Board of Building Standards

EDUCATION COMMITTEE MEETING
AGENDA (REVISED AUGUST 9, 2023)

DATE: AUGUST 10, 2023
TIME: 10:00 AM
LOCATION: BBS LIBRARY, 6606 TUSSING ROAD, REYNOLDSBURG, OHIO 43068
Click here to join the meeting

Call to Order

Consent Agenda

Course Applications

ER-1 2024 IBC/IEBC Significant Changes (ICC)
All certifications (1.5 hours)
Staff Notes: Code not current in Ohio.
Committee Recommendation:

ER-2 2024 IECC Changes and Status (ICC)
All certifications (1.5 hours)
Staff Notes: Code not current in Ohio
Committee Recommendation:

ER-3 2024 IRC Significant Changes (ICC)
All certifications (1.5 hours)
Staff Notes: Code not current in Ohio.
Committee Recommendation:

ER-4 Application and Administration of the 2021 I-Codes (ICC)
All certifications (1.5 hours)
Staff Notes: IBC/IRC Chapter 1 course: required for testing but not code in Ohio. Recommend approval.
Committee Recommendation:

ER-5 OPC Chapter 7: Sanitary Drainage (Franklin County Public Health)
All certifications (7 hours)
Staff Notes: There are no visuals other than the OPC chapter and a whiteboard.
Committee Recommendation:

ER-6 Western Section IAEI Annual Meeting (Conference/IAEI Western)
All certifications (18 hours)
Staff Notes: Two-and-a-half day 18-hour conference like the "Special Meeting" last spring (BBS2023-645) but with different courses. There are ten courses (mostly an hour or 90 minutes long) and three Q&A sessions. The submission does not include slides.
Committee Recommendation:

Old Business

New Business

Adjourn

EDUCATION COMMITTEE MEETING
CONSENT AGENDA

Course Applications

EC-1 2021 IEBC Essentials (International Code Council)
All certifications (6 hours)

EC-2 Authority-Having-Jurisdiction Seminar (Koorsen Fire and Security)
All certifications (7 hours)

EC-3 Building Code Enforcement: Global Best Practices (Panel Discussion) (ICC)
All certifications (3 hours)

EC-4 Evaluation Reports: Purpose and Criteria (ICC)
All certifications (1.5 hours)

EC-5 Commercial Energy 2021 IECC (ICC)
All certifications (1.5 hours)

EC-6 Fire Safety in the 2021 IBC (ICC)
All certifications (1.5 hours)

EC-7 Grant Basics for Code Officials (ICC)
All certifications (1.5)

EC-8 How to Be a Better Leader by Practicing Active Listening (ICC)
All certifications (1.5 hours)

EC-9 Professional Ethics (ICC)
All certifications (1.5 hours)

EC-10 The Plumbing Industry (ICC)
All certifications (3 hours)

EC-11 The Tiny House (ICC)
All certifications (1.5 hours)

EC-12 2017 vs. 2023 NEC Review (Southwest Ohio Electrical Organization)
All certifications (four 7.5-hour sessions)

EC-13 2023 NEC (ICC)
All certifications (1.5 hours)

EC-14 2023 NEC Code Changes Chapters 1-4 (Matthews Electrical Services)
All certifications (4 hours)

EC-15 2023 NEC Code Changes Chapters 5-9 (Matthews Electrical Services)
All certifications (4 hours)

EC-16 2023 NEC Significant Changes Overview (Matthews Electrical Services)
All certifications (4 hours)

EC-17 Motors, Transformers, and the 2020 NEC (Matthews Electrical Services)
All certifications (4 hours)

EC-18 Significant Changes to the 2023 NEC (Dayton Area Electrical JATC)
All certifications (12 hours, two 6-hour sessions)

File Attachments for Item:

ER-1 2024 IBC/IEBC Significant Changes (ICC)

All certifications (1.5 hours)

Staff Notes: Code not current in Ohio.

Committee Recommendation:

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

Website: https://www.iccsafe.org/edu

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: 2024 IBC / IEBC Significant Changes

Course instructor: Douglas Thornburg

Course description:

This session addresses selected significant changes in the 2024 International Building Code (IBC) from the 2021 edition. In addition, a few key changes between the 2021 and 2024 editions of the International Existing Building Code (IEBC) will be covered. The discussion will be general in nature, focusing on those additions, modifications and clarifications that will have an impact on the design, plan review and inspection of buildings regulated by these 2024 I-Codes. Emphasis will be placed on the intent and application of the new and revised code provisions.

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

- ☐ Code Administration
- ☑ Existing Buildings
- ☐ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☐ On Demand
- ☐ Webinar

Course Website:

- [ ] No

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- [ ] Residential Certifications Only
- [x] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [x] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PPT-2024 IBC Sig Chngs.pdf	523.25 kB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

2024 IBC/IEBC Significant Changes

Description:

This session addresses selected significant changes in the 2024 International Building Code (IBC) from the 2021 edition. In addition, a few key changes between the 2021 and 2024 editions of the International Existing Building Code (IEBC) will be covered. The discussion will be general in nature, focusing on those additions, modifications and clarifications that will have an impact on the design, plan review and inspection of buildings regulated by these 2024 I-Codes. Emphasis will be placed on the intent and application of the new and revised code provisions.

Learning Objectives:

- Identify those important code changes that occurred in 2024 International Building Code (IBC)
- Provide an analysis of how those modifications that change the application of the IBC and provisions new to the IBC are to be viewed
- Discuss those code changes that simply clarify the IBC where no change in application of the 2021 requirements is intended
- Identify a few key changes that occurred in the 2024 International Existing Building Code

(Timed Outline - 90 minutes)

I.	Administration and Definitions	5 minutes
II.	Occupancy Classification	10 minutes
III.	Allowable Heights and Areas	5 minutes
IV.	Fire-Resistance-Rated Construction	15 minutes
V.	Fire Protection Features	15 minutes
VI.	Means of Egress	10 minutes
VII.	Accessibility	10 minutes
VIII.	Structural Loads and Materials	10 minutes
IX.	Elevators	5 minutes
X.	International Existing Building Code	5 minutes
		90 minutes

2024 IBC/IEBC Significant Changes

Instructor Bio

Douglas W. Thornburg, AIA, CBO, is currently Vice-President and Technical Director of Products and Services for the International Code Council (ICC) where he provides administrative and technical leadership for the ICC product development activities. Prior to employment with ICC in 2004, he was in private practice as a code consultant and educator on building codes for nine years. Doug also spent ten years with the International Conference of Building Officials (ICBO) where he served as Vice-President/Education. He began his career in building codes in 1980 with the City of Wichita, Kansas as a building inspector, followed by that as a plans reviewer and then building codes administrator.

In his current role, Doug creates and presents building code seminars nationally and develops numerous educational texts and resource materials. He was presented with ICC's inaugural Educator of the Year Award in 2008, recognizing his outstanding contributions in education and training.

A graduate of Kansas State University and a registered architect, Doug has over 40 years of experience in building code training and administration. He has authored a variety of code-related support publications, including the *IBC Illustrated Handbook* and the *Significant Changes to the International Building Code*.

I.

2024 IBC/IEBC Significant Changes

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1

104 Building Official Duties and Powers

- Provisions of Section 104 have been reformatted for consistency with other I-Codes
- In addition, approach for reviewing for code compliance significantly updated to reflect current manner that alternate materials, methods and designs are evaluated
- Four methods identified for determination of compliance:
  - Listed compliance
  - Technical assistance
  - Alternate materials, design and methods
  - Modifications

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202 Definition—Limited or Physical Assistance

- Applicable to Group I-1 and R-4 occupancies, more clarity is provided for determining if Condition 2 designation is appropriate for group homes, assisted living facilities and other custodial care uses
- Category includes persons who may not independently recognize, respond or evacuate without limited verbal or physical assistance during an emergency situation
- Limited verbal assistance includes prompting, giving and repeating instructions
- Limited physical assistance includes help with transfer to walking aids or mobility devices and assistance with egress

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202 Definition—High-Rise Building

- Special provisions, found primarily in Section 403, are mandated for buildings defined as “high-rise”
- Historically, such buildings are those with an occupied floor more than 75 feet above the lowest level of fire department vehicle access
- “High-rise” designation now also applies where occupiable roof is located above the 75-foot point
- Applicable concerns include:
  - Presence of occupants
  - Combustible furnishings
  - Difficulty of performing ground-based operations

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304.1 Group B Occupancy Classification

- Electronic data processing has been modified to electronic data entry
  - Data entry is considered an activity performed in an office environment
  - Data processing is essentially automated work occurring in facilities typically accessed solely by maintenance personnel
    - More appropriately classified as Group F
- Lithium-ion and lithium metal battery testing, research and development activities newly addressed specifically and identified as Group B
  - Moderate-hazard classification is appropriate due to extensive protection features as established in IFC 1207, including:
    - Detection
    - Suppression
    - Explosion control

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307.1.1, 414.1 Group H Occupancy Exemptions

- Provides for a more organized and comprehensive presentation of those conditions and materials that are exempt from:
  - Classification as a Group H occupancy, and
  - Needing to comply with any of general hazardous material regulations
- Replaces previous listing of exceptions in Section 307.1.1 and applicable notes to Tables 307.1(1) and 307.1(2)

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307.1.1, 414.1 Group H Occupancy Exemptions

TABLE 307.1.1 HAZARDOUS MATERIAL EXEMPTIONS[a]

Material Classification	Occupancy or Application	Exemption
Combustible fiber	Baled Cotton	Densely packed baled cotton shall not be classified as combustible fiber, provided that the bales comply with the packing requirements of ISO 8115
Corrosive	Building materials	The quantity of commonly used building materials that are classified as corrosive materials is not limited
	Personal and household products	The quantity of personal and household products that are classified as corrosive materials is not limited in retail displays, provided that the products are in original packaging.
	Retail and wholesale sales occupancies	The quantity of medicines, foodstuffs or consumer products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable, is not limited. To qualify for this allowance, such materials shall be packaged in individual containers not exceeding 1.3 gallons.

(continued)

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310.4 Group R Occupancy Classification

- In addition to several clarifications of various residential uses, the lodging house provisions have been revised.
- The scoping provisions for bed and breakfast establishments and similar lodging houses classified as a Group R-3 occupancy no longer mandate a maximum of 10 occupants
- In addition, there is no longer an occupant load limit required for construction of an owner-occupied lodging house under the *International Residential Code*
- The sole factor for lodging house classification that remains is the limit permitting no more than five guest rooms

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411 Puzzle Rooms

- Puzzle rooms no longer required to comply with Section 411 as special amusement areas where the means of egress meets the fundamental requirements of Chapter 10
  - Unlocked
  - Readily available
  - Always available
- Previously, puzzle room exiting had to comply with one of three options:
  - Compliance with Chapter 10
  - Alternative design approved by building official
  - Exit system open and readily available upon activation by automatic fire alarm system, automatic sprinkler system, and a manual control at a constantly attended location

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Table 509.1 Incidental Uses

- Sprinkler protection is now mandated in the following incidental use areas in ambulatory care facilities:
  - Storage rooms greater than 50 square feet
  - Waste and linen collection rooms with an aggregate volume of 8.67 cubic feet or greater
- Such rooms now require both the previously mandated 1-hour fire barrier and sprinkler protection
- Additional changes include lowering the following thresholds for inclusion as an incidental use for consistency with CMD federal standard:
  - Waste/linen collection rooms: Reduction from ≥ 10 cf to ≥ 8.67 cf
  - Storage rooms: Reduction from < 100 sf to < 50 sf

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Table 509.1 Incidental Uses

TABLE 509.1 INCIDENTAL USES

In Group I-2, laundry rooms over 100 square feet	1 hour and provide automatic sprinkler system
Group I-3 cells and Group I-2 patient rooms equipped with padded surfaces	1 hour and provide automatic sprinkler system
In Group I-2, physical plant maintenance shops	1 hour and provide automatic sprinkler system
In ambulatory care facilities or Group I-2 occupancies, waste and linen collection rooms with containers that have an aggregate volume of ~~10~~ 8.67 cubic feet or greater	1 hour and provide automatic sprinkler system
In other than ambulatory care facilities and Group I-2 occupancies, waste and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system
In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than ~~100~~ 50 square feet	1 hour and provide automatic sprinkler system
Electrical installations and transformers	See Sections 110.26 through 110.34 and Sections 450.8 through 450.48 of NFPA 70 for protection and separation requirements.

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510.2 Horizontal Building Separation

- Where the horizontal building separation allowance (podium buildings) of Section 510 is applied, the restriction on occupant loads for the upper building has been eliminated
- Previously, the only Group A occupancies permitted above the podium level were those with an occupant load of less than 300
- In addition, where vertical offsets occur in the horizontal separation required between the upper and lower buildings, the offsets shall be constructed as for fire barriers

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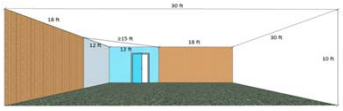
602.4.2 Exposed Mass Timber in Type IV-B Construction

- The allowable unprotected mass timber on the ceilings of Type IV-B buildings has been increased from 20% to 100%
  - Revisions are based on fire research conducted at the Research Institute of Sweden
  - Tests exhibited satisfactory performance in that no significant fire growth was observed and temperatures within the compartment decreased continuously until the end of the four-hour test
- The separation distance between unprotected mass timber elements is now only required for walls



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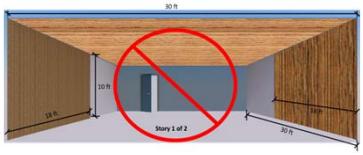
602.4.2 Exposed Mass Timber in Type IV-B Construction

- In addition, multiple-story floor areas are prohibited from being used to determine the allowable exposed mass timber in ceilings and walls in multi-story dwelling units and fire areas
  - Prohibition due to no testing of such conditions
- Each story to be evaluated on a story-by-story basis



For example, it would not be appropriate to have 100% of the ceiling and 60% of the walls (based on floor area) exposed on one of the two stories.

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705.6 Exterior Wall Fire Rating Continuity

- The continuity requirements for the fire-resistance rating of exterior walls are now addressed for two conditions
- The required rating shall extend from the top of the foundation or floor/ceiling below to one of the following:
  - Underside of floor or roof sheathing , deck or slab above, or
  - Underside of floor/ceiling or roof/ceiling assembly having a fire-resistance rating ≥ the exterior wall, and the fire separation distance > 10 feet

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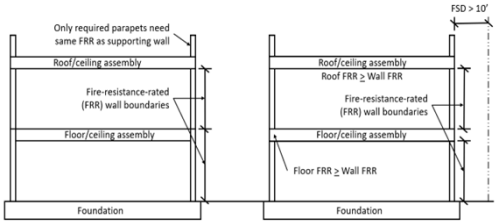
705.6 Exterior Wall Fire Rating Continuity



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705.7.1 Exterior Wall/Floor Intersections in Type III Construction

- New provisions for load-bearing exterior walls in Type III construction clarify detailing where floors intersect the exterior wall in typical "platform" framing
- Fire-resistance rating of portion of floor assembly that supports exterior wall to be ≥ than the rating required for the exterior wall per Table 601
  - The rating provided by the portion of the floor assembly supporting and within the plane of the exterior wall is permitted to include the contribution of the ceiling membrane when considering exposure from fire to the inside
- Where wall is load-bearing, floor construction within plane of the exterior wall to be in accordance with requirements for interior building elements of Type III construction
  - Includes rim joists, rim boards and blocking

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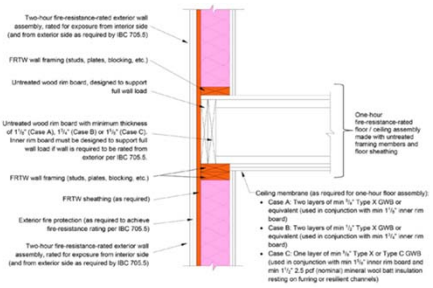
705.7.1 Exterior Wall/Floor Intersections in Type III Construction



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706.1.2, 706.2 Fire Walls—Deemed to Comply

- The use of NFPA 221, *Standard for High Challenge Fire Walls, Fire Walls and Fire Barrier Walls*, was previously recognized as acceptable for dealing with structural stability requirement of IBC
- Fire walls now may be fully designed and constructed in accordance with NFPA 221, except where IBC addresses similar issues
  - For example, NFPA 221 does not contain any requirement for fire wall fire-resistance ratings. Therefore, provisions of IBC Section 706.4 will apply

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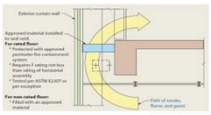
715.4, 715.5 Exterior Curtain Wall and Floor Intersections

- Voids created at the intersection of exterior curtain wall assemblies and floor or floor/ceiling assemblies are required to be filled or protected to prevent the interior spread of fire
  - Fire-resistance-rated floor or floor/ceiling assemblies: Protected
  - Nonfire-resistance-rated floor or floor/ceiling assemblies: Filled
- Three new exceptions now provided where such voids do not require protection or filling
  - Floors within a single dwelling unit
  - Floors and ramps within parking garages
  - Mezzanine floors



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903.2 Sprinkler System Required – Lithium-ion and Lithium Metal Batteries

- Sprinkler systems are required in certain Group B, F-1, M and S-1 occupancies where these batteries are involved.
- Not limited to use in Energy Storage Systems as previously done.
- Addresses the unique fire hazard the batteries create and the potential for a thermal runaway fire.
- Sprinkler required for:
  - Group B: Laboratories, testing, research and development of batteries
  - Group F-1: Manufacture of batteries or vehicles, ESS or equipment using them
  - Group M: Storage
  - Group S-1: Storage or repair of vehicles powered by these batteries with Fire Area over 500 sq. ft.

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903.2 Sprinkler System Required – Lithium-ion and Lithium Metal Batteries

- A number of other provisions have been added in other sections to better address the hazards of these types of batteries. This includes:
- Sprinkler system design is based upon fire tests to address specific hazard and arrangement. Does not use standard density requirements for the general occupancy area.
- New IFC Sections 320 and 322 which address Battery Storage and Powered Micromobility Devices respectively.
- IFC 322 does not require a sprinkler system but addresses other protection issues for storage, charging, location, planning, etc.

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903.3.1.2 NFPA 13R Sprinkler Systems

- Increases the height of a Group R-2 occupancy building which can use an NFPA 13R sprinkler system.
- Changes from a 30-foot maximum height to the highest floor level to a maximum 45-foot height to the roof assembly.
- 45-foot height continues to be measured from lowest level of fire department vehicle access to the eave of highest pitched roof, intersection of highest roof and exterior wall, or top of highest parapet, whichever is greatest height.

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903.3.1.2 NFPA 13R Sprinkler Systems

- Residential occupancies other than Group R-2 will continue to use the maximum 30-foot height limitation
- The revised provisions addressing Group R-2 provide greater consistency with the 2018 thresholds for 13R protection
  - Requirements also consistent with provisions addressing protection of attic spaces where a 13R sprinkler system is provided
- 2021 provisions were felt to be too restrictive for Group R-2 occupancies

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907.2 Fire Alarm and Detection Systems

- Two new exceptions exempt manual fire alarm boxes and occupant notification system in smaller (<15,000 occupants) Group A-5 outdoor bleacher seating, and in temporary outdoor Group A-5 seating.
- Limitations for compliance include items such as:
  - Enclosed spaces under or attached; including whether it is allowed, size limits and separation.
  - Requirement for public address system with standby power in permanent facility
  - Use limit of 180 days for temporary facilities
  - Egress/evacuation plans per exceptions
- Exceptions based on Section 309 of ICC 300

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907.2 Fire Alarm and Detection Systems

- New sections added to require detection systems in areas containing lithium-ion and lithium metal batteries.
- Similar to 903.2, requirements apply to Group B, F, M and S occupancies
- Requires an alarm system activated by air sampling-type smoke detection or radiant energy-sensing detection.
- Helps to prevent/limit fire or thermal runaway hazard by early detection of battery failures
- Since fires are almost impossible to extinguish, this helps detect problems to allow evacuation, or mitigation efforts prior to fire occurrence.

