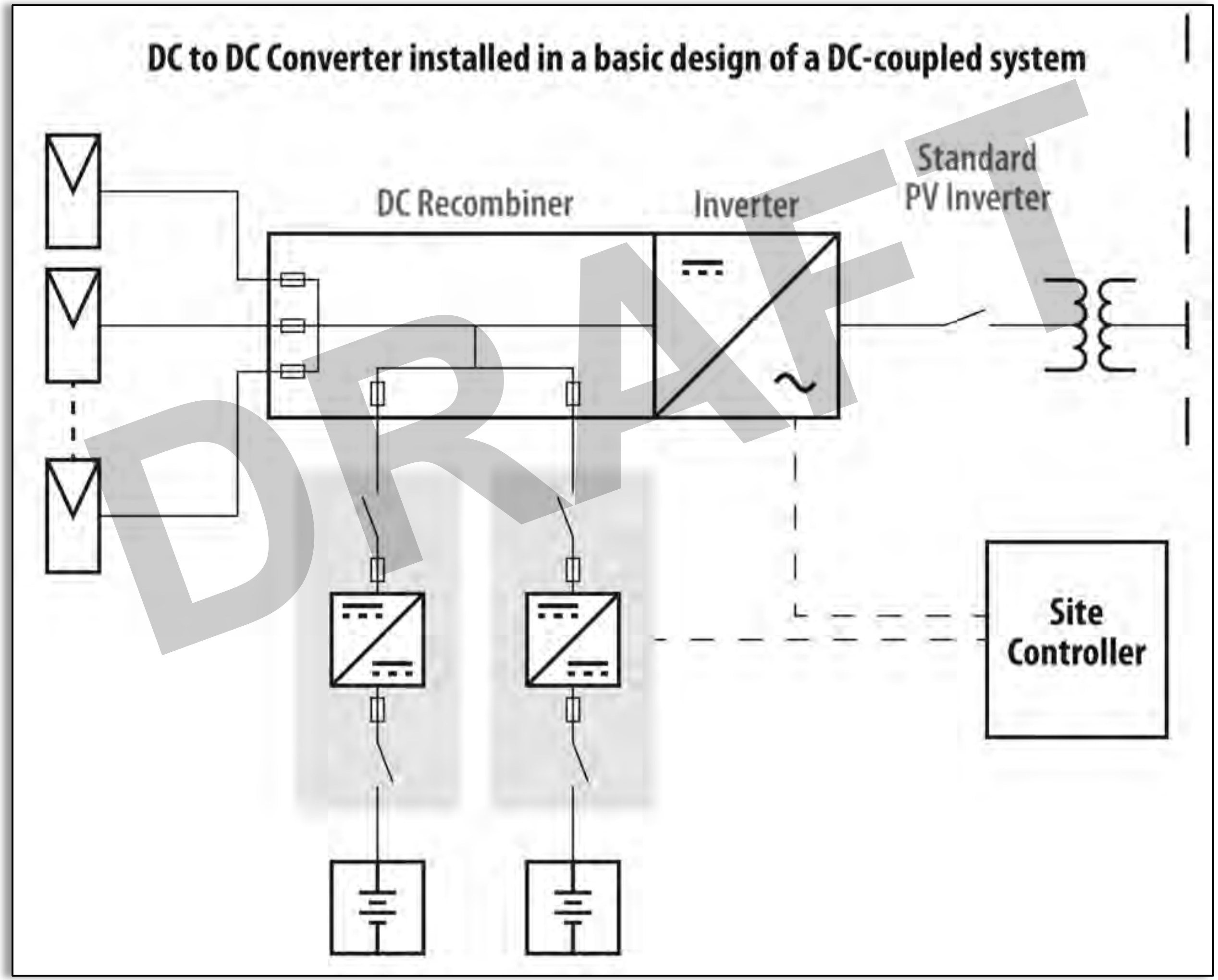
Definition of DC-to-DC Converter

Change Summary

- The varying versions of the term *DC-to-DC Converter* have been removed from Articles 690, 606, and 712.
- One common definition of the term has been incorporated into Article 100.
- CMP-4 retains technical responsibility of the term in the 2020 *NEC*.

Article 100

REVISION



Article 100

REVISION / RELOCATE

Definition of Equipotential Plane

Change Summary

- The definition of the term *equipotential plane* has been simplified and relocated in Article 100.
- This definition applies to Articles 680 and 682.
- The definition of "equipotential plane" in Section 547.2 remains in that section and applies only to agricultural facilities.

Article 100

REVISION / RELOCATE

Article 100

NEW

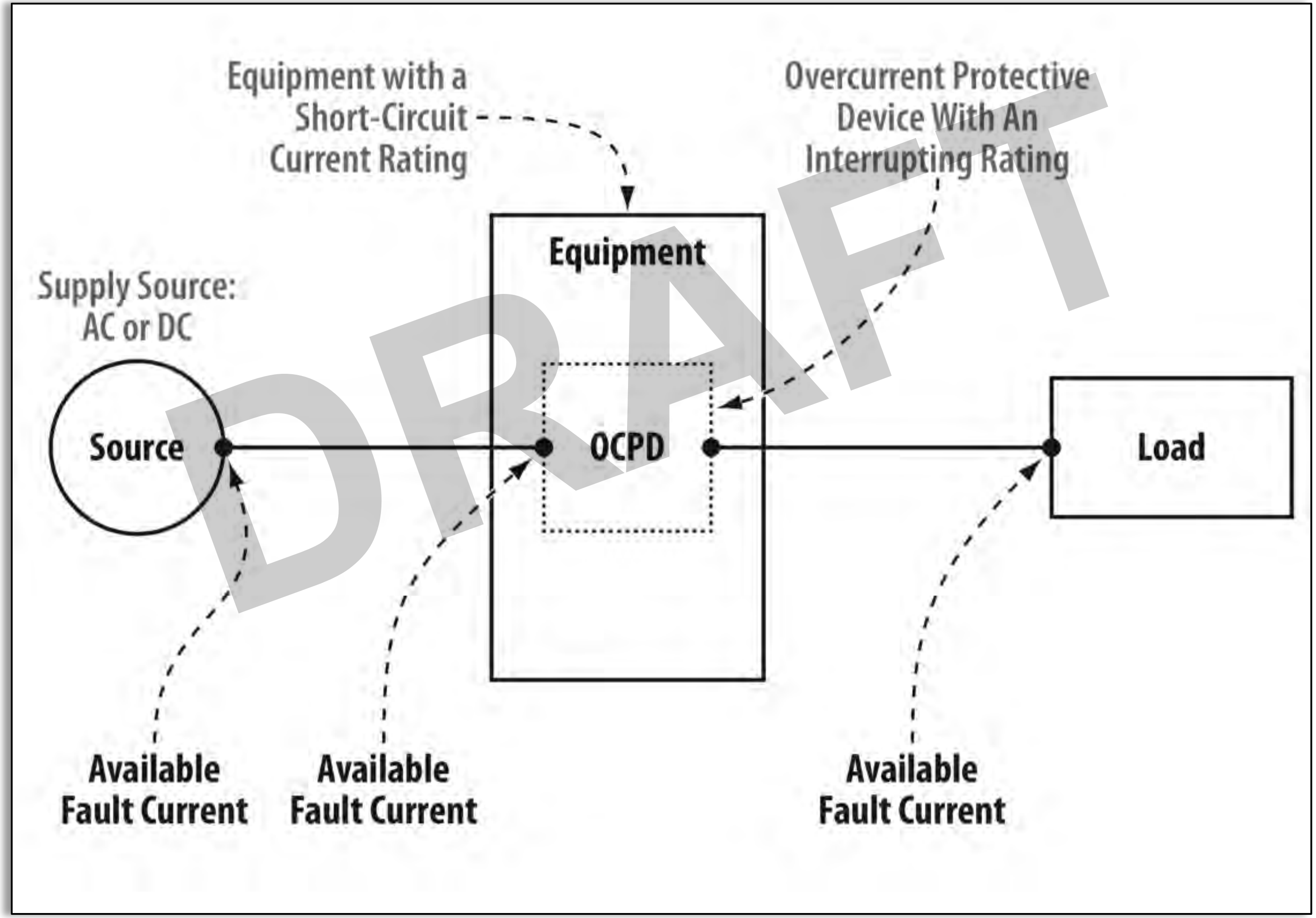
Definition of Fault Current and Available Fault Current

Change Summary

- 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*.

Article 100

NEW



Article 100

NEW

Definition of Habitable Room

Change Summary

- A new definition of the term *habitable room* has been added to Article 100.
- The new definition describes what constitutes a habitable room and differentiates it from one that is not.
- The new definitions align with the same defined term that is included in *NFPA 5000* with similar context to the defined term in the IRC and IBC.

Article 100

NEW

Article 100

REVISION

Definition of Interactive Inverter

Change Summary

- The definition of the term *interactive inverter* has been revised and clarified.
- The term *interactive inverter* is no longer limited in use within *NEC* rules addressing interaction with a utility.
- Interactive inverters are capable of delivering power to the utility where identified for that use in accordance with Section 705.6.

Article 100

REVISION

Courtesy of Eaton

Article 100

REVISION / RELOCATE

Definition of Inverter

Change Summary

- The definition of the term *Inverter* has been revised and simplified.
- The definition has been relocated to Article 100 to comply with the *NEC Style Manual*.
- The term *inverter* is applicable to multiple types of systems and not limited in application to just photovoltaic (PV) systems.

Article 100

REVISION / RELOCATE

Article 100

NEW

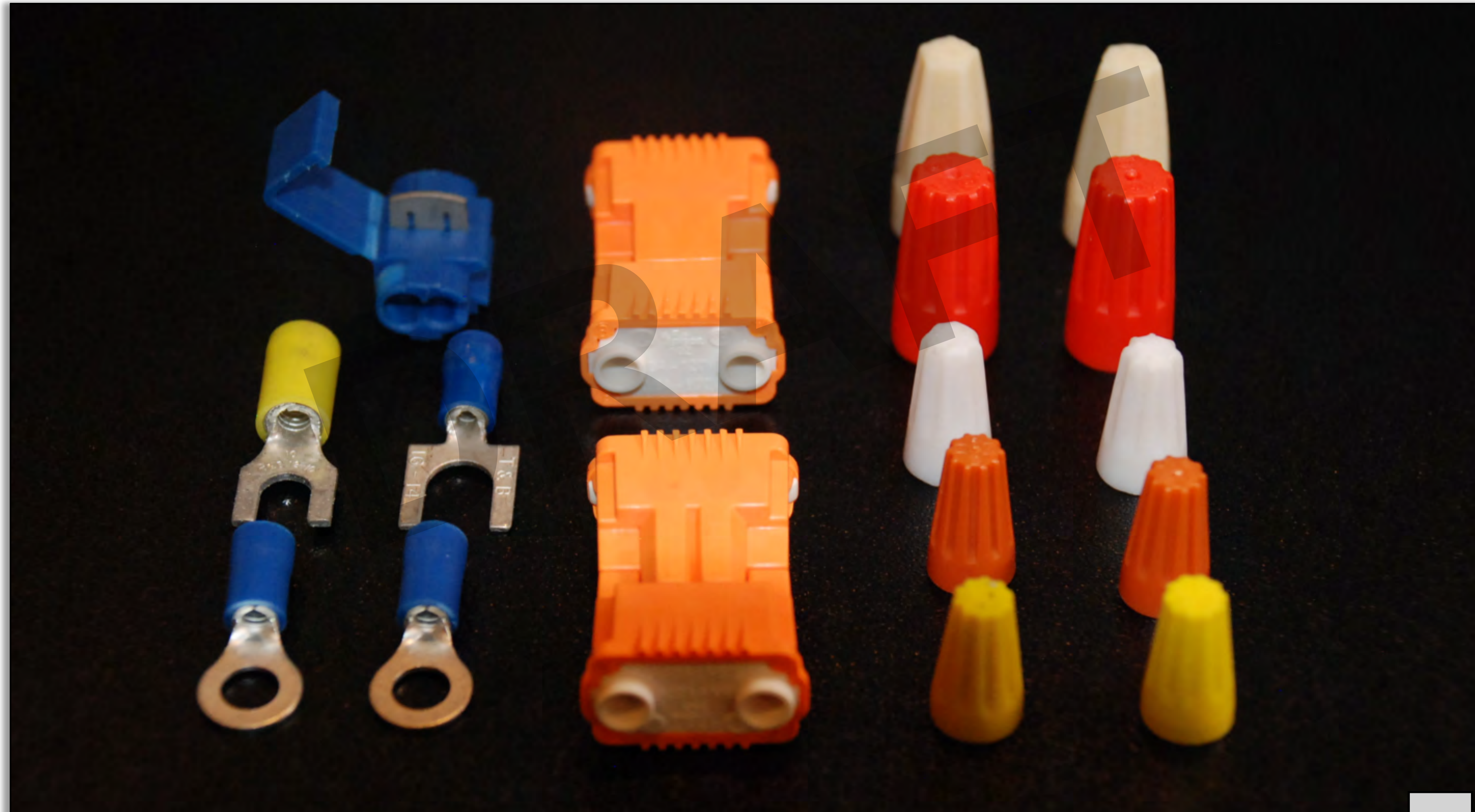
Definition of Labeled – New Informational Note

Change Summary

- A new informational note has been added following the definition of the term *Labeled*.
- Clarification has been provided about what constitutes labeling as defined in the *NEC*.
- The labeling can appear on the smallest package of the product in cases where the equipment is small or installed in a harsh environment.

Article 100

NEW



Article 100

NEW

Definition of Laundry Area

Change Summary

- A new definition of the term *Laundry Area* has been added to Article 100.
- This is an area containing or designed to contain a laundry tray, clothes washer, or clothes dryer.
- The definition of laundry area in Section 550.2 is no longer necessary and has been deleted.

Article 100

NEW

Article 100

NEW

Definition of Messenger or Messenger Wire

Change Summary

- A definition of the term(s) *messenger* and *messenger wire* have been added to Article 100.
- This unique definition applies to either term used within the *NEC*.
- A messenger can be current carrying or be dead-ended on both ends and used only for support.

Article 100

NEW

Article 100

REVISION

Definition of Photovoltaic (PV) System

Change Summary

- The definition of the term *Photovoltaic (PV) System* has been revised.
- As revised, the system includes all components, circuits, and equipment up to and including the PV system disconnecting means.
- The text about connecting to a utilization load has been deleted.

Article 100

REVISION

Article 100

NEW

Definition of Prime Mover

Change Summary

- A definition of the term *Prime Mover* has been added to Article 100.
- It is defined as the machine that supplies mechanical horsepower to a generator.
- CMP-13 has been assigned technical responsibility of this term.

Article 100

NEW

Article 100

REVISION NEW

Definition of Receptacle – New Informational Note

Change Summary

- The words "or strap" have been added following the word "yoke" in two instances within this definition.
- This revision aligns with *NEC* requirements that use the phrase mounting yoke or strap, such as in 314.16(B)(4), 404.10(B), and 406.5.
- The informational note clarifies that a duplex receptacle is two receptacles on a single mounting yoke or strap.

Article 100

REVISION NEW

Article 100

NEW

Definition of Reconditioned

Change Summary

- The term *reconditioned* has been added in multiple articles of the *NEC* and is now defined in Article 100.
- The process of reconditioning equipment differs from normal servicing of equipment that remains in place.
- Reconditioned equipment is often referred to as rebuilt, refurbished, or remanufactured.

Article 100

NEW

Article 100

REVISION

Definition of Service Equipment

Change Summary

- The definition of the term *Service Equipment* has been revised.
- The word “usually” has been removed to reduce ambiguity and the word “cutoff” has been replaced by the *NEC* term *disconnecting means*.
- Technical responsibility of this definition has been reassigned from CMP-4 to CMP-10.

Article 100

REVISION

Article 100

REVISION

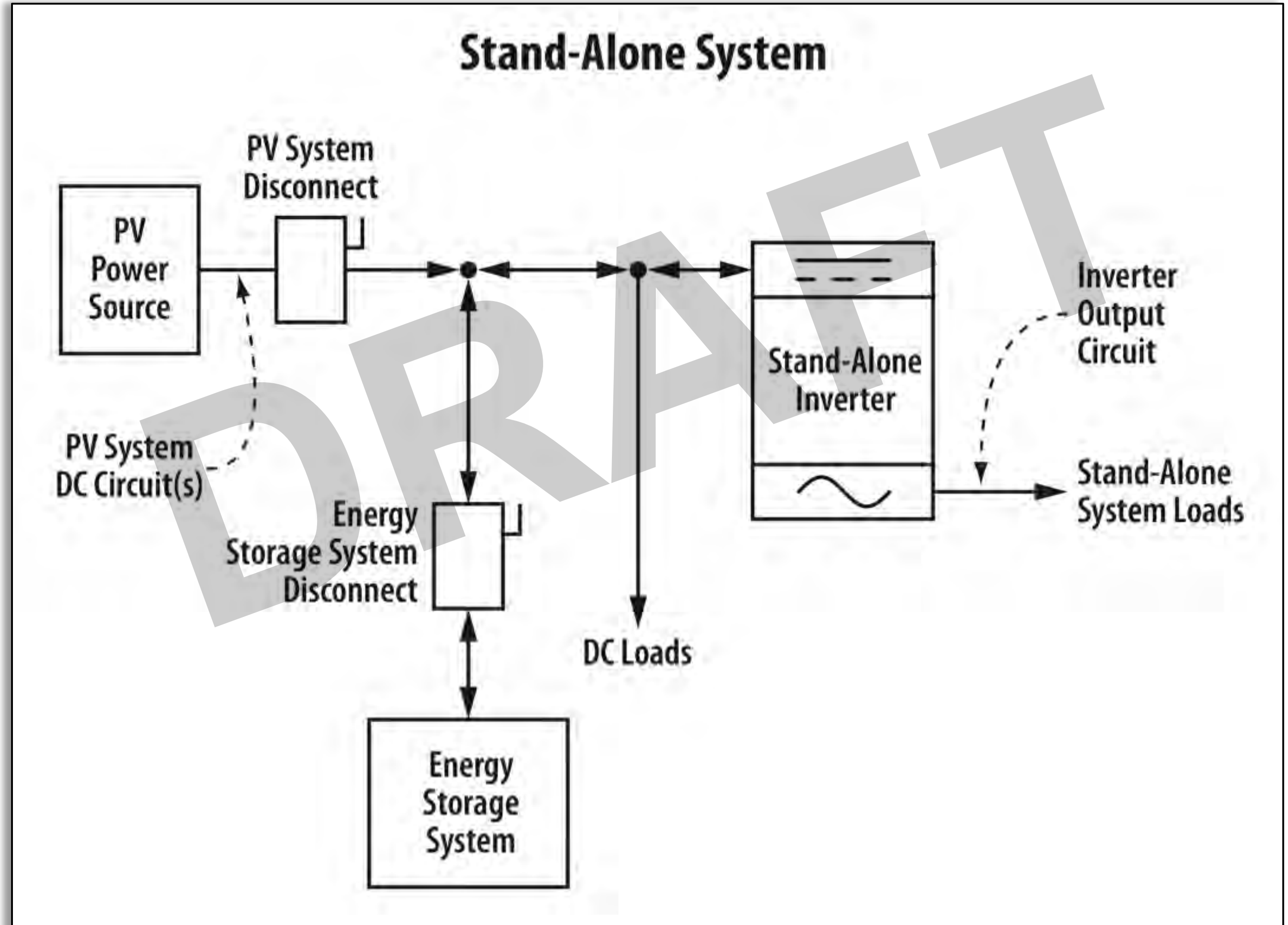
Definition of Stand-Alone System

Change Summary

- The definition of the term *Stand-Alone System* has been revised.
- The revision clarifies that a stand-alone system is capable of supplying power and is independent of an electric power production and distribution network.
- Examples of stand-alone systems are those powered solely by photovoltaic (PV), wind electric systems, fuel cell systems, all of which are often combined with energy storage systems.

Article 100

REVISION



Article 100

NEW

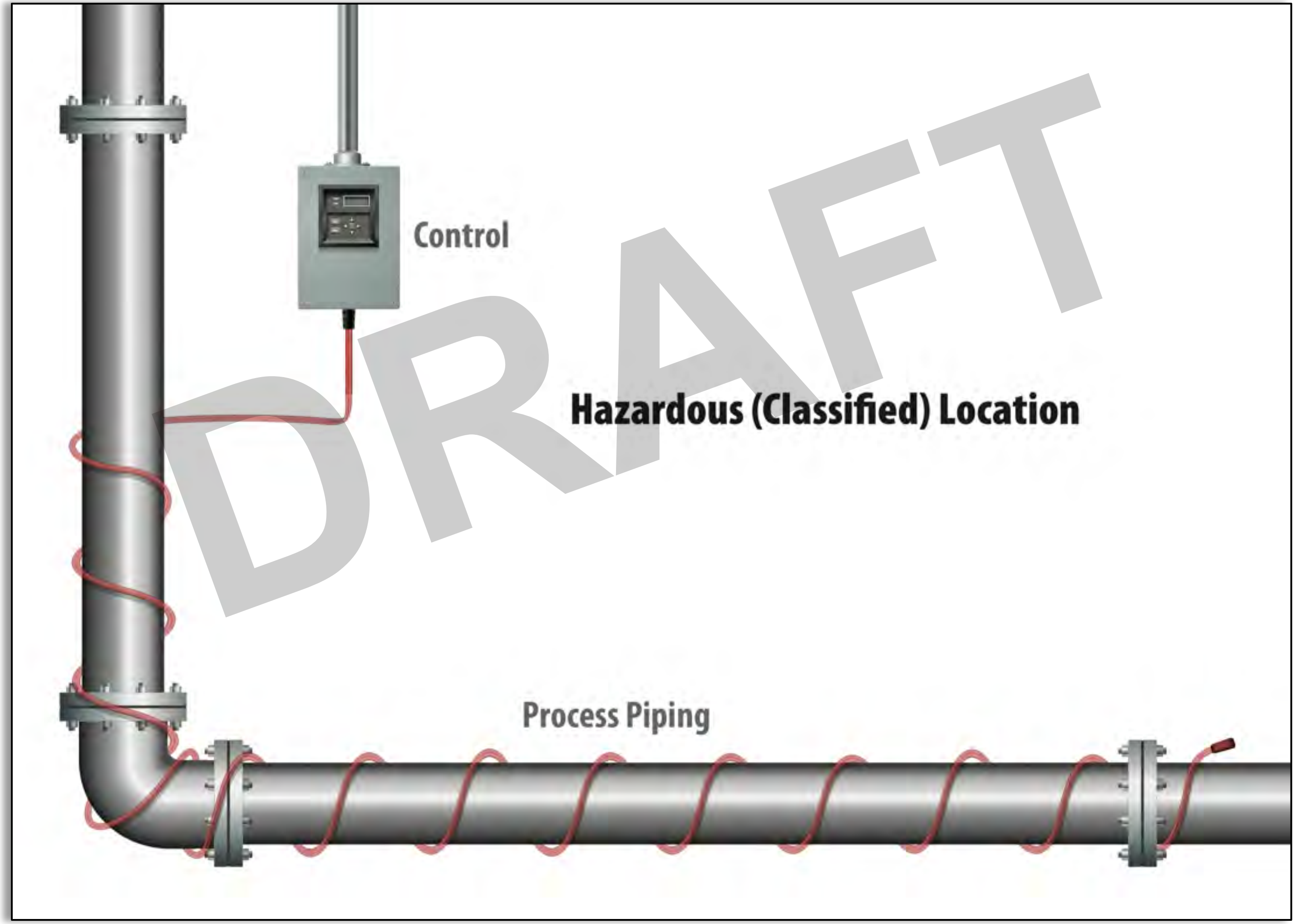
Definition of Electrical Resistance Trace Heating

Change Summary

- A new definition of the term *electrical resistance trace heating* has been incorporated into Part III of Article 100.
- Part III of Article 100 now includes all definitions of words and terms related to hazardous (classified) locations.
- A new informational note refers to the applicable standard (ANSI/*UL 60079-30-1*) for electrical resistance trace heating general and testing requirements.

Article 100

NEW



Article 100

NEW

Definition of Inherently Safe Optical Radiation "op is"

Change Summary

- A new definition of the term *inherently safe optical radiation "op is"* has been added to Article 100.
- Part III of Article 100 has been designated specifically for the defined terms associated with hazardous (classified) locations.
- The new informational note provides an important reference to ANSI/*UL 60079* containing information related to explosive atmosphere ignition concerns.

Article 100

NEW

Article 100

NEW

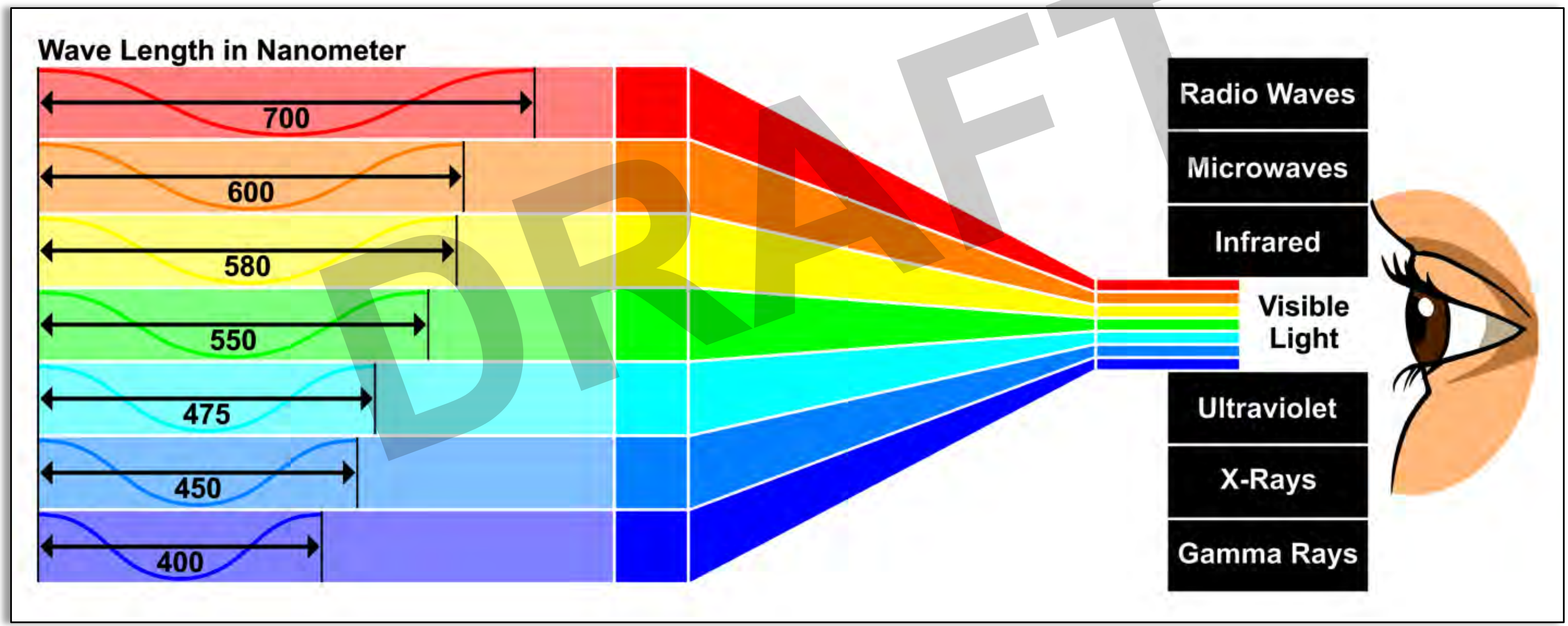
Definition of Optical Radiation

Change Summary

- A new definition of the term *optical radiation* has been added to Part III of Article 100.
- Part III of Article 100 is now designated for defined terms used in *NEC* rules that address hazardous (classified) locations.
- The new informational note provides an important reference to ANSI/*UL 60079* containing information related to explosive atmosphere ignition concerns.

Article 100

NEW



Article 100

NEW

Definition of Protected Optical Fiber Cable

Change Summary

- A new definition of the term *Protected Optical Fiber Cable* has been added to Article 100.
- Part III of Article 100 has been designated specifically for the defined terms associated with hazardous (classified) locations.
- The new informational note provides an important reference to ANSI/*UL 60079* containing information related to explosive atmosphere ignition concerns and protection techniques that can be used.