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907.2.11.3 Smoke Alarms Near Cooking Appliances

- Modifies the location requirements applicable to smoke alarms due to changes in the listing standard.
- New testing standards help reduce nuisance alarms caused by cooking sources.
  - Align with NFPA 72 and UL 217
- Requires 10-foot horizontal separation to permanently installed cooking appliance, with exception permitting reduction to 6 feet to ensure detectors are installed where required by 907.2.11.1 or 907.2.11.2.
- Code previously used 20 feet, 10 feet or 6 feet, depending on alarm type.

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915 Carbon Monoxide Detection

- Detection now required in all normally occupied occupancies where a carbon monoxide producing device is present.
- Previously was only required in Group I-1, I-2, I-4 and R occupancies and in classrooms of Group E occupancies.
- An exception exempts detection requirement in F, S and U occupancies that are not normally occupied.
- Requirements have also been substantially revised and reformatted.
- Relies on definition in Chapter 2 which helps limit scope to permanent CO sources or regularly used vehicles (vehicles in garage, propane forklifts, etc.) and not temporary or infrequent sources.

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915 Carbon Monoxide Detection

- Reformatting helps clarify requirements and how each aspect is applied.
  - 915.1 addresses where CO detection is needed
  - 915.2 specifies where detection devices are placed for best protection
  - 915.3 through 915.5 deals with installation itself, including compliance with NFPA 72, detectors being hardwired, and interconnection
- System requirements depend on other features in the building. Can be stand-alone if no fire alarm system is present, done as part of a fire alarm system by adding detectors, or as a part of a security system that the occupant may already have (when done per NFPA 72).

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1006.3.3, Table 1006.3.3 Egress from Stories and Occupiable Roofs

- New definition added to Chapter 2 for Occupiable Roof
- Roof is designed for human occupancy and access is for other than maintenance or repair
- Revisions throughout code from “occupied roof” to “occupiable roof” which will provide better consistency when applying provisions
- Egress is required from “occupiable roof” whether it is occupied or not

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1010.2.4, 1010.2.5 Locks and Latches

- Adds four definitions (automatic flush bolt, constant latching bolt, dead bolt, and manual bolt)
- Reformats provisions and provides a table to clarify which type of latching bolt is permitted in various applications.
- Modifies existing "main door" exception to clarify it as being the main door into the building or tenant space and excludes secondary doors.
- Eliminates the occupant load limit of 10 for dwelling units or sleeping units to use night latch, dead bolt or security chain.
  - Now permitted for units permitted a single means of egress.

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1010.2.14 Elevator Lobby Exit Access Doors

- Permits electronically locked exit access doors to serve as the means of egress from an elevator lobby.
- Eliminates the need for an elevator lobby to have direct access to an exit and allow the egress path to go through a tenant space which could normally be locked and unavailable.
- Requires eight conditions to be met, including:
  - NFPA 13 sprinkler system
  - Fire alarm system
  - Smoke detection system in lobby
  - Other occupants of floor to have access to two exits without travel through lobby
  - Two-way communication system within the lobby

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1013.2 Low-level Exit Signs in Group R-1

- New exception eliminates the requirement for low-level exit signs in areas serving the guestrooms of Group R-1 occupancies when the building is sprinklered.
  - The exception will required either an NFPA 13 or 13R system throughout the building.
- Low-level exit signs would still be required in older buildings which are not sprinklered and may lack many other current safety features.
- These additional exit signs were not felt to be justified based on many improvements in the fire safety record of R-1 occupancies. This includes compartmentation, sprinklers, alarms and loss history.

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1029.3 Egress Courts – Opening Protection

- New exception eliminates the egress court requirements for a fire-resistance-rated wall and protected openings when the occupants have multiple egress path options.
- With options, it is unlikely that both egress paths would be blocked.
- Conceptually similar to existing exception permitted for egress balconies in Section 1021.2.
- Walls with limited fire separation distance would still require protection based on those requirements, but not necessarily based on the egress court protection requirement.

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1106.3 Parking for Groups R-2, R-3 and R-4

- Clarifies that accessible parking requirements for Group R-2, R-3 and R-4 occupancies to be based on "the greatest number" of either the 2% requirement or at least one space for each Accessible and Type A unit.
- Code previously was not clear how to apply these two provisions so often was interpreted as providing a choice to use one or the other.

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1106.3, 1106.7.1 Accessible Parking

- Group I-1 and R-1 (previous Item 2) removed from this section since they must provide accessible parking per Table 1106.2.
- Previous item 4 moved to location requirements of 1106.7.1. This expands the application to ***all occupancies*** and requires accessible parking be provided beneath the building if any parking is provided beneath the building.

36

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1108.6.1.1 Group R-1 Accessible Units

- New exception permits more limited bathing options where none of the Accessible units in the building contain bathtubs.
- Where NONE of the units within the building contain tubs, standard or alternate roll-in showers with seats are permitted.
- Maintains concept that people with disabilities should be treated the same as other occupants.
- A second exception allows transfer showers to be substituted for all but the minimum number of roll-in showers from Table 1108.6.1.1

37

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1112.6 Tactile Room Identification Signs

- Provisions for tactile signage for interior and exterior signs identifying permanent rooms and spaces moved from Appendix Section E107.2.
  - Technical requirements for signage found in A117.1-17 Section 703
- Insertion into Chapter 11 results in no requirement for specific adoption
- Also clarifies that tactile signage only required "where provided"

38

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1110.4 Adult Changing Stations

- New provisions will require adult changing stations (or regulate them if they are just provided)
- They are required for:
  - Assembly and mercantile with aggregate of 6 or more male and female required water closets
  - Group B education facilities with aggregate of 12 or more male and female required water closets
  - Group E with an assembly room or space that requires an aggregate of 6 or more male and female water closets for that room
  - At highway rest stops and highway service plazas

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1110.4 Adult Changing Stations

- Required to be located in a single occupant toilet room or in a family or assisted use toilet room
- Are prohibited from requiring travel through a security checkpoint from the general separate-sex toilet and bathing rooms
- Located on accessible route within two stories and a maximum of 2,000 feet of travel
- The water closet and lavatory within the room can be included to satisfy the occupancy's overall fixture requirements

40

40

Chapter 16 Structural Design Loads

- Updated loads
  - Snow
  - Wind
  - Rain
  - Seismic
  - Guards and handrails
- Tornado loads – new
  - RC III & IV
- Elevators & Escalators
  - Wind
  - Snow
  - Seismic

41

41

Table 1705.3 Special Inspection – Rebar Welding

- Continuous special inspection
  - Reinforcement
    - Special moment frames
    - Boundary elements of special structural walls
    - Coupling beams
  - Reinforcement splices
  - Primary tension reinforcement in corbels

42

42

1807.2.5 Guards on Retaining Walls

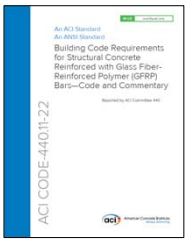
- Where required
  - ≤ 36" of walking surfaces
  - > 30" vertically & ≤ 36" horizontally
  - Loads per 1607.9
- Height ≥ 42"
- Openings per 1015.4
- Exception
  - Not publicly accessible

43

43

Chapter 19 Concrete

- New GFRP standard
  - Low seismic areas
  - Highly corrosive environments
  - Supporting MRI equipment
- Seismic provisions reorganized
  - ACI 318 revisions removed
  - Supplemental provisions remain



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Chapter 21 Masonry

- Updated standards
  - Mortar requirements for adhered masonry veneers
  - GFRP for low seismic areas
  - Empirical design of Adobe Masonry references TMS 402-16

45

45

Chapter 22 Steel

- Updated standards
  - Structural stainless steel
  - CFS diaphragm panels
  - Steel decks
  - Industrial shelving & platforms
    - Stairs, ladders and guards
- Metal building systems
  - New definition
  - New provisions
  - New special inspections

46

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Chapter 23 Wood

- Updated standards
  - 2024 NDS
  - 2024 WFCM
- Revised FRTW provisions
  - FRT LVL
- Wind speeds updated
  - WSP wall sheathing
  - Rafter/truss uplift loads
- Connection fire protection
  - Type IV-A, IV-B & IV-C
- Wood shear walls and diaphragms
  - CLT and soil loads
- Hillside light-frame wood construction for seismic

47

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2902.3.6 Locking of Toilet Room Doors

- In a multi-user toilet room, the egress door is now permitted to be lockable from the interior side provided three conditions are met
- Egress door to be:
  - Lockable from inside of the toilet room only by authorized personnel by the use of a key or other approved means
  - Readily openable from the toilet room in accordance with Section 1010.2
  - Capable of being unlocked from outside the toilet room with a key or other approved means
- Allows for a safe area of refuge in the event of an emergency such as an active shooter

48

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3001.2 Elevator Emergency Communication Systems

- Technical details of required elevator emergency communications system are no longer addressed in IBC as they are provided in reference standard
  - ASME—2019/CSA B44-19 *Safety Code for Elevators and Escalators*
- In addition, IBC now requires system to provide a means to enable authorized personnel to verify:
  - The presence of someone in car
  - That the person(s) is trapped
- Once an entrapment is verified, system to enable authorized personnel to:
  - Determine if assistance is needed
  - Communicate when help is on the way
  - Communicate when help arrives on the site

49

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3006.3 Smoke Protective Curtain Assemblies at Elevator Hoistways

- Where Section 3006.2 requires protection at an elevator hoistway door, a fifth method of protection utilizing a *smoke protective curtain assembly* has been established
- Defined as "a listed smoke and draft control curtain assembly consisting of a curtain coil, control unit, and perimeter sealing system"
- Curtain assembly to:
  - Comply with smoke and draft control requirements in Section 716.2.2.1.1 when tested per UL 1784 without an artificial bottom seal
  - Be equipped with a control unit listed to UL 864
  - Comply with Section 2.11.6.3 of ASME A17.1/CSA B44
  - Be installed and maintained in accordance with NFPA 105

50

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IEBC 306.6.1.1 Additions for Elevators

- When an addition is added solely to add an elevator for an accessible means of egress to multiple floors, the existing route on the exit level may be maintained.

51

51

IEBC 309.2.1 Automatic Sprinkler Systems

- Automatic sprinkler systems are required when adding combustible exterior wall coverings on high-rise buildings.

52

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IEBC 803.2.2, 803.2.5 Municipal Water

- Exceptions to requiring automatic sprinkler systems when adequate municipal water is not available are clarified to address the water being available on the floor where the work area is located.

53

53

IEBC Appendix E Temporary Emergency Uses

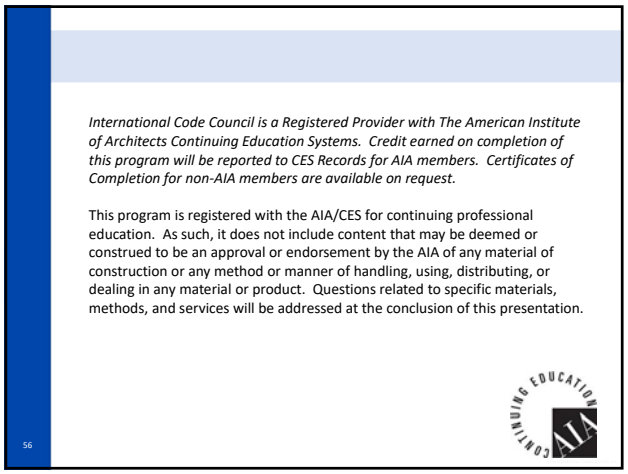
- A new appendix providing guidance for emergencies that exceed pre-planned emergency responses is added.

54

54

Thank you for Attending
Discussion
• Visit learn.iccsafe.org for more training opportunities
55

55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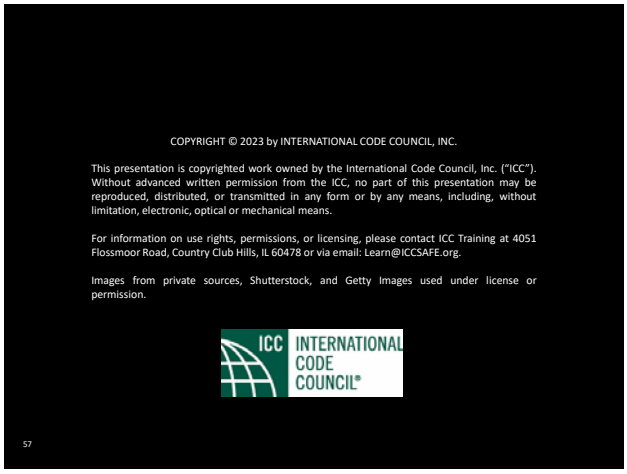
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File Attachments for Item:

ER-2 2024 IECC Changes and Status (ICC)

All certifications (1.5 hours)

Staff Notes: Code not current in Ohio

Committee Recommendation:

Application for Continuing Education Course Approval

Provider Information

Name *	Organization	Email *	Phone Number *
Laura Morris	International Code Council	lmorris@iccsafe.org	(708) 799-2300

Address *	City *	State *	Zip Code *
4051 W Flossmoor Road	country Club Hills	IL	60478

Website	Conference Sponsor (if applicable)	Conference Email
https://www.iccsafe.org/edu		

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429)

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: 2024 IECC Changes and Status

Course instructor: Kris Stenger

Course description

This course will cover the proposed changes in the 2024 IECC. Participants will also learn how the standards development process and a new scope and intent have affected the development of the 2024 IECC.

Instructional hours per session	Number of Sessions	Course Date	Course Location
1.5	1	2023-10-10	St. Louis, MO

Special Content

- ☐ Code Administration
- ☐ Existing Buildings
- ☐ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course	Conference Name	Conference location

Course to be offered online?

- ☐ Yes
- ☑ No

☐ On Demand ☐ Webinar

Course Website

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- [ ] Residential Certifications Only
- [x] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [x] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PTT_2024 IECC Changes and Status.pdf	2.29 MB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

2024 IECC Changes and Status

90 minutes / 1.5 hrs.

Description

This course will cover the proposed changes in the 2024 IECC. Participants will also learn how the standards development process and a new scope and intent have affected the development of the 2024 IECC.

Learning Objectives

- Understand the new development process for the IECC
- Review the new scope and intent of the IECC
- Overview of Proposed changes to the IECC- Residential/IRC Chapter 11 Energy Efficiency
- Overview of Proposed changes to the IECC-Commercial

Timeline

0-15 Introduction, review of new IECC development process, new scoping

16-30 Cost Effectiveness, Proposed Changes to the IECC-R

31-45 Changes in Prescriptive, Simulated Performance, and ERI compliance paths

46-60 New Appendices, Overall energy efficiency reduction over time through code cycles, Questions

61-75 Proposed Changes to the IECC-C, thermal bridging

76-90 Total System Performance Ratio, Additional Energy Efficiency Credits, New Appendices, Questions

Kristopher Stenger, AIA, CBO, LEED AP joined the International Code Council as the Director of Energy Programs in the Spring of 2021. Prior to joining the Code Council Kris served for 16 years as an architect, permitting manager, and sustainability director in city and county government within Central Florida. A Florida licensed Architect, Certified Building Official, and Certified Sustainability Professional Kris has served on the AIA National Codes and Standards Committee; Consensus Committee Member on the ICC 700 National Green Building Standard; the ICC's Sustainability, Energy, and High Performing Buildings Code Action Committee; and all offices of the Central Florida Chapter Building Officials Association of Florida. Kris holds a Bachelors of Science in Architecture from the University of Illinois-Urbana-Champaign, and a Masters of Architecture from Arizona State University. Kris and his wife, Holly Stenger, AIA, designed and constructed their own LEED Gold net-zero energy home in Orlando where they reside with their two children.

2024 IECC Changes and Status

- Kristopher Stenger, AIA, CBO
  ICC Director of Energy Programs
  kstenger@iccsafe.org

1

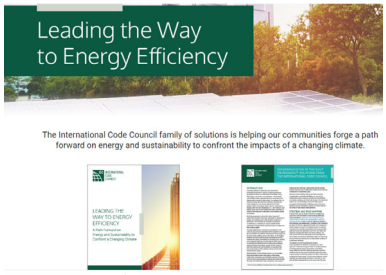
Learning Objectives

- Understand the new development process for the IECC
- Review the new scope and intent of the IECC
- Overview of Proposed changes to the IECC- Residential/IRC Chapter 11 Energy Efficiency
- Overview of Proposed changes to the IECC-Commercial

2

Leading the Way to Energy Efficiency

- Iccsafe.org/energy



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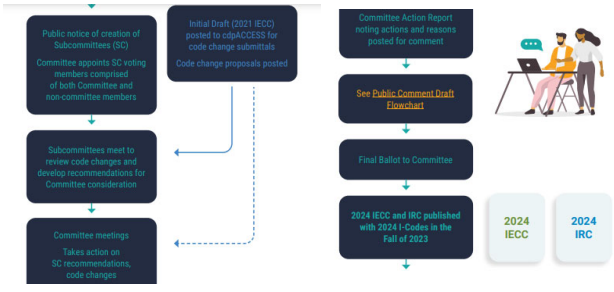
Leading the Way to Energy Efficiency



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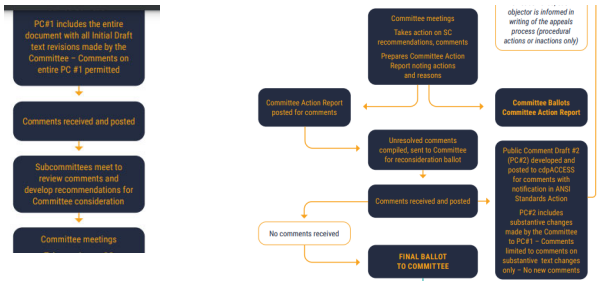

5

Scope and Intent

RESIDENTIAL ENERGY PROVISIONS

R101.2 Scope

This code applies to the design and construction of residential buildings.

R101.3 Intent

The International Energy Conservation Code-Residential provides market-driven, enforceable requirements for the design and construction of residential buildings, providing minimum efficiency requirements for buildings that result in the maximum level of energy efficiency that is safe, technologically feasible, and life cycle cost effective, considering economic feasibility, including potential costs and savings for consumers and building owners, and return on investment. Additionally, the code provides jurisdictions with optional supplemental requirements, including requirements that lead to achievement of zero energy buildings, presently, and, through glidepaths that achieve zero energy buildings by 2030 and on additional timelines sought by governments, and achievement of additional policy goals as identified by the Energy and Carbon Advisory Council and approved by the Board of Directors. The code may include non-mandatory appendices incorporating additional energy efficiency and greenhouse gas reduction resources developed by the Code Council and others. Requirements contained in the code will include, but not be limited to, prescriptive- and performance-based pathways. The code will aim to simplify code requirements to facilitate the code's use and compliance rate. The code is updated on a three-year cycle with each subsequent edition providing increased energy savings over the prior edition. The IECC residential provisions shall include an update to Chapter 11 of the International Residential Code. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this intent. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

6

Cost Effectiveness

Pacific Northwest

Evaluating Cost Effectiveness

The working group recommends adoption of two simplified cost effectiveness methodologies allowing proponents flexibility when providing information.