Article 100

NEW

1000

Article 100

NEW

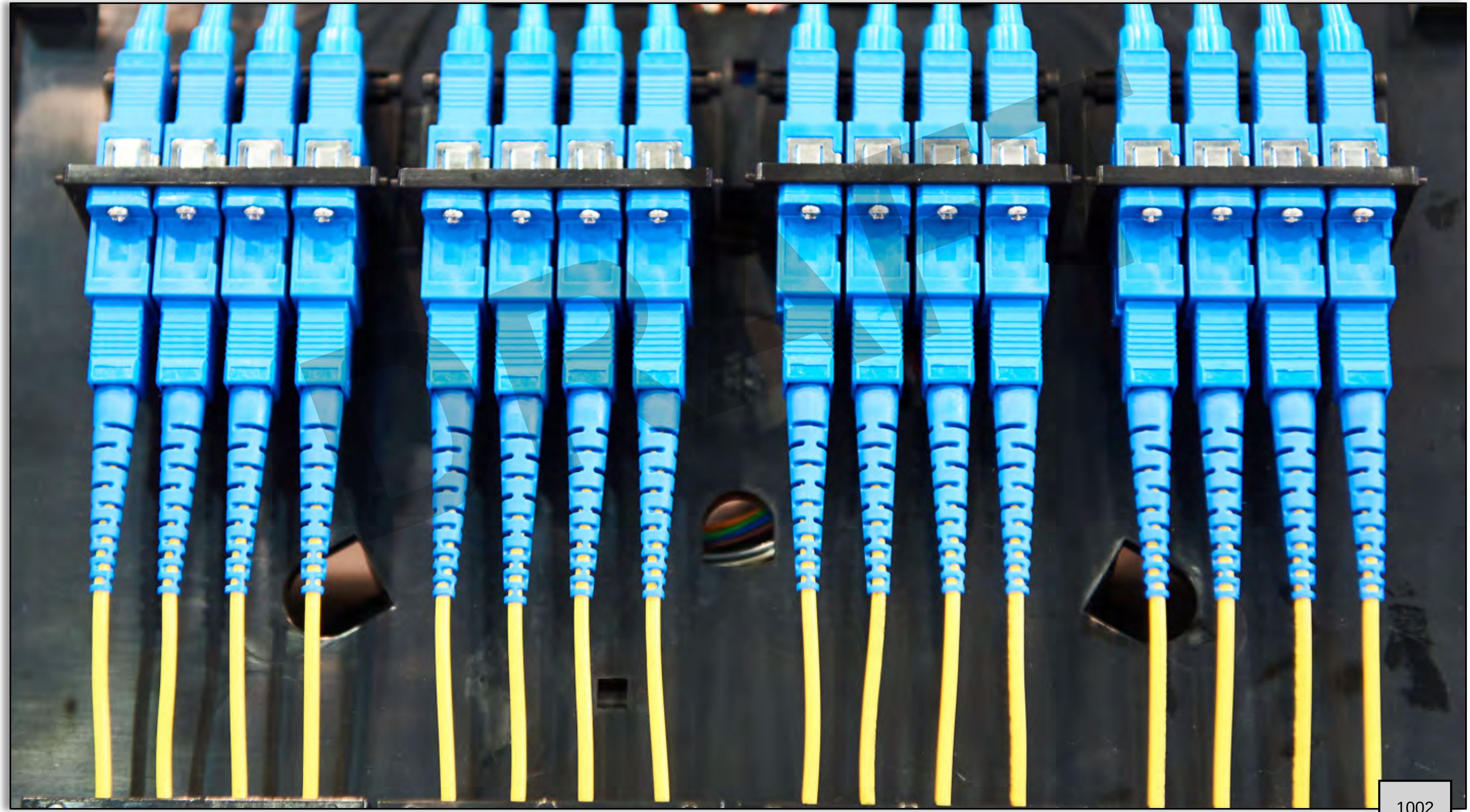
Definition of Protected Optical Fiber Radiation

Change Summary

- A new definition of the term *Protected Optical Fiber Radiation* has been added to Article 100.
- Part III of Article 100 has been designated specifically for the defined terms associated with hazardous (classified) locations.
- The new informational note provides an important reference to ANSI/*UL 60079* containing information related to explosive atmosphere ignition concerns and protection techniques.

Article 100

NEW



110.3(B)

NEW

Installation and Use

Change Summary

- Section 110.3(B) was revised and reworded to include the words “or both” in the rule.
- Equipment that is listed (certified), either bears the listing mark, bears a label, or both, often in combination.
- The revision aligns with the fact that most but not all listed (certified) equipment is labeled.

110.3(B)

NEW

OFF
150
BOTTOM OF BREAKER
(SCREW HEADS ARE LIVE)
IS LESS THAN 1/2 INCH
TO ANY METAL SURFACE.
TYPE CC
150 AMP
240 VAC
40 °C
CAT. NO. CC3150
CURRENT INTERRUPTING
RATING
MAX. RMS SYM
10,000 AMPS @ 240VAC
USE ANY TWO POLES FOR
SINGLE PHASE APPLICATIONS
WIRE CONNECTOR DATA
CAT No. TA150CC
TORQUE TO 180 LB-IN
#6-4/0 AWG
AL-CU
SUITABLE FOR USE WITH WIRE RATED
75°C OR ABOVE, SIZED PER THE
AMPACITY OF 75°C CONDUCTORS.
CIRCUIT BREAKER
3 POLE UNIT

110.12(C)

NEW

Cables and Conductors – Workmanship

Change Summary

- A new subdivision (C) titled *Cables and Conductors* has been added in Section 110.12 which is titled *Mechanical Execution of Work*.
- It 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.

110.12(C)

NEW

110.14(D)

REVISION

Terminal Connection Torque

Change Summary

- The title of subdivision (D) has been changed from “Installation” to “Terminal Connection Torque.”
- The term *calibrated* has been deleted from this section.
- Three new informational notes provide practical guidance for installers and inspectors.

110.14(D)

REVISION

110.21(A)(2)

REVISION

Reconditioned Equipment Exception

Change Summary

- The exception has been revised to provide clarification as to when this exception can be applied.
- New Informational Note No. 2 explains that terms such as *refurbished*, *rebuilt*, or *remanufactured* are often used interchangeably with the term *reconditioned*.
- New Informational Note No. 3 explains that the original listing mark could include the mark of the certifying body, and not an entire label.

110.21(A)(2)

REVISION

110.22(A)

REVISION

Disconnect Marking

Change Summary

- A new second sentence has been added to Section 110.22(A).
- Identification of the source circuit supplying the disconnecting means is now required for other than one- and two-family dwelling installations.
- The revision enhances the ability to establish an electrically safe work condition as addressed in *NFPA 70E*.

110.22(A)

REVISION

Feeder supplied switchboard, switchgear and panelboards in other than dwelling must be marked to indicate the source.

110.24(A)

NEW

Published Values of Available Fault Current

Change Summary

- Section 110.24(A) has been revised for accuracy and clarification.
- The word “maximum” has been deleted in front of “available fault current” because it is not necessary.
- New Informational Note No. 2 explains that available fault current values are typically provided and published by utilities.

110.24(A)

NEW

SES#	1 PH 120/240 POLE/PAD XFMR		3 PH 120/240 Closed Delta POLE TOP XFMR		3 PH 120/240 Open Delta POLE TOP XFMR		3 PH 120/240 Open Delta PAD XFMR *(based upon a 167/75kva transformer)*		3 PH 120/208 POLE TOP XFMR		3 PH 120/208 PAD XFMR		3 PH 277/480 POLE TOP XFMR		3 PH 277/480 PAD XFMR	
AMPS	**kVA**	**Isc**	**kVA**	**Isc**	**kVA**	**ISC**	**kVA**	**Isc**	**kVA**	**Isc**	**kVA**	**Isc**	**kVA**	**Isc**	**kVA**	**Isc**
100	50	8,890	3-25	9,948	75-75	19,953	167-75	23,971	3-25	8,895	112.5	12,684	75	5,192	112.5	8,688
125	50	8,890	3-25	9,948	75-75	19,953	167-75	23,971	3-25	8,895	112.5	12,684	150	9,613	112.5	8,688
150	50	8,890	3-25	9,948	75-75	19,953	167-75	23,971	3-25	8,895	112.5	12,684	150	9,613	112.5	8,688
200	75	14,318	3-25	10,478	75-75	25,625	167-75	33,705	3-25	10,483	112.5	16,178	150	10,347	150	12,076
***400**	100	20,955	3-50	20,034	75-75	28,369	167-75	39,681	3-50	21,553	150	27,478	300	20,938	300	25,573
600	167	32,755	3-75	28,369	100-75	35,297	167-75	44,187	3-75	33,789	225	39,066	500	31,615	500	25,773
800	167	36,451	3-100	33,208	167-75	44,186	167-75	44,187	**3-100	43,106	300	49,505			750	25,773
1,000									**3-100	45,740	300	53,011			750	25,773
1,200											500	53,011			1,000	25,773
1,600											500	56,194			1,500	32,990
2,000											750	56,194			1,500	33,207
2,500											750	56,194			2,000	44,250
3,000											1,000	56,194			2,000	44,346

Sample Published Available Fault Current Levels for Utility Service

110.26(A)

REVISION

Planning for an Electrically Safe Work Condition

Change Summary

- The informational note to Section 110.26(A) has been revised and expanded.
- The date of *NFPA 70E* has been changed from 2015 to 2018 to reference the current edition.
- The phrase “including establishing an electrically safe work condition” has been incorporated.

110.26(A)

REVISION

110.26(C)(2)

REVISION

Sum of Service Disconnect Ratings Added

Change Summary

- Section 110.26(C)(2) has been revised and restructured into a list format.
- Two entrances and egress paths from the work space are required if the sum of the two-to-six service disconnects is 1200 amperes or more.
- Open equipment doors on large equipment shall not impede the entry to or egress from the required working space.

110.26(C)(2)

REVISION

110.26(C)(3)

REVISION NEW

Listed Fire Exit Hardware

Change Summary

- 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.
- The revision differentiates listed panic hardware from listed fire exit hardware.

110.26(C)(3)

REVISION NEW

110.28

NEW

Dusttight Enclosure Use and Application

Change Summary

- Two new informational notes have been added to Section 110.28.
- Informational Note No. 3 references the specific "uses permitted" sections with Articles 502, 503, and 506.
- Informational Note No. 4 indicates that these types of enclosures are permitted in any unclassified location and limited to Class II, Division 2; Class III, and Zone 22 hazardous (classified) locations.

110.28

NEW

1022

Courtesy of Eaton

110.31(A)(4)

REVISION

Listed Panic and Fire Exit Hardware

Change Summary

- Section 110.31(A)(4) has been revised to clarify the personnel door opening must be in the direction of egress.
- The terms *listed panic hardware* and *listed fire exit hardware* have been incorporated in this section.
- The informational note to Section 110.26(C)(3) provides references to two UL standards that address listed panic hardware and listed fire exit hardware.

110.31(A)(4)

REVISION

110.32

REVISION

Work Space About Equipment

Change Summary

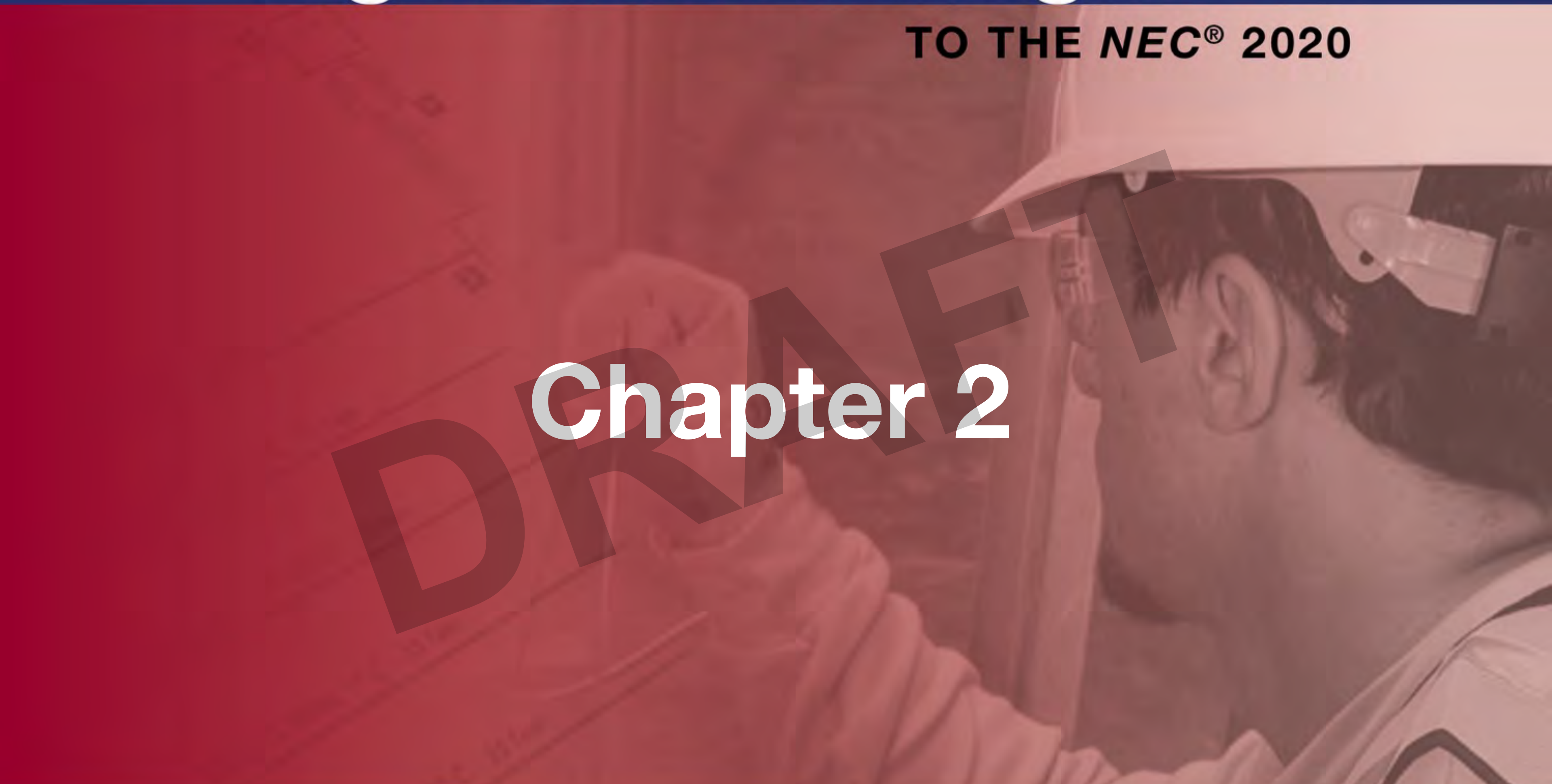
- This section has been revised and expanded to align with similar requirements in 110.26(A) and (B).
- The work space shall not be used for storage.
- Live parts that are exposed for inspection or servicing must be suitably guarded.

110.32

REVISION

Significant Changes

TO THE *NEC*® 2020



Chapter 2

electrical training ALLIANCE IBEW - NECA IN COLLABORATION WITH NECA NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

200.3

REVISION

Connection to Grounded System

Change Summary

- Section 200.3 has been revised for improved clarity and usability.
- The word *utility* has been deleted from this section as it was redundant and implied by definition of premises wiring.
- The term *direct electrical connection* provides a clear distinction from a connection through electromagnetic induction.

200.3

REVISION

200.10(B)

REVISION

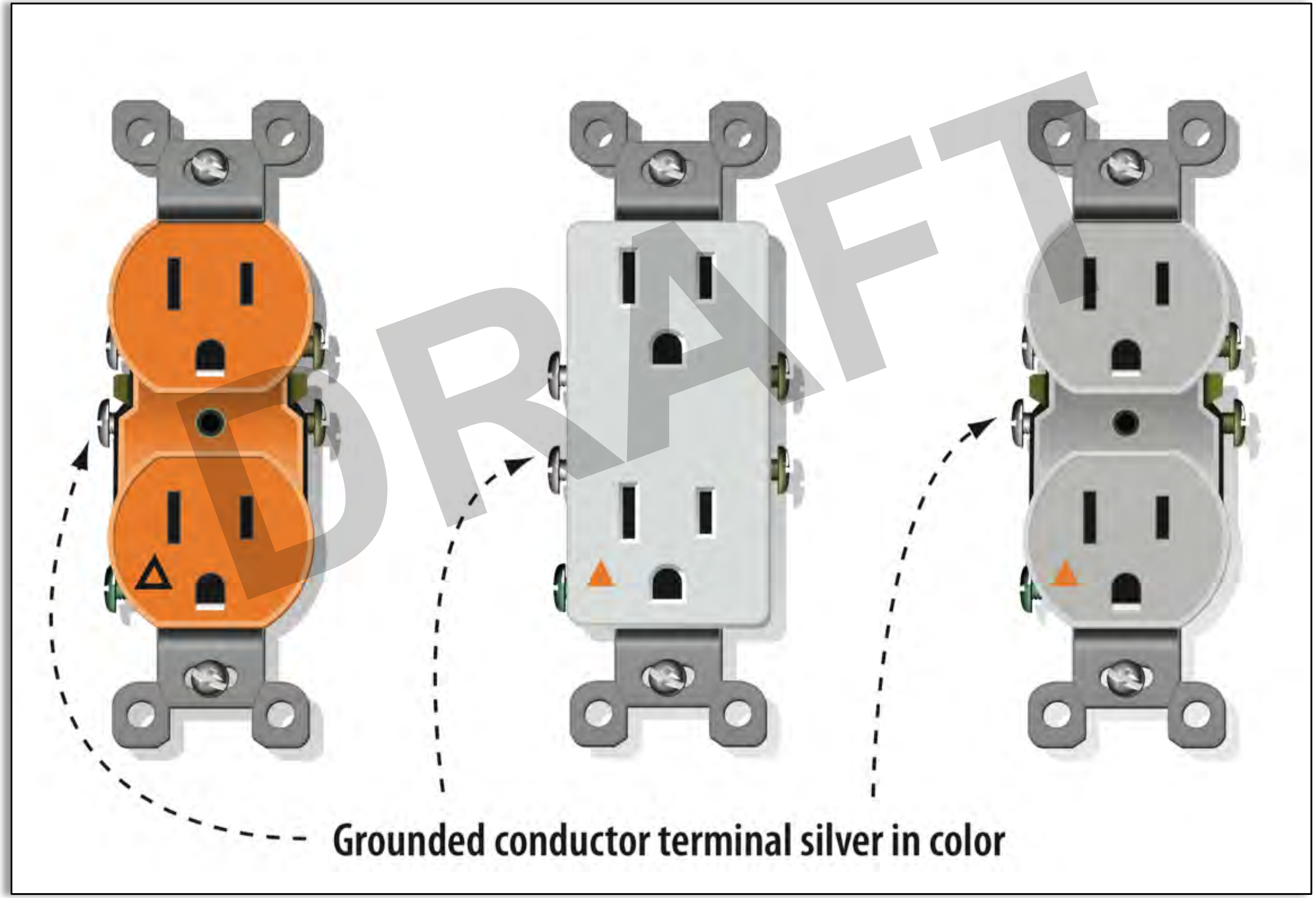
Identification of Grounded Conductor Terminals

Change Summary

- The words “or silver” have been added to second level subdivision (1).
- Receptacles, polarized attachment plugs, and cord connectors for plugs and polarized plugs typically include a terminal that is silver or chrome in color, as compared to brass or gold color.
- The revision reflects the common identification means employed by product manufacturers.

200.10(B)

REVISION



210.5(C)(1)

REVISION

Identification of Ungrounded Conductors

Change Summary

- 210.5(C)(1) now requires ungrounded conductors be identified by phase or line and *by system voltage class*.
- Clarification is provided to permit different voltage systems within the same premises with the same *system voltage class* to use the same means of identification.

210.5(C)(1)

REVISION

NECA Electric, Bethesda MD 20814			
Ungrounded Conductor Identification			
Voltage Class			
Less than 150 volts to ground and not over 300 volts to phase to phase		**Over 150 volts to ground and not over 300 volts to phase to phase**	
A-Phase	Black	A-Phase	Brown
B-Phase	Red	B-Phase	Orange
C-Phase	Blue	C-Phase	Yellow
Neutral	White	Neutral	Gray

210.8

REVISION

GFCI Protection for Personnel

Change Summary

- Measuring distance from receptacles is modified. Doors or doorways do not eliminate GFCI requirements.
- 210.8(C) for boat hoists is relocated into 555.9. An informational note is added.
- In 210.8 two first level subdivisions are deleted and three are added.

210.8

REVISION

210.8(A)

REVISION

GFCI, Dwelling Units

Change Summary

- The parent text in 210.8(A) is expanded to include all 125-volt through 250-volt receptacles rated 150 volts or less to ground.
- List item 210.8(A)(5) is no longer limited to unfinished areas and applies to all receptacles in basements.
- New list item 11 requires GFCI protection for indoor damp and wet locations.

210.8(A)

REVISION

210.8(B)

REVISION

GFCI, Other Than Dwelling Units

Change Summary

- Parent text in 210.8(B) is revised for clarity. Accessory buildings are added in 210.8(B)(8).
- 210.8(B)(2) Kitchens include areas with a sink and permanent provisions for either food preparation or cooking.
- Two new list items are added to include laundry areas, bathtubs and shower stalls.

210.8(B)

REVISION

210.8(D), (E), & (F)

NEW DELETION

GFCI Protection for Personnel

Change Summary

- Existing 210.8(D) is deleted and GFCI requirements for dishwashers are expanded and relocated to 422.5.
- New 210.8(D) references 422.5 to coordinate GFCI protection.
- New 210.8(E) references 210.63 requiring GFCI protection and new (F) includes general GFCI requirements for outdoor outlets other than those in 210.8(A)(3) Exception.

210.8(D), (E), & (F)

NEW **DELETION**

210.11(C)(3) & (C)(4)

REVISION

Bathroom and Garage Branch Circuits

Change Summary

- Requirements for branch circuits in 210.11 are modified for clarity.
- The required receptacle outlet(s) in 210.52(D) and any other countertop or similar work surface receptacle outlets in bathrooms must be supplied by one or more 120-volt, 20-amp branch circuits.
- The required 120-volt, 20-amp branch circuit in 210.11(C)(4) is intended to supply the required receptacle outlet(s) in 210.52(G)(1).

210.11(C)(3) & (C)(4)

REVISION

210.12(A)

REVISION

AFCI Protection, Dwelling Units

Change Summary

- The exception for an individual branch circuit supplying a fire alarm system is modified to permit any metal raceway, metal auxiliary gutter, steel armored cable, Type MC or Type AC cable.
- The IN reference to UL Subject 1699C, *Outline of Investigation for System Combination Arc-Fault Circuit Interrupters* is retained.

210.12(A)

REVISION

Courtesy of Eaton

210.12(C)

REVISION

…Sleeping Rooms, Nursing, Limited-Care Facilities

Change Summary

- The AFCI requirements of 210.12 are expanded to include patient sleeping rooms in nursing homes and limited care facilities.
- These sleeping rooms are very similar in nature to those found in dwelling units, guest rooms, guest suites, and dormitory units.

210.12(C)

REVISION

210.12(D)

REVISION

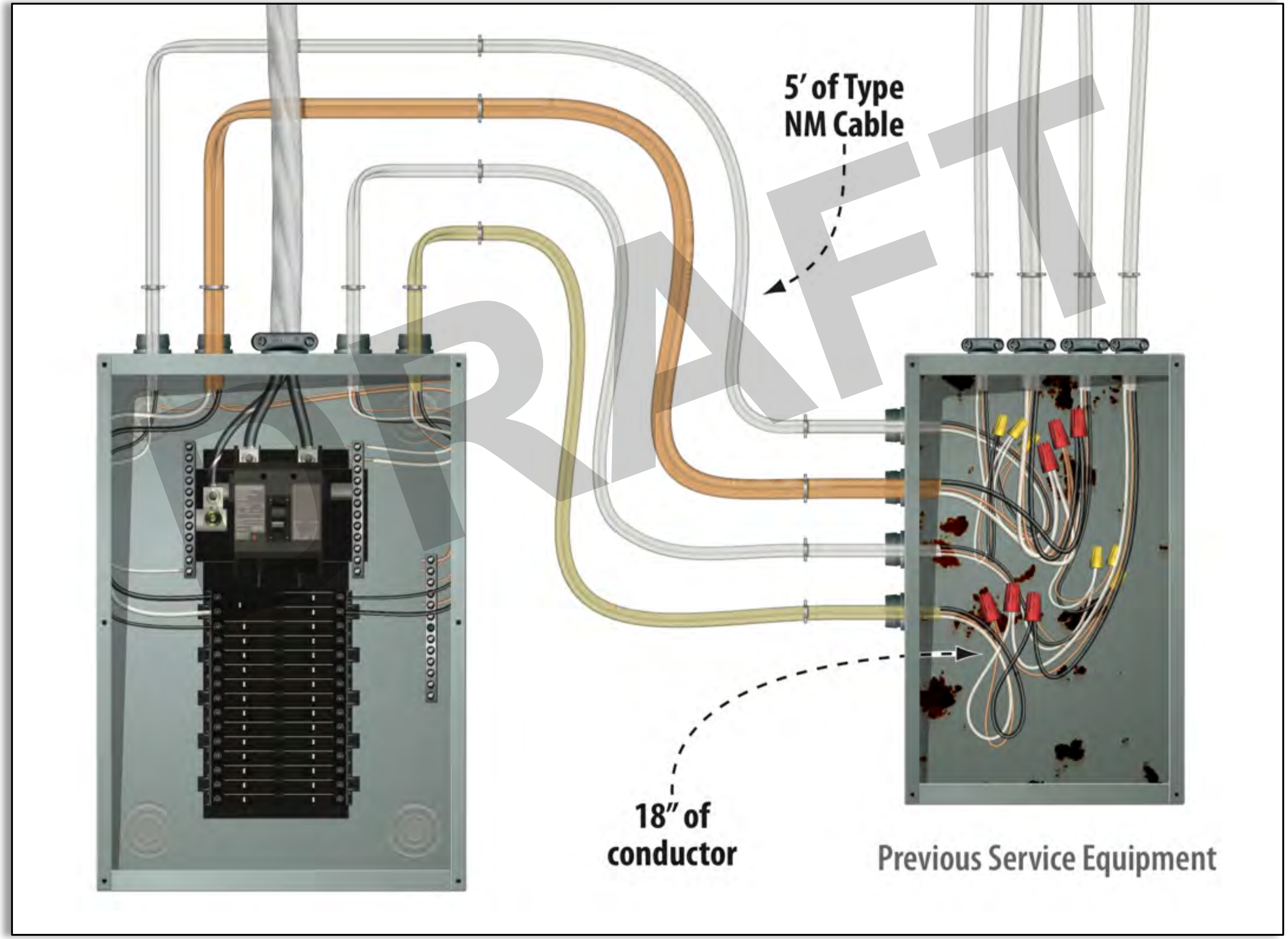
BC Extensions/Modifications, Guest Rooms/Suites

Change Summary

- 210.12(D) is expanded to include guest rooms and guest suites.
- New text is added to clarify the exception for branch circuit conductor extensions not more than 6 feet.
- Splicing devices are permitted. The 6-foot measurement does not include conductors inside an enclosure, cabinet, or junction box.