1. **Scalar Method** –The simple payback of a measure is compared to a pre-determined Scalar Ratio Threshold. This is the method used by ASHRAE 90.1. A measure is deemed cost effective when:

$$\frac{First\ Cost}{Energy\ \&\ Maintenance\ Cost\ Savings} < Scalar\ Ratio\ Threshold$$

2. **Net Present Value (NPV) Method** –First cost and annual electricity, fossil fuel and maintenance cost savings are multiplied by NPV Factors. If the NPV of the cost savings is greater than the NPV of the financed first cost than a measure is deemed cost effective.

$$Fuel\ \$\ Savings * NPV\ Fuel\ Factor + Elec.\ \$\ Savings * NPV\ Elec.\ Factor + Maint.\ \$\ Savings * NPV\ Maint.\ Factor > First\ Cost * NPV\ Cost\ Factor$$

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Cost Effectiveness

Pacific Northwest

Example of how to use the recommended criteria

Consider a proposal with a service life of 15 years with a measure first cost of $1000, and electricity savings of $100 and fossil fuel savings of $100.

Using criteria for 7% Real Discount Rate.

Scalar Method

Simple payback = 5 ($1000/$200)

Weighted Scalar Threshold = 11.7 * ($100/$200) + 10.9 * ($100/$200) = **11.3**

Simple payback < Scalar threshold measure demonstrates cost effectiveness

Net Present Value (NPV) Method

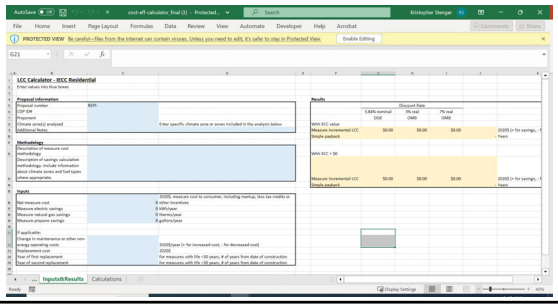
NPV Electricity Savings = $100 * 8.11 = $811 and NPV Fuel Savings = $100 * 8.71 = $871.

NPV Savings = $1056 + $1142 = **$1,682** **NPV First Cost** = $1000 * 0.92 = **$920**

NPV Savings > NPV Costs measure demonstrates cost effectiveness

8

Cost Effectiveness



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2024 Residential Code Development

Instead of code hearings, 2024 IECC was developed like a standard Residential Consensus Committee (48 members, selected in early 2021)

- 15 Code Officials (ID, NJ, NY, MA, ME, TX, GA, NC, IA, FL, VA, LA, CO, MD)
- 10 Builders (NAHB, LBA, Habitat for Humanity, other homebuilders)
- 9 Public Segment (DOE, PNNL, NBI, EECC, SWEEP, MEEA, NRDC)
- 7 Users (Raters, Architects)
- 4 Manufacturers (AHRI, insulation, windows & doors, solar)
- 2 Utilities

Six Sub-Committees: Admin, Envelope, HVAC & HW, EPLR, & Modeling

1st call for proposals were due in October 2021

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2024 Residential Code Development

Over 200 proposals received; reviewed by sub-committees and Main by September 2022

~100 failed to attain consensus (i.e., two-thirds or 32 Yes votes)

~100 were approved as submitted, or more often, as modified

1st Public Comment draft posted online in October 2022

Over 400 proposals received; reviewed by sub-committees and Main by April 2023

2nd Public Comment draft will be posted online in May 2023

Over ## proposals received; reviewed by sub-committees and Main by September 2023

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Code Changes to expect in 2024 IECC-R

R401 General

R401.2 Application. Residential buildings shall comply with ~~Section R401.2.5 and~~ either Section R401.2.1, R401.2.2, R401.2.3 or R401.2.4.

~~R401.2.5 Additional energy efficiency. This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.~~

~~1. For buildings complying with Section R401.2.1, one of the additional efficiency package options shall be installed according to Section R408.2.~~

~~2. For buildings complying with Section R401.2.2, the building shall meet one of the following:~~

- ~~2.1. One of the additional efficiency package options in Section R408.2 shall be installed without including such measures in the proposed design under Section R405; or~~
- ~~2.2. The proposed design of the building under Section R405.3 shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design.~~

~~3. For buildings complying with the Energy Rating Index alternative Section R401.2.3, the Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified in Table R406.5.~~

~~The option selected for compliance shall be identified in the certificate required by Section R401.3.~~

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Code Changes to expect in 2024 IECC-R

R402 Building Thermal Envelope

Flipped the rows and columns to match IECC-C format
Changes to fenestration and ceiling insulation U-factors

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
FENESTRATION U-FACTOR[g]	0.50	0.50	0.40	0.30	0.30	~~0.30~~0.28[e]	~~0.30~~0.28[e]	~~0.30~~0.27[e]
SKYLIGHT[d] *U*-FACTOR	~~0.75~~0.60	~~0.75~~0.60	~~0.65~~0.60	~~0.55~~0.53	~~0.55~~0.53	~~0.55~~0.50	~~0.55~~0.50	~~0.55~~0.50
GLAZED FENESTRATION SHGC[f,g]	0.25	0.25	0.25	0.25	0.40	~~0.40~~NR	NR	NR
CEILING *U*-FACTOR[i]	0.035	0.035	~~0.026~~0.030	~~0.026~~0.030	~~0.024~~0.026	~~0.024~~0.026	~~0.024~~0.026	~~0.024~~0.026

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Code Changes to expect in 2024 IECC-R

R402 Building Thermal Envelope

F-factors for slabs

CLIMATE ZONE	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
UNHEATED SLAB F-FACTOR[a]	0.73	0.73	0.73	0.54	0.51	0.51	0.48	0.48
HEATED SLAB F-FACTOR[a]	0.74	0.74	0.74	0.66	0.66	0.66	0.66	0.66

Total "UA" replaced with "TC", where TC is UA + FP
What you won't see:
- Changes to prescriptive wall U-factors
- Anything related to embodied carbon or linear/point thermal bridges

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Code Changes to expect in 2024 IECC-R

R402 Building Thermal Envelope

Air Leakage (Technical & Organizational changes)
Clarify the max allowed for each path & home type
Increased stringency:
- R405 & R406: 5 ACH50 drops to 4.0 ACH50
- Prescriptive:
  - 5 ACH50 drops to 4.0 ACH50 in CZ 0-2
  - 3 ACH50 drops to 2.5 ACH50 in CZ 6-8

Multifamily:
Increased stringency: 0.30 cfm50/ft² drops to 0.27
Add a sampling protocol for buildings with 8+ units
Reduced air leakage allowance if using guarded tests

15

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Code Changes to expect in 2024 IECC-R

R403 Systems

R403.1.2 Heat Pump Supplementary Heat
New language to clarify the controls needed
Applies to all supplementary heat (electric resistance & other fuels)

16

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Code Changes to expect in 2024 IECC-R

R403 Systems

R403.3 Ducts

Technical, Editorial, and Organizational changes

- Revised and added definitions
- Created a table for max duct leakage values
- Provide greater leakage allowance where there are more returns
- Add test exemption for ductless systems (< 10 ft of ductwork)
- Add a sampling protocol for buildings with 8+ units
- Added duct sizing requirements (points to IRC and IMC)

17

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Code Changes to expect in 2024 IECC-R

R403 Systems (continued)

R403.5.4 Hot Water Pipe Volume calculations

TABLE R403.5.4
INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION TUBING

	OUNCES OF WATER PER FOOT OF TUBE								
NOMINAL SIZE (inches)	COPPER TYPE M	COPPER TYPE L	COPPER TYPE K	CPVC CTS SDR 11	CPVC SCH 40	CPVC SCH 80	PE-RT SDR 9	COMPOSITE ASTM F1281	PEX CTS SDR 9
3/8	1.06	0.97	0.84	N/A	1.17	-	0.64	0.63	0.64
1/2	1.69	1.55	1.45	1.25	1.89	1.46	1.18	1.31	1.18
3/4	3.43	3.22	2.90	2.67	3.38	2.74	2.35	3.39	2.35
1	5.81	5.49	5.19	4.43	5.53	4.67	3.91	5.06	3.91
1 1/4	8.70	8.36	8.09	6.61	9.66	8.24	5.81	8.49	5.81
1 1/2	12.18	11.83	11.45	9.22	13.20	11.38	8.09	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	19.11	13.86	21.48	13.86

For SI: 1 foot = 304.8 mm, 1 inch = 25.4 mm, 1 liquid ounce = 0.030L, 1 oz/ft² = 305.15 g/m².
N/A = Not available.

18

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Code Changes to expect in 2024 IECC-R

R403 Systems (continued)

R403.5.4 Hot Water Pipe Volume calculations
R403.5.5 Demand Responsive Water Heating
What you won't see: demand responsive HVAC (only as a point in R408)

R403.6.1 Heat or energy recovery ventilation
Expands requirement into CZ 6

19

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Code Changes to expect in 2024 IECC-R

R403 Systems (continued)

R403.5.4 Hot Water Pipe Volume calculations
R403.5.5 Demand Responsive Water Heating
What you won't see: demand responsive HVAC (only as a point in R408)

R403.6.1 Heat or energy recovery ventilation
Expands requirement into CZ 6

R403.7.1 Electric resistance space heating limits
In CZ 4 to 8, 2 kW max unless at least ONE heat pump is installed
What you won't see: a prohibition on using gas / oil (see Appendix RE)

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Code Changes to expect in 2024 IECC-R

R404 Electrical Power, Lighting, and Renewable Energy Systems

R404.1 to R404.3 Lighting
R404.4 Renewable energy certificate (REC) documentation
R404.5 Electric Readiness
Provide sufficient electric infrastructure where non-electric cooktop, oven, clothes dryer, or water heater installed
What you won't see:
- Electric readiness requirement for space heating

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Code Changes to expect in 2024 IECC-R

R404 Electrical Power, Lighting, and Renewable Energy Systems (cont'd)

R404.6 Renewable Energy Infrastructure
- Provide solar-ready zones (some Exceptions)
- What you won't see:
- Solar mandate (Appendix only)
- Energy storage mandates (Appendix only)

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Code Changes to expect in 2024 IECC-R

R404 Electrical Power, Lighting, and Renewable Energy Systems (cont'd)

R404.7 Electric Vehicle Power Transfer Infrastructure
- EV-capable, EV-ready, or EV-installed (some Exceptions)
- Single family (IRC):
  - One (1) space per unit
- Group R-2:
  - 40% of dwelling units or spaces, whichever is less

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Code Changes to expect in 2024 IECC-R

R405 Simulated Building Performance

Clarifies that only dwelling units are modeled; common areas must instead meet prescriptive requirements in R402, R403, and R404.
Allows credit for HVAC & DHW efficiency and duct location
85% energy cost savings required for electric; 80% for mixed-fuel homes
Homes larger than 5,000 ft² have to perform 5% better (80 and 75%)
Envelope backstop updated from 2009 IECC to 1.08 or 1.15 X $TC_{2024\ IECC}$
New site-to-source multipliers (2.51 for electric, 1.09 for other fuels)
New site energy savings alternative to energy cost or source savings
Requires software to demonstrate compliance with ASHRAE Std 140
What you won't see: credit for lights, appliances, or renewables

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Code Changes to expect in 2024 IECC-R

R406 Energy Rating Index Compliance

Clarifies that only dwelling units are modeled; common areas must instead meet prescriptive requirements in R402, R403, and R404.
Requires software tools to demonstrate compliance with ASHRAE Std 140
Removes the ventilation rate deviation
Updates to use ANSI 301-2022 instead of 2019
Same envelope backstop as R405; no different if on-site power is present
No limit on how much on-site solar PV can contribute to code compliance
….but if you use OPP, your ERI Max is much lower
Reduce the ERI Max by 1 point compared to the 2021 IECC table values
For MF, allows the average ERI to be used to demonstrate compliance

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Code Changes to expect in 2024 IECC-R

R406.5 ERI-based compliance. Compliance based on an ERI analysis requires that the *rated design* and each confirmed as-built *dwelling unit* be shown to have an ERI less than or equal to the applicable value indicated in Table R406.5 where compared to the *ERI reference design* as follows:

1. Where on-site renewables are not installed, the maximum ENERGY RATING INDEX NOT INCLUDING OPP applies.
2. Where on-site renewables are installed, the maximum ENERGY RATING INDEX INCLUDING OPP applies.

Exceptions:

1. Where the ERI analysis excludes OPP, the maximum ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted.
2. For buildings with twenty or more *dwelling units*, where *approved* by the *code official*, compliance shall be permitted using the Average Dwelling Unit Energy Rating Index, as calculated in accordance with ANSI/RESNET/ICC 301.

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0-1	51	35
2	51	34
3	50	33
4	53	40
5	54	43
6	53	43
7	52	46
8	52	46

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Code Changes to expect in 2024 IECC-R

R408 Additional Efficiency Requirements
Instead of 5 'packages', pick 2 'measures' that sum to 10 or more 'points'
Over 45 measures across 11 Measure Categories

1. Enhanced Building Envelope
2. More efficient Heating & Cooling
3. More efficient Hot Water
4. More efficient Duct Distribution
5. More efficient Ventilation
6. Energy Efficient Appliances
7. On-site renewables
8. Off-site renewables
9. Demand response HVAC
10. Opaque Walls
11. Whole home lighting control

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New (or updated) Appendices in 2024 IECC-R

Appendix RC – Zero net energy residential buildings (updated)
Appendix RD – Electric Energy Storage Provisions (new!)
Appendix RE – All-Electric residential buildings (new!)
Appendix RF – Alt. building thermal envelope insulation R-values (new!)
Appendix RP – On-Site Renewable Energy (new!)
Appendix RG – 2024 IECC Stretch Code (new!)
Appendix RH – Operational Carbon Rating and Energy Reporting (new!)

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PNNL Progress Indicator

Summary of Results

National Weighted Average		Site Energy [kBtu/ft²-yr] Energy Cost [$/residence-yr] Emissions [tons/kft²-yr]		% Savings
		IECC 2021	IECC 2024	
Whole Building	Site Energy	34	31.7	6.66%
	Energy Cost	2,009	1,881	6.41%
	Emissions	10.79	10.1	6.41%

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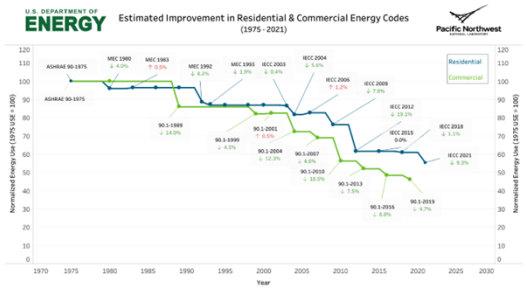

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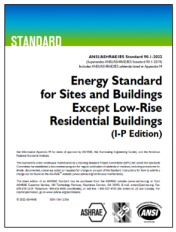
Commercial Building Energy Codes

ASHRAE 90.1



IECC

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Commercial Building Energy Codes

The changes for the IECC are not finalized but it is likely that the following are some of the major changes will likely be included;

- **Additional efficiency credits** – Credits have been part of IECC codes for several cycles, but the 2024 will be expanded and somewhat align with the new credit option added to ASHRAE 90.1
- Addition of **Total System Performance Ratio** (TSPR)
- **Occupied standby controls** – Allow unoccupied rooms to change setpoint and ventilation during the occupied mode
- **Interior LPA reductions** – Reduction in lighting power levels
- **Egress lighting** off when unoccupied
- **Fan Energy Reductions** – Modification of fan power allowance to use a new watts/cfm and allowances for size of system resulting in a 10% reduction in fan energy. (Note this did not make ASHRAE 90.1-2022)
- **VAV turndown** requirements
- Parking garage ventilation
- 5% increase in renewable energy **to 0.75 w/ft2** for the largest 3 floors
- Adoption of revised **HVAC efficiency tables** from ASHRAE 90.1 2022
- Other miscellaneous changes

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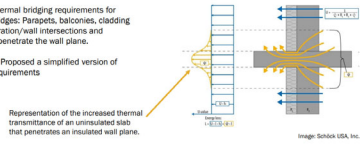
Commercial Building Energy Codes

Thermal bridging is the difference in thermal transmittance that occurs at the junction of different materials in a building envelope assembly. Mitigating thermal bridges that increase thermal transmittance is important to ensure the overall energy efficiency of building envelope.

ASHRAE 90.1: Robust thermal bridging requirements for certain linear thermal bridges: Parapets, balconies, cladding supports, vertical fenestration/wall intersections and intermediate floors that penetrate the wall plane.

IECC 2024 Commercial: Proposed a simplified version of 90.1 thermal bridging requirements



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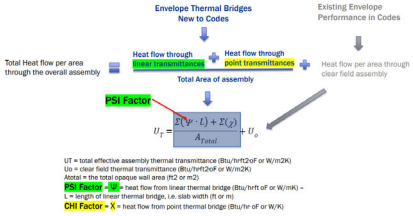
Commercial Building Energy Codes



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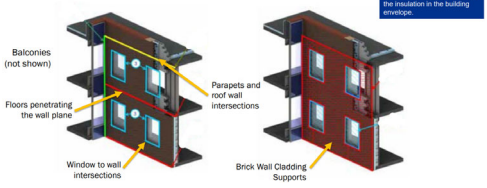
Commercial Building Energy Codes

Provisions in ASHRAE 90.1 and proposed for IECC 2024 would prescribe minimum performance of the most common linear thermal bridges.

linear thermal bridge – horizontal, vertical or diagonal linear element that penetrates the insulation in the building envelope.



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Commercial Building Energy Codes

IECC 2024 (proposed)

- Common set of mitigated and unmitigated Psi-factors for all above grade wall construction classes
- No requirements to account for point thermal bridges.
- Allows trade-offs using Component Performance Alternative or Total System Performance.

ASHRAE 90.1

- Different mitigated and unmitigated Psi-factors for each above grade wall construction class (ie: wood, steel-frame).
- Requirement to account for certain point thermal bridges
- Option to use whole building performance rather than meeting prescriptive mitigated psi-factors or chi-factors.

		ASHRAE 90.1 (Final)				IECC 2024 (Proposed)	
		Unmitigated		Mitigated Default		Unmitigated	Mitigated Default
		Psi- Factor	Chi- Factor	Psi- Factor	Chi- Factor	Psi- Factor	Psi- Factor
Steel-frame	Roof edge	0.45		0.14			
	Parapet	0.289		0.151		0.4	0.2
	Intermediate floor to wall intersection	0.487		0.177		0.5	0.2
	Intermediate floor balcony or overhang to opaque wall intersection	0.487		0.177		0.5	0.2
	Intermediate floor balcony in contact with Vertical Fenestration	0.974		0.177		0.5	0.2
	Cladding Support	0.314		0.217		0.3	0.2
	Wall to Vertical Fenestration intersection	0.262		0.112		0.3	0.15
	Other Element and Assembly Intersections		1.73		0.91		

Image credit PNNL

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Commercial Building Energy Codes

Basic Idea: Set HVAC system performance requirement and allow equivalent HVAC system tradeoffs by comparing a buildings proposed TSPR to a target TSPR.