210.12(D)

REVISION



210.19(A)(1)

REVISION

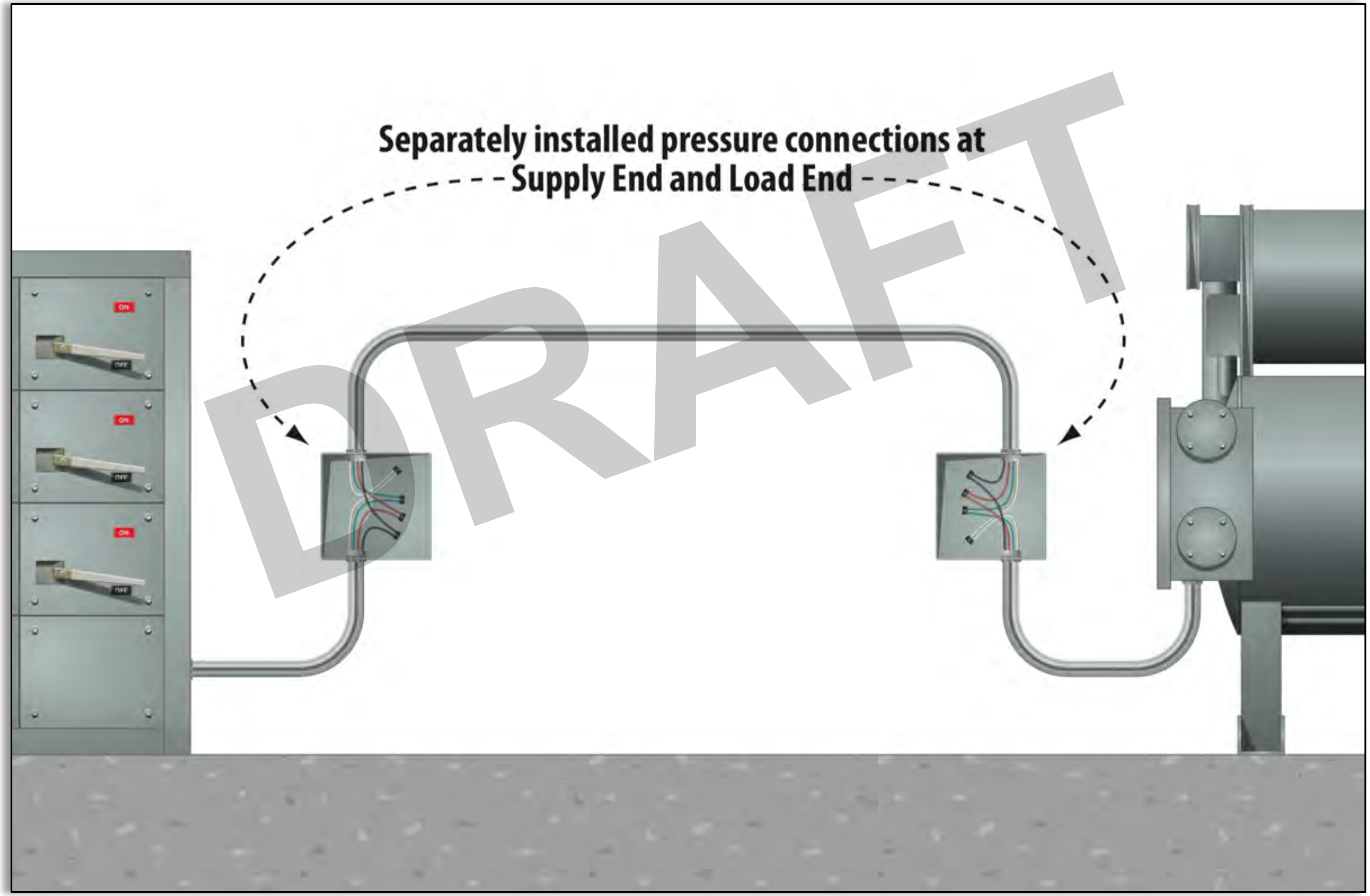
Conductors, Minimum Ampacity and Size

Change Summary

- The minimum ampacity and size of branch circuit conductors must also comply with 110.14(C) for equipment terminations.
- The existing exception is clarified to apply to only 210.19(A)(1)(a).
- A new Exception No. 2 is added to permit portions of the branch circuit (not the full length) to have an allowable ampacity of not less than the sum of the continuous load plus the noncontinuous load.

210.19(A)(1)

REVISION



210.25(B)

REVISION

Common Area Branch Circuits

Change Summary

- A new informational note is added in 210.25(B) to provide examples of common areas or public spaces.
- These areas include, but are not limited to, lobbies, corridors, stairways, laundry rooms, roofs, elevators, washrooms, storerooms, driveways (parking), and mechanical rooms.

210.25(B)

REVISION

210.52(C)

REORGANIZE

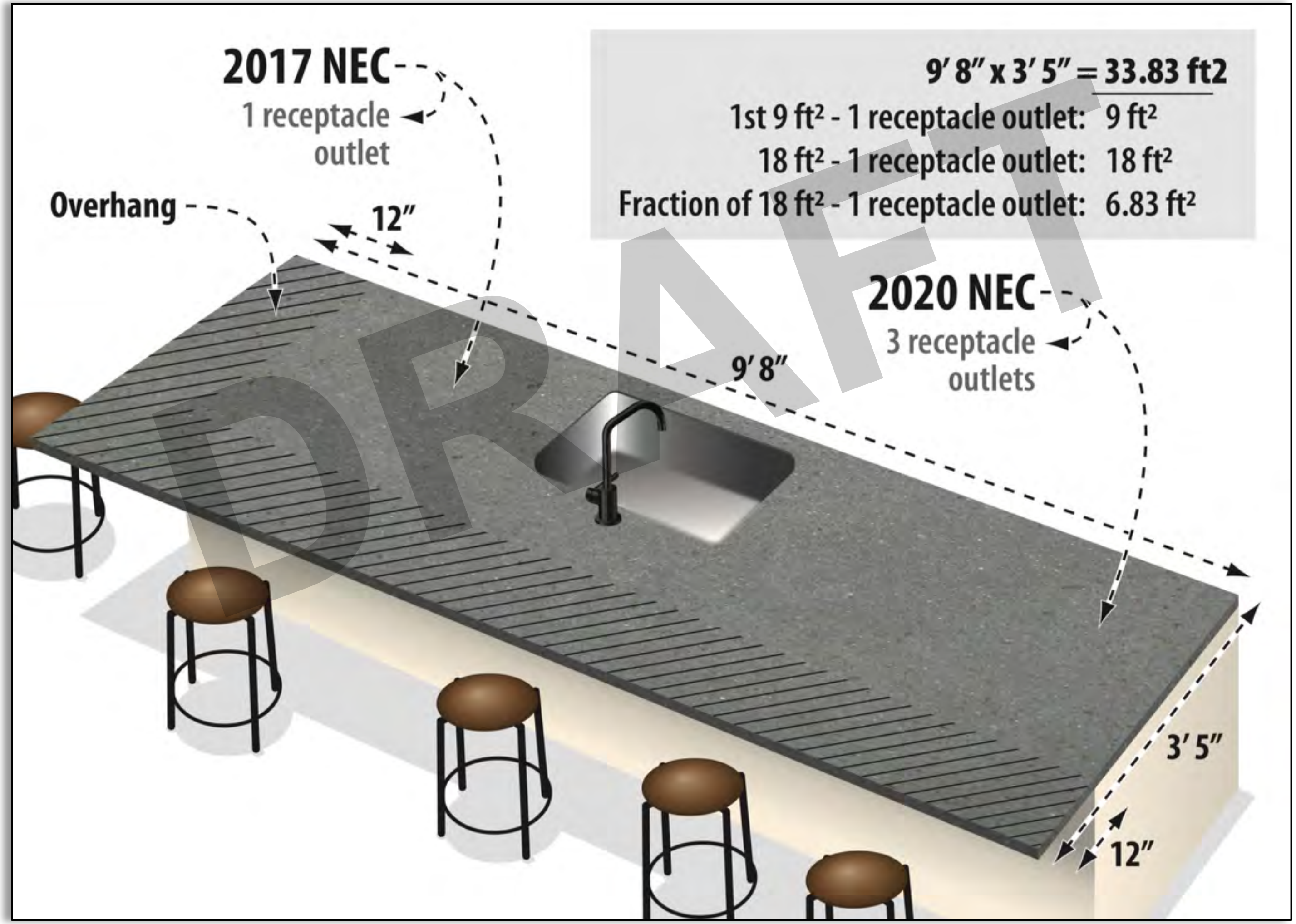
Receptacle Outlets, Countertops and Work Surfaces

Change Summary

- Requirements for island and peninsular countertops are combined.
- 9 ft.^{2} of space or any fraction will require a receptacle and one more for every 18 ft.^{2} or any fraction thereof.
- A peninsular countertop work surface must have a receptacle outlet within 2 feet of the end of the countertop or work surface.

210.52(C)

REORGANIZE



210.52(E) & (G)

REVISION

Outdoor Outlets and Basements, Garages, …

Change Summary

- New text modifies receptacle outlet requirements for decks and porches; accessibility from inside an attachment is no longer required.
- Multifamily dwellings must now comply with 210.52(G).
- Garage spaces not attached in multifamily dwellings are not required to have a receptacle outlet in each vehicle bay.

210.52(E) & (G)

REVISION

210.63

REVISION

Equipment Requiring Servicing

Change Summary

- 210.63 and 210.64 are revised and combined into a single section.
- The exceptions to 210.64 are deleted.
- A new requirement now mandates a receptacle outlet for all indoor equipment requiring dedicated equipment space.

210.63

REVISION

210.65

REVISION

Meeting Rooms

Change Summary

- Meeting room receptacle requirements are relocated from 210.71 to 210.65.
- Clarity is provided for the number of, and location of, receptacle outlets in fixed walls.
- Revisions also address non-rectangular meeting rooms and floor outlets to supply receptacles that could be in hardwired furniture.

210.65

REVISION

210.70

REVISION

Lighting Outlets Required

Change Summary

- 210.70 is modified to require lighting outlets “controlled by a listed wall-mounted control device.”
- Listed snap switches are permitted.
- This revision recognizes technology that utilizes remote devices that wirelessly communicate to control a lighting outlet or receptacle.

210.70

REVISION

215.10

NEW

Ground Fault Protection of Equipment

Change Summary

- New Exception No. 3 now permits temporary feeders to be installed without ground-fault protection for the time necessary to repair and maintain equipment.
- This permission is limited to the time period necessary, but not more than 90 days.
- Editorial revisions were made in the remainder of this section.

215.10

NEW

D379 CATERPILLAR
DOW CORNING
732
Multi-Purpose Sealant
TRACEY

220.11, 220.12(A) & (B)

NEW / REVISION

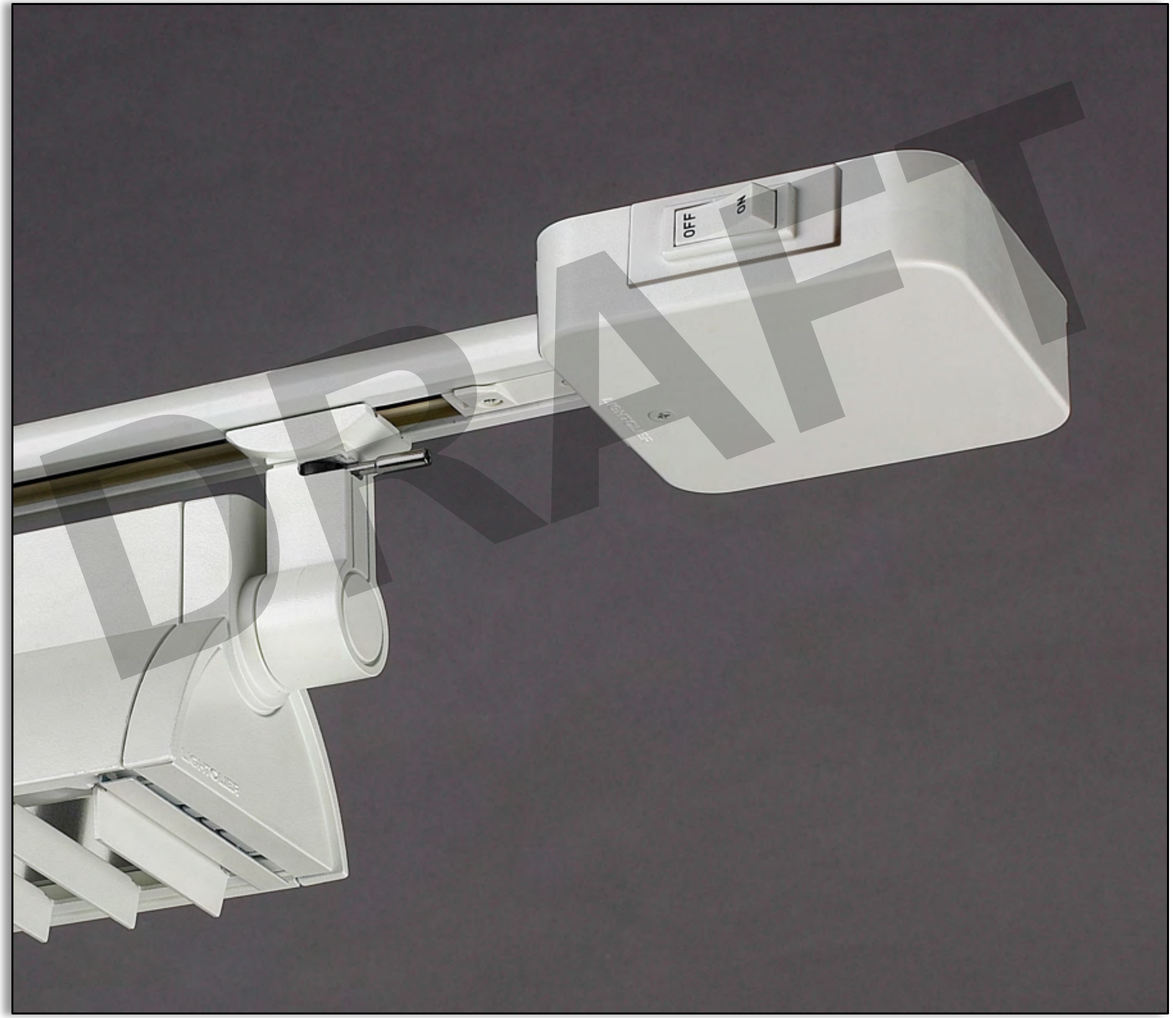
Floor Area, Lighting Load Non-Dwelling Occupancies

Change Summary

- The parent text of 220.12 is modified editorially and relocates requirements to determine floor area to a new section 220.11.
- Energy Code requirements are added in 220.12(B) and Exception No. 1 is deleted.
- Exception No. 2 is deleted as the values in Table 220.12 are revised.

220.11, 220.12(A) & (B)

NEW / REVISION



Courtesy of Koninklijke Philips Electronics N. V-Lightolier

Table 220.12

REVISION

General Lighting Loads by Non-Dwelling Occupancy

Change Summary

- Table 220.12 is now limited to non-dwelling occupancies.
- Significant revisions are included for types of occupancies to correlate with ASHRAE 90.1.
- The unit load for most occupancies has been significantly reduced.

Table 220.12

REVISION

220.14(J), (K), & (M)

NEW REVISION

Dwelling Units, Office Buildings, Hotels, and Motels

Change Summary

- General lighting load requirements for dwelling units are relocated to 220.14(J).
- 220.14(K) now clarifies that the value in (K) has demand factors applied.
- New 220.14(M) clarifies that the minimum unit load in table 220.12 includes the lighting at receptacle outlets specified.

220.14(J), (K), & (M)

NEW **REVISION**

220.42

REVISION

General Lighting

Change Summary

- Demand factors for derating feeder and service conductors in hospitals are deleted.
- Demand factors for feeder and service conductors in hotels, motels, and apartment houses without provision for cooking, are increased to correlate with revisions in Table 220.12.

220.42

REVISION

220.87

REVISION

Determining Existing Loads

Change Summary

- 220.87 permits actual maximum demand values to determine existing loads.
- Where feeder or service conductors have a renewable energy system, or any form of peak load shaving, actual maximum demand is not obtainable and Section 220.87 cannot be applied.

220.87

REVISION

225.10, 230.43, & 230.44

NEW / REVISION

Wiring on Buildings (or Other Structures)

Change Summary

- Type TC-ER cable is now a permitted wiring method for outside feeders and branch circuits and services.
- Type TC-ER cable complies with the crush and impact requirements of Type MC cable.
- Type SE cable is now specifically identified as permitted in 225.10, 230.43, and 230.44.

225.10, 230.43, & 230.44

NEW REVISION

1077

225.15

REVISION

Supports Over Buildings

Change Summary

- Section 225.15 is revised by removing the reference to 230.29.
- The requirement for outside branch-circuits and feeders supported over a building is that they be "securely supported."
- Applying the requirements of 230.29 in Article 225, and bonding the grounded conductor to metal support structures violates 250.142(B).

225.15

REVISION

225.19

REVISION

Overhead Spans Open/Multiconductor Cable

Change Summary

- Parent text is added to clarify that this section applies only to overhead spans of open conductors and open multiconductor cables.
- Cable assemblies, such as Type SE or UF are not "open multiconductor cables."
- The requirements of 225.19 do not apply to raceways or cable assemblies.

225.19

REVISION

225.30(A)

NEW

Special Conditions (Number of Supplies)

Change Summary

- 225.30(A) is modified to permit additional feeders or branch circuits for docking facilities and piers.
- This revision recognizes the need for increased levels of ground fault protection in marinas and similar installations.
- Section 555.35 requires shore power receptacles to have GFPE not exceeding 30 mA. Feeders and branch circuits must have GFPE set to open at not more than 100 mA.

225.30(A)

NEW

225.30(B)

NEW

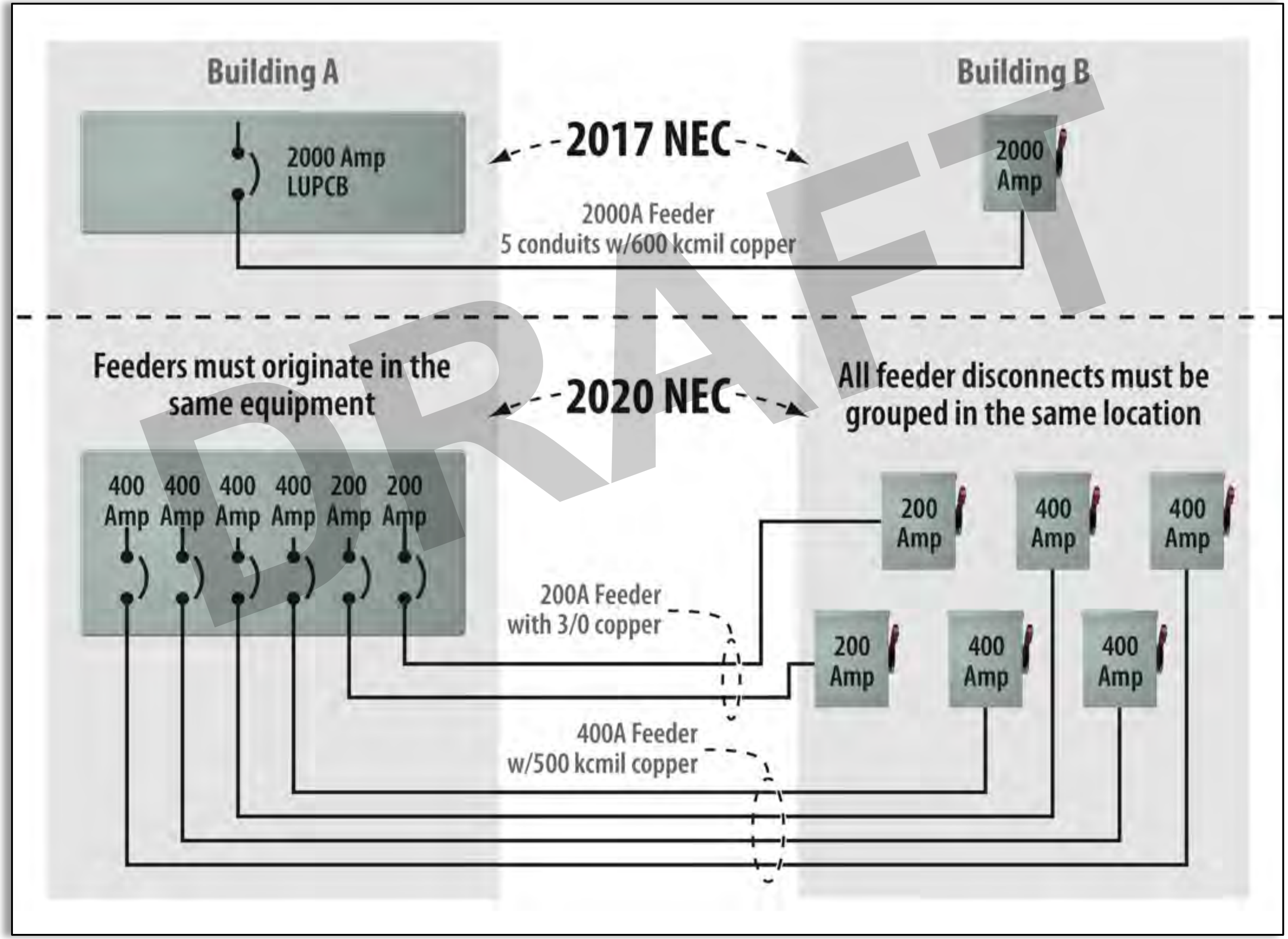
Common Supply Equipment

Change Summary

- 225.30(B) now permits up to six feeders to supply a separate building or structure.
- All of the feeder conductors must originate in the same panelboard, switchboard, or other distribution equipment.
- Each feeder must terminate in a single disconnecting means, and all of the feeder disconnects in the building or structure supplied, must be grouped in the same location.

225.30(B)

NEW



Building A
Building B
2000 Amp
LUPCB
2017 NEC
2000
Amp
2000A Feeder
5 conduits w/600 kcmil copper
Feeders must originate in the same equipment
2020 NEC
All feeder disconnects must be grouped in the same location
400 Amp
400 Amp
400 Amp
400 Amp
200 Amp
200 Amp
200 Amp
400 Amp
400 Amp
200A Feeder
with 3/0 copper
200 Amp
400 Amp
400 Amp
400A Feeder
w/500 kcmil copper
DRAFT

230.46

REVISION

Spliced and Tapped Conductors

Change Summary

- The requirement for marking power distribution blocks used on service conductors is moved from 314.28(E)(1) to 230.46.
- All power distribution blocks, pressure connectors, and devices for splices and taps of service conductors must be listed.
- Effective January 1, 2023, pressure connectors and devices for splices and taps on service conductors must be marked as suitable.

230.46

REVISION

230.62(C)

NEW

Barriers

Change Summary

- The requirements of 408.3(A)(2) are relocated and expanded into new 230.62(C).
- All service equipment is now required to be provided with barriers to prevent line side inadvertent contact.
- This includes, but is not limited to panelboards, switchboards, switchgear, motor control centers, individual circuit breaker enclosures, SUSE rated transfer switches, and fused disconnects.

230.62(C)

NEW

230.67

NEW

Surge Protection, Dwelling Units

Change Summary

- New 230.67 requires services supplying dwelling units to be provided with an SPD.
- The SPD must be located in or next to the service equipment. An exception permits an alternate location, provided an SPD is located at each next level distribution equipment downstream toward the load.
- All of the requirements in this new section apply where service equipment is replaced.

230.67

NEW

230.71

REVISION

Maximum Number of Disconnects, Two to Six

Change Summary

- The requirements in 230.71(B) permitting up to six service disconnects are significantly revised.
- Panelboards, for example, must be provided with a single main in each enclosure.
- 230.71(B)(1) through (4) outline the permitted methods for two to six service disconnects.

230.71

REVISION

230.75

REVISION

Disconnection of Grounded Conductor

Change Summary

- A new informational note is added in 230.75, to explain how this requirement is typically met.
- In order to performance test GFPE, there must be a means to disconnect the grounded conductor from premises wiring.
- A short section of bus is typically installed so that it can be easily removed, and it is typically identified as a *neutral disconnect link.*

230.75

REVISION

230.82 (1), (3), (5), & (6)

REVISION

Equipment…Supply Side of Service Disconnect

Change Summary

- Other current-limiting devices are not permitted to act as a "cable limiter."
- Where service conductors are spliced, the rules of 240.21 do not apply.
- 230.82(6) now requires PV systems, fuel cells, and wind energy, etc. connected on the supply side of the service disconnect to be provided with service rated disconnecting means and overcurrent protection.

230.82 (1), (3), (5), & (6)

REVISION

230.82 (10) & (11)

REVISION

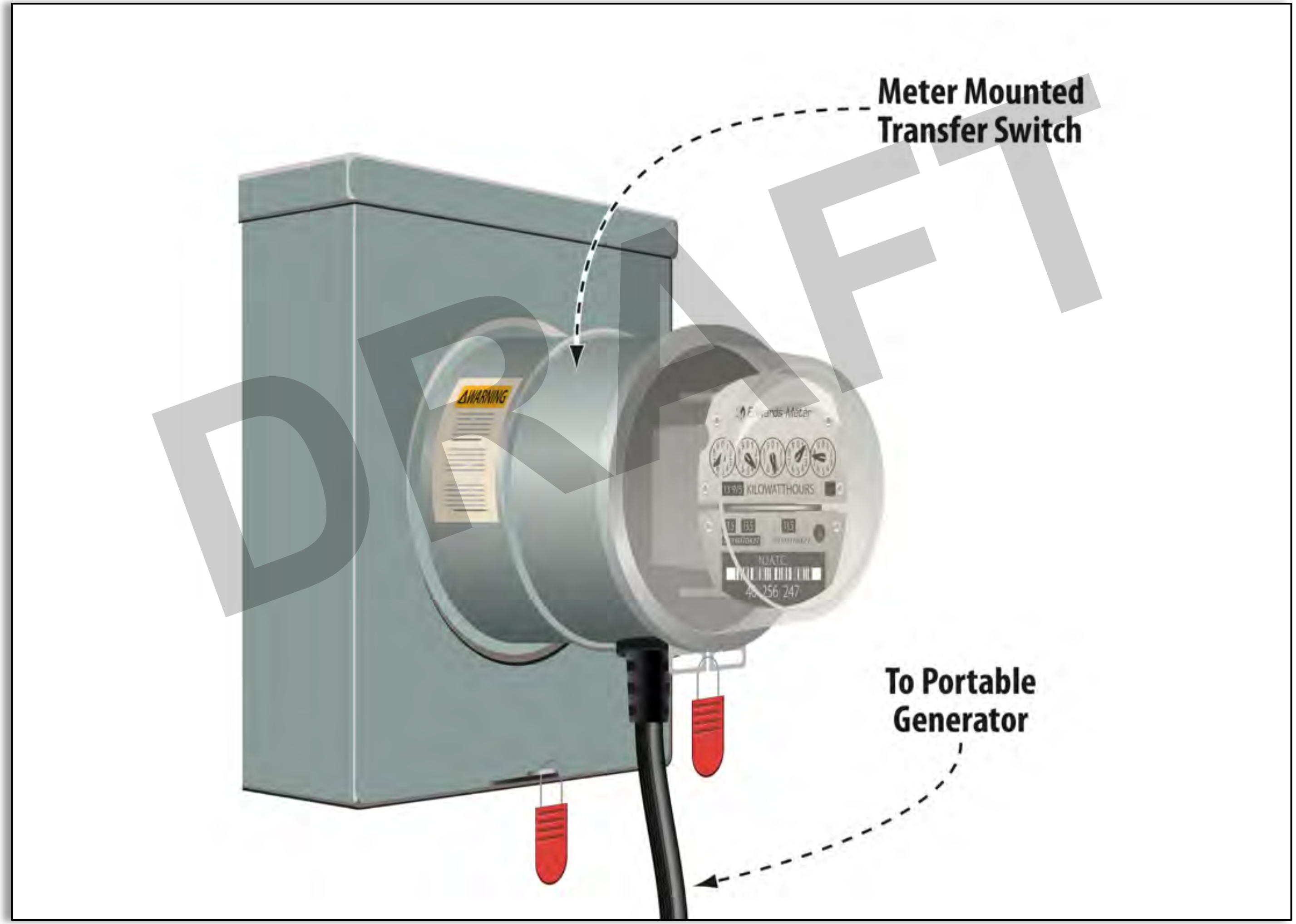
Equipment…Supply Side of Service Disconnect

Change Summary

- Emergency disconnects required by 230.85 are permitted to be connected on the supply side of the service disconnect.
- Meter mounted transfer switches are added in list item (11) and are permitted for optional standby use.

230.82 (10) & (11)

REVISION



230.85

NEW

Emergency Disconnects

Change Summary

- All services for one and two family dwellings are now required to have emergency disconnects installed in a readily accessible outdoor location.
- These disconnects are necessary for first responders in a fire or other emergency.
- Similar requirements are added in this *NEC* cycle for energy storage systems and permanently mounted generators.