Currently TSPR has been adopted into:
ASHRAE 90.1 -2022 (optional)
State of Washington Energy Code (mandatory)

And is being considered as an optional compliance path in:
IECC 2024 Commercial and **NY Stretch 2023.**

Why HVAC Performance (TSPR)?
- A particular building may have trouble with a prescriptive requirement like fan power limits or economizers
- Allows trade off within HVAC system, get credit for higher equipment efficiencies, reduced pump power or more DCV.
- Results in equivalent energy input for a "good" system selection
- Reduces complexity compared to a whole building analysis
- Can drive HVAC performance with out violating EPACT rules

HVAC Performance Metric:

TSPR = Heating + Cooling Loads Delivered / **Annual HVAC Operating Input***

TSPR is the HVAC system performance for the whole building HVAC system

Image credit PNNL

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Commercial Building Energy Codes

Alignment with Appendix G Modeling Process

Compliance achieved when:

$TSPR_{proposed}$ must be ≥ $TSPR_{reference}$ / MPF

- **Proposed System** – Your Building HVAC System
- **Reference System** – Aligned with Appendix G (ca. 2004)
- **Target System** – Aligned with prescriptive, but not worst option
- **MPF** – Mechanical Performance Factor

$$MPF = \frac{TSPR\ reference}{TSPR\ target}$$

Building Area Type	Climate Zone 0A and 1A	0B and 1B	2A
Multifamily	0.68	0.70	0.66
Healthcare/	0.60	0.60	0.58

Image credit PNNL

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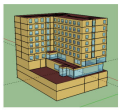
Commercial Building Energy Codes

Compliance Calculation Tool

- Based on code language that describes the ruleset
- New tool provided by DOE (free)
- Simplified tool for assessing building energy efficiency
  - Not a prototype approach, based on actual simplified building
- Uses default ASHRAE 90.1 Appendix C loads and schedules
- Lighting, equipment and envelope loads same as reference



Detailed Energy Model

Block Based Simplified Model

Image credit PNNL

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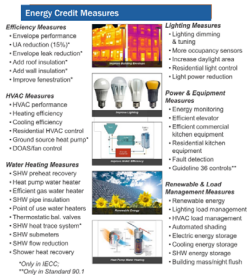
Commercial Building Energy Codes

32 Energy Credit Measures
Requirements achieve 7% building energy cost savings

Each credit represents 1/10% whole building site energy

Measure points requirements selected to be cost effective

Allow portion of energy credit to be met with load management and renewable credits



Graphic credit PNNL

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File Attachments for Item:

ER-3 2024 IRC Significant Changes (ICC)

All certifications (1.5 hours)

Staff Notes: Code not current in Ohio.

Committee Recommendation:

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

Website: https://www.iccsafe.org/edu

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: 2024 IRC Significant Changes

Course instructor: Sandra Hyde

Course description:

This seminar covers the most significant changes to the 2024 International Residential Code. Each topic selected focuses on the section changed, the significance of the change and how it will likely change dwelling and townhouse design. The course familiarizes building officials, fire officials, plans examiners, inspectors and design professionals with many of the significant changes in the 2024 IRC. It assists code users in identifying the specific code changes that have occurred, and more importantly, understanding the reason behind the change.

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

- ☐ Code Administration
- ☐ Existing Buildings
- ☐ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☐ On Demand
- ☐ Webinar

Course Website:

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- [ ] No

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- [x] Residential Certifications Only
- [x] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [x] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PPT -2024 IRC Sig Changes ABM.pdf	4.74 MB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

2024 IRC Significant Changes

Description

This seminar covers the most significant changes to the *2024 International Residential Code*. Each topic selected focuses on the section changed, the significance of the change and how it will likely change dwelling and townhouse design. The course familiarizes building officials, fire officials, plans examiners, inspectors and design professionals with many of the significant changes in the 2024 IRC. It assists code users in identifying the specific code changes that have occurred, and more importantly, understanding the reason behind the change.

Learning objectives

At the end of the course attendees will be able to:

1. Discuss changes to snow loads and wind speeds to increase structural safety.
2. List increases to life safety for energy storage systems, solar panels, lofts and guardrail anchorage.
3. Describe clarification of fire safety requirements for townhouses and two-family dwellings.
4. Identify improvements in return air exchange.

Outline of Seminar (1.5 hours = 90 minutes)

Welcome (5 minutes)

Goal & Objectives (5 minutes)

I. Part 1: Chapter 3 (25 minutes)
   - A. Reorganization of Chapter 3
   - B. Wind and Snow
   - C. Fire Resistance
   - D. Floods
   - E. Sleeping Lofts, Stairs
   - F. Accessibility
   - G. Elevators, ESS

II. Part 2: Chapters 4-9 (25 minutes)
   - A. Foundation Anchorage
   - B. Roll Bracing
   - C. Vapor Retarders, Flashing, Decks
   - D. Fasteners, Wall Height, Portal Frames
   - E. WRBs
   - F. Cladding

III. Part 3: Mechanical & Plumbing (15 minutes)
   - A. Makeup Air and Closets
   - B. Exhaust Openings
   - A. Return Air Openings
   - B. DWV Testing
   - C. Appliances in Pans

X. Part 4: Appendices (10 minutes)
   - A. Existing Buildings

B. Accessory Dwelling Units

XI. Summary and Debrief (5 minutes)

SANDRA HYDE, P.E.

Sandra Hyde, P.E. is Managing Director of Product Development for the International Code Council (ICC) where she develops books and seminars about the structural provisions of the *International Building Code* (IBC), *International Residential Code* (IRC), *International Existing Building Code* (IEBC) and structural topics. Sandra has coauthored books and seminars on these topics including the *Special Inspection Manual* and the *Significant Changes to the IRC* and *IBC*. She has experience in manufacturing and research of engineered wood products with Weyerhaeuser. Sandra is a Registered Civil Engineer and a member of EERI and NCSEA.

Significant Changes to the 2024 IRC

Based on the 2024 *International Residential Code*® (IRC®)

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2

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3

INSTRUCTOR

Sandra Hyde, PE

- Managing Director – Product Development
- International Code Council, Inc.
- shyde@iccsafe.org
- Mobile: 971-645-8041

4

GOAL & OBJECTIVES

This course will cover the most significant changes to the 2024 International Residential Code. At the end of the course attendees will be able to:

1) Discuss changes to snow loads and wind speeds to increase structural safety.
2) List increases to life safety for energy storage systems, solar panels, lofts and guardrail anchorage.
3) Describe clarification of fire safety requirements for townhouses and two-family dwellings.
4) Discuss improvements in return air exchange.

5

COURSE OUTLINE

- Chapter 3 – Structural, Fire and Life Safety requirements
- Chapters 4-9 – Foundation, Floor, Wall and Roof requirements
- Chapters 12-23 – Mechanical requirements
- Chapters 25-37 – Plumbing requirements
- Appendices

6

Chapter 3

Loads, Fire, Life Safety

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7

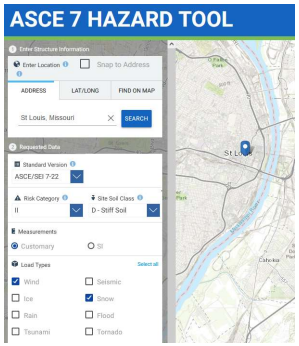
Chapter 3 Reorganization

- Structural (R301-307)
- Fire (R308 -311)
- Rooms and spaces (R312-316)
- Means of egress (R317-R319)
- Accessibility/Elevators (R320-R321)
- MEP (R322-R326)
- Energy (R327-R330)

8

R301.2.1.1 Wind Speeds

- Wind speed can be found in the ASCE 7 Hazard Tool or approved equivalent.
- asce7hazardtool.online



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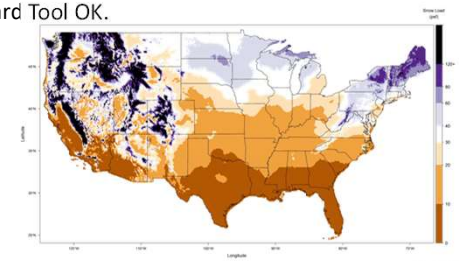
R301.2.3 Snow Loads

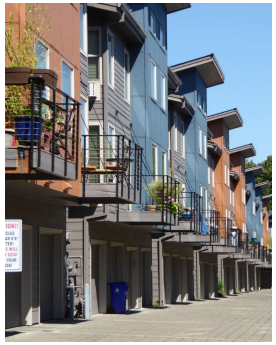
- The snow load map is updated to show snow loads across the continental United States with fewer case study areas.
- Use of ASCE 7 Hazard Tool OK.



10

R302.1 Exterior Walls

- For FSD, dwellings and townhouses on the same lot shall be assumed to have an imaginary line between them.
- FSD and requirements of Section R302.1 do not apply to walls separating townhouse units (party walls).

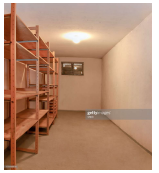


11

R302.2 Shared Accessory Rooms

- These accessory rooms must be separate from both dwelling units
- Intended for laundry, storage spaces and similar spaces

SEPARATION	MATERIAL
From the dwelling units and attics	• ≥ 1/2-inch gypsum board or equivalent • Accessory room side wall
From habitable rooms above or below the accessory room	≥ 5/8-inch Type X gypsum board or equivalent
Structures supporting floor/ceiling assemblies used for separation required by this section	≥ 1/2-inch gypsum board or equivalent



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R306.2 Flood Elevation Requirements

- Detached garage and accessory structure floor elevation requirements added
- Either:
  - At or above DFE or BSE + 1 ft
  - Below DFE and only used for parking or storage with additional requirements

13

R306.3 Flood Elevation Requirements

- Stem walls in Coastal A zones measure the lowest horizontal structural member at the top of the foundation wall

14

R315 Sleeping Lofts

- Maximum area requirements added for sleeping lofts along with a definition
- Considered portion of story below

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R315 Sleeping Lofts

- Qualify as sleeping loft if meet the following:
  - Area < 70 ft^2
  - Ceiling height for < one-half of floor area > 7 ft tall
  - Ceiling height min. 3 ft tall
  - Floor area limited to areas with 3 ft tall ceiling height
  - Permanent means of egress
  - Floor below min. 7 ft ceiling height

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R315 Exception: Small Sleeping Lofts

- Need not comply with Section R326 if all are true:
  - Max depth of less than 3 feet
  - Floor area of less than 35 square feet
  - Not provided with a permanent means of egress

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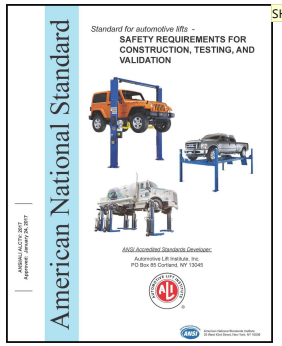
R317.6, R317.7 EV Charging and Lifts

- EV charging stations must be installed per NEC, listed and labeled per UL 2202 with supply equipment listed and labeled per UL 2594
- Automotive lifts must be listed and labeled per ALI ALCTV



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18

R318.7.6 Stair Landings

- Stair landings have all exceptions grouped into one section
  - Top landings may be on the opposite side of a door
  - Landings may be up to 7¾ inches below the threshold
  - No top landing required with less than 3 risers
  - Exterior stairs may have min. landing width of 36 inches with less than 4 risers

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R320.3 Care Facility Accessibility

R320.1 Dwelling units or sleeping units.

R320.2 Live/work units.

R320.3 Care facilities.

- Where permitted
- May use IRC for design
- Must be accessible per Chapter 11 of the *International Building Code* in the care facility portion of the building.

20

R323 Elevators and Hoistways

- Hoistways added to elevator and platform lift section
- Private residence elevators to conform to ASME A17.1/CSA B44, Section 5.3
- Hoistway enclosures and opening protection to meet ASME A17.1 Sections 5.3.1.1 and 5.3.1.8

21

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R330.4 Storage areas for ESS

- ESS may be stored in basements and utility spaces if specific requirements are met to protect building occupants

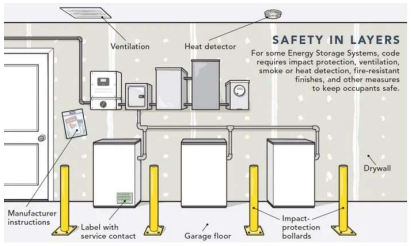


Image courtesy of Fine Homebuilding/Kate Francis

22

R330.8 Impact Protection

- ESS must be protected in garages from impact by cars and trucks

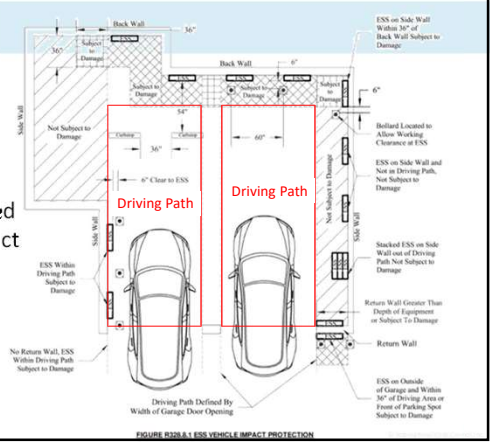
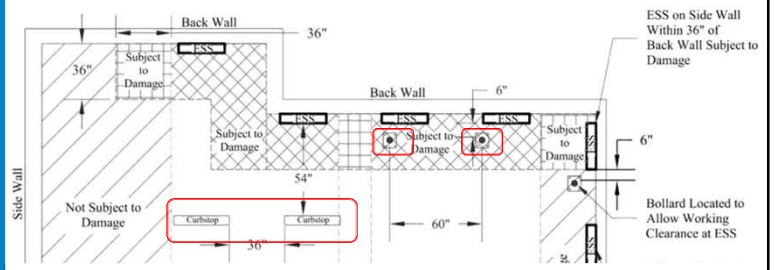


FIGURE R328.8.1 ESS VEHICLE IMPACT PROTECTION

23

R330.8 Impact Protection

- Back wall minimum clearances



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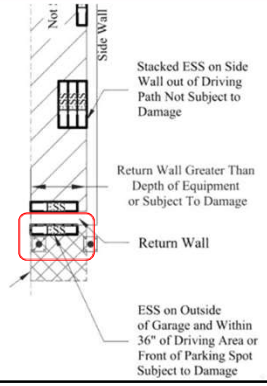
R330.8 Impact Protection

- Side wall minimum clearances



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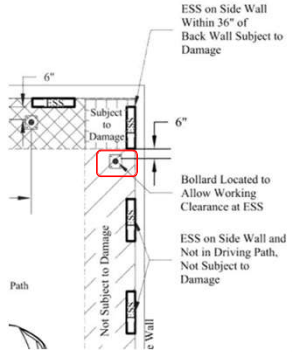
R330.8 Impact Protection

- Side wall minimum clearances



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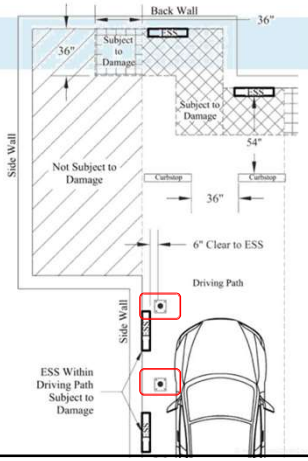
R330.8 Impact Protection

- Side walls with bump-outs



27

Chapters 4-9

Foundations, Floors, Walls and Roofs

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28

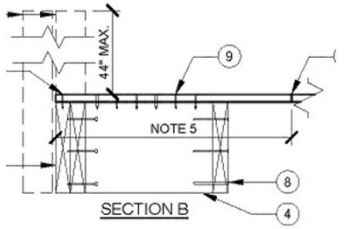
Figure R403.1(1) Foundation Anchorage

- Adds requirement for a concrete slab in a basement or crawl space when walls retain more than 4 feet of backfill.

29

R502.11 Roll Bracing

- Details for bracing a floor when attaching a guard are added



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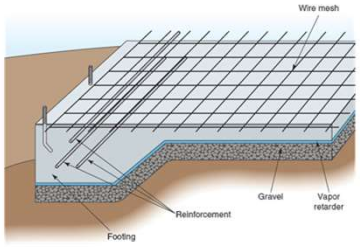
R506.2.3 Vapor Retarder

- The minimum thickness of vapor retarders is changed back to 6 mil

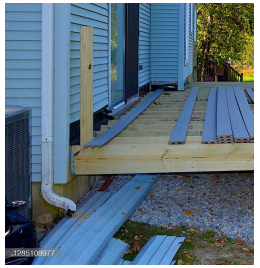


31

SH0

R507.9.1 Deck Ledger Flashing and WRBs

- When ledgers attach to existing walls without water-resistive barriers, a water-resistive barrier is installed behind the ledger and ledger flashing.



32

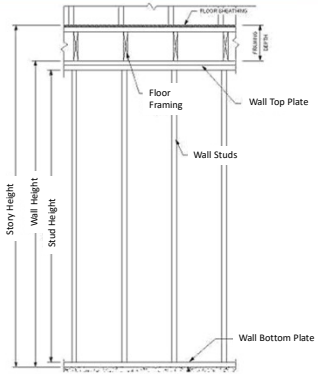
Table R602.3(1) Roof Sheathing Fastener Schedule

- Fastener spacing applies where roof framing SG ≥ 0.42.
- Where roof framing ≤ 0.42 SG ≤ 0.35, fastening of roof sheathing shall be with RSRS-03 (2½" × 0.131" × 0.281" head) nails.

33

R602.10.3.1 Wall Height

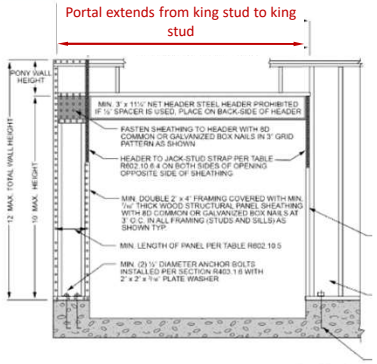
- Wall height shall be the vertical distance from the lower edge of the bottom plate to the upper edge of the upper top plate



34

R602.10.6 Extent of Portal Frame

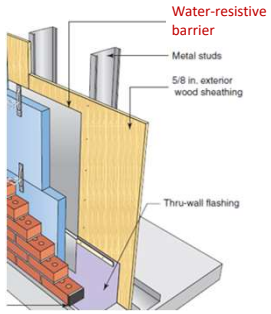
- Header shall not extend over more than one opening



35

R703.2 Water-resistive Barrier

- Provide a continuous WRB behind the exterior wall veneer and deck ledgers



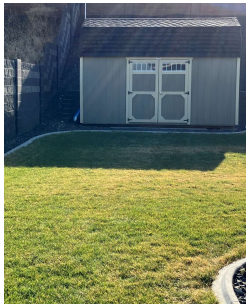
36

R703.2 Water-resistive Barrier, Exception

Exception:

WRB not required in unconditioned detached tool sheds, storage sheds, playhouses, and other similar accessory structures if:

1. Exterior wall covering is limited to siding that is attached direct to studs.
2. Exterior walls are uninsulated.
3. Interior side of exterior walls has no wall covering or wall finishes.



37

R905 Wind Resistance

- Roof cladding must resist component and cladding loads

38

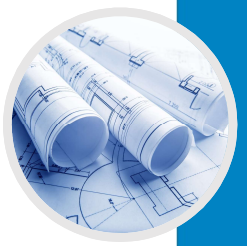
R908.3 Roof Replacement

- Self-adhering underlayment may be left on when reroofing, if the underlayment meets certain requirements

39

Chapters 12-23

Mechanical Requirements



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M1502.6 Makeup Air and Closets

- Minimum opening size requirements are added for a closet door transfer air grill

41

M1504.3 Exhaust Openings

- Two exceptions are added for exhaust openings, one for an opening less than a foot from another opening and the other for factory-built combination terminals

42

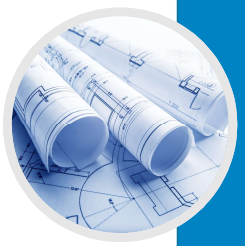
M1602.2 Return Air Openings

- Requirements for return air openings for closets and mechanical, boiler and furnace room doors are expanded

43

Chapters 25-33

Plumbing Requirements



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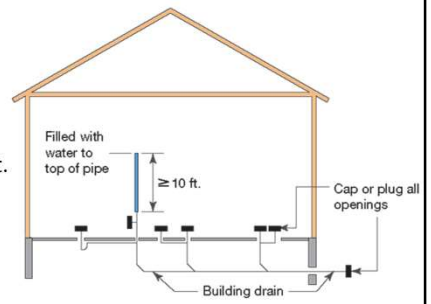
P2503.5.2 DWV Final Test

- Changes final test requirement to a visual test.
- Water tightness must be evaluated.