230.85

NEW

240.6(C)

REVISION

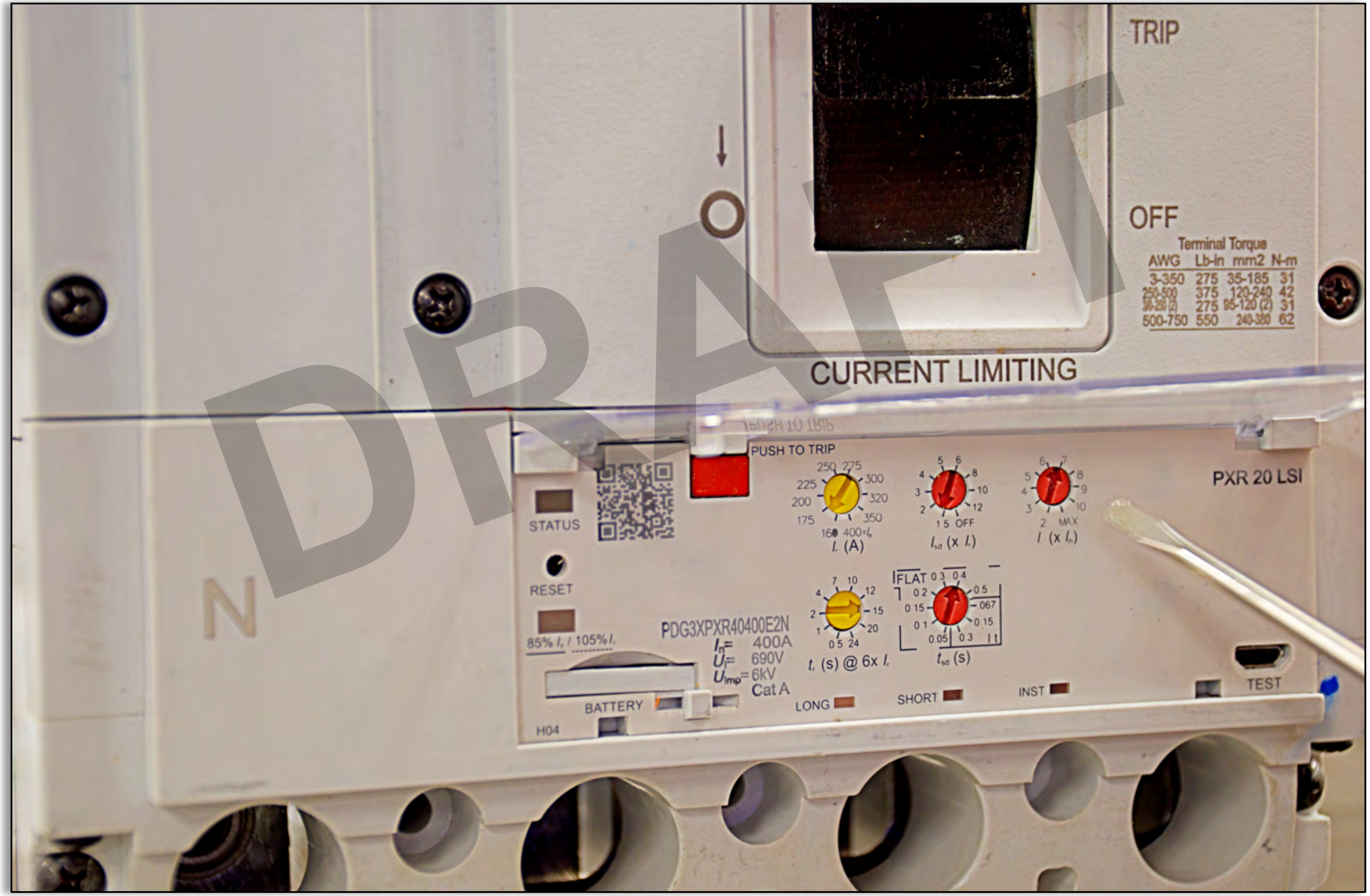
Restricted Access Adjustable-Trip Circuit Breakers

Change Summary

- Adjustable trip circuit breakers may be rated at the adjusted current setting, provided there is restricted access to the device.
- 240.6(C) list items (1) through (3) are editorially modified for clarity.
- New list item (4) permits an adjustable trip circuit breaker that is password-protected with the password accessible only to qualified personnel to be considered as having restricted access.

240.6(C)

REVISION



240.21(B)

REVISION

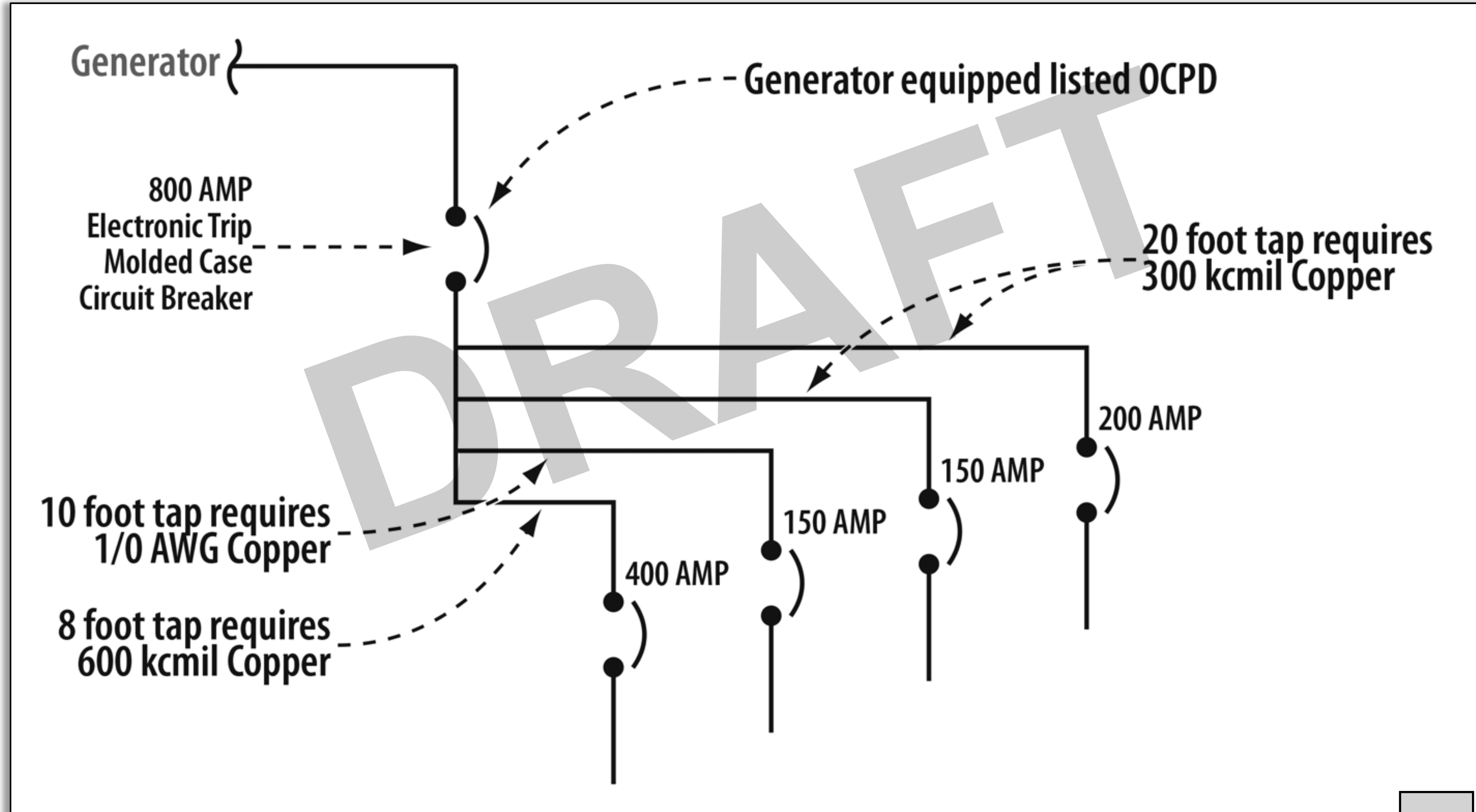
Feeder Taps

Change Summary

- The parent text 240.21(B) is modified for clarity.
- Feeders are permitted to be tapped at any point on the load side of the feeder overcurrent protective device.
- Generator supplied feeder tap conductors are often installed in this manner. See 445.13(B).

240.21(B)

REVISION



240.62, 240.88, & 240.102

NEW

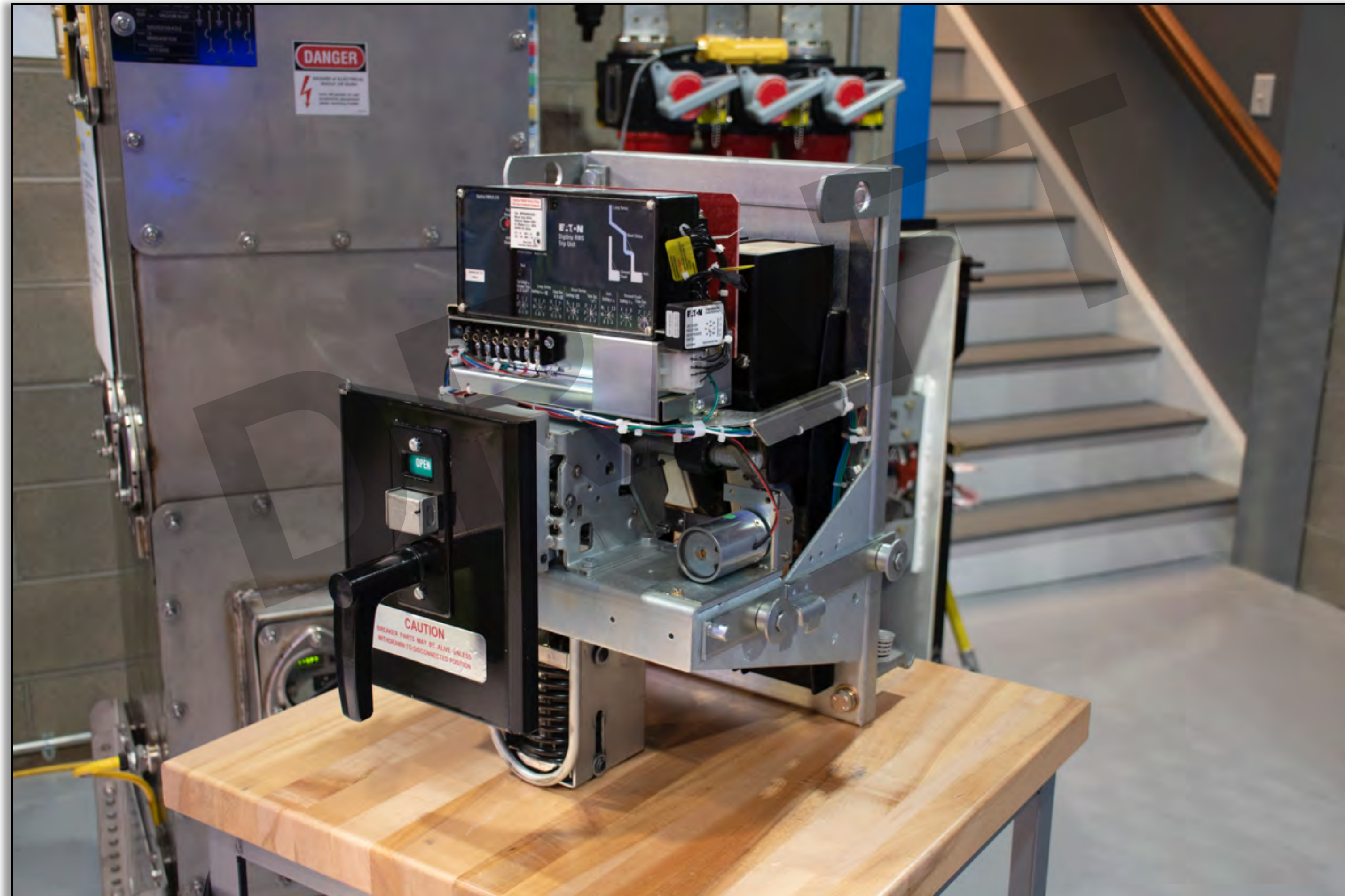
Reconditioned Equipment

Change Summary

- Low and medium voltage fuse holders/non-renewable fuses are not permitted to be reconditioned.
- Molded case circuit breakers and low voltage power circuit breaker electronic trip units are not permitted to be reconditioned.
- Low, medium voltage power CBs, high voltage CBs, electromechanical protective relays, and current transformers are permitted to be reconditioned.

240.62, 240.88, & 240.102

NEW



Courtesy of Eaton

240.67

REVISION

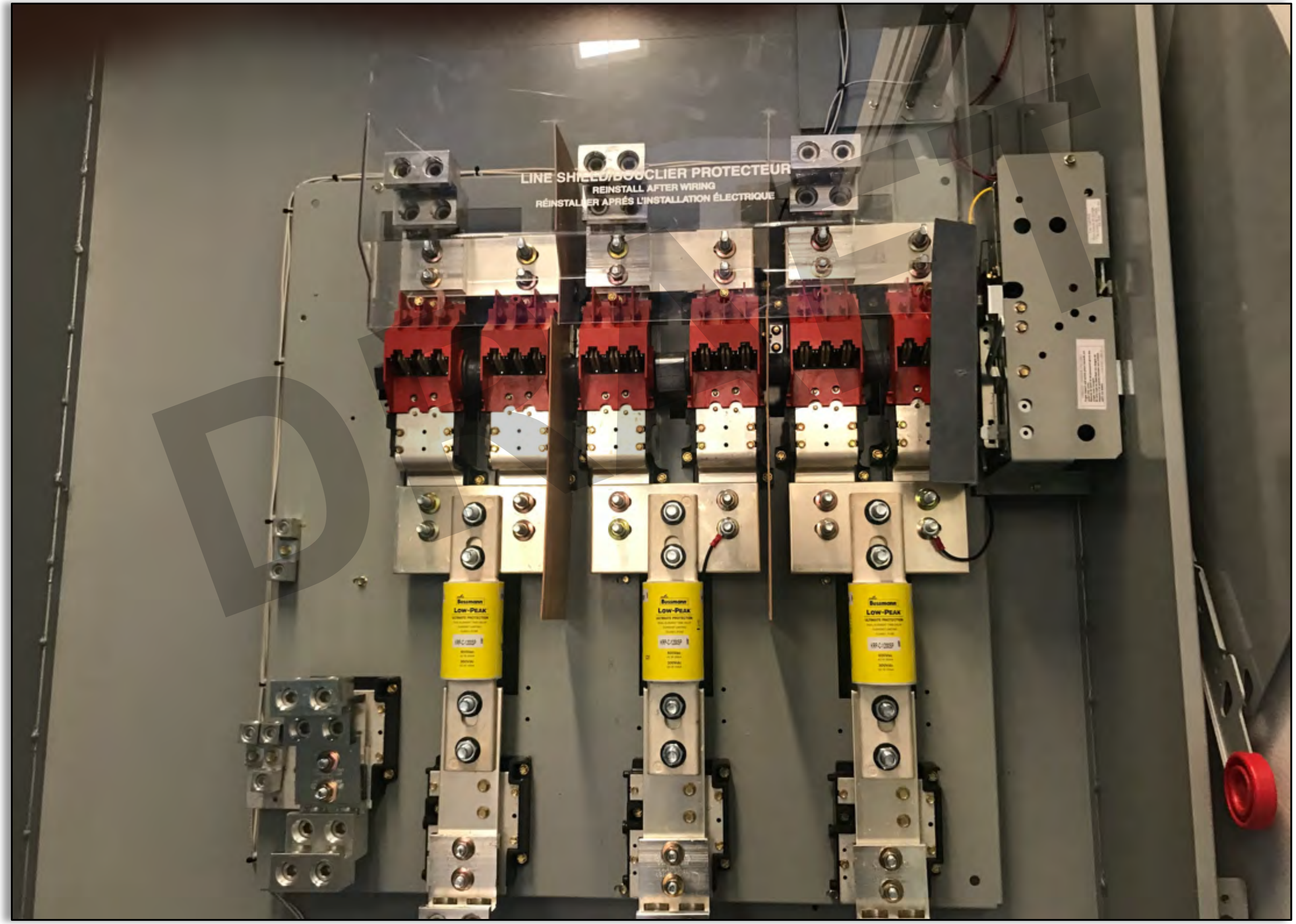
Arc Energy Reduction

Change Summary

- Documentation is now required to demonstrate that the method chosen to reduce clearing time will operate at a value below the arcing current.
- 240.67(B) requires that the method chosen to reduce clearing time operates at a value below the arcing current.
- Current limiting electronically actuated fuses are now a permitted arc energy reduction method in 240.67.

240.67

REVISION



Courtesy of Eaton

240.67(C) & 240.87(C)

NEW

Performance Testing

Change Summary

- Arc energy reduction methods must be performance tested when first installed onsite.
- Testing must be performed by qualified persons in accordance with the manufacturers’ instructions.
- A written record of this testing must be made available to the AHJ.

240.67(C) & 240.87(C)

NEW

Courtesy of Eaton

240.87

REVISION

Arc Energy Reduction

Change Summary

- Temporary adjustment of the instantaneous trip setting to achieve arc energy reduction is prohibited.
- All arc energy reduction methods chosen, must operate at less than the available arcing current. This must be documented.

240.87

REVISION

Courtesy of Eaton

Article 242

NEW / **RELOCATE**

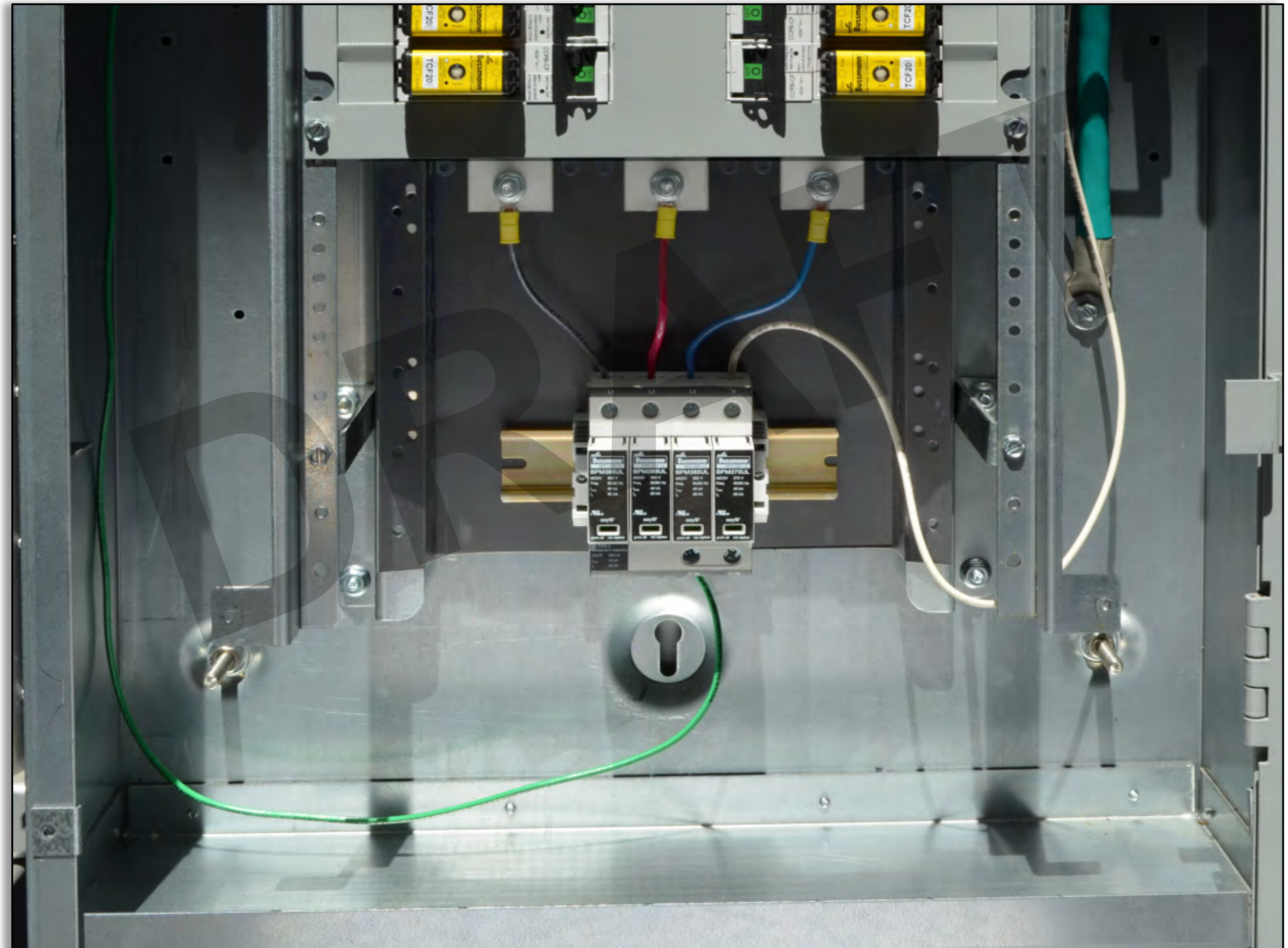
Overvoltage Protection

Change Summary

- Articles 280 and 285 have been combined to form a new Article 242 titled Overvoltage Protection.
- The article has three parts, General, Surge Protective Devices (SPDs) 1000 Volts or Less, and Surge Arresters Over 1000 Volts.
- Technical responsibility for Article 242 and its associated definitions in Article 100 has been shifted from CMP-5 to CMP-10.

Article 242

NEW **RELOCATE**



250.2

DELETION / RELOCATE

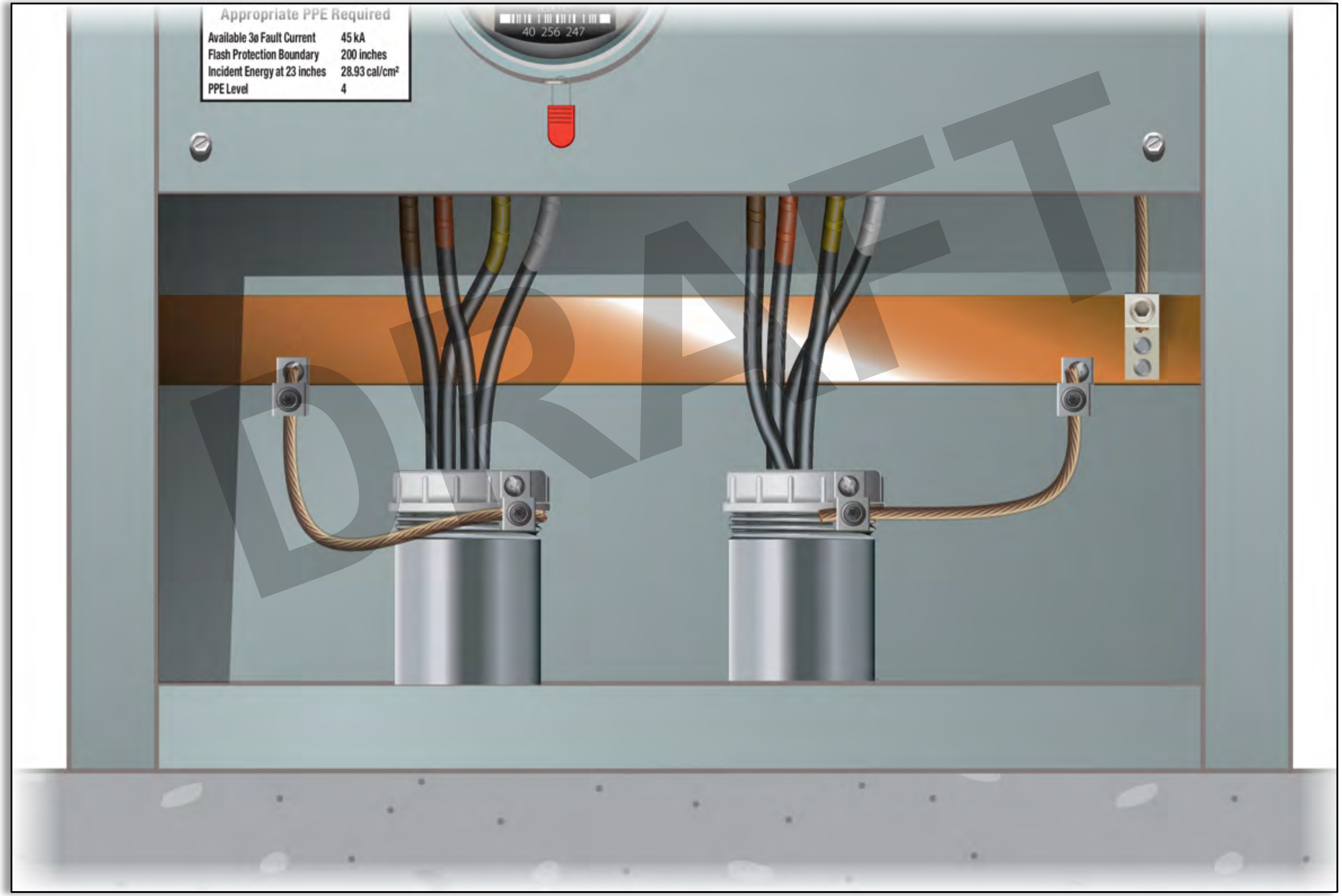
Definition of Bonding Jumper, Supply-Side

Change Summary

- The definition of the term *Bonding Jumper, Supply-Side* has been deleted from 250.2.
- The definition, without revision has been located into Part I of Article 100.
- This relocation aligns with the requirements of Section 2.2.2.1 of the *NEC Style Manual*.

250.2

DELETION / **RELOCATE**



250.20(B) & 250.36 Informational Note

NEW

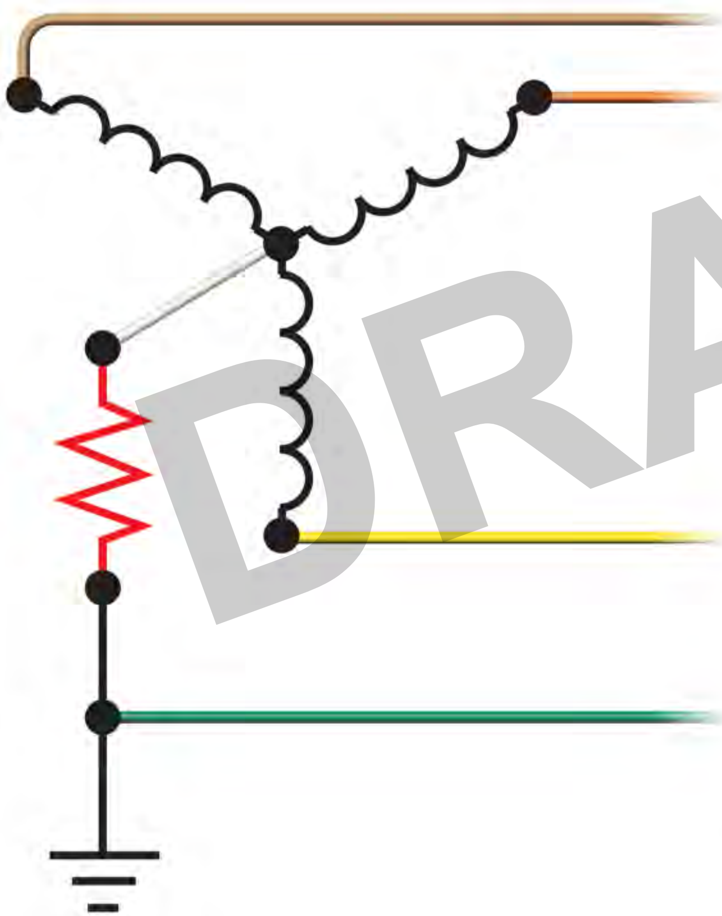
Informational Note References *NFPA 70E*

Change Summary

- A new informational note has been added following Section 250.20(B) and 250.36.
- The informational note references *NFPA 70E Standard for Electrical Safety in the Workplace, Annex O.*
- High-impedance grounded systems limit arc energy in a first phase-to-ground fault event that occurs in a high impedance grounded system.

250.20(B) & 250.36 Informational Note

NEW



Grounding location is between the grounding electrode conductor and the neutral grounding point.

Neutral conductor has to be fully insulated.

Neutral conductor must have an ampacity no less than the maximum current rating of the grounding impedance.

Grounding connection can only be made through the grounding impedance device.

250.25

NEW

Grounding on Supply Side of Disconnect

Change Summary

- A new section 250.25 titled “Grounding Systems Permitted to Be Connected on the Supply Side of the Disconnect” has been added in Part II of Article 250.
- The new section provides rules for grounding of systems connected to the supply side of the service disconnect as permitted in 230.82.
- The new section addresses systems supplied by grounded and ungrounded utility sources.

250.25

NEW

PHOTOVOLTAIC SYSTEM DEDICATED KWH METER
DANGER
INVERTERS LOCATED IN GARAGE
AC DISCONNECT SWITCH
RAIN DIAL
WARNING
WARNING
PHOTOVOLTAIC SYSTEM
EQUIPPED WITH
RAPID SHUTDOWN

250.28

REVISION

Main Bonding Jumper and System Bonding Jumper

Change Summary

- The words "aluminum, copper-clad aluminum" have been added to Section 250.28(A).
- This clarifies the conductive materials permitted to be used as main and system bonding jumpers.
- This revision also aligns with the permitted materials listed in 250.102(C)(1), and with materials that manufacturers sometimes use for main and system bonding jumpers within listed equipment.

250.28

REVISION

250.30

REVISION

Grounding Separately Derived AC Systems

Change Summary

- Multiple separately derived systems connected in parallel are considered a single separately derived system, only where the systems are of the same type.
- Section 250.30(A)(2) was revised to clarify that the system bonding jumper is connected to the enclosure, not the disconnecting means.
- Exceptions were relocated to follow the rule to which they apply to comply with the *NEC Style Manual*.

250.28

REVISION

250.34(A) & (B)

REVISION

Trailer-Mounted Generators

Change Summary

- The term *trailer-mounted* has been incorporated into Section 250.34(B).
- The requirements apply to portable, vehicle, and trailer-mounted generators.
- Subdivision (C) remains as in the 2017 *NEC* due to Second Revision 7793 failing ballot.

250.34(A) & (B)

REVISION

250.64(A)

REVISION

Aluminum and Copper-Clad Aluminum Conductors

Change Summary

- This section was restructured into a list format to meet the *NEC Style Manual* requirements.
- The revision in (1) prohibits direct contact with concrete.
- (2) has been revised to permit terminations of aluminum and copper-clad aluminum conductors connections within 18 inches of the earth where within enclosures listed for the environment.

250.64(A)

REVISION

250.64(B)(2) & (B)(3)

REVISION

Securing and Protection Against Physical Damage

Change Summary

- The term *Schedule 80* has been added to second-level subdivisions (2) and (3).
- The revision clarifies the type of PVC conduit that is suitable to provide protection against physical damage.
- Schedule 80 PVC conduit provides impact and crush resistant characteristics, while schedule 40 does not.

250.64(B)(2) & (B)(3)

REVISION

250.64(E)(1) & (E)(3)

REVISION

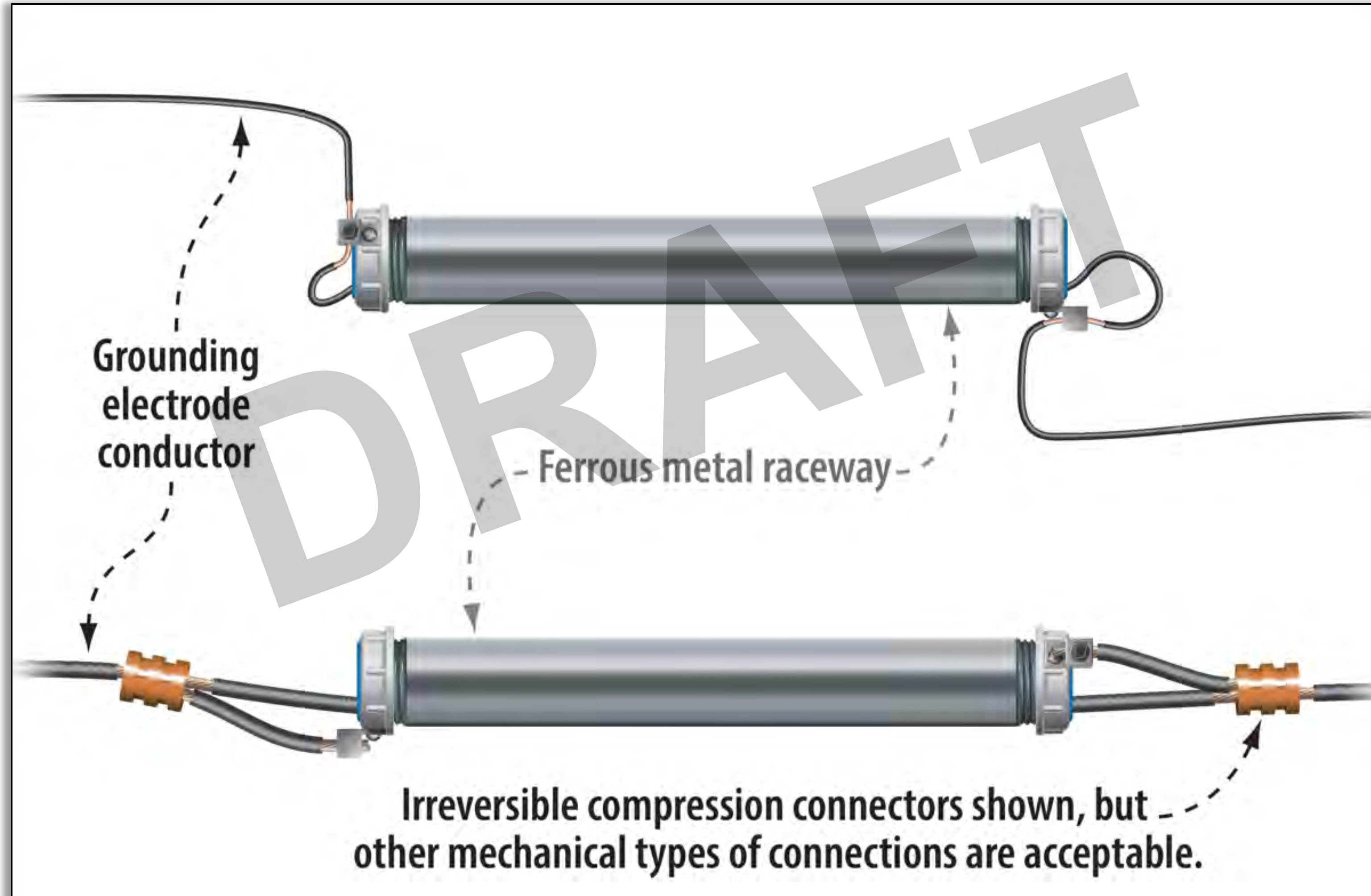
Raceways and Enclosures for GECs

Change Summary

- The term *cable armor* has been added to second-level subdivision (1).
- (3) has been revised to clarify minimum sizing requirements for bonding jumpers that are connected to ferrous metal raceways, or cable armor that encloses a GEC.
- The minimum size must not be smaller than the largest contained GEC in the same enclosure.

250.64(E)(1) & (E)(3)

REVISION



250.68(C)(3)

NEW / REVISION

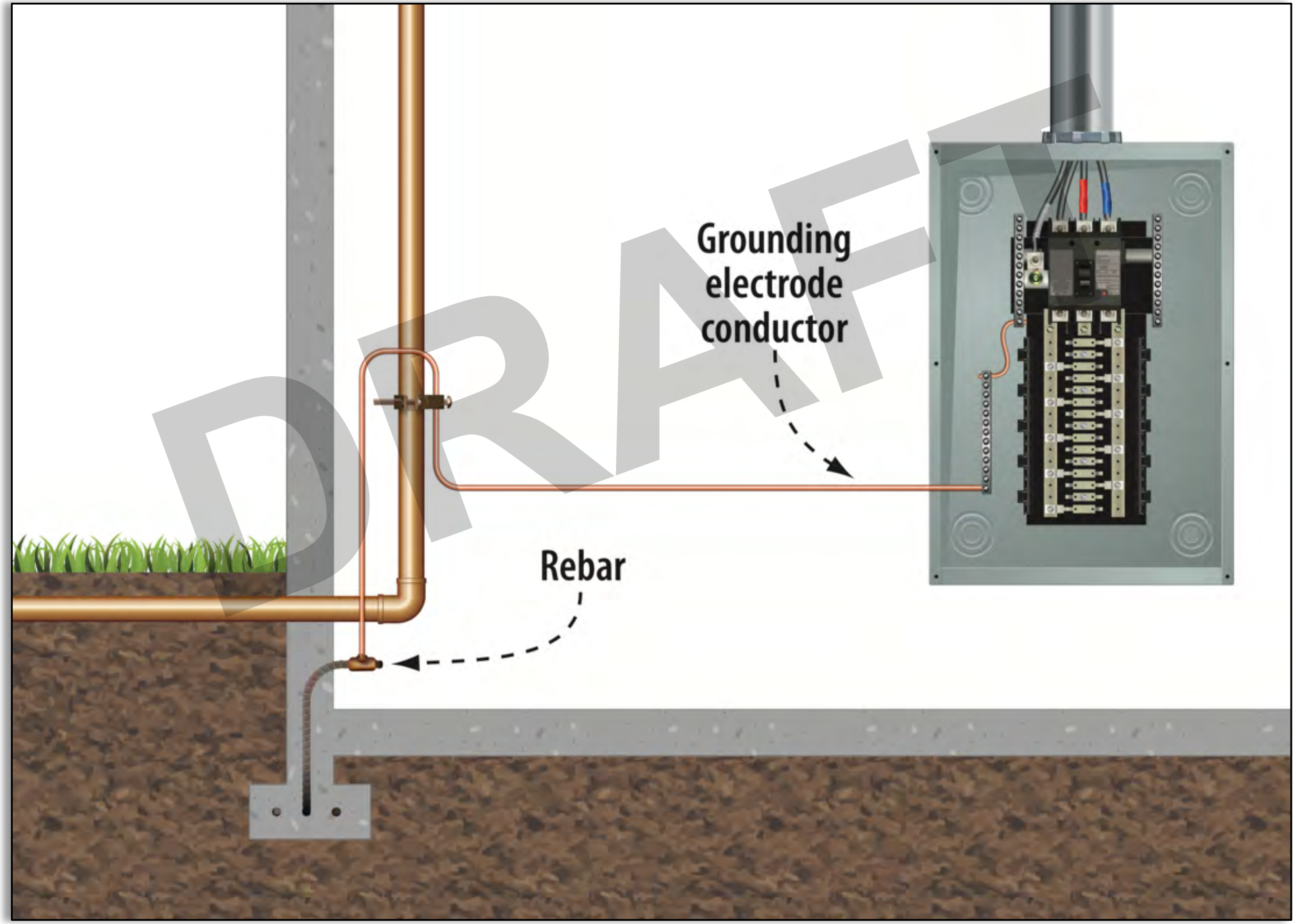
Grounding Electrode Conductor Connections

Change Summary

- The rebar extension must be connected to the rebar in the foundation or footing.
- The rebar extension shall not be exposed to earth contact without corrosion protection.
- The rebar extension shall not be used to interconnect electrodes of the grounding electrode system.

250.68(C)(3)

NEW / REVISION



250.92(B)

REVISION

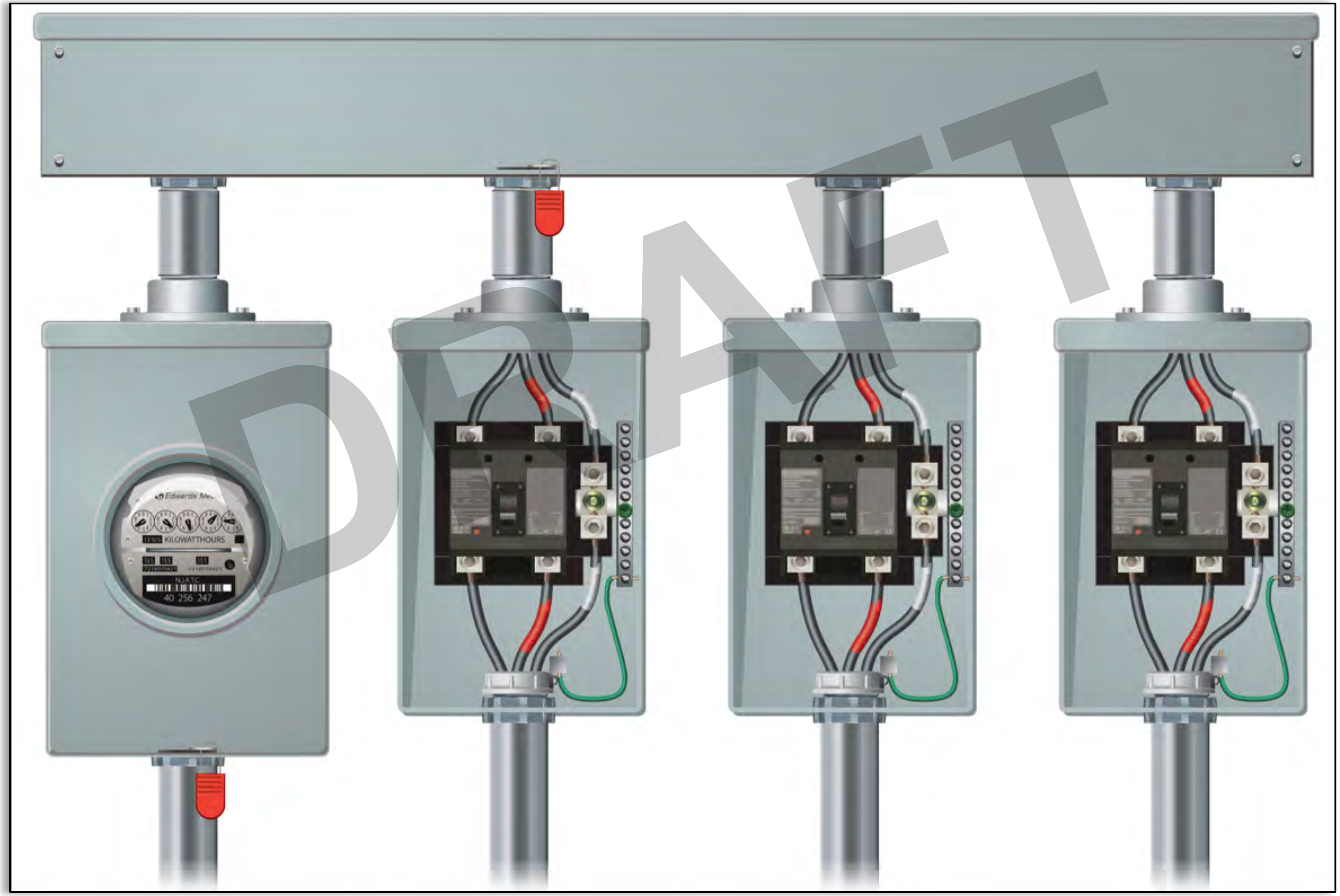
Method of Bonding at the Service

Change Summary

- The words “listed threaded hubs” have been incorporated into list item (2) of this section.
- Standard hubs that have not been evaluated and listed for use in service bonding applications are not permitted.
- Listed products are identified for the uses for which they are permitted.

250.92(B)

REVISION



250.98

REVISION

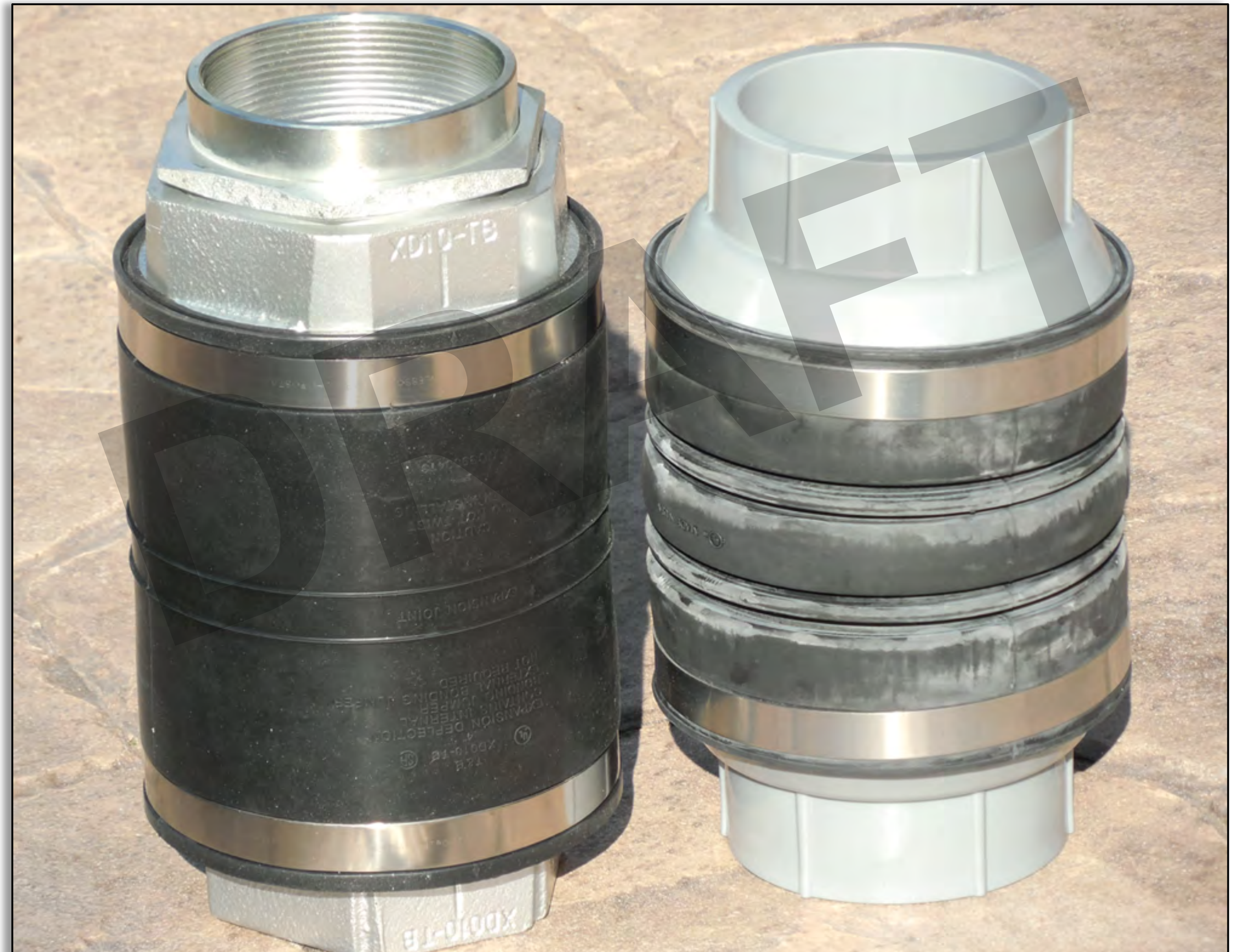
Bonding Loosely Joined Metal Raceways

Change Summary

- The words “expansion-deflection, or deflection” have been incorporated into this section.
- Bonding requirements in this section now apply to expansion deflection, and deflection fittings, as well as telescoping expansion fittings.
- Some fittings have integral bonding jumpers, others do not, and bonding jumpers must be installed.

250.98

REVISION



Courtesy of ABB

250.104(A)(B)(C)(D)

REVISION

Bonding of Piping Systems and Exposed Structural Metal

Change Summary

- The words “except that it shall not be required to be larger than 3/0 copper or 250 kcmil aluminum or copper-clad aluminum” have been restored within this section.
- Bonding jumper sizes do not have to exceed 3/0 copper or 250 aluminum as appeared in the 2014 *NEC* and prior.
- Informational note references to *NFPA 54* and *NFPA 780* have been updated.

250.104(A)(B)(C)(D)

REVISION

1141

250.119(B)

REVISION

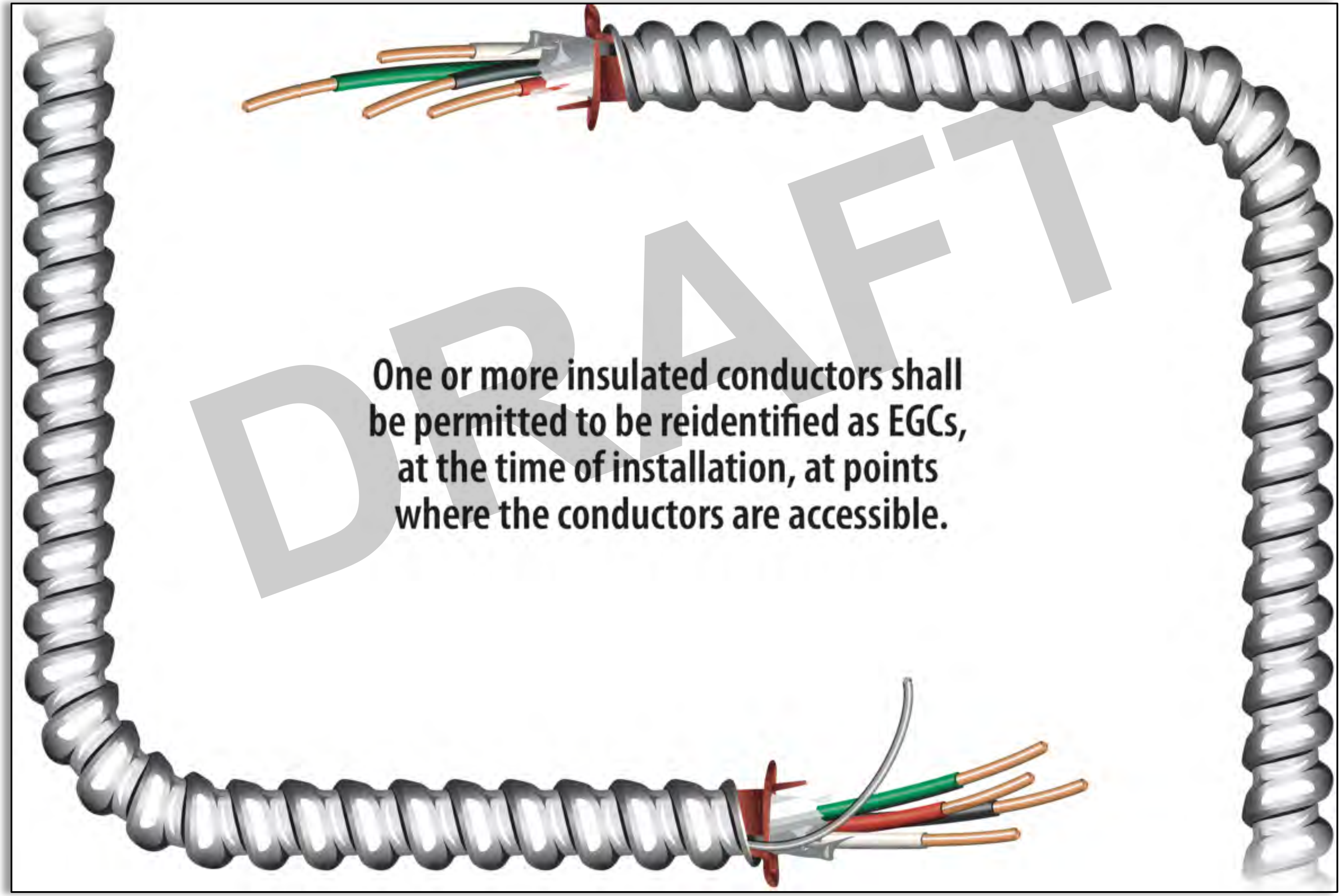
Multiconductor Cable Reidentified

Change Summary

- This section provides allowances for reidentifying equipment grounding conductors.
- The words “Where the conditions of maintenance and supervision ensure that only qualified persons service the installation” have been removed from this section.
- No other such restrictions exist that deal with reidentification of conductors.

250.119(B)

REVISION



250.121(B)

NEW

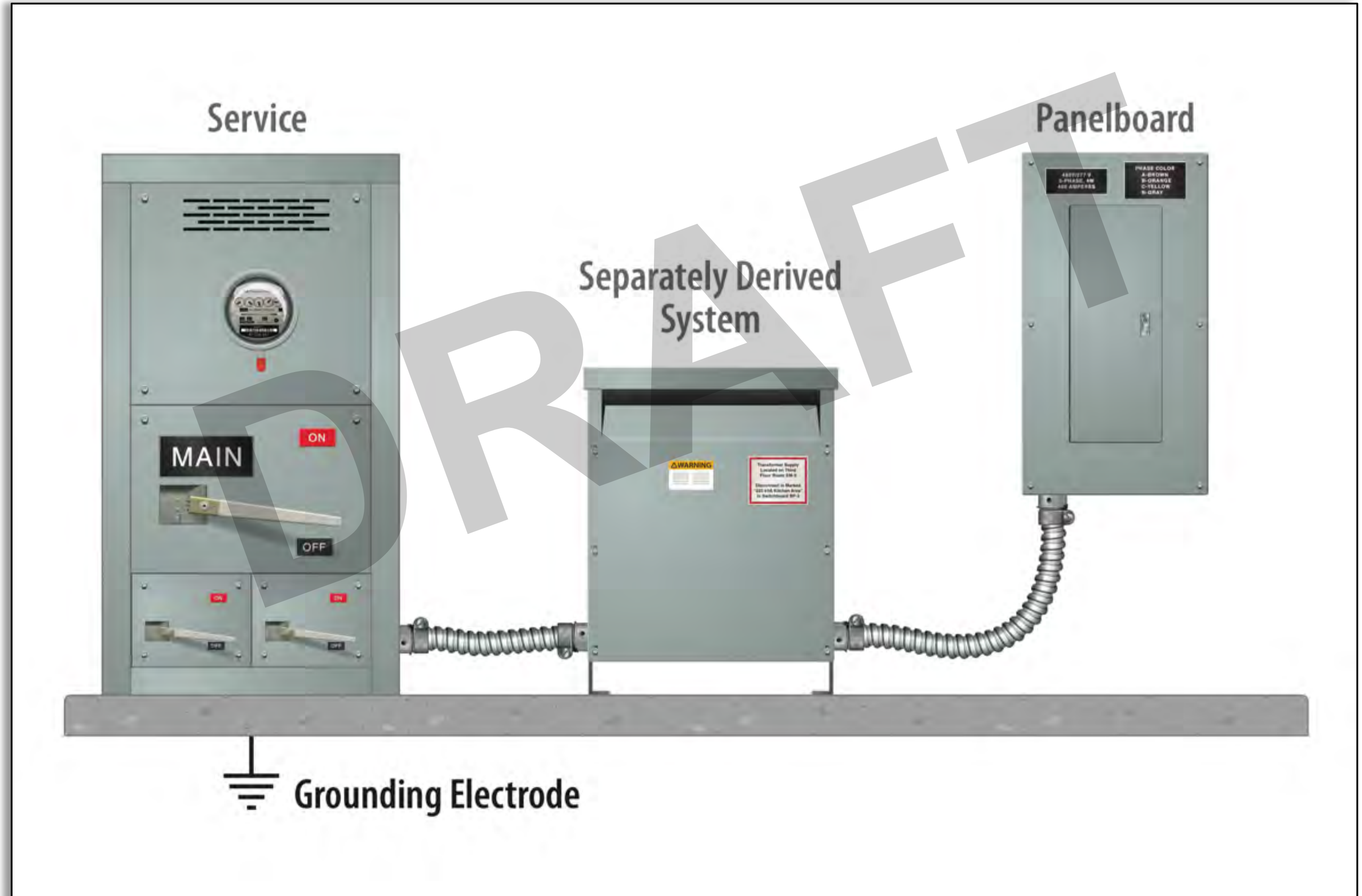
Metal Frame of Building or Structure

Change Summary

- The word “restricted” has been added to the title of this section.
- Added text in (B) restricts structural metal building frames from use as equipment grounding conductors.
- The revision provides consistency with the provisions of 250.136(A).