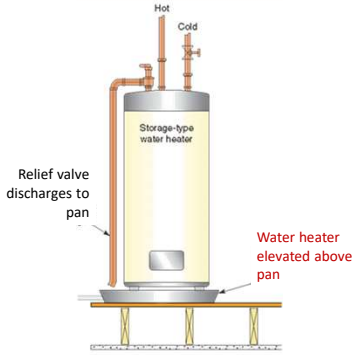


During construction – test with water or vacuum
Final inspection – visual check only required

45

P2801.6.3 Appliance, Equipment and Insulation in Pans

- If an appliance is subject to water damage, it must be elevated above its pan



46

Appendices

47

Appendix J Existing Buildings

- Requirements for existing buildings are expanded

48

Appendix AZ Accessory Dwelling Units (ADUs)

- Appendix on ADUs is added
  - Contains limits to ADU location
  - Conditions where they may be built

49

Discussion

50

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File Attachments for Item:

ER-4 Application and Administration of the 2021 I-Codes (ICC)

All certifications (1.5 hours)

Staff Notes: IBC/IRC Chapter 1 course: required for testing but not code in Ohio. Recommend approval.

Committee Recommendation:

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: Country Club Hills

State *: IL

Zip Code *: 60478

Website: https://www.iccsafe.org/edu

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: 2021 Application and Administration of the I-Codes

Course instructor: John Gibson

Course description:

This seminar provides a review of Chapter 1 administrative provisions of the International Codes. The provisions found in the various I-codes are very similar in application, resulting in this course's relevance to any, and all I-codes. The basis of this seminar is the provisions found in the 2021 International Building Code.

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

- ☑ Code Administration
- ☐ Existing Buildings
- ☐ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☑ No

☐ On Demand ☐ Webinar

Course Website:

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- [ ] Residential Certifications Only
- [x] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [x] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PPT_Application and Administration of the I-Codes- ABM.pdf	1.27 MB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

2021 Application and Administration of the I-Codes
Based on the 2021 International Building Code
(90 minute- seminar)

Description:

This seminar provides a review of Chapter 1 administrative provisions of the International Codes. The provisions found in the various I-codes are very similar in application, resulting in this course's relevance to any, and all I-codes. The basis of this seminar is the provisions found in the 2021 International Building Code.

Objectives:

At the end of this presentation, attendees will be better able to:

1) Understand the purpose of Chapter 1 as established in the ICC International Codes
2) Identify those provisions that establish the scope and application of the technical code requirements
3) Determine those decisions and actions necessary to proper administration of a building safety department
4) Recognize the basic legal principles that are applicable to a building safety department

Timed Outline:

Introductions and Overview & Scope: **10 minutes**
Application of Chapter 1 to the I-Codes' Technical Provisions: **25 minutes**
- Scope, Appendices, Intent, Referenced Codes & Standards, Conflicts, Other Laws, Existing Structures (15 minutes)
- Code Compliance Department, Duties of the Building Official, Modifications, Alternatives, Research Reports (10 minutes)

Administrative Functions as set forth in Chapter 1 of the I-Codes: **25 minutes**
- Application & Permits, Exemptions from permits, Emergency repairs, Permit applications, Validity of permits, Expiration/Suspension/Revocation (10 minutes)
- Submittal Documents, Construction Documents, Examination of Documents, Document Approvals, Design Professional, Deferred Submittals, Amended Documents (10 minutes)
- Temporary structures, Fees, Work without a permit, Inspections, Inspection Agencies, Inspection requests, Required Inspections, Approval required, Change of Occupancy, Certificate Issuance, Temporary Occupancy (5 minutes)

Legal Principles contained in chapter 1 of the I-Codes: **20 minutes**
- Duties of the Building Official, Right of Entry, Liability, Means of Appeals, Limitations on Authority, Qualifications of Board (10 minutes)
- Violations, Stop Work Orders, Unsafe Structures, Notice of Unsafe Structures (10 minutes)

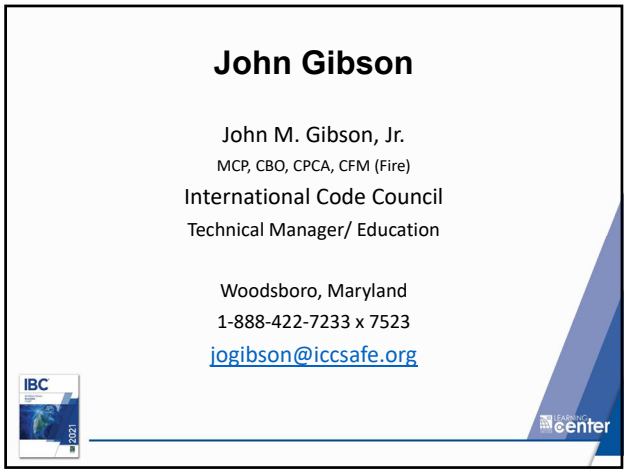
Closing: **10 minutes**

90 minutes

John M. Gibson, Jr., M.C.P., C.B.O., C.P.C.A., C.F.M. –

John is a Technical Manager and Instructor for the International Code Council (ICC). A certified Master Code Professional and Certified Fire Marshal; he has forty (40) other certifications, including thirty- three (33) from the ICC. Having earned a B.S. in Engineering from the University of Delaware, he has also studied Architecture at Georgia Tech and completed courses in Emergency Management and Fire Prevention at the National Emergency Training Center. Formerly the Director of the Department of Permits and Inspections for Frederick County Maryland, he is an ICC Honorary Member, has served on the ICC- Evaluations Services (ICC- ES) Board of Directors, the ICC Code Correlating Committee, the Board of Directors for BOCA International, Inc., Maryland's Governor's Smart Code Strategy Group, Chaired the ICC Board for International Professional Standards and is an Honorary Member and Past President of the Maryland Building Officials Association. He currently teaches ICC administrative, building, residential, existing building, property maintenance, zoning, green building, wildland/urban interface, energy courses, and is a contract instructor at the Dept. of Homeland Security, United States Fire Administration, National Fire Academy, and Emmitsburg, MD. He received the ICC Educator of the Year award in 2010.

1



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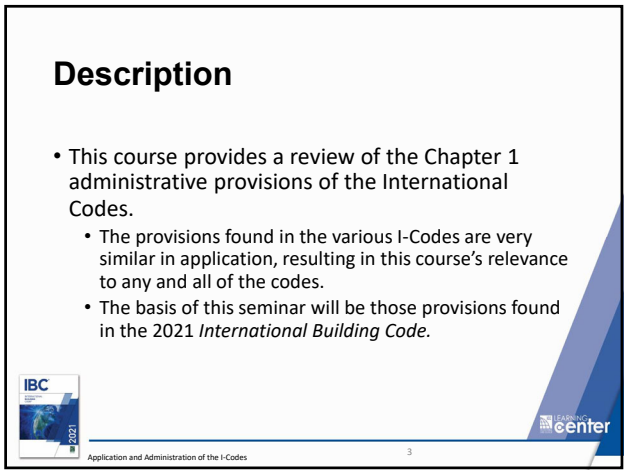

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Goal

- This seminar is designed to familiarize and assist code users in the administration of a code compliance agency and the proper application of the technical provisions of the adopted codes.

4

4

Objectives

- Upon completion, participants will be better able to:
  - Understand the purpose of Chapter 1 as established in each of ICC's *International Codes*.
  - Identify those provisions that establish the scope and application of the technical code requirements.
  - Determine those decisions and actions necessary to the proper administration of a building safety department.
  - Recognize the basic legal principles that are applicable to a building safety department.

5

5

Course Overview

Module I	Overview and Scope of Chapter 1 in the *International Codes*
Module 2	Application of Chapter 1 to the *I-Codes'* Technical Provisions
Module 3	Administrative Functions as set forth in Chapter 1 of the *I-Codes*
Module 4	Legal Principles included in Chapter 1 of the *International Codes*

6

6

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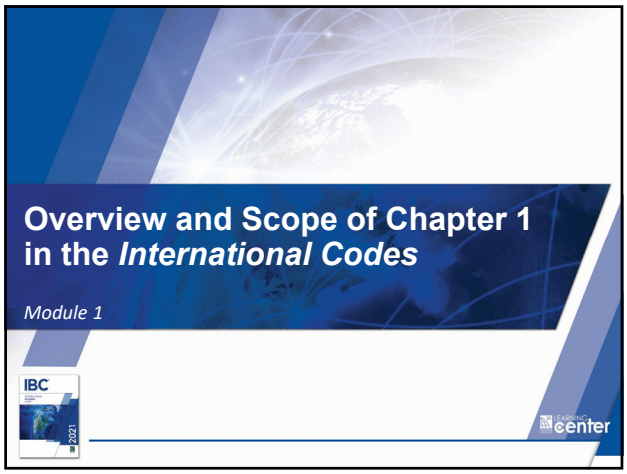

7

Modification/Replacement

- Although many jurisdictions modify or replace the provisions of Chapter 1 to varying degrees, the fundamental concepts and principles typically remain.
  - Some degree of direction must be provided to guide users in the proper application of the various *I-Codes*.
- Modifications typically address:
  - Special jurisdictional operations
  - References to other codes and standards
  - Relationship with higher jurisdictional authority

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8

Areas of Emphasis

- Chapter 1 primarily addresses two very important areas:
  - Application of code requirements based upon:
    - Minimum standard
    - AHJ interpretive authority
    - Alternate methods, materials and design
    - Coordination of potential conflicting provisions
  - Administrative functions, including:
    - Code official, plan reviewer and inspector functions
    - Board of appeals

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Application of Chapter 1 to the I-Codes' Technical Provisions

Module 2

10

Scope – 101.2, Scope – 101.2, Exc.

- Provisions of IBC apply to the following aspects of buildings and structures:

Construction	Equipment
Alteration	Use and occupancy
Relocation	Location
Enlargement	Maintenance
Replacement	Removal
Repair	Demolition

- *International Building Code* (IBC) not intended to apply to:
  - One- and two-family dwellings
  - Townhouses
  - Structures accessory to such dwellings and townhouses
  - Limited-occupant care facilities

Such structures are regulated by *International Residential Code* (IRC)

11

Appendices – 101.2.1

- Appendices not considered a part of the code unless specifically adopted.
- Appendix topics addressed separately from code for a variety of reasons, including:
  - Regional in nature
  - New methodology or issue not yet universally accepted
  - Significant, but not universal, support for inclusion in base document
  - Often addressed by local or state administrative authority
  - Not directly viewed as building construction issues

12

12

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Intent – 101.3

- Purpose of code is to establish **minimum standard** for reasonable level of:
  - Safety
  - Public health
  - General welfare
- Provisions intended to identify necessary requirements without mandating those that are unnecessary.
- "Minimum standard" concept is critical in code's application.

13

13

Intent – 101.3 (cont.)

- Requirements address reasonable levels of:
  - Structural strength
  - Means of egress facilities
  - Stability
  - Sanitation
  - Adequate light and ventilation
  - Energy conservation
  - Safety to life and property from fire, explosion and other hazards
  - Safety to fire fighters and emergency responders during emergency operations

Application and Administration of the I-Codes 14

14

Intent – 101.3 (cont.)

15

15

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Referenced Codes – 101.4

- Other *I-Codes* as listed and referenced elsewhere in IBC to be considered as part of IBC **to prescribed extent of each such reference**.
- Such referenced codes include:
  - *International Fuel Gas Code*
  - *International Mechanical Code*
  - *International Plumbing Code*
  - *International Fire Code*
  - *International Existing Building Code*
  - *International Energy Conservation Code*
  - *International Property Maintenance Code*

16

Referenced Standards – 102.4

- Codes and standards referenced in IBC to be considered as part of IBC **to prescribed extent of each such reference.**
- Entire standard may be referenced as applicable, or only that portion of the standard that is specifically addressing the code provision under consideration.

17

Conflicting Provisions – 102.1

- Where there is a conflict between a *general* requirement and a *specific* requirement, **specific** requirement to apply.
  - Applicable regardless if specific is more restrictive or less restrictive than general requirement.
- Where, in a specific case, different code provisions specify different materials, methods of construction, or other requirements, **most restrictive** to govern.

18

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Other Laws – 102.2

- Requirements of code do not nullify any provisions of local, state or federal law.
  - An example of local laws superseding the code would be zoning ordinances that require building setbacks.

19

Existing Structures – 102.6

- Legal occupancy of any structure existing on date of adoption of IBC permitted to continue without change, except as specifically provided for in:
  - International Existing Building Code
  - International Property Maintenance Code
  - International Fire Code

20

Not Previously Occupied – 102.6.1

- A building, or portion of a building, that has not been previously occupied or used for its intended purpose, is to comply with code:
  - For new construction, or
  - With current permit for such occupancy.
- Building considered as new structure until it is occupied in whole or in part.
  - Tenant build-outs permitted to comply with code adopted at time of initial construction unless permit has expired.
  - If expired, then current code is applicable.

21

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Code Compliance Department – 103

- Code Compliance Department is created as enforcement agency.
- Building official appointed to apply IBC and other codes/standards.
- Building official to appoint staff members, including technical officers and other employees.
  - Such employees to have powers as delegated by building official.
  - Duties and powers established in Section 104 apply to building official as well as designated employees.

22

Code Compliance Department – 103

- The official in charge is recognized by the code as the:
  - Building official IBC, IRC
  - Fire code official IFC
  - Zoning code official IZC
  - Code official IPMC, IECC, IEBC, IPC, IMC
- The title used in the jurisdiction may different from that set forth in the code.

23

Duties of Building Official – 104.1

- Building official authorized and directed to enforce provisions of IBC.
- Building official has **authority to interpret IBC**, as well as adopt policies and procedures to clarify IBC's application. (Includes Performance and Prescriptive requirements.)
- Interpretation authority can be as broad as established by the building official, and includes:
  - Provisions intended to be interpreted on a case-by-case basis, including those where code requires an "approved" solution, and
  - Established criteria where tolerance may be considered.

24

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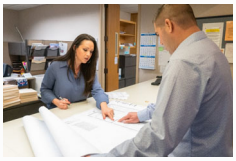
Duties of Building Official – 104.1

- Such interpretations, policies and procedures to meet **intent and purpose** of IBC.
  - Key to proper application based on understanding of provision's intent.
- No allowance to waive requirements specifically set forth in code.



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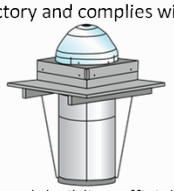
Modifications – 104.10

- Building official must find that:
  - Special individual reason makes strict letter of code impractical
  - Modification meets **intent and purpose** of code
  - Such modification does not lessen:
    - Health
    - Accessibility
    - Life safety and fire safety
    - Structural requirements
- Details of action granting modification to be recorded and entered into department files.

26

Alternates – 104.11

- Provisions of code not intended to prevent installation of any material, or prohibit any method or design not specifically prescribed by code where:
  - Such alternate has been approved by code official
  - Proposed design is satisfactory and complies with **intent** of code:
    - Quality
    - Strength
    - Effectiveness
    - Fire resistance
    - Durability
    - Safety
- Where alternate not approved, building official to respond in writing stating reasons for decision.



27

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Research Reports – 104.11.1

- Supporting data, where necessary to assist in approval of assemblies or materials not specifically addressed in code, to consist of valid research reports from approved sources.
- Building official to identify approved sources, typically based upon reliability and accuracy.
- ICC Evaluation Service (ICC ES) is one of a number of agencies that provide research reports for alternative materials and methods.
  - Acceptance of such reports is subject to that of the building official.

28

Administration Functions as set forth in Chapter 1 of the I-Codes

Module 3

29

Applications and Permits – 104.2

- Building official to:
  - Receive applications
  - Review construction documents
  - Issue permits
  - Inspect premises
  - Enforce compliance with IBC
- In addition, building official to issue necessary notices or orders to ensure compliance with IBC.

30

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Applications and Permits – 104.4

- Building official to:
  - Make required inspections, or
  - Accept reports of inspection by approved agencies or individuals.
- Building official also authorized to engage expert opinion as necessary to report on unusual technical issues that arise.

Application and Administration of the I-Codes 31

31

Required Permits – 105.1

- As a general rule, permits are required for the following work:
  - New construction
  - Addition
  - Alteration
  - Movement
  - Demolition
  - Change of occupancy
  - Electrical, fuel gas, mechanical and plumbing

Application and Administration of the I-Codes 32

32

Work Exempt from Permits – 105.2

- Variety of conditions where permits not required due to limited nature of work or limited hazard potential.
- Exemption from permitting requirements **does not grant authorization** for any work to be done in violation of code or any other laws or ordinances.

Accessory structures:
- Detached, and
- One-story, and
- 120 square feet maximum, and
- Used for:
  - Tool and storage sheds, or
  - Playhouses, or
  - Similar uses

Fences not over 7 feet in height

Swimming pools, prefabricated…

Application and Administration of the I-Codes 33

33

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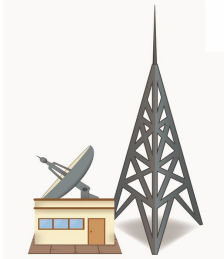
Electrical Exemptions – 105.2
Gas Exemptions – 105.2
Mechanical Exemptions – 105.2
Plumbing Exemptions – 105.2

- Repairs and maintenance
- Radio and television transmitting stations
- Portable heating appliances
- Stopping of leaks in drains, water, soil, waste or vent pipe



Application and Administration of the I-Codes 34

34

Emergency Repairs, PSA's – 105.2

- Where equipment replacement and repairs must be performed in an emergency situation, permit application to be submitted within next working day (to building official).
- Permit not required for installation, alteration or repair of generation, transmission, distribution or metering, or other related equipment, that is under ownership and control of public service agencies.

Application and Administration of the I-Codes 35

35

Application for Permit – 105.3

- To obtain permit, applicant must file application.
- Building official to examine application within a reasonable time period.
  - If denied, reason to be given in writing
  - If acceptable, permit to be issued as soon as practical
- Application to be deemed abandoned after 180 days unless:
  - Application has been pursued in good faith, or
  - Permit has been issued.
- One or more 90-day extensions permitted.

Application and Administration of the I-Codes 36

36

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Validity of Permit – 105.4

- Issuance of permit not to be construed as an approval for any violation.
  - Permits presuming to give authority to violate code provisions are not valid.
- Issuance based on construction documents and other data shall not prevent building official from requiring such documents to be corrected.
- Building official authorized to prevent occupancy or use of structure where in violation of code.

37

Expiration of Permit – 105.5
Suspension or Revocation – 105.6

- Permit becomes invalid unless work on site commenced within 180 days after its issuance.
- Permit also invalid if work is suspended or abandoned for period of 180 days after time work commenced.
- Building official authorized to grant, in writing, one or more extensions of not more than 180 days each.
  - Justifiable cause for such extensions to be demonstrated.
- Building official authorized to suspend or revoke a permit wherever permit issued:
  - In error, or
  - On basis of incorrect, inaccurate or incomplete information, or
  - In violation of any jurisdictional ordinance or regulation, or
  - In violation of provisions of IBC.

38

Submittal Documents – 107.1
(107 Construction Documents)

- Minimum of two sets of submittal documents to be provided with each permit application, including, where applicable:
  - Construction documents
  - Statement of special inspections
  - Geotechnical report
  - Other necessary data.

(allowance for digital submittals upon approval of the Bldg. Off.)