250.121(B)

NEW


Service
Panelboard
Separately Derived System
MAIN
ON
OFF
Grounding Electrode
DRAFT

250.122

REVISION

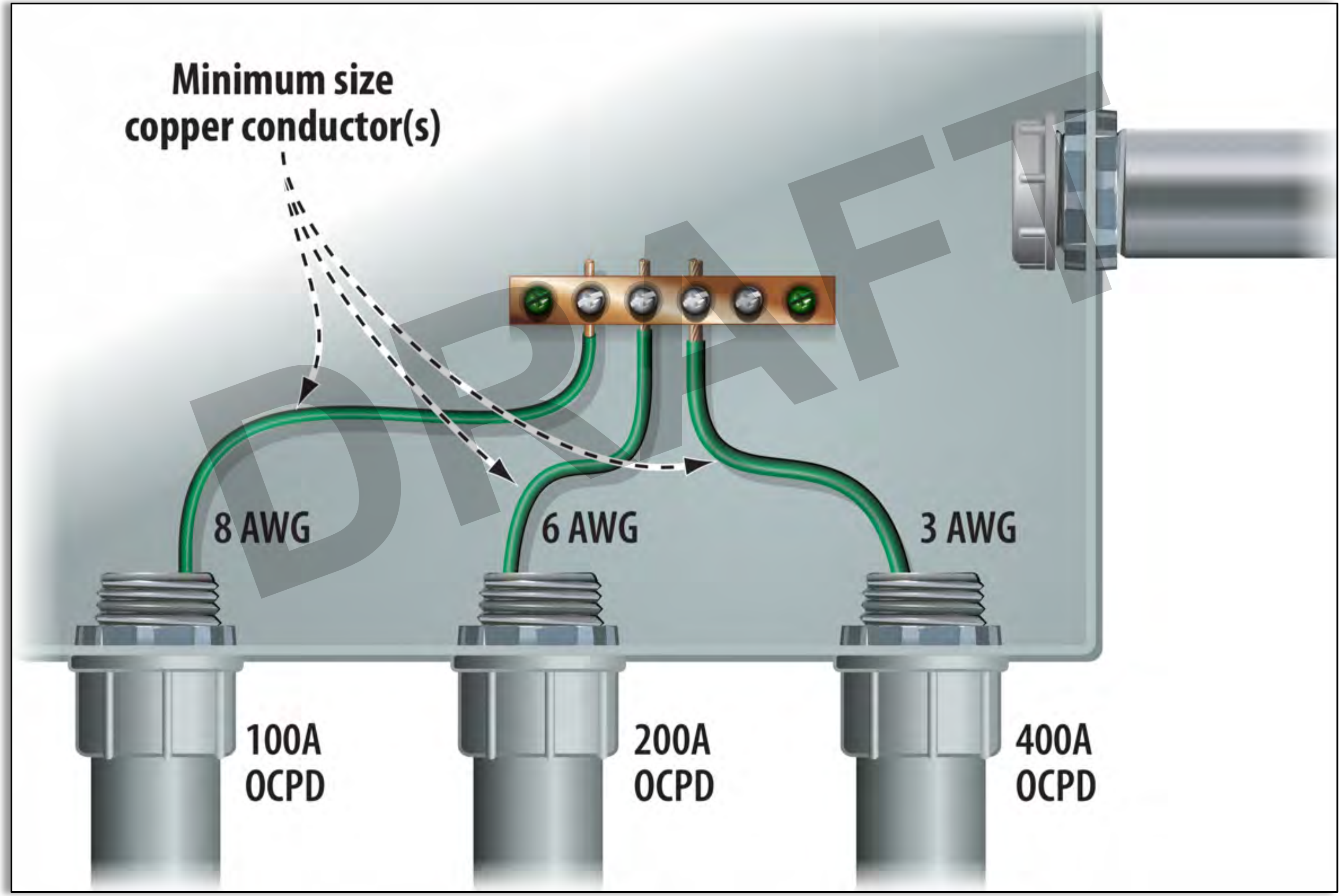
Size of Equipment Grounding Conductors

Change Summary

- Subdivision (B) is revised to clarify that adjustment and/or correction factors do not require an increase in the size of the EGC.
- The new exception to (B) indicates qualified persons shall be permitted to size equipment grounding conductors to provide an effective ground-fault current path.
- EGC sizes for 5000 and 6000 amperes are revised to correlate with Table 8, Chapter 9.

250.122

REVISION



250.134

REVISION

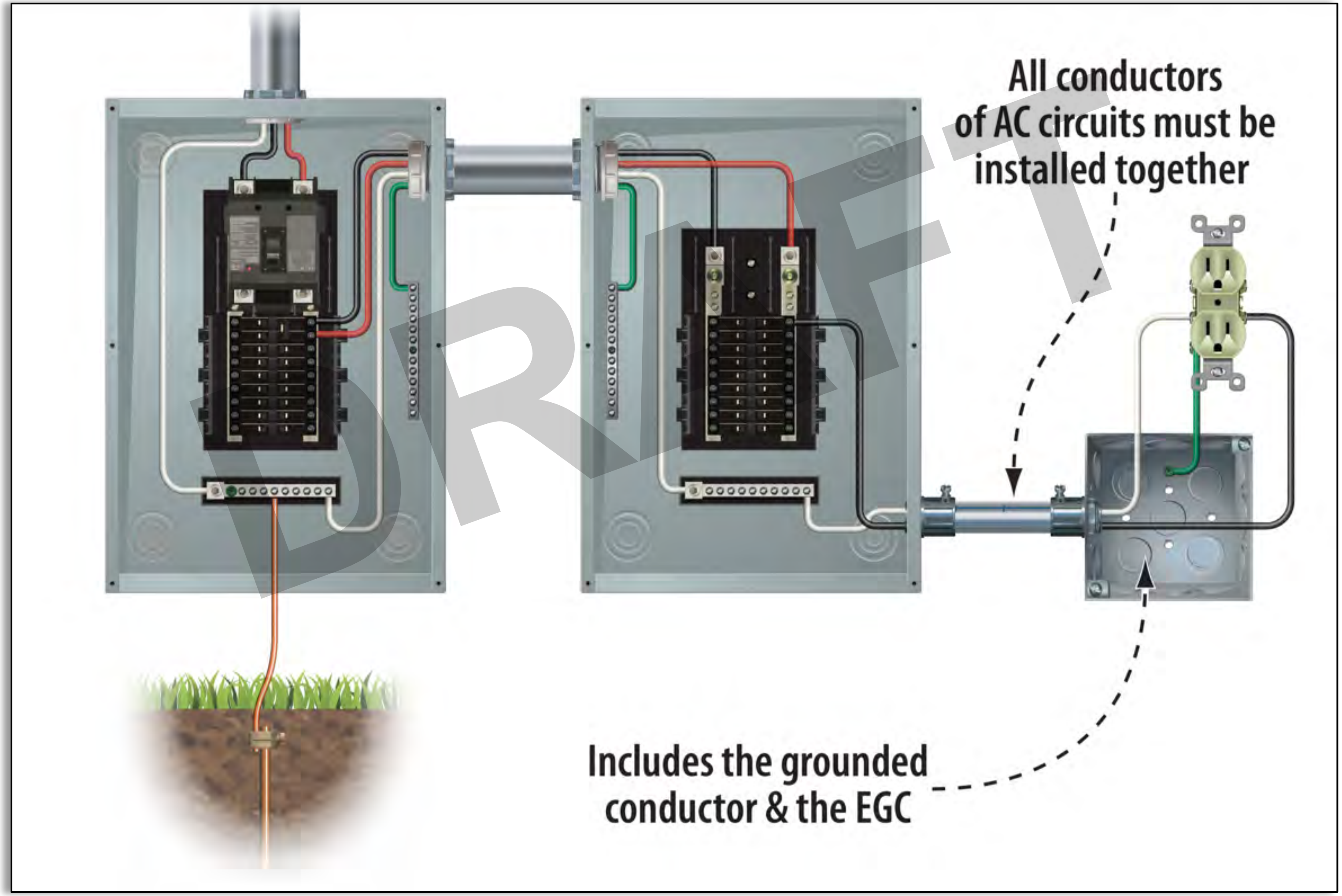
Connections to an Equipment Grounding Conductor

Change Summary

- This section has been rearranged into a list format in accordance with the *NEC Style Manual*.
- Revisions in (2) include the words “of the wire type” and “contained within the same” for clarification.
- Informational Note No. 2 now includes both flexible cords and flexible cables.

250.134

REVISION



250.136

REVISION

Equipment Secured to Grounded Metal Supports

Change Summary

- The title of this section has been revised to “Equipment Secured to Grounded Metal Supports.”
- Text was added to clarify that the metal rack or structure must be connected to an equipment grounding conductor of the circuit.
- Former Subdivision (B) has been deleted as it is redundant to the equipment grounding conductor requirements in Part IX of Article 620 covering elevators.

250.136

REVISION

250.142

REVISION / DELETION

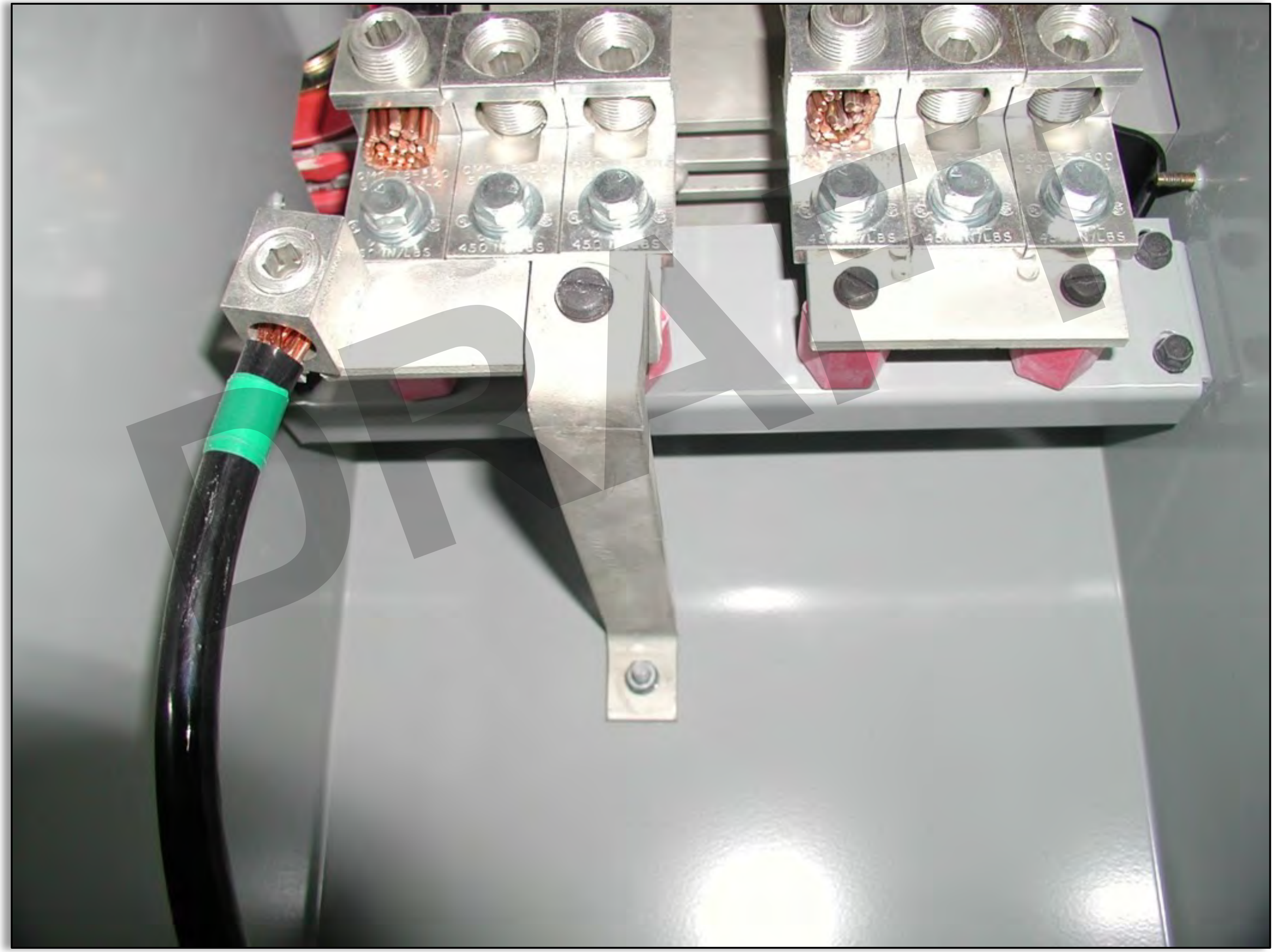
Line- and Load-Side Equipment Grounding

Change Summary

- This section has been revised to be consistent with the use of defined *grounding* and *bonding* terms.
- A new item has been added to (A), which recognizes the grounded conductor for grounding in a supply-side disconnect application that is not at the service.
- Exception No. 3 to 250.142(B) has been removed.

250.142

REVISION / DELETION



250.146

REVISION

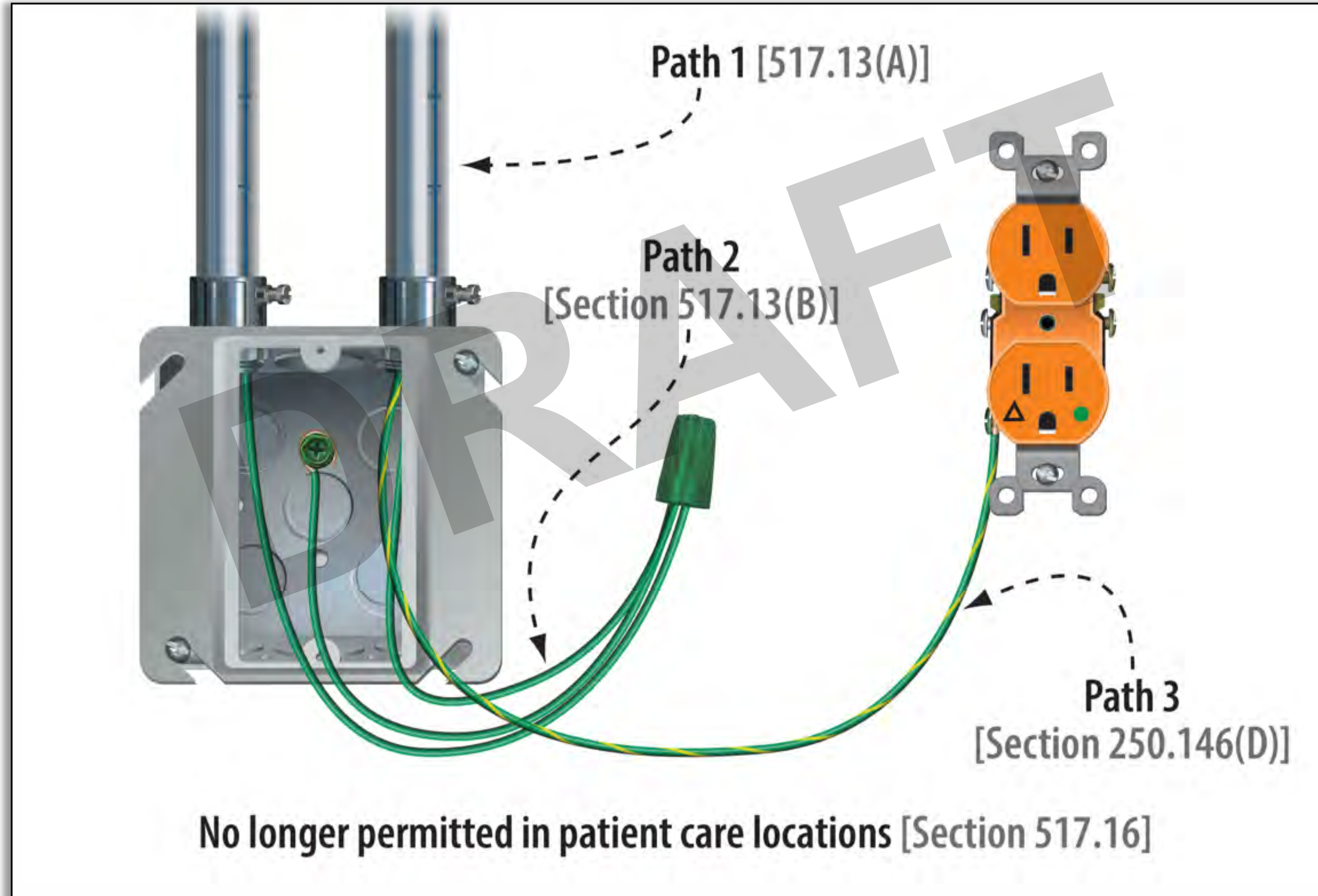
Receptacle Grounding Connections to Grounded Boxes

Change Summary

- The phrase “the provisions of” has been removed as part of a global revision in the NEC.
- The title of Section 250.146 has been changed to remove the word “box” and replace it with the term *equipment grounding conductor*.
- The revised text provides clarification about the metal box that is connected to an EGC.

250.146

REVISION



250.148

REVISION

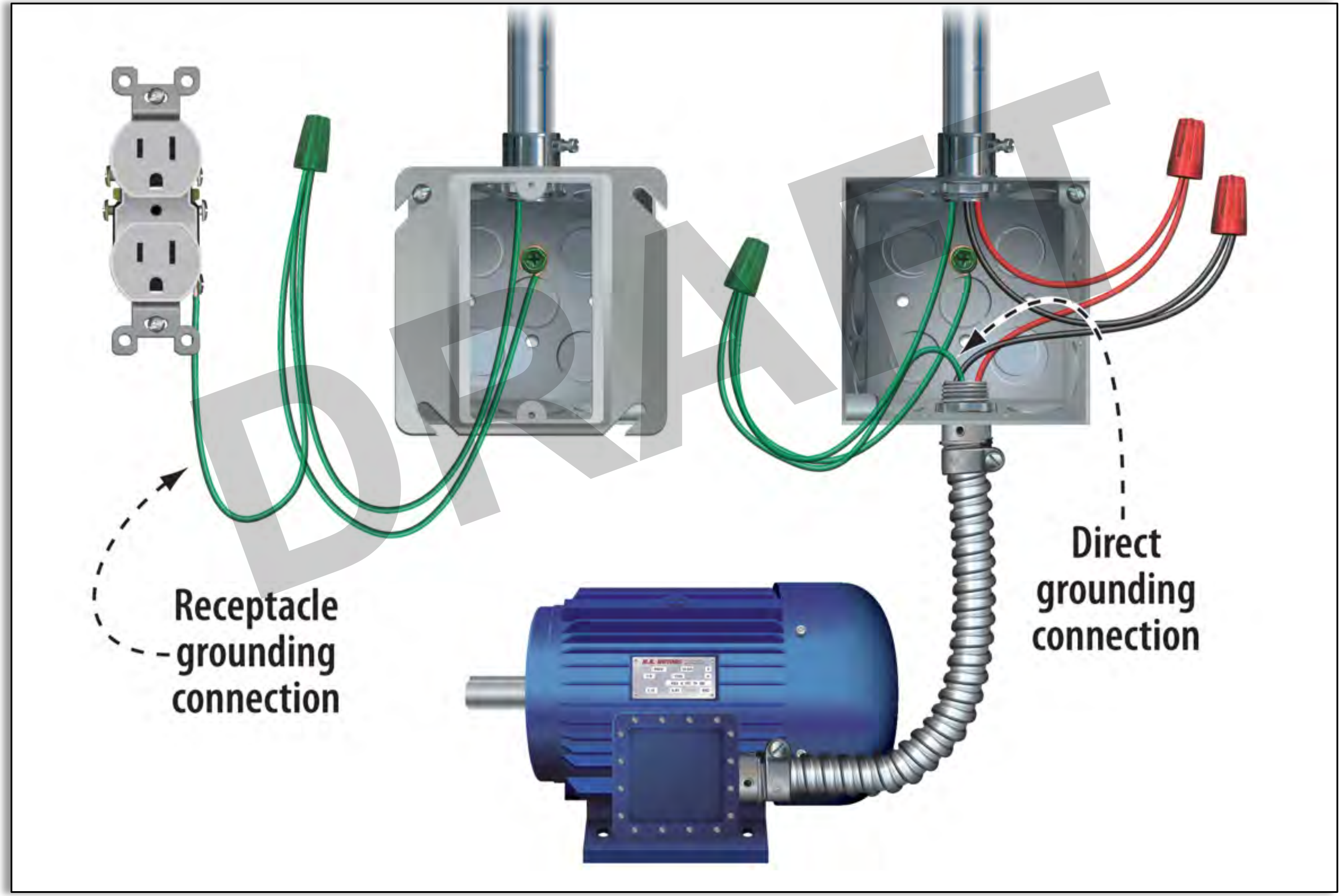
Continuity of EGCs and Attachment in Metal Boxes

Change Summary

- The title of this section has been revised by replacing the word "to" with the word "in."
- This section has been revised to restore the words "associated with any of those circuit conductors" that appeared in the 2014 *NEC*.
- Subdivision (E) has been deleted as the restrictions related to soldered connections is covered in 250.8.

250.148

REVISION



250.184(A)(1) & (C) Exception

REVISION

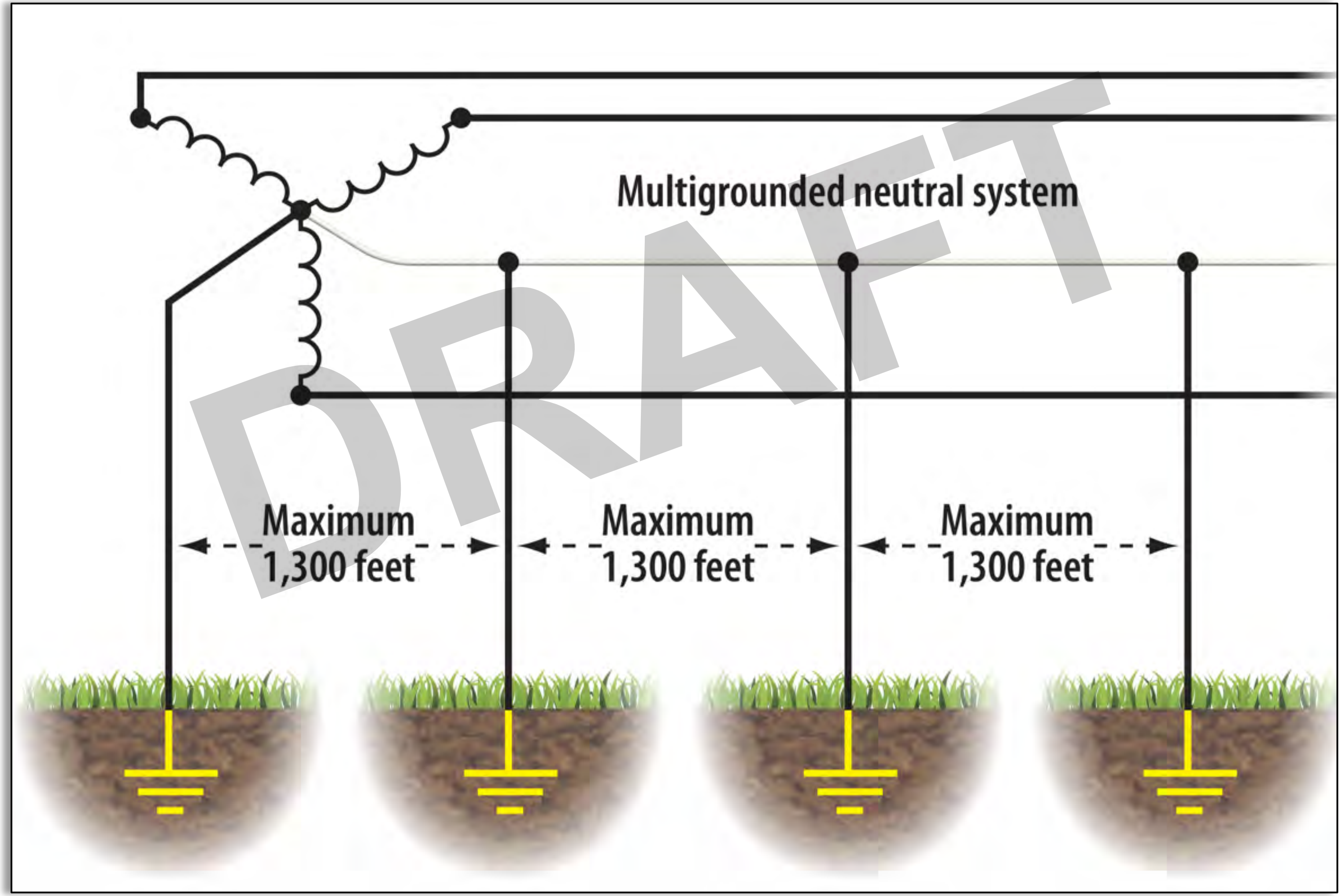
Multipoint Grounded Neutral Systems

Change Summary

- Exception No. 1 to 250.184(A)(1) has been revised to remove the word “bare” and add the text “For multigrounded neutral systems as permitted in 250.184(C), bare…” (See NEC text).
- A new exception to 250.184(C) relaxes the distance requirement if the only purpose is to remove the cable sheath to make a grounding electrode connection.

250.184(A)(1) & (C) Exception

REVISION



Significant Changes

TO THE *NEC*® 2020

Chapter 3

electrical training ALLIANCE IBEW - NECA IN COLLABORATION WITH NECA NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

300.3(B)(1)

REVISION

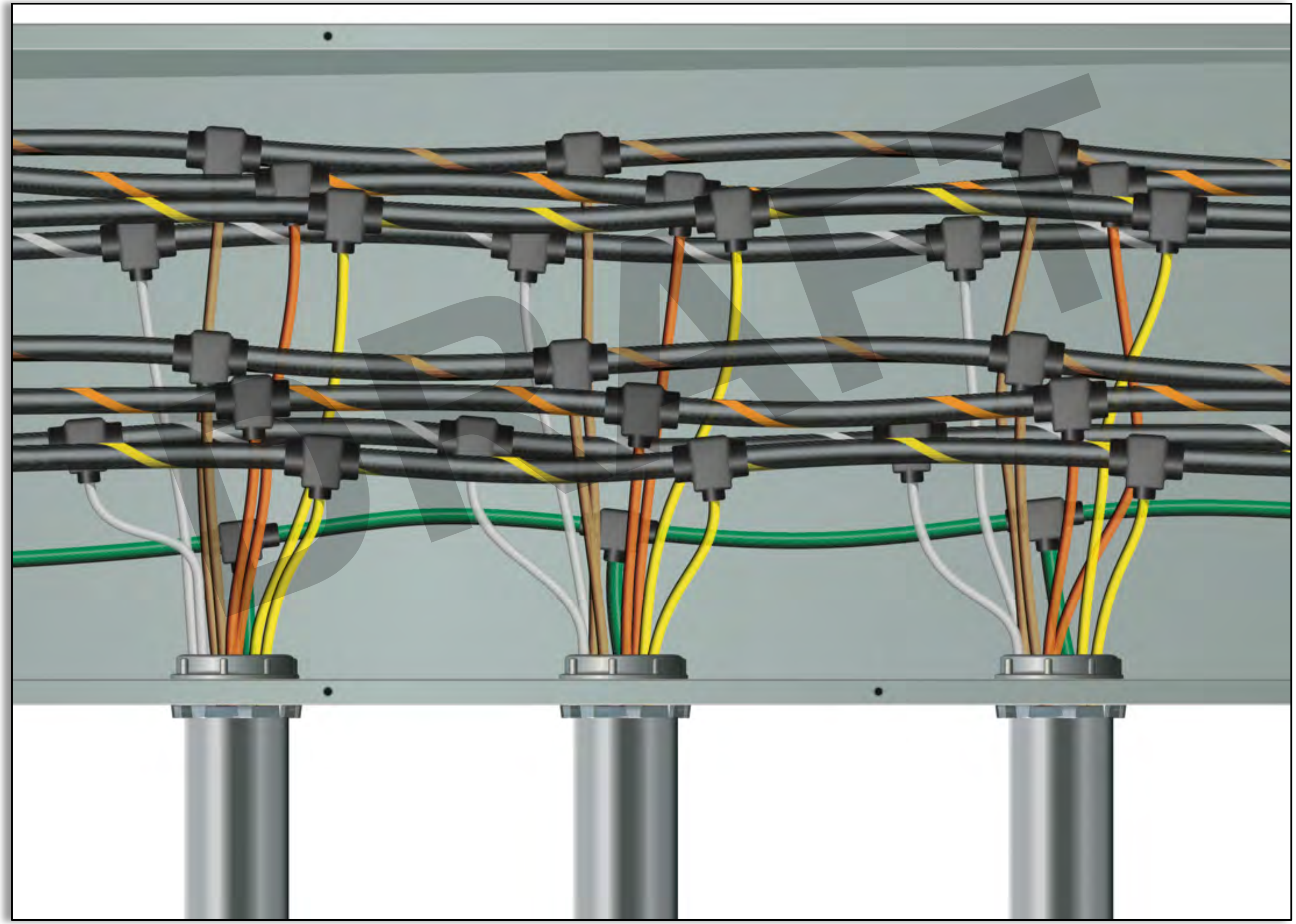
Conductors, Paralleled Installations

Change Summary

- 300.3(B)(1) is modified to require connections, taps or extensions from paralleled conductors be made in a manner to equalize the current.
- This revision attempts to provide additional clarity for the termination of and tapping from paralleled conductors.
- 310.10(H) does not address potential misapplication of connections to paralleled conductors.

300.3(B)(1)

REVISION



300.4(G)

REVISION

Protection Against Physical Damage, Fittings

Change Summary

- 300.4(G) is modified to recognize multiple methods for fittings to provide protection in positive text.
- Physical protection is required, not insulation. New list items are added.
- The exception is deleted and rolled into new list item (3).

300.4(G)

REVISION

300.7(A)

REVISION

Raceways Exposed… Temperatures, Sealing

Change Summary

- 300.7(A) is revised to correlate with 225.27.
- Products used to seal raceways or sleeves must be identified for the use.
- Compatibility with the cable/conductor insulation, bare conductor, shield or other component is required.

300.7(A)

REVISION

Courtesy of ABB

300.25

NEW

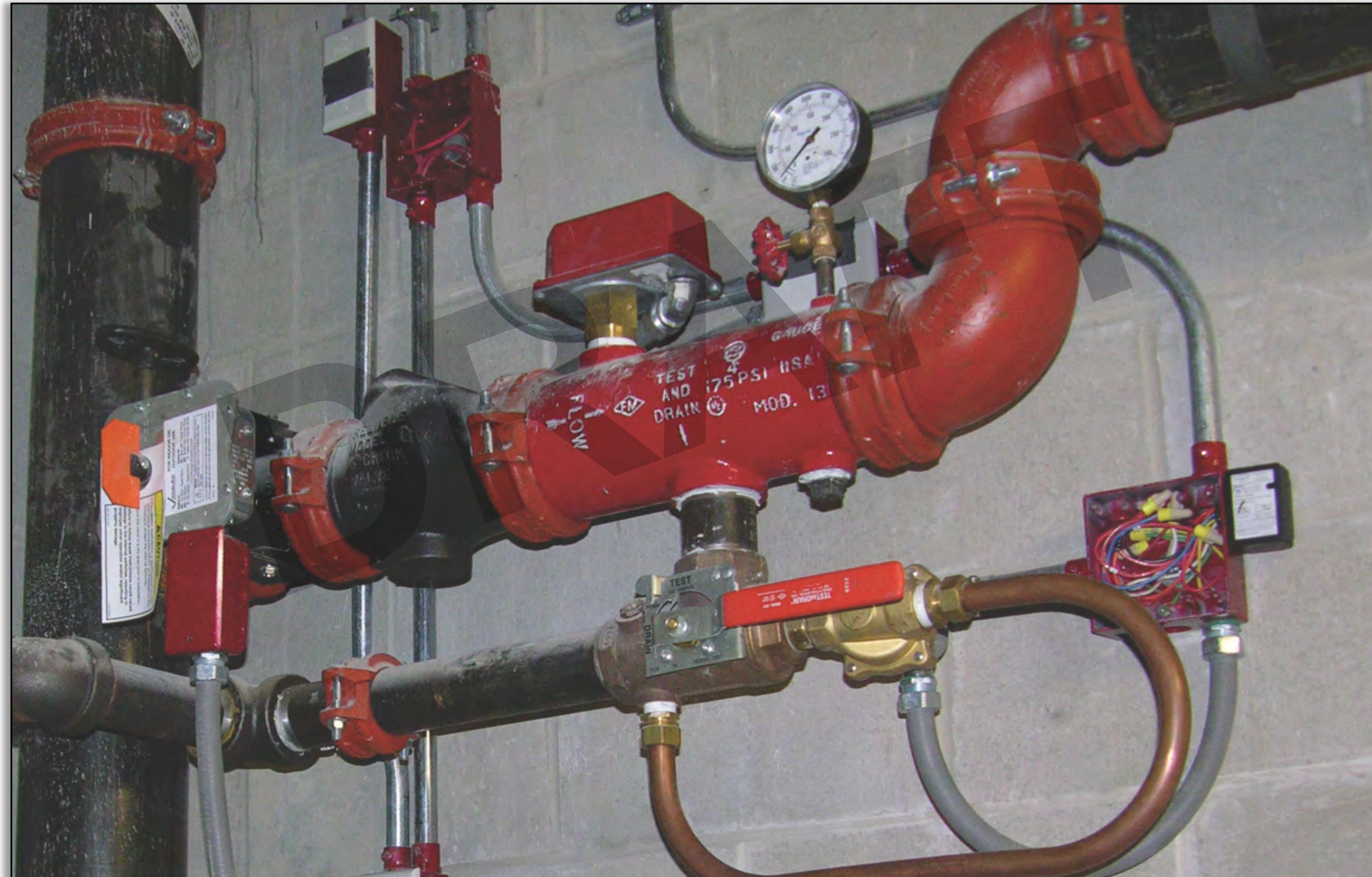
Exit Enclosures (Stair Towers)

Change Summary

- New section 300.25 addresses the installation of wiring methods in stair towers.
- Only wiring methods serving equipment permitted by the AHJ are permitted.
- This new section correlates with existing requirements in *NFPA 101, the Life Safety Code.*

300.25

NEW



310.1 & 310.3

NEW

Article Scope and Conductors

Change Summary

- The scope of article 310 is now limited to not more than 2000 volts.
- Requirements and ampacity tables for conductors over 2000 volts are relocated into new Article 311.
- Copper clad aluminum (CCA) conductors must meet the material requirements of the definition in Article 100.

310.1 & 310.3

NEW

310.12

RELOCATE

Single-Phase Dwelling Services and Feeders

Change Summary

- Previous requirements of 310.15(B)(7) are relocated into new section 310.12.
- The existing table in Annex D, previously located in 310.15(B)(7) is reinserted as Table 310.12.
- Table 310.12 is permitted to be applied where no ampacity adjustment or correction factors are required.

310.12

RELOCATE

310.14 & 310.15

RELOCATE NEW

Ampacity Tables

Change Summary

- Previous requirements in 310.15(A)(1) through (A)(3) are relocated into new 310.14.
- Under engineering supervision interpolation of the conductor, ampacities are permitted.
- 310.15(A) is modified to require that conductor ampacity complies with 310.15(A) through (F) and 310.12.

310.14 & 310.15

RELOCATE NEW

310.15(B) & (C)

NEW / REVISION / RELOCATE

Ambient Temperature Correction/Adjustment Factors

Change Summary

- Requirements for ambient temperature correction factors are completely reorganized.
- Six new sections are added to correlate with remaining ampacity tables.
- Revised structure increases clarity and usability.

310.15(B) & (C)

NEW / **REVISION** / **RELOCATE**

Article 311

NEW

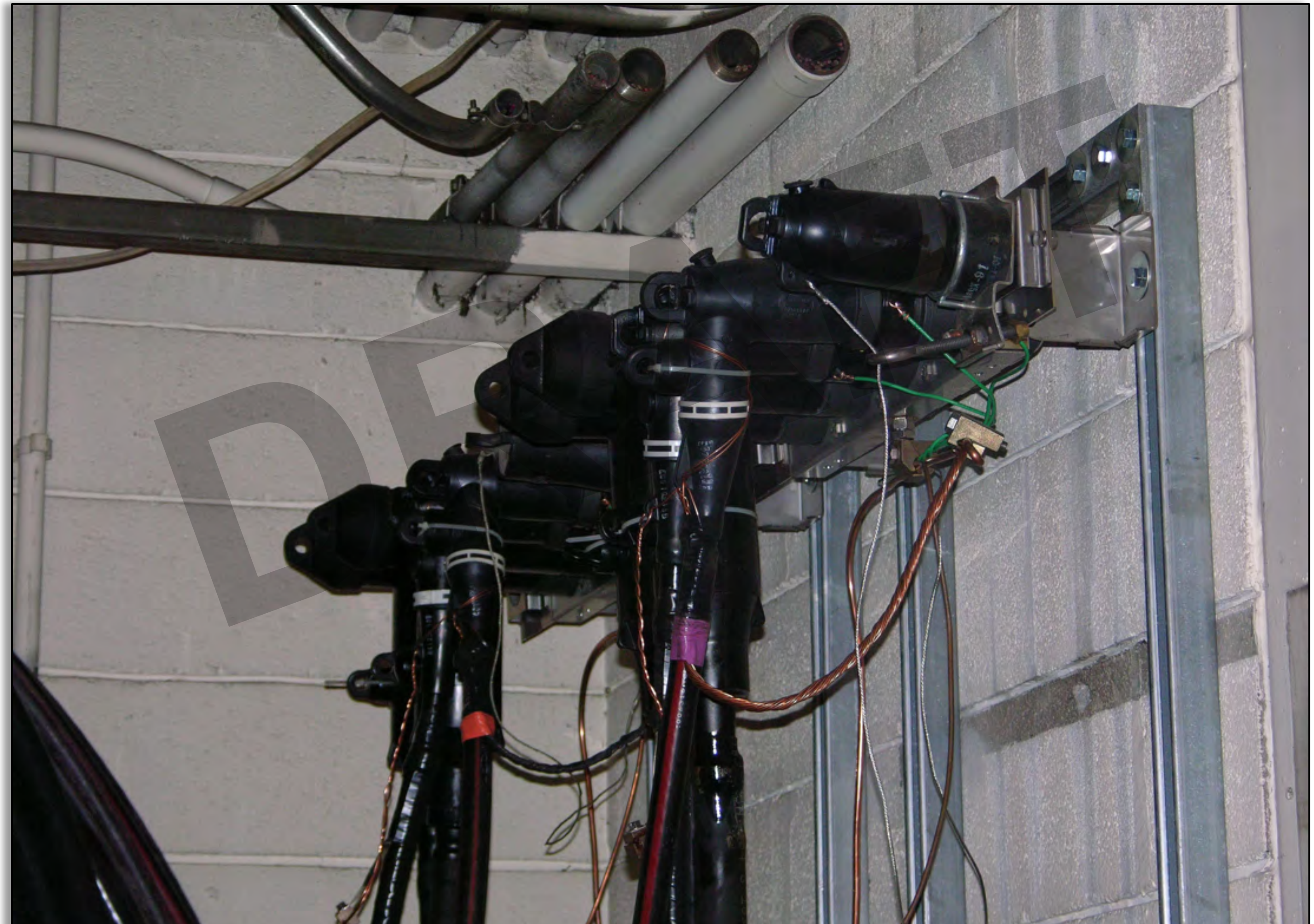
Article 311 Medium Voltage Conductors and Cable

Change Summary

- New Article 311 is added to cover the use, installation, construction specifications, and ampacities for Type MV medium voltage conductors and cable.
- Article 328 for MV cable is deleted.
- Requirements for conductors rated over 2000 volts are removed from Article 310 into 311.

Article 311

NEW



312.8(B)

REVISION

Power Monitoring or Energy Management Equipment

Change Summary

- 312.8(B) now addresses both power monitoring and energy management systems.
- New requirements are added for conductors used exclusively for control or instrumentation circuits.
- Existing requirements are separated into subdivisions for clarity.

312.8(B)

REVISION

1180

Courtesy of Eaton

314.16

REVISION

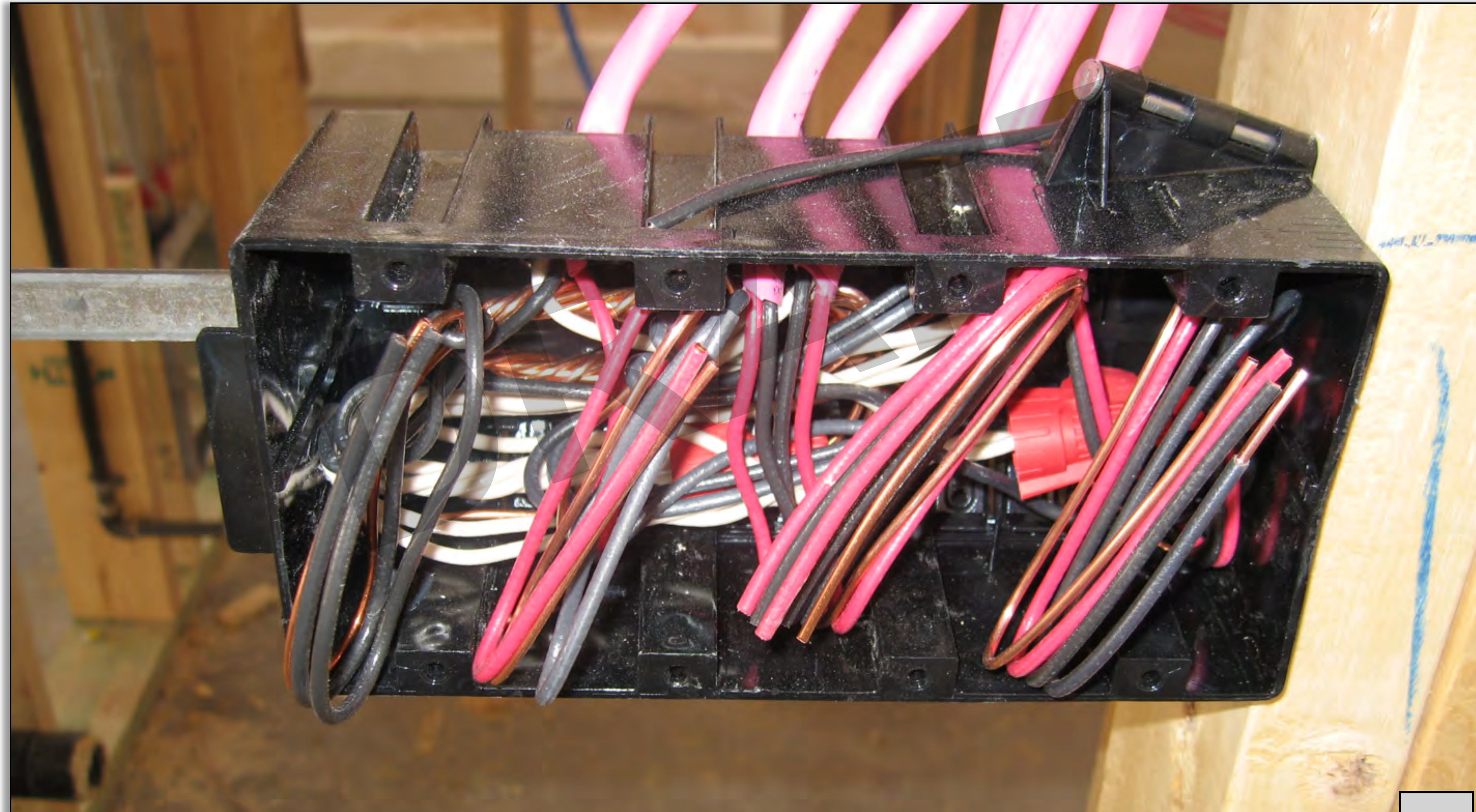
Number of Conductors...Box Volume/Fill

Change Summary

- The single volume allowance for EGCs and EBJs is limited to four of these conductors.
- A ¼ volume allowance based upon the largest EGC or EBJ in the box is added for each EGC or EBJ over four.
- Editorial revisions are made in the parent text and Table 314.16(A).

314.16

REVISION



1182

314.17

REVISION

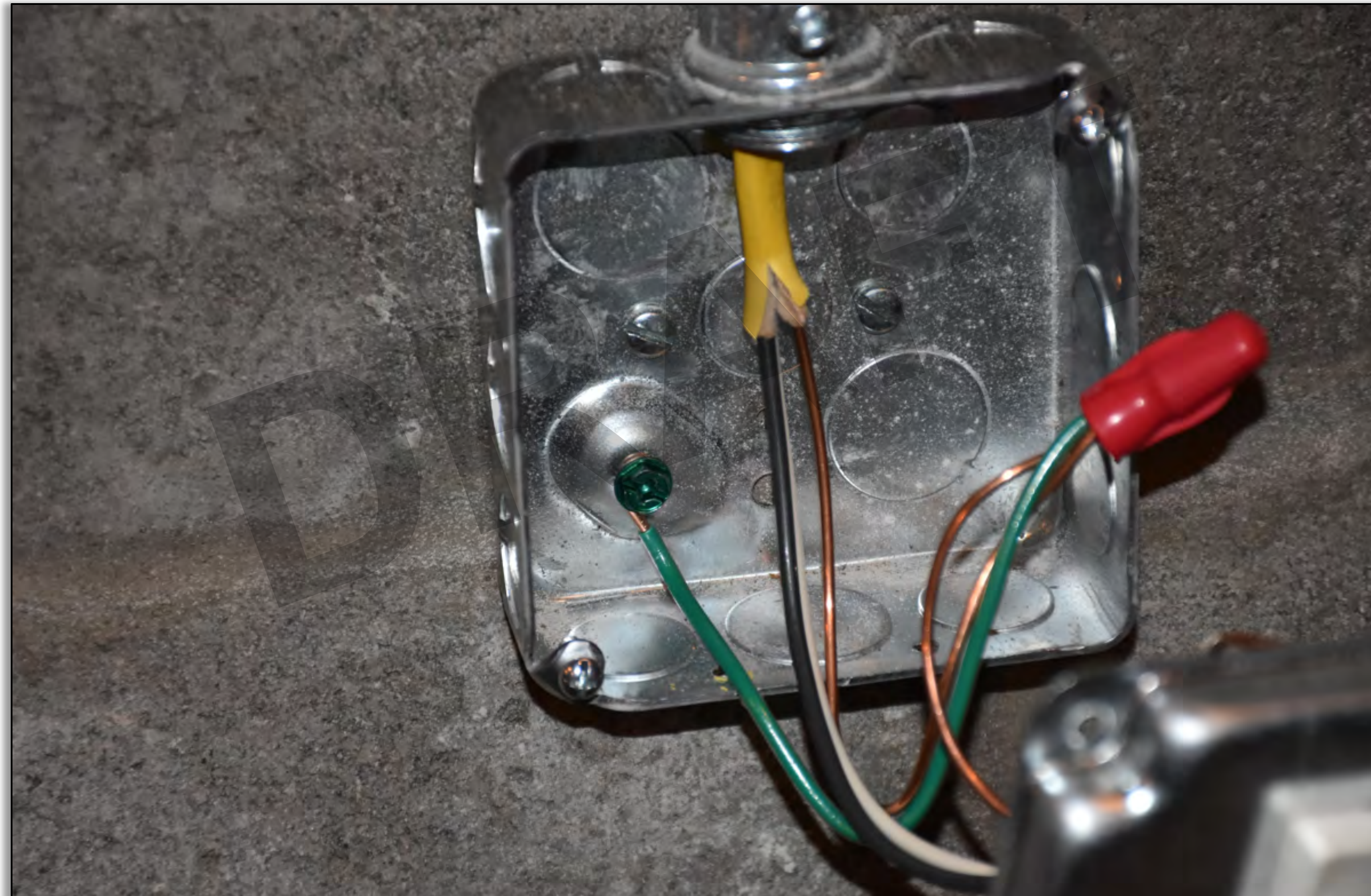
Conductors Entering Boxes, Conduit Bodies, or Fittings

Change Summary

- Openings through which conductors enter must now be closed in a manner *identified* for the application.
- 314.17(B) is retitled as *Boxes and Conduit Bodies* and is separated into four second-level subdivisions.
- 314.17(B)(4) *Temperature Limitation* requires nonmetallic boxes/conduit bodies to be suitable for the lowest temperature rated conductor.

314.17

REVISION



314.27

REVISION

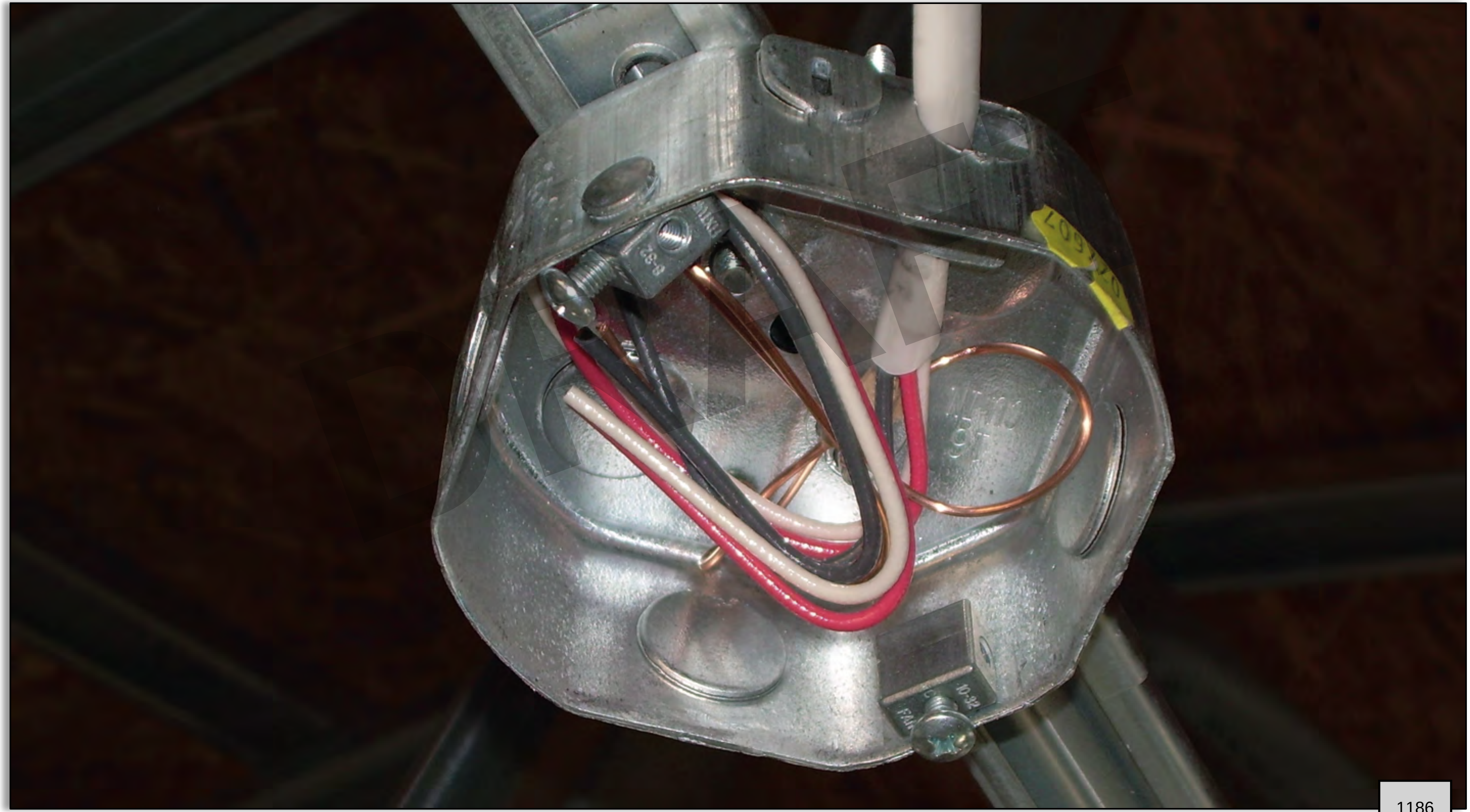
Boxes at Ceiling-Suspended (Paddle) Fan Outlets

Change Summary

- The limitation of this requirement to “where spare, separately switched, ungrounded conductors, are provided to a ceiling-mounted outlet box” is deleted.
- Boxes listed for the sole support of ceiling suspended fans and those providing access to structural framing capable of supporting a ceiling-suspended fan bracket, or equivalent are permitted.

314.27

REVISION



320.80(A), 330.80(C), & 338.10(B)(4)

NEW REVISION

Ampacity

Change Summary

- New text in 320.80(A), 330.80(C) and 338.10(B)(4) are added to address the installation of more than two cables in thermal insulation.
- Where space is not maintained between cables that are in contact with thermal insulation, caulk, or sealing that foam, capacity must be adjusted in accordance with Table 310.15(C)(1).
- Editorial revisions are made in 330.80(B) to reference tables in new Article 311 MV Conductors and Cables.

320.80(A), 330.80(C), & 338.10(B)(4)

NEW REVISION

330.130

NEW

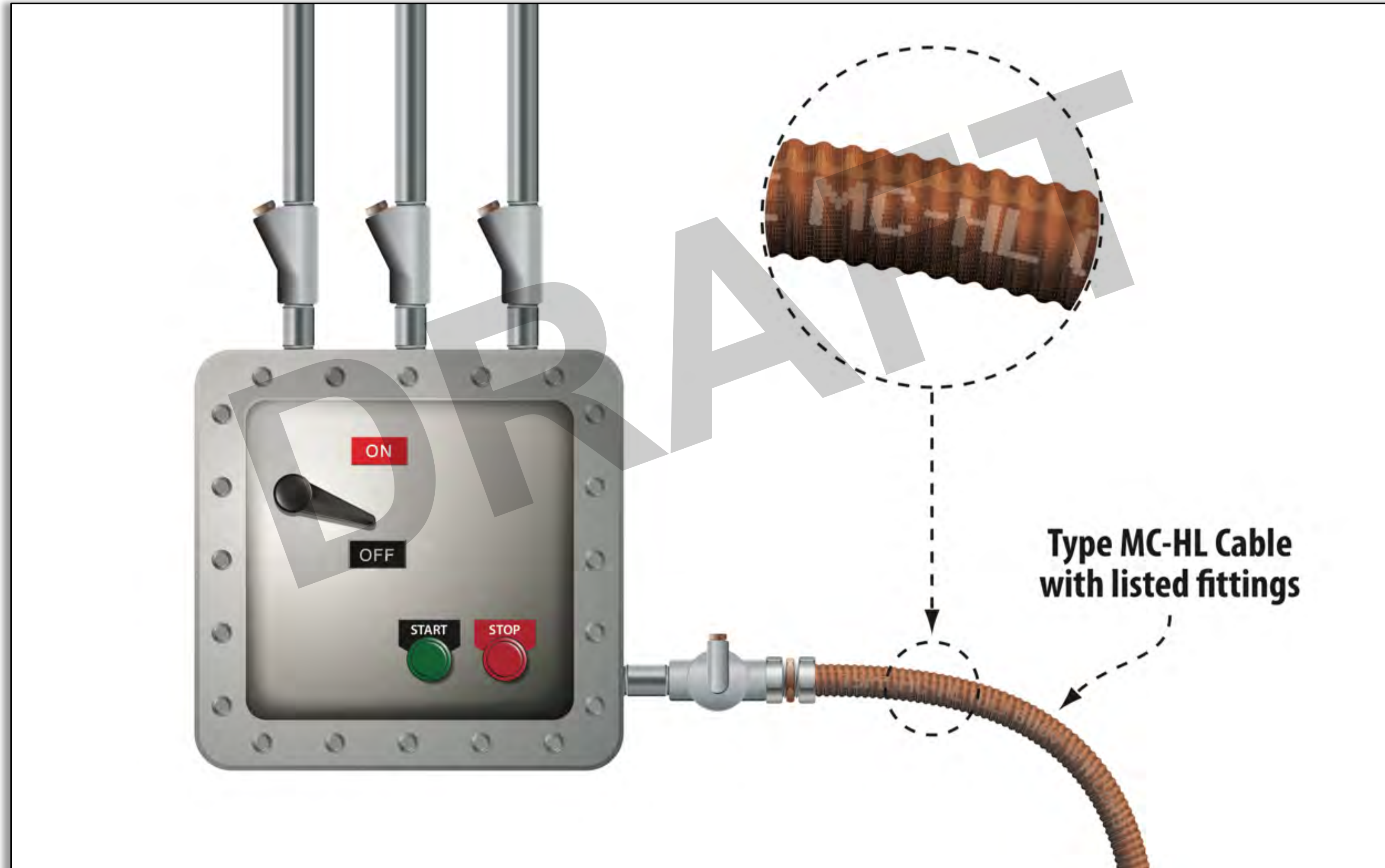
Hazardous (Classified) Locations

Change Summary

- New 330.130 provides construction requirements for Type MC-HL cable.
- Type MC-HL cable is built to the UL Product Category, *Cable for Use in Hazardous Locations, PJPP*.
- Type MC-HL cable is recognized for use in some hazardous location applications.

330.130

NEW



MC-HL
ON
OFF
START
STOP
Type MC-HL Cable
with listed fittings
DRAFT

330.104 & 336.104

REVISION

Conductors

Change Summary

- To address minimum conductor sizes for control and signal conductors, the following revisions are implemented.
- 18 AWG copper, nickel, or nickel-coated copper, 14 AWG copper clad aluminum, and 12 AWG aluminum.
- 14 AWG copper clad aluminum is permitted for only controlling signal conductors.