39

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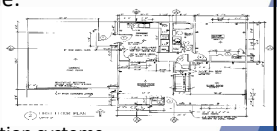
Submittal Documents – 107.1

- Construction documents shall be prepared by a registered design professional where required by statutes of jurisdiction where project is to be constructed.
- Building official authorized to waive submission of construction documents and other data if:
  - Not required to be prepared by a registered design professional, and
  - Nature of work is such that review of such documents not necessary to obtain compliance with code.
- In some cases a pre-construction meeting should be held with all parties to review all department requirements

40

Construction Documents – 107.2

- Construction documents to be of sufficient clarity to indicate location, nature and extent of work.
  - Must show in detail that it will conform to provisions of code and all applicable laws and ordinance.
- Specific requirements include:
  - Means of egress system
  - Exterior wall envelope
  - Structural information
  - Relocatable buildings
  - Shop drawings for fire protection systems
  - Exterior balconies and elevated walking surfaces
  - Site plane, including design flood elevations



41

Examination of Documents – 107.3

- Submittal documents to be reviewed and ascertained whether construction described meets code requirements and other laws.
  - A zoning review is typically conducted in addition to those addressed in the I-Codes.

42

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Document Approvals – 107.3.1

- When building official issues a permit, the construction documents to be approved:
  - In writing, or
  - By stamp as
  - "Reviewed for Code Compliance."

- One set of construction documents retained by building official, other returned to applicant and kept at site of work.
  - At site, documents to be open to inspection by building official or authorized representative.
- One set of approved construction documents to be retained by building official for at least 180 days from date of completion of work.
  - Unless state or local laws required otherwise.

43

Design Professional – 107.3.4

- Where required that documents be prepared by a registered design professional, building official authorized to require owner to designate a registered design professional in responsible charge.
  - Role is to review and coordinate submittal documents prepared by others, including phased and deferred submittal items, for compatibility with design of building.

44

Deferred Submittals – 107.3.4.1

- Deferred submittal items to have prior approval of building official.
- Such deferrals to be listed on construction documents for review by building official.
  - Such items shall not be installed until deferred submittal documents approved by building official.

45

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Amended Documents – 107.4

- Work is to be installed in accordance with approved construction documents.
- Any changes made during construction that are not in compliance with approved documents shall be resubmitted for approval as an amended set construction documents.

46

Temporary Structures – 108.1, 108.2

- Building official authorized to issue a permit for temporary structures and temporary uses.
- Such permits to be limited to:
  - Time of service, but
  - Not for more than 180 days.

- Building official may grant extensions for demonstrated cause.
- Temporary structures and uses to comply with Section 3103 Temporary structures:

47

Fees – 109.1, 109.3

- Permit not to be issued until applicable fees are paid.
- Applicant to provide estimated total value of work, which shall include:
  - Materials and labor, including all trades.
- If building official deems valuation is underestimated, permit to be denied unless applicant can provide detailed documentation.
- Final building permit valuation to be set by the building official.

48

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Work w/o Permit – 109.4

- Any person starting work before obtaining necessary permits to be subject to a fee established by building official.
  - Such fee to be set by building official.

City of Arlington

NOTICE OF VIOLATION

49

Inspections – 110.1

- Work for which a permit is required to be subject to inspection by building official.
- Such work to remain visible and able to be accessed for inspection purposes until approved.
- Inspection approval shall not be construed as an approval of a violation.
  - Inspections presuming to grant authority to violate or cancel provisions of code shall not be valid.
- Before issuing a permit, building official authorized to inspect a building or site for which a permit application has been received.

50

Required Inspections – 110.3

- Required inspections, as applicable, include:
  - Footing and foundation
  - Concrete slab and under-floor
  - Lowest floor elevation
  - Frame
  - Types IV-A, IV-B, IV-C connection protection
  - Lath, gypsum board and gypsum product
  - Weather-exposed balcony/walking surface waterproofing
  - Fire- and smoke-resistant penetrations
  - Energy efficiency
  - Others as required to ensure compliance
  - Special inspections
  - Final

51

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Inspection Agencies – 110.4

- Building official authorized to accept reports of approved inspection agencies, provided such agencies satisfy requirements as to qualifications and reliability.

52

Inspection Requests – 110.5
Approval Required – 110.6

- It shall be duty of holder of building permit, or authorized agent, to notify building official when work is ready for inspection.
- It shall be duty of permit holder to provide access to, and means for inspection of, such work as required by code.
- Work shall not be done beyond point indicated in each successive inspection without first obtaining building official approval.
- Any noncomplying portions to be corrected and not covered until authorized by building official.

53

Change of Occupancy – 111.1

- Building shall not be used or occupied, and a change of occupancy shall not be made, until building official has issued a certificate of occupancy.
  - Certificates of occupancy not required for work exempt from permits per Section 105.2.
- Issuance of a certificate of occupancy shall not be construed as approval of a violation of the code.

Certificate of Occupancy

Jurisdiction of _____

This structure or portion of structure as described below has been inspected for compliance with the International Residential Code (IRC) and is hereby issued a certificate of occupancy.

Description of applicable portion of structure _____ Building permit number _____

Address of the structure _____ Code edition _____

Name of owner or owner's authorized agent _____ Sprinkler system required ☐ yes ☐ no

Address of owner or owner's authorized agent _____ Sprinkler system installed ☐ yes ☐ no

Special conditions _____

Building Official _____

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Certificate Issuance – 111.2

- Information to also be contained on C/O:
  - Building permit number
  - Address of structure
  - Name and address of owner or owner's agent
  - Description of that portion of structure for which C/O is issued
  - Statement of compliance with code requirements for occupancy as classified
  - Name of building official
  - Edition of code under which permit was issued
  - Occupancy classification
  - Type of construction
  - Design occupant load
  - Where sprinklers are provided, whether it is required
  - Any special stipulations and conditions of permit.

55

Temporary Occupancy – 111.3

- Building official authorized to issue temporary certificate of occupancy before completion of all work covered by permit provided such portions can be occupied safely.
  - Time period for validity of temporary certificate of occupancy to be established by building official.
- Where a temporary certificate of occupancy is issued, it is important that the full C/O be obtained as soon as possible.

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Legal Principles contained in Chapter 1 of the I-Codes

Module 4

57

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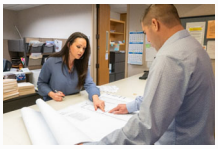
Duties of Building Official – 104.1

- Such interpretations, policies and procedures to meet **intent and purpose** of IBC.
  - Key to proper application based on understanding of provision's intent.
- No allowance to waive requirements specifically set forth in code.



- Establishes the "duty of care" owed by the building official.

58

Right of Entry – 104.6

- Building official carrying proper ID authorized to enter structure or premises at reasonable times to inspect or perform duties established by IBC in order to:
  - Make an inspection to enforce code provisions, or
  - Address a reasonable concern that a condition exists that is in violation of IBC that makes structure or premises:
    - Unsafe,
    - Dangerous, or
    - Hazardous

- Entry must be requested.
  - If entry refused, action must be taken in accordance with applicable laws to secure access to the structure or premises.

59

Liability – 104.8

- Building official, board of appeals members and employees charged with enforcement of code are not personally rendered liable civilly or criminally for any damage to persons or property as a result of an act or omission in discharge of official duties.
  - Requires that individual is acting in **good faith and without malice** in discharge of required duties
- Building official responsibility is still subject to superseding local, state and federal laws.
- Lawsuits against jurisdictional officer/ employee, defended and paid by the jurisdiction through final termination of proceedings.

60

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Means of Appeals – 113.1

- Board of appeals shall be created to hear and decide appeals of orders, decisions and determinations of building official relative to application and interpretation of the code.
- Board to be appointed by applicable governing authority and shall hold office at its pleasure.
- Board to adopt rules of procedure for conducting its business.

Department of Building Safety
Application for Appeal
Board of Appeals

Building Department
City Of

Project address _____
Use of structure _____
Description of work _____
Owner's name _____ Phone _____
Owner's address _____

In accordance with the provisions of Section R112 of the *International Residential Code for One- and Two-Family Dwellings* (IRC), I hereby appeal to the Board of Appeals the determination made by the building official relative to the interpretation of Section ____ in order that I might construct the above structure or portion thereof as proposed and shown on the attachments.

Appellant is advised to submit any documentation in support of the appeal. An application for appeal shall be based on a claim that the true intent of the code has been incorrectly interpreted, the provisions of the code do not fully apply, or an equally good or better form of construction is proposed. The board has no authority to waive requirements of the code. The appellant or the appellant's authorized party may appear to present reasons for granting an appeal at the time of the scheduled meeting.

_____
Signature of owner or appellant Date

Meeting date _____
Time _____
Location _____

61

Limitations on Authority – 113.2
Qualifications of Board – 113.3

- Appeals to be limited to:
  - Claim that true intent of code incorrectly interpreted, or
  - Provisions of code do not fully apply, or
  - Equivalent or better form of construction proposed.
- Board shall not have authority to waive requirements of code.
- Board of appeals to consist of members qualified by experience and training to address matters related to building construction.
- Members not to be employees of jurisdiction.
  - (Appendix B- Qual's, Rules/Proced, Notices, Decisions)

62

Violations – 114

- Unlawful to do any work in violation of code.
- Building official authorized to serve notice of violation as applicable.
  - Such order to direct discontinuation of illegal action or condition and abatement of violation.
- If no prompt compliance with notice of violation, building official authorized to enlist legal counsel to institute appropriate proceeding at law.
- Violations to be subject to penalties as prescribed by law.

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Stop Work Order – 115

- Building official authorized to issue stop work order.
- Stop work order to be in writing, and issued to owner, owner's agent or person performing work.
- Upon issuance, work shall immediately cease.
- Order to state:
  - Reason for order, and
  - Conditions under which cited work permitted to resume
- If work continues, persons subject to penalties as prescribed by law.

64

Unsafe Structures – 116.1

- Building deemed unsafe if:
  - Inadequate means of egress, or
  - Inadequate light and ventilation, or
  - Constitutes a fire hazard, or
  - Otherwise dangerous to human life or public welfare, or
  - Involve illegal or improper occupancy, or
  - Inadequate maintenance.
- Unsafe structures to be taken down and removed, or made safe.
- Vacant structure not secured against unauthorized access is deemed unsafe.

65

Notice of Unsafe Structure – 116.2- .5

- Building official to file report on unsafe condition.
- Written notice to be properly served on owner, agent or person in control of structure.
  - Notice to describe the condition that is unsafe and specifies required repairs or improvements to abate unsafe condition, or requires unsafe structure to be demolished within a set period of time.
- Repairs, alterations, additions and/or change of occupancy to comply with IEBC.

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Conclusion

- This concludes the presentation addressing the provisions of administrative provisions found in Chapter 1 of the various I-Codes.
- Through the proper use of these provisions, the code can be applied in a manner that is:
  - Efficient
  - Consistent
  - Legal

67

Final Reflection

This slide will help the learner to reflect on the day and what they will take back to the job and apply.

- **What?** What happened and what was observed in the training?
- **So what?** What did you learn? What difference did this training make?
- **Now what?** How will you do things differently back on the job as a result of this training?

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IACET Accreditation

- The International Code Council has been accredited as an Authorized Provider by the International Association for Continuing Education and Training (IACET).
  - As a result of their Authorized Provider accreditation status, ICC is authorized to offer IACET CEUs for its programs that qualify under the ANSI/IACET Standard.
- You will obtain full CEUs for this course, if you actively participate in the training activities and stay for the entire session. Evidence of this will be the sign out sheet.

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AIA Accreditation

International Code Council is a Registered Provider with The American Institute of Architects Continuing Education Systems. Credit earned on completion of this program will be reported to CES Records for AIA members. Certificates of Completion for non-AIA members are available on request.

This 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. Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

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or
E-mail: learn@iccsafe.org

Website: learn.iccsafe.org

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File Attachments for Item:

ER-5 OPC Chapter 7: Sanitary Drainage (Franklin County Public Health)

All certifications (7 hours)

Staff Notes: There are no visuals other than the OPC chapter and a whiteboard.

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: Brien L. Bellous

Course Submitter: Brien L Bellous (Contact Name)

Organization: Franklin County Public Health (Organization/Company)

Address: 280 E Broad St. (Include Room Number, Suite, etc.)

City: Columbus State: Ohio Zip: 43215

E-Mail: brienbellous@franklincountyohio.gov

Telephone: 614-525-5333 Fax: 614-525-3851

Course Sponsor: _____

COURSE INFORMATION:

Course Title: Ohio Plumbing Code Chapter 7; Sanitary Drainage

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

Purpose and Objective: A complete look at the principles of sanitary drainage systems from an ICC perspective. Includes general requirements, materials, cleanouts, pipe transition methods, drainage fixture calculations and theory, exhaustive coverage of drainage pipe sizing as well as stack connections and offsets. In depth study of sewage lift stations and connections to the sanitary system.

Number of Instructional Contact Hours that can be obtained upon completion: 7

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

Program Applicable for the Following Participants:

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

Electrical Safety Inspectors ☐

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

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

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

Ohio Plumbing Code chapter 7: Sanitary Drainage

Course Outline, Agenda and Schedule

Class overview:

Advanced principles of the sanitary plumbing system from an ICC perspective. Course will cover general regulations, approved materials and transition methods. Connections between drainage pipe and fittings will be reviewed, highlighting prohibited joints and connections. Advanced principles of drainage fixture units, drainage system sizing and cleanout placement will be discussed. Sumps and ejectors will be reviewed in framework of chapter 7.

7:00 am – 7:15 am:	Student sign in and seating
7:15 am – 8:45 am:	OPC chapter 7 general requirements and materials (OPC 701 and OPC 702)
8:45 am – 9:30 am:	Drainage pipe installation, change in drain size, connections to base of stacks and future fixtures (OPC 704)
9:30 am – 9:45 am:	Student break
9:45 am – 10:30 am:	Joints and approved transitions (OPC 705)
10:30 am – 11:00 am:	Connections between drainage pipe and fittings (OPC 706)
11:00 am – 12:00 pm:	Prohibited connections and cleanouts (OPC 707 and OPC 708)
12:00 pm – 1:00 pm:	Student lunch
1:00 pm – 2:00 pm:	Drainage fixture unit theory and calculations (OPC 709)
2:00 pm – 3:00 pm:	Drainage system sizing; building drains, sewers and stacks (OPC 710)
3:00 pm – 3:15 pm:	Student break
3:15 pm – 4:45 pm:	Drainage system sizing (cont.) and Sumps & ejectors (OPC 710 and OPC 712)

BRIEN BELLOUS

2785 Beal Dr., Columbus, Ohio 43232 · (614) 381-9410
bbellous@gmail.com

Professional Certifications

All certifications are current and issued by the Ohio Boards of Building Standards. All Ohio certifications require a combination of experience and an ICC passing test in specialty.

- Commercial Plumbing Inspector
- Commercial Plumbing Plans Examination
- Commercial Mechanical Inspector
- ASSE 6020 Medical Gas Inspector
- Residential Building Inspector
- Residential Building Official

EXPERIENCE

APRIL 5, 2021 – PRESENT

PLUMBING, MEDICAL GAS INSPECTOR, PLUMBING PLANS EXAMINER FRANKLIN COUNTY PUBLIC HEALTH

Inspect commercial and residential plumbing and medical gas systems in accordance with approved plans and Ohio codes. Review commercial and residential plumbing drawings. Work with internal and external customers to enforce the minimum provisions of the Ohio Plumbing Code and NFPA 99.

MARCH, 2018 – APRIL 1, 2021

PLUMBING, MECHANICAL AND BUILDING INSPECTOR, PICKAWAY COUNTY, OHIO

Inspect commercial and residential plumbing and mechanical systems in accordance with approved plans and Ohio codes. Review commercial plumbing drawings when appropriate. Inspect residential building to approved plans and Ohio Residential Code. Function as Residential Building Official when necessary.

DECEMBER, 2014 – MARCH, 2018

PLUMBING ESTIMATOR/PROJECT MANAGER, WATERWORKS PLUMBING CO.

Responsible for generating plumbing estimates based on client needs, managing plumbing jobs and crews and performing plumbing work in field as needed.

Sabbatical from work to care for elderly parent with dementia. January, 2013 to December, 2014

APRIL, 1997 – JANUARY, 2013

PLUMBING INSPECTOR FIELD SUPERVISOR, CITY OF COLUMBUS, OHIO

Perform commercial, industrial and residential plumbing inspections per approved plans and local ordinances. Plumbing plan review when needed. Medical gas inspections when required. Manage 5 plumbing inspectors and liaison between industry and Department. Appointed to point team implementing new "Accela Automation" inspection software for City of Columbus.

EDUCATION

JUNE, 1993

JOURNEYMAN PLUMBING APPRENTICE, APHC COLUMBUS OHIO

Successfully completed Federal apprenticeship program. GPA was first in class.

JUNE 1983

HIGH SCHOOL GRADUATE, IRVINE HIGH SCHOOL, IRVINE CALIFORNIA

High school graduation.

PROFESSIONAL ACCOMPLISHMENTS

- Board Trustee for the Ohio Association of Plumbing Inspectors 2003-2008
- Committee member for ICC Plumbing and Mechanical Code Committee 2001-2008
- Committee Chair for ICC Plumbing Committee 2006-2007
- APHC apprenticeship teacher 2002-2006
- Industry CEU instructor Central Ohio region
- Appointed to technology point team for implementation of Accela Automation software for City of Columbus. Largest Building Department software implementation in State of Ohio.

ACTIVITIES

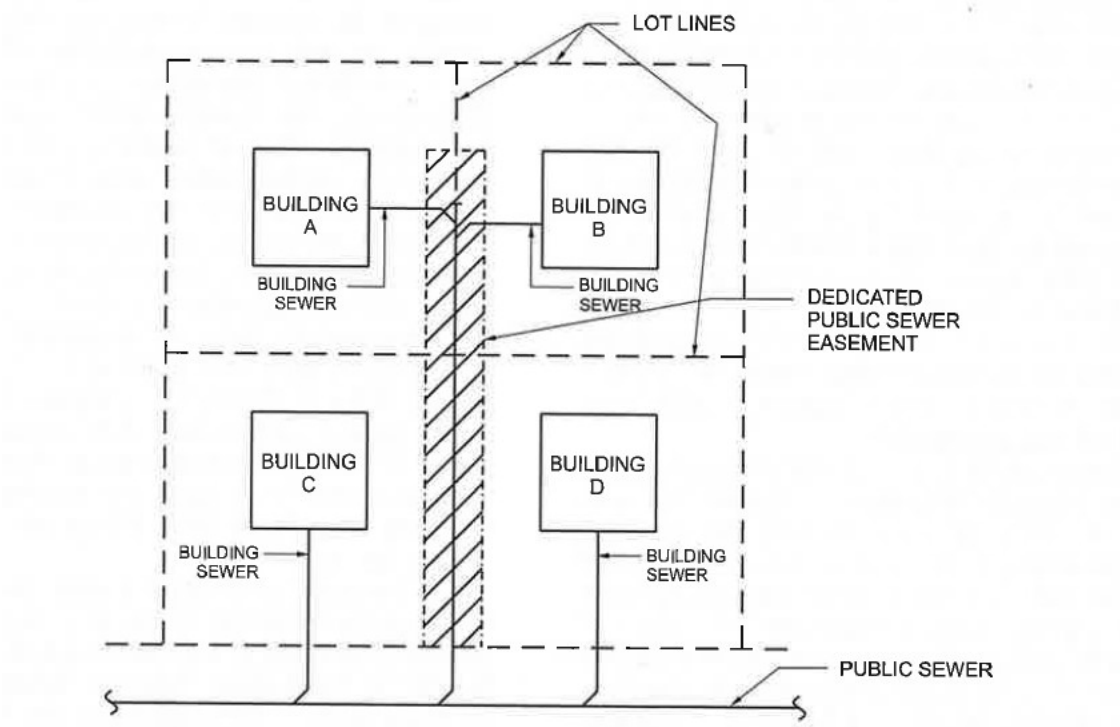
I like to be involved with industry groups and professional conferences. I continue to enjoy learning new technology and serving trade groups when needed. Faith, family and community are all very important to me.