330.104 & 336.104

REVISION

Courtesy of Copperweld Bimetallics LLC

334.30

REVISION

Securing and Supporting

Change Summary

- New text in 334.30 mandates that the cable length between the cable entry and the closest cable support shall not exceed 18 inches.
- This is necessary where loops are left for future modifications.
- All references to, and requirements for, Type NMS cable are deleted throughout Article 334.

334.30

REVISION

336.10

REVISION

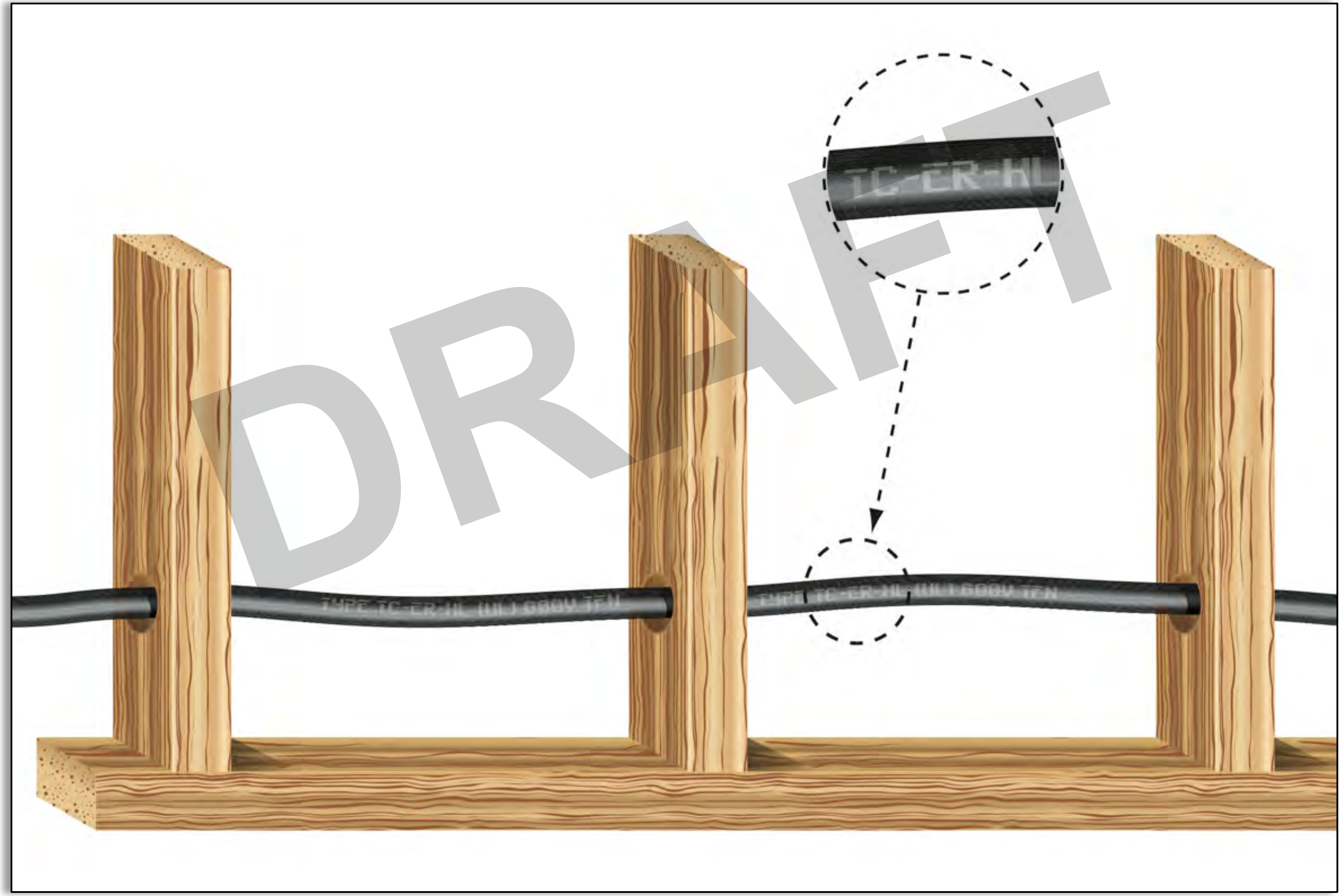
Type TC Cable, Uses Permitted

Change Summary

- Only Type TC-ER-JP cable containing both power and control conductors is permitted in one- and two-family dwelling units.
- Type TC-ER-JP cable installed on the exterior of a dwelling unit must comply with Part II of Article 340.
- Type TC cable is now permitted in hazardous locations where specifically referenced elsewhere in the *Code*.

336.10

REVISION



336.130

REVISION

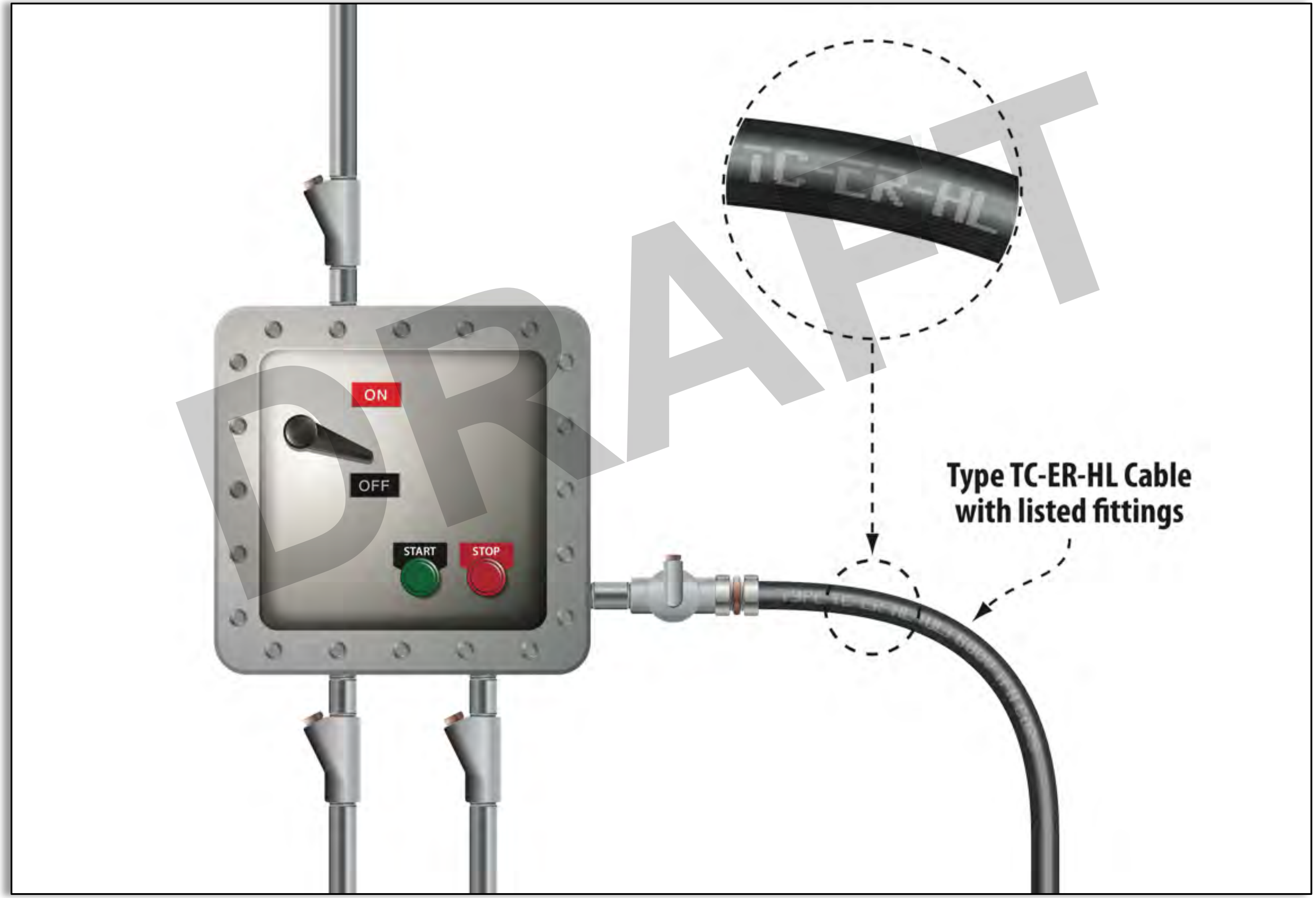
Hazardous (Classified) Location Cable

Change Summary

- New construction requirements for Type TC-ER-HL are added to correlate with 336.10(11).
- The use of Type TC-ER-HL in hazardous locations has been expanded.
- TC-ER-HL cable larger than 1 inch in diameter must meet additional requirements.

336.130

REVISION



Article 337

NEW

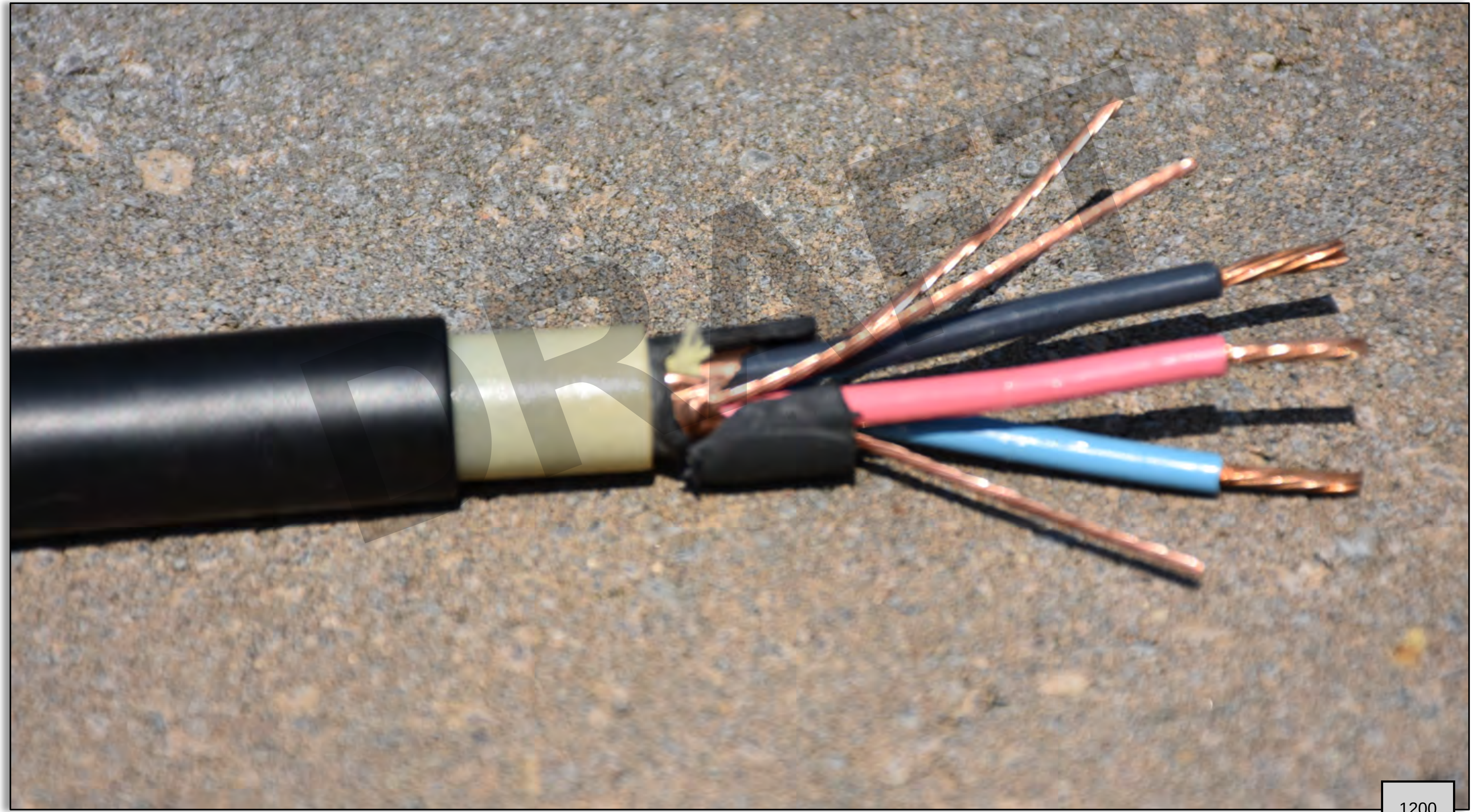
Type P Cable

Change Summary

- New Article 337 now permits the installation of Type P cable (marine shipboard cable).
- Type P cable has been used in land-based oil and gas rigs for over four decades.
- Type P cable is limited to industrial installations and hazardous locations.

Article 337

NEW



338.2 & 338.100

NEW *REVISION*

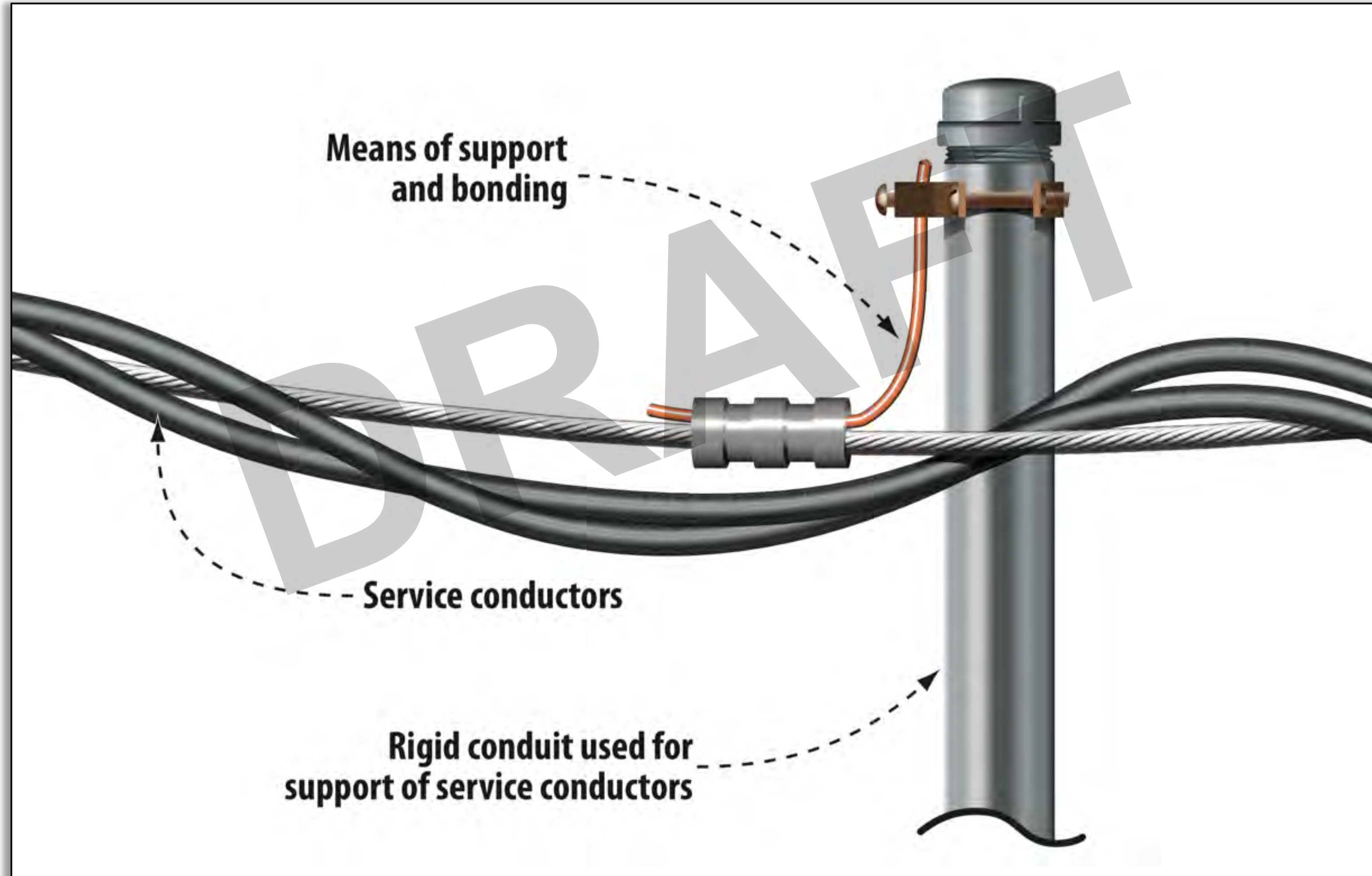
Service Entrance Conductor Assembly

Change Summary

- A new definition of “Service Entrance Conductor Assembly” is added to 338.2.
- This definition is necessary to address assemblies of single insulated USE conductors.
- Construction requirements are modified to recognize service entrance conductor assemblies.

338.2 & 338.100

NEW / REVISION



342.10(E), 344.10(E), & 358.10(E)

NEW

Physical Damage and Severe Physical Damage

Change Summary

- Physical damage is now specifically addressed in the XXX.10(E) sections for IMC, RMC, and EMT.
- IMC and RMC are permitted to be installed in areas subject to severe physical damage.
- EMT is permitted to be installed in areas subject to physical damage.

342.10(E), 344.10(E), & 358.10(E)

NEW

342.14, 344.14, & 358.14

REVISION

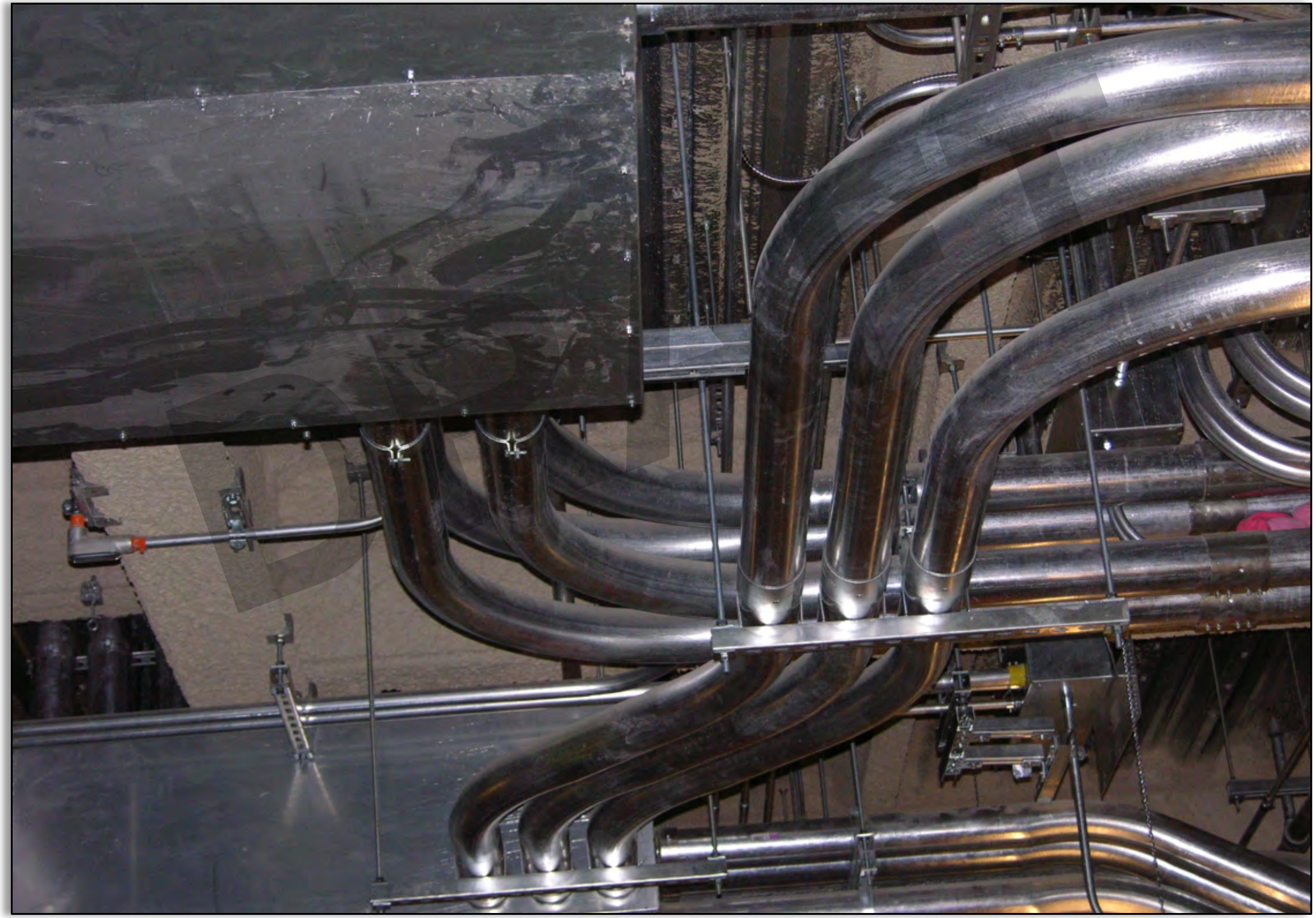
Dissimilar Metals

Change Summary

- Galvanized IMC/RMC/EMT are permitted to be used with stainless steel and aluminum fittings where not subject to severe corrosive influences.
- Stainless steel IMC/RMC/EMT must be installed with stainless fittings, boxes and enclosures.
- Steel boxes and enclosures are permitted where not subject to corrosive influences.

342.14, 344.14, & 358.14

REVISION



392.30(B) & 392.44

NEW / REVISION

Securing/Supporting and Expansion Splice Plates

Change Summary

- Cable ties used in cable tray must be listed and identified for the application and for securement and support.
- Cable ties for securement and support must have the suffix S, 2S or 21S.
- Expansion splice plates for cable trays are required where necessary, to compensate for thermal expansion and contraction.

392.30(B) & 392.44

NEW *REVISION*

Courtesy of ABB

392.46

REVISION

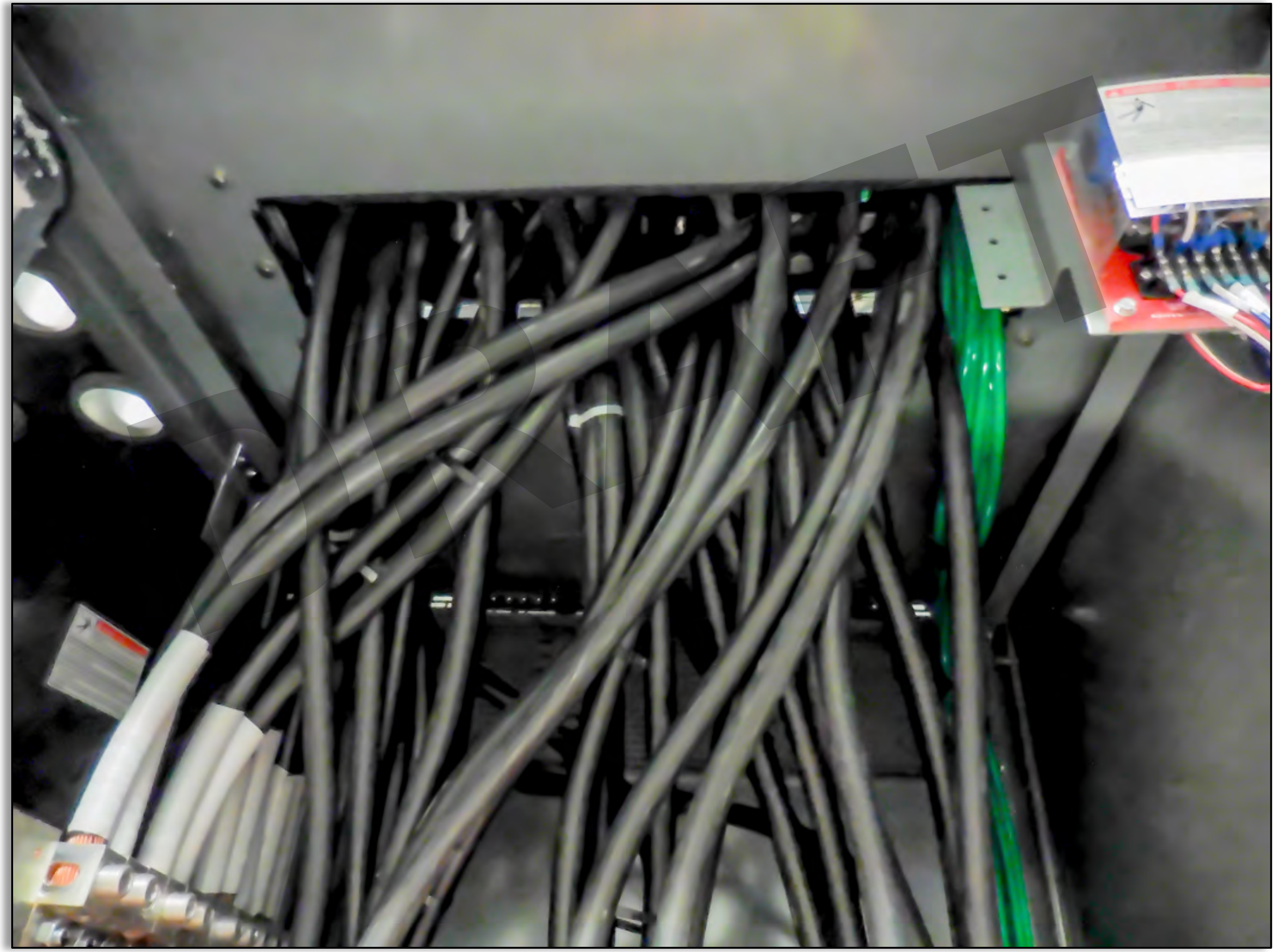
Bushed Conduit and Tubing, Flanged Connections

Change Summary

- 392.46 is separated into first-level subdivisions for clarity.
- Only nonmetallic cables or conductors are permitted to transition through bushed conduit, tubing or flanged connections.
- Conduits, tubing, and flanged connections must be protected from the abrasion and sealed to prevent debris from entering.

392.46

REVISION



1210

Courtesy of Mark Hilbert

Resume of
John K Brown

Purpose:

1) To certify as an OCIEB training instructor for the continuing education requirements for electrical certificate holders in the fields of National Electrical Code, Business, and Technology.

2) To certify as an Ohio Department of Commerce Board of Building Standards training instructor for the continuing education requirements for Electrical Safety Inspector recertification requirements of The National Electrical Code.

Experience :(field related work History)

1) Journeyman Electrician for 38 Years
2) 2007-2013: Foreman/Service Truck/Bucket Truck/Derrick Truck Operator with Roberts Electrical/Service Group. Traveled in Ohio and Penn., W.V., Kentucky, Indiana, Michigan, South Carolina, Texas, N.M., Arizona, Nevada working on Generator, Fire Alarm, Temp. Control Projects @ ATT facilities and for Fed Ex @ airport ramp facilities.
3) 1997-2006: Foreman/Service Truck/Various Projects with Century Electric, Inc. Supervised upgrades @ Cooper Stadium, Musco Lighting @ Marysville High School Stadium.
4) 1992-1996: Foreman/Service Truck/Bucket Truck Operator with MGM Electric Supervised installation of Electrical Projects @ Timken Railroad Bearing Plant
5) 1986-1991: Foreman/Service Truck/Bucket Truck/Digger Derrick Truck Operator with American Line Construction Supervised installation of Electrical Projects @ Timken Railroad Bearing Plant, Tornado Siren upgrades for Franklin County EMA.
6) 1976 – 1985: Worked on and was job Foreman on numerous electrical projects in the Columbus Ohio area

Experience: (educational instructor)

Education

1) 1976-1980: Electrical Apprenticeship program for International Brotherhood of Electrical workers
2) 1984- Present: Numerous National Electrical Code, Business, and technology courses that were needed to maintain Electrical Safety Inspector certification, and City of Columbus and State Contractor license
3) 1970-1972: Columbus Technical Institute-Associate Degree-Accounting

Licenses:

1) Electrical Safety Inspector (Ohio Certificate # 2362)
2) OCIEB Electrical Contractor License (State ID#21522)
3) Fire Alarms / Detection certification(Ohio State Fire Marshall Certificate #54.25.0227)
4) Electrician-West Virginia (WV #J447957REOH1208)

Professional Organizations :

1) International Brotherhood of Electrical Workers
2) Columbus Joint Apprenticeship and Training for the Electrical Industry.

John K. Brown