OPC Chapter 7: Sanitary Drainage

Sanitary Drainage Systems from a model code perspective

The conventional method of sizing a sanitary drainage system is by drainage fixture unit load values. The drainage fixture unit approach takes into consideration the probability of a load on the drainage system. The probability method of sizing drainage systems was developed largely by Dr. Roy Hunter. Through his research, doctor hunter attempted to standardize and simplify design principles, while reducing the cost of plumbing systems. Fixture unit values were determined based on the average rate of discharge by a fixture, the time of a single operation and the frequency of use or interval between operations. The theoretical approach considers a large group of fixtures being connected to the plumbing system with only a small fraction of the total number of fixtures in use simultaneously. The probability method has also been effective in the design of smaller plumbing systems because of the excessive design factors added by Dr. Hunter. Because the fixture unit values have a built-in probability factor, they cannot be directly translated into flow or discharge rates. For example, one DFU is equivalent to a discharge rate of 1 cubic foot per minute (which is approximately 7.5 gallons per minute.) Two independent fixtures, however, each having a value of 1 DFU, cannot be considered as having a combined discharge rate of 15 gallons per minute because the DFU value incorporates the element of probability.

OPC 701.3 Separate sewer connection



Commentary Figure 701.3(1)
COMMON BUILDING SEWER LOCATED WITHIN A PUBLIC UTILITY SEWER EASEMENT

OPC 701.3 Separate sewer connection

A building having plumbing fixtures installed and intended for human habitation, occupancy or use on premises abutting on the street, alley or easement in which there is a public sewer shall have a separate connection with the sewer. Were located on the same lot, multiple buildings shall not be prohibited from connecting to a common building sewer that connects to the public sewer.

This requirement is intended to prohibit the combining of sewers serving different buildings prior to connection to the public sewer. The only exception is where the sewers to be combined are serving buildings on the same lot or parcel of land. This section does not prohibit the use of adjoining properties that have been included in a dedicated easement approved by the administrative authority. The commentary figure shown illustrates the use of a dedicated public sewer easement to accommodate buildings A and B. The common building sewer is an extension of the public sewer and under control of the public authority. When the sanitary discharge from more than one building is connected to the public sewer by means of a shared or common sewer line, the responsibility for maintenance of the common sewer line can become a problem. Should a stoppage develop in the common portion of the drain, all parties connected to the drain could disclaim responsibility for having the stoppage cleared. This presents a problem because there is no one party to hold responsible for the maintenance of the drain. Also, replacement or repairs of the sewer that are the responsibility of all parties sharing a common drain connection, and the process of determining the point of origin of the wastes into the common drain is more difficult. The first sentence of this section is intended to apply to the connection of more than one building where each building is under separate ownership, and the second sentence applies in instances where connection of more than one structure is proposed where all the buildings are under the same ownership.

OPC 702.1 Above-ground sanitary drainage and vent pipe

Above ground soil, waste and vent pipe shall conform to one of the standards listed in table 702.1

This section is about the material requirements of piping and fittings for all sanitary drainage, waste and vent systems. The reference table indicates piping materials that are pre-qualified for use in above ground DWV systems. The term pre-qualified is chosen here to better describe the intent of this section. It is possible that other types of piping could be used for these applications, however this table represents the common types of piping and their applicable standards that have appropriate drainage fittings and usually have widespread availability. The pipe materials in the table are not the only possible materials that could be used. Section 105.2 allows for alternative materials to be proposed and reviewed for approval by the code official. Some pipe products may be certified to more than one standard and some may only be certified to one standard. For example, in 702.1, one of the standards indicated for PVC pipe is ASTM D2665. Some manufacturers pipe products might also be listed to ASTM D1785 however, some manufacturers might choose to list their pipe products only to ASTM D1785. Simply because some manufacturers dual certify their pipe products to these standards doesn't mean that another manufacturer's product that is certified to only ASTM D1785 is in automatically in compliance with ASTM D2665. The pipe might look the same and the fittings might seem to fit the same way but ASTM D1785 doesn't indicate use of the pipe for DWV applications. Review Table 702.1

TABLE 702.1
ABOVE-GROUND DRAINAGE AND VENT PIPE

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe in IPS diameters, including Schedule 40, DR 22 (PS 200) and DR 24 (PS 140); with a solid, cellular core or composite wall	ASTM D2661; ASTM F628; ASTM F1488; CSA B181.1
Cast-iron pipe	ASTM A74; ASTM A888; CISPI 301
Copper or copper-alloy pipe	ASTM B42; ASTM B43; ASTM B302
Copper or copper-alloy tubing (Type K, L, M or DWV)	ASTM B75; ASTM B88; ASTM B251; ASTM B306
Galvanized steel pipe	ASTM A53
Glass pipe	ASTM C1053
Polyolefin pipe	ASTM F1412; CSA B181.3
Polyvinyl chloride (PVC) plastic pipe in IPS diameters, including Schedule 40, DR 22 (PS 200), and DR 24 (PS 140); with a solid, cellular core or composite wall	ASTM D2665; ASTM F891; ASTM F1488; CSA B181.2
Polyvinyl chloride (PVC) plastic pipe with a 3.25-inch O.D. and a solid, cellular core or composite wall	ASTM D2949, ASTM F1488
Polyvinylidene fluoride (PVDF) plastic pipe	ASTM F1673; CSA B181.3
Stainless steel drainage systems, Types 304 and 316L	ASME A112.3.1

❖ Table 702.1 identifies the materials (and the applicable standards) that are acceptable (without need for additional approval) for possible use in above-ground drainage, waste and vent systems.

OPC 702.2 Underground building sanitary drainage and vent pipe

Underground building sanitary drainage and vent pipe shall conform to one of the standards listed in table 702.2

The reference table specifies and identifies the materials and the applicable standards acceptable for use in underground drainage and vent systems. Note that some materials are different than those found in Table 702.1. For example, copper or copper alloy meeting ASTMB42 and B43 and Galvanized pipe.

TABLE 702.3
BUILDING SEWER PIPE

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe in IPS diameters, including Schedule 40, DR 22 (PS 200) and DR 24 (PS 140); with a solid, cellular core or composite wall	ASTM D2661; ASTM F628; ASTM F1488; CSA B181.1
Acrylonitrile butadiene styrene (ABS) plastic pipe in sewer and drain diameters, including SDR 42 (PS 20), PS 35, SDR 35 (PS 45), PS 50, PS 100, PS 140, SDR 23.5 (PS 150) and PS 200; with a solid, cellular core or composite wall	ASTM F1488; ASTM D2751
Cast-iron pipe	ASTM A74; ASTM A888; CISPI 301
Concrete pipe	ASTM C14; ASTM C76; CSA A257.1M; CSA A257.2M
Copper or copper-alloy tubing (Type K or L)	ASTM B75; ASTM B88; ASTM B251
Polyethylene (PE) plastic pipe (SDR-PR)	ASTM F714
Polypropylene (PP) plastic pipe	ASTM F2736; ASTM F2764; CSA B182.13
Polyvinyl chloride (PVC) plastic pipe in IPS diameters, including Schedule 40, DR 22 (PS 200) and DR 24 (PS 140); with a solid, cellular core or composite wall	ASTM D2665; ASTM F891; ASTM F1488
Polyvinyl chloride (PVC) plastic pipe in sewer and drain diameters, including PS 25, SDR 41 (PS 28), PS 35, SDR 35 (PS 46), PS 50, PS 100, SDR 26 (PS 115), PS 140 and PS 200; with a solid, cellular core or composite wall	ASTM F891; ASTM F1488; ASTM D3034; CSA B182.2; CSA B182.4
Polyvinyl chloride (PVC) plastic pipe with a 3.25-inch O.D. and a solid, cellular core or composite wall	ASTM D2949, ASTM F1488
Polyvinylidene fluoride (PVDF) plastic pipe	ASTM F1673; CSA B181.3
Stainless steel drainage systems, Types 304 and 316L	ASME A112.3.1
Vitrified clay pipe	ASTM C4; ASTM C700

For SI: 1 inch = 25.4 mm.

OPC 702.4 Fittings

Pipe fittings shall be approved for installation with the piping material installed and shall comply with the applicable standards listed in table 702.4

Drainage waste and vent pipe fittings are designed specifically for use with specified types of pipe materials. For example, fittings for ABS pipe cannot be solvent cemented to PVC fittings except as allowed for by section 705.16.4. This section should not be construed as prohibiting transitions from one pipe material - to a fitting for another pipe material using appropriate transitions in accordance with section 705.16. For example, a PVC pipe could be connected to the hub of a cast iron fitting using an approved adapter fitting. However, simply because code sanctioned transition methods are available doesn't mean that material mismatches between fitting and pipe are always appropriate. For example, using hubless cast iron fittings with PVC pipe to install a new DWV system isn't sensible. The code official has the ability to disapprove the fittings for the pipe material to be installed in order to avoid a “cobbling together” of new piping installations. The fittings for the wet portions of a DWV system must be of specific dimensional patterns so that the gravity flow of wastewater in the piping is not impeded. The standards for the fittings either have dimensional pattern information in the standard or reference another standard having that information. For example, ASTM A74 has the pattern information for cast iron pipe fittings whereas ASTM D2665 for PVC fittings references ASTM D3311 having the pattern information. The fitting dimensional information applies names to the fittings and in turn, manufacturers use the same naming conventions to enable designers and installers to comply with table 706.3

TABLE 702.4
PIPE FITTINGS

MATERIAL	STANDARD
Acrylonitrile butadiene styrene (ABS) plastic pipe in IPS diameters	ASTM D2661; ASTM F628; CSA B181.1
Acrylonotrile butadiene styrene (ABS) plastic pipe in sewer and drain diameters	ASTM D2751
Cast iron	ASME B16.4; ASME B16.12; ASTM A74; ASTM A888; CISPI 301
Copper or copper alloy	ASME B16.15; ASME B16.18; ASME B16.22; ASME B16.23; ASME B16.26; ASME B16.29
Glass	ASTM C1053
Gray iron and ductile iron	AWWA C110/A21.10
Polyethylene	ASTM D2683
Polyolefin	ASTM F1412; CSA B181.3
Polyvinyl chloride (PVC) plastic in IPS diameters	ASTM D2665; ASTM F1866
Polyvinyl chloride (PVC) plastic pipe in sewer and drain diameters	ASTM D3034
Polyvinyl chloride (PVC) plastic pipe with a 3.25-inch O.D.	ASTM D2949
Polyvinylidene fluoride (PVDF) plastic pipe	ASTM F1673; CSA B181.3
Stainless steel drainage systems, Types 304 and 316L	ASME A112.3.1
Steel	ASME B16.9; ASME B16.11; ASME B16.28
Vitrified clay	ASTM C700

For SI: 1 inch = 25.4 mm.

❖ The table indicates the standards for the fittings that are to be used with various pipe materials.

OPC 704.1 Slope of horizontal drainage piping

Horizontal drainage piping shall be installed in uniform alignment at uniform slopes. The slope of a horizontal drainage pipe shall be not less than that indicated in table 704.1 except that where the drainage piping is upstream of a grease interceptor, the slope of the piping shall not be less than 1/4 inch per foot.

The installation slope of horizontal drainage piping is critical for encouraging flow toward the intended destination. The minimum desired velocity in a horizontal drainage pipe is approximately 2 feet per second when the pipe is flowing half full. The velocity is often referred to as the quote scouring velocity End Quote however, this terminology is not to be construed as cleaning the entire inside wall of the drainage pipe. For example, if the velocity is too low such as where a pipe is excessively oversized or is not installed with adequate slope, the solids in the flow will tend to drop out of suspension and settle to the bottom or the invert of the pipe. This may eventually result in a drain stoppage. A greater velocity is required to move solids at rest that is required to keep moving solids in suspension. A true scouring velocity would then be higher than the velocity initially used to transport the solid.

TABLE 704.1
SLOPE OF HORIZONTAL DRAINAGE PIPE

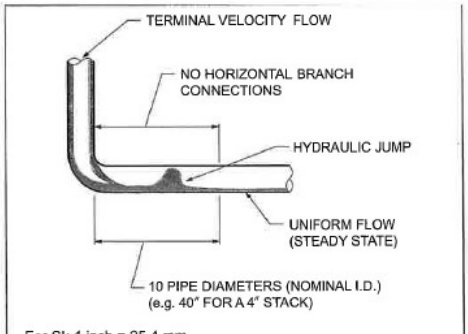
SIZE (inches)	MINIMUM SLOPE (inch per foot)
$2^1/_2$ or less	$^1/_4$ [a]
3 to 6	$^1/_8$ [a]
8 or larger	$^1/_{16}$ [a]

For SI: 1 inch = 25.4 mm, 1 inch per foot = 83.33 mm/m.

a. Slopes for piping draining to a grease interceptor shall comply with Section 704.1.

OPC 704.3 Connections to offsets and bases of stacks

Horizontal branches shall connect to the bases of stacks at a point located not less than 10 times the diameter of the drainage stack downstream from the stack. Horizontal branches shall connect to horizontal stack offsets at a point located not less than 10 times the diameter of the drainage stack downstream from the upper stack.



Commentary Figure 704.3
ZONE FOR POTENTIAL HYDRAULIC JUMP

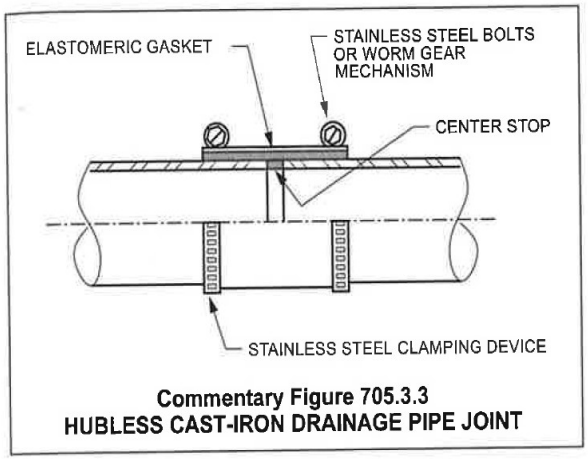
OPC 704.4 Future Fixtures

Drainage piping for future fixtures shall terminate with an approved cap or plug.

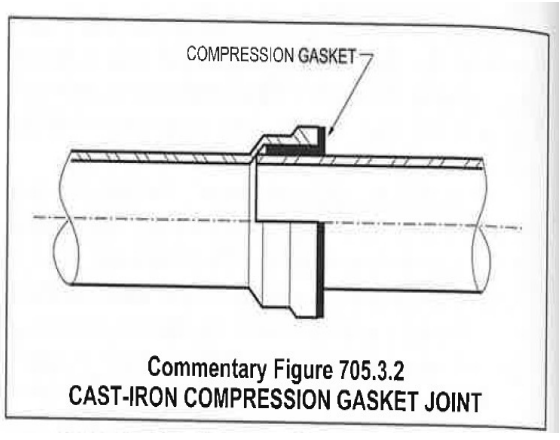
It is common practice to rough in drainage piping for fixtures to be installed after other portions of the building have plumbing fixtures set and the building is occupied. Obviously, the upstream ends of the roughed end piping needs to be closed off so that foul odors do not come inside the building. The requirement for code official approval of the cap or plug allows the code official to make an appropriate judgment about the adequacy and permanency of the closure for the purposes intended. For example, where buildings are under construction and the piping is for fixtures that to be installed before the building is occupied, solvent cemented test caps closet flanges with integral knockouts or secured rubber caps or plugs are usually viewed as adequate until the fixtures are set. Where piping terminations are to be closed off for long periods of time after the building is occupied, perhaps more permanent caps comma plugs or other types of closure devices are warranted especially where the termination are in concealed construction or buried.

OPC 705.1 Joints – General

This section contains requirements that apply to materials used for the joining of pipes and the installation of those materials. Acceptable joints and connections for the sanitary drainage piping materials addressed in section 702 are listed in alphabetical order in this chapter. The main section title identifies the piping material to which the section applies. Subsequent sections list acceptable joints or connections for each particular material. Joints and connections between dissimilar materials are regulated in section 705.16



Commentary Figure 705.3.3
HUBLESS CAST-IRON DRAINAGE PIPE JOINT



Commentary Figure 705.3.2
CAST-IRON COMPRESSION GASKET JOINT

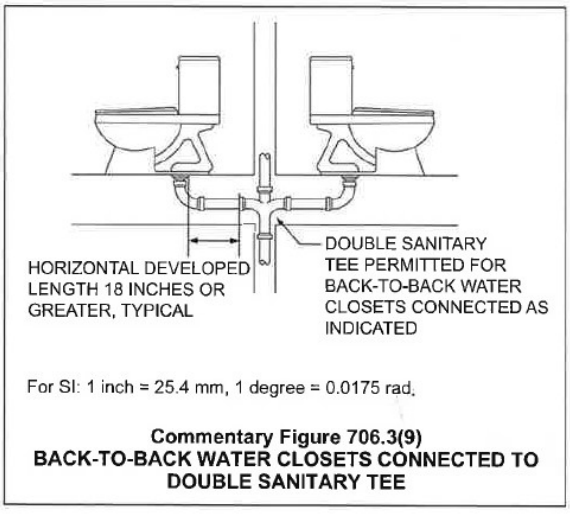
OPC 706.3 Installation of fittings

Fittings shall be installed to guide sewage and waste in the direction of flow. Change in direction shall be made by fittings installed in accordance with table 706.3. The changes in direction by combination fittings side inlets or increasers shall be installed in accordance with table 706.3 based on the pattern of flow created by the fitting. Double sanitary tea patterns shall not receive the discharge of back-to-back water closets and fixtures or appliances with pumping action discharge. Exception back-to-back water closet connections to double sanitary Tees shall be permitted where the horizontal developed length between the outlet of the water closet and the connection to the double sanitary tea pattern is 18 inches or greater.

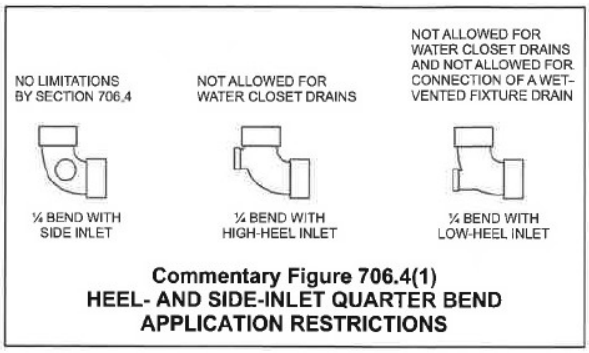
TABLE 706.3
FITTINGS FOR CHANGE IN DIRECTION

TYPE OF FITTING PATTERN	CHANGE IN DIRECTION		
	Horizontal to vertical	Vertical to horizontal	Horizontal to horizontal
Sixteenth bend	X	X	X
Eighth bend	X	X	X
Sixth bend	X	X	X
Quarter bend	X	X[a]	X[a]
Short sweep	X	X[a,b]	X[a]
Long sweep	X	X	X
Sanitary tee	X[c]	—	—
Wye	X	X	X
Combination wye and eighth bend	X	X	X

For SI: 1 inch = 25.4 mm.
a. The fittings shall only be permitted for a 2-inch or smaller fixture drain.
b. Three inches or larger.
c. For a limitation on double sanitary tees, see Section 706.3.



Commentary Figure 706.3(9)
BACK-TO-BACK WATER CLOSETS CONNECTED TO DOUBLE SANITARY TEE



Commentary Figure 706.4(1)
HEEL- AND SIDE-INLET QUARTER BEND APPLICATION RESTRICTIONS

OPC 708.1.5 Cleanout Size

Cleanouts shall be the same size as the piping served by the clean out, except that cleanouts for piping larger than four inches need not be larger than 4 inches.

Exceptions:

1. *A removable P trap with slip or ground joint connections can serve as a clean out for drain piping that is one size larger than the P trap size.*
2. *Clean outs located on stacks can be one size smaller than the stack size.*
3. *The size of cleanouts for cast iron piping can be in accordance with the reference standards for cast iron fittings as indicated in table 702.4*

OPC 708.1.10 Cleanout Access

Required cleanouts shall not be installed in concealed locations. For purposes of this section, concealed locations include, but are not limited to, the inside of plenums, within walls, within floor or ceiling assemblies, below grade and in crawl spaces where the height from the crawl space floor to the nearest obstruction along the path from the crawl space opening to the clean out location is less than 24 inches.

OPC 708.1.11 Prohibited Use

the use of a threaded clean out opening to add a fixture or to extend piping shall be prohibited except where another clean out of equal size is installed with the required access and clearance.

OPC 709 Fixture Units

This section contains the requirements to establish fixture unit amounts for plumbing fixtures for use in determining drainage system piping size. The method of sizing a sanitary drainage system is based on the DFUW values indicated in table 709.1. The minimum sizes of piping are determined using tables 710.1(1) and 710.1(2) as appropriate.

Table 709.1 identifies common plumbing fixtures with their corresponding DFU values. The DFU values are used to determine the load on a drain, which, in turn is used to determine the minimum drainage pipe size requirement for the load served. In determining the fixture unit values each fixture was evaluated for its impact on the sanitary drainage system. Fixture unit values were developed by doctor Roy Hunter. Doctor Hunter conceived the idea of assigning a fixture unit value to represent the degree to which a fixture loads the system when used at the maximum assumed frequency. The scale was based on two fixtures - The lavatory and the water closet. Doctor Hunter determined that a lavatory load on a drainage system was 1/6 of that for a water closet. Hence the lavatory was assigned the value of 1 while the water closet was assigned a 6.

TABLE 709.1
DRAINAGE FIXTURE UNITS FOR FIXTURES AND GROUPS

FIXTURE TYPE	DRAINAGE FIXTURE UNIT VALUE AS LOAD FACTORS	MINIMUM SIZE OF TRAP (inches)
Automatic clothes washers, commercial[a,g]	3	2
Automatic clothes washers, residential[g]	2	2
Bathroom group as defined in Section 202 (1.6 gpf water closet)[f]	5	—
Bathroom group as defined in Section 202 (water closet flushing greater than 1.6 gpf)[f]	6	—
Bathtub[b] (with or without overhead shower or whirlpool attachments)	2	1 1/2
Bidet	1	1 1/4
Combination sink and tray	2	1 1/2
Dental lavatory	1	1 1/4
Dental unit or cuspidor	1	1 1/4
Dishwashing machine[c], domestic	2	1 1/2
Drinking fountain	1/2	1 1/4
Emergency floor drain	0	2
Floor drains[h]	2[h]	2
Floor sinks	Note h	2
Kitchen sink, domestic	2	1 1/2
Kitchen sink, domestic with food waste disposer, dishwasher or both	2	1 1/2
Laundry tray (1 or 2 compartments)	2	1 1/2
Lavatory	1	1 1/4
Shower (based on the total flow rate through showerheads and body sprays)		
Flow rate:		
5.7 gpm or less	2	1 1/2
Greater than 5.7 gpm to 12.3 gpm	3	2
Greater than 12.3 gpm to 25.8 gpm	5	3
Greater than 25.8 gpm to 55.6 gpm	6	4
Service sink	2	1 1/2
Sink	2	1 1/2
Urinal	4	Note d
Urinal, 1 gallon per flush or less	2[e]	Note d
Urinal, nonwater supplied	1/2	Note d
Wash sink (circular or multiple) each set of faucets	2	1 1/2
Water closet, flushometer tank, public or private	4[e]	Note d
Water closet, private (1.6 gpf)	3[e]	Note d
Water closet, private (flushing greater than 1.6 gpf)	4[e]	Note d
Water closet, public (1.6 gpf)	4[e]	Note d
Water closet, public (flushing greater than 1.6 gpf)	6[e]	Note d

For SI: 1 inch = 25.4 mm, 1 gallon = 3.785 L, gpf = gallon per flushing cycle, gpm = gallon per minute.

a. For traps larger than 3 inches, use Table 709.2.

b. A showerhead over a bathtub or whirlpool bathtub attachment does not increase the drainage fixture unit value.

c. See Sections 709.2 through 709.4.1 for methods of computing unit value of fixtures not listed in this table or for rating of devices with intermittent flows.

TABLE 709.2
DRAINAGE FIXTURE UNITS FOR FIXTURE DRAINS OR TRAPS

FIXTURE DRAIN OR TRAP SIZE (inches)	DRAINAGE FIXTURE UNIT VALUE
1 1/4	1
1 1/2	2
2	3
2 1/2	4
3	5
4	6

For SI: 1 inch = 25.4 mm.

OPC 710 Drainage System Sizing

The maximum number of drainage fixture units connected to a given size of building sewer, building drain or horizontal branch of the building drain shall be determined using table 710.1(1)

The maximum number of drainage fixture units connected to a given size of horizontal branch or vertical soil or waste stack shall be determined using table 710.1(2)

Note that the language is specific in defining the proper table. Branches are mentioned in BOTH tables. A branch of the building drain is sized per 710.1(1) but a branch connecting to a stack is sized using table 710.1(2). Also note "A" on 710.1(2) specifically states that the table does not include branches of the building drain. In essence 710.1(1) sizes all drainage piping in the system EXCEPT for stacks and branches of stacks.

TABLE 710.1(1)
BUILDING DRAINS AND SEWERS

DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS CONNECTED TO ANY PORTION OF THE BUILDING DRAIN OR THE BUILDING SEWER, INCLUDING BRANCHES OF THE BUILDING DRAIN[a]			
	Slope per foot			
	1/16 inch	1/8 inch	1/4 inch	1/2 inch
1 1/4	—	—	1	1
1 1/2	—	—	3	3
2	—	—	21	26
2 1/2	—	—	24	31
3	—	36	42	50
4	—	180	216	250
5	—	390	480	575
6	—	700	840	1,000
8	1,400	1,600	1,920	2,300
10	2,500	2,900	3,500	4,200
12	3,900	4,600	5,600	6,700
15	7,000	8,300	10,000	12,000

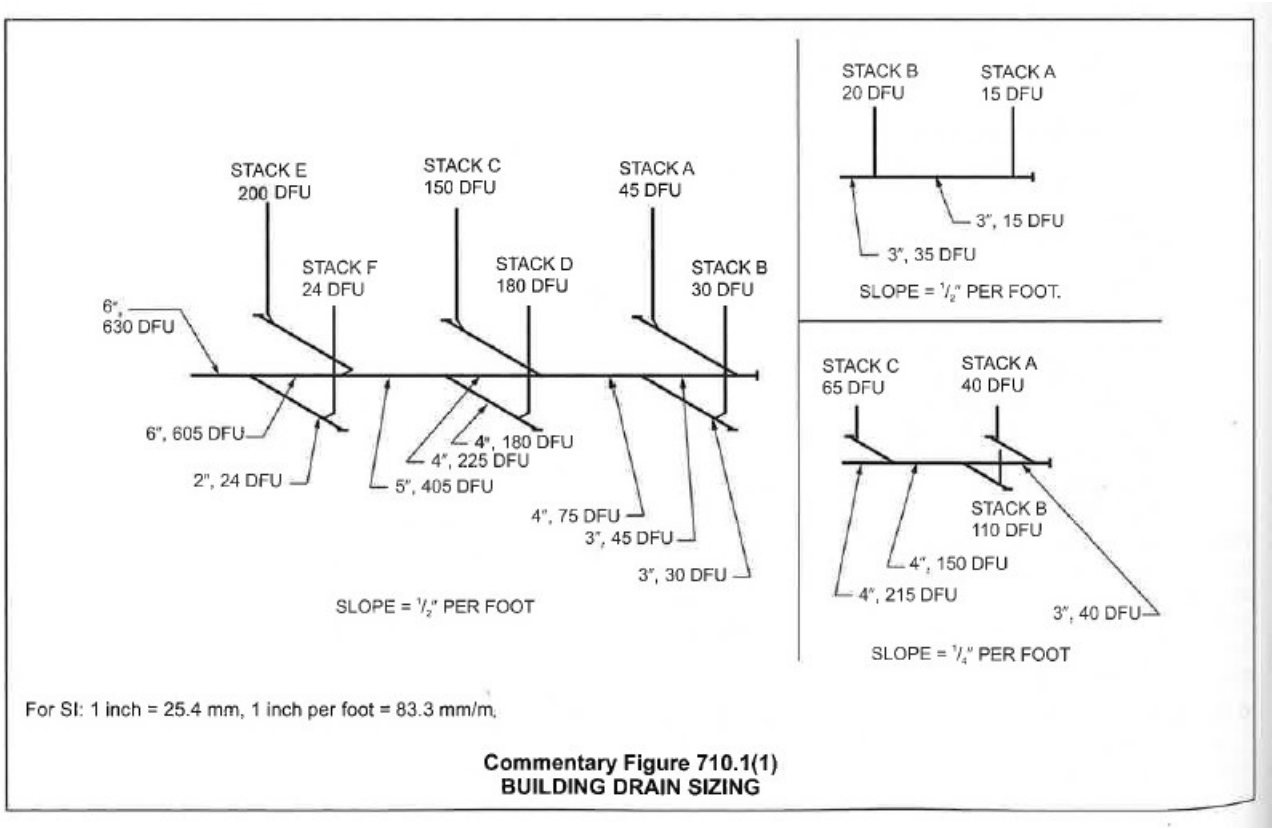
For SI: 1 inch = 25.4 mm, 1 inch per foot = 83.3 mm/m.

a. The minimum size of any building drain serving a water closet shall be 3 inches.

Note the language of the Table. "…Connected to any portion of the building drain or building sewer, including branches of the building drain."

Based on slope per foot, this table sizes all piping that is defined as building drain or building sewer!

Building drain sizing example:



Commentary Figure 710.1(1)
BUILDING DRAIN SIZING

The building drain is defined in the plumbing code as:

"That part of the lowest piping of a drainage system that receives the discharge from soil, waste and other drainage pipes inside and that extends 30 inches (762 mm) in developed length of pipe beyond the exterior walls of the building and conveys the drainage to the building sewer."

A Stack is defined as:

A general term for any vertical line of soil, waste, vent or inside conductor piping that extends through at least one story with or without offsets.

BUILDING DRAINS ARE NOT STACKS. BUILDING DRAINS RECEIVE THE DISCHARGE OF STACKS. In light of these definitions, it is reasonable to say that the building drain terminates at the base of the vertical stack.

Sizing of Stacks and branches of stacks:

TABLE 710.1(2)
HORIZONTAL FIXTURE BRANCHES AND STACKS[a]

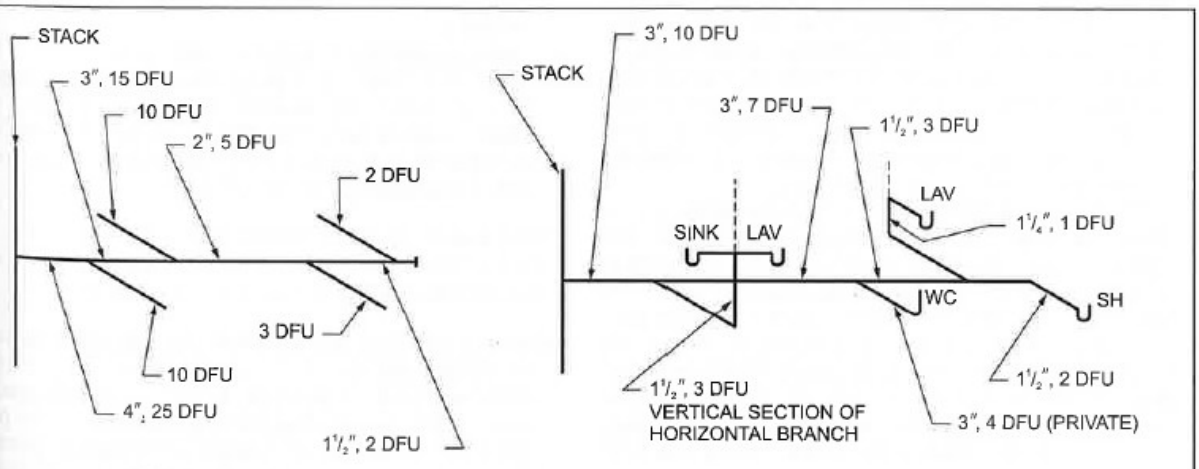
DIAMETER OF PIPE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)			
		Stacks[b]		
	Total for horizontal branch	Total discharge into one branch interval	Total for stack of three branch Intervals or less	Total for stack greater than three branch intervals
1 1/2	3	2	4	8
2	6	6	10	24
2 1/2	12	9	20	42
3	20	20	48	72
4	160	90	240	500
5	360	200	540	1,100
6	620	350	960	1,900
8	1,400	600	2,200	3,600
10	2,500	1,000	3,800	5,600
12	3,900	1,500	6,000	8,400
15	7,000	Note c	Note c	Note c

For SI: 1 inch = 25.4 mm.

a. Does not include branches of the building drain. Refer to Table 710.1(1).

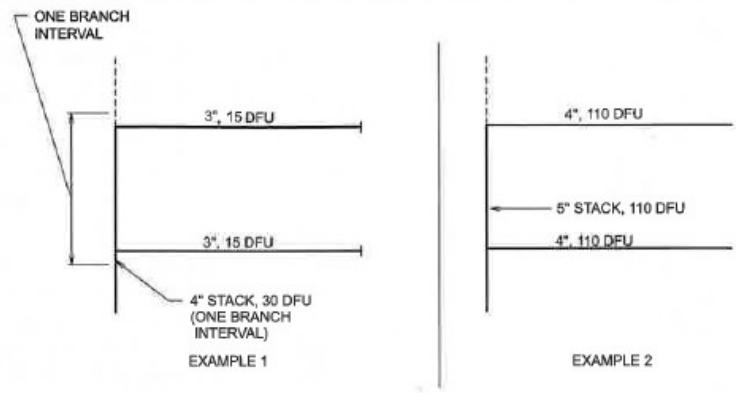
b. Stacks shall be sized based on the total accumulated connected load at each story or branch interval. As the total accumulated connected load decreases, stacks are permitted to be reduced in size. Stack diameters shall not be reduced to less than one-half of the diameter of the largest stack size required.

c. Sizing load based on design criteria.



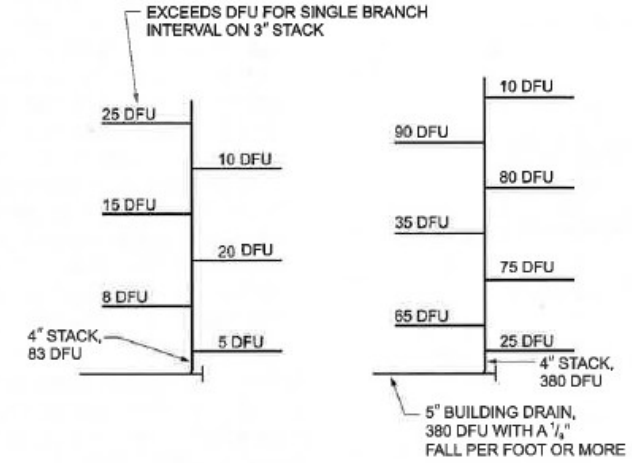
For SI: 1 inch = 25.4 mm.

Commentary Figure 710.1(2)
HORIZONTAL BRANCH SIZING
(Complete venting not shown)



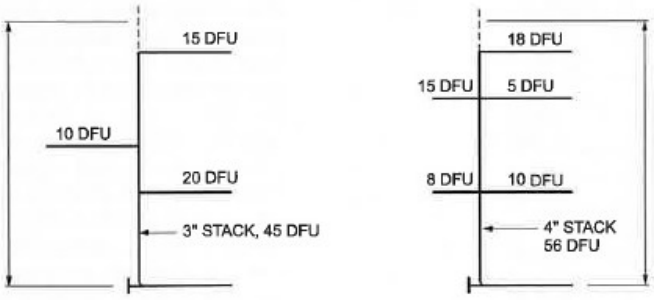
For SI: 1 inch = 25.4 mm.

Commentary Figure 710.1(4)
STACK SIZING



For SI: 1 inch = 25.4 mm.

Commentary Figure 710.1(5)
STACK SIZING GREATER THAN THREE BRANCH INTERVALS



For SI: 1 inch = 25.4 mm.

Commentary Figure 710.1(6)
SIZING OF STACK THREE BRANCH INTERVALS OR LESS

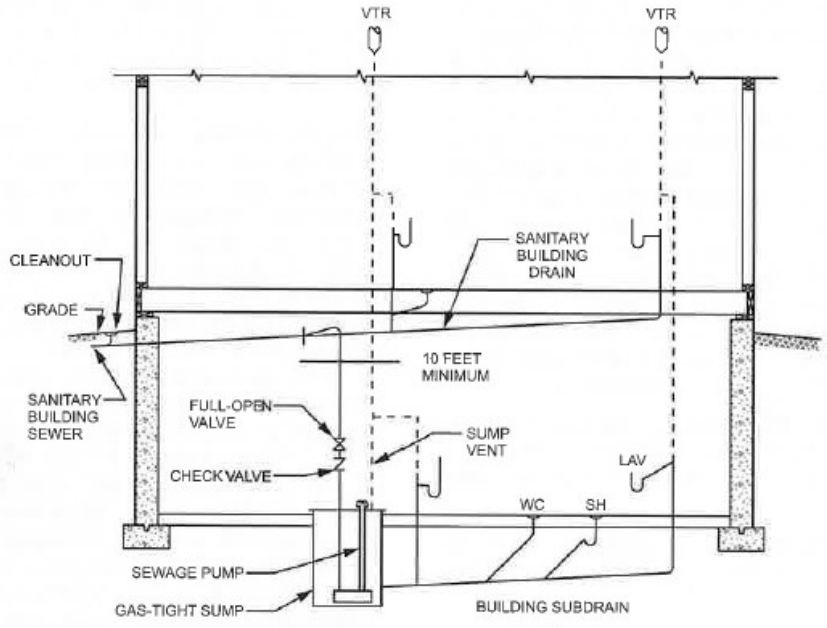
Class work examples. Using charts, size the shown stacks for branch, branch interval and stack.

OPC 710.1(2) Sizing of Stacks

When sizing is stack, there are 3 main criteria that must be considered: the discharge into a branch interval of a stack, the total discharge into a stack and the total number of branch intervals on the stack. For sizing a stack of 3 branch intervals or less table within the branch of this may receive is limited that would have to be increased in size. Commentary figure 710.1(4), example 1, depicts two 3 inch horizontal branches connecting within one branch interval. The total fixture unit load is 30, meaning that the stack diameter must be a minimum of 4 inches. The example demonstrates a situation where the branches must be only 3 inches and, because of the location of their connection to the stack, a larger stack size is required. In this example, the total permitted capacity of a 3-inch stack was not exceeded; only the limitation for a given branch interval was exceeded.

OPC 712: Sumps and ejectors

OPC 712.1: Building sub drains that cannot be discharged to the sewer by gravity flow shall be discharged into a tightly covered and vented sump from which the liquid shall be lifted and discharged into the building gravity drainage system by automatic pumping equipment or other approved method. In other than existing structures, the sump shall not receive drainage from any piping within the building capable of being discharged by gravity to the building sewer.



For SI: 1 foot = 304.8 mm.

Commentary Figure 712.2
SEWAGE PUMP INSTALLATION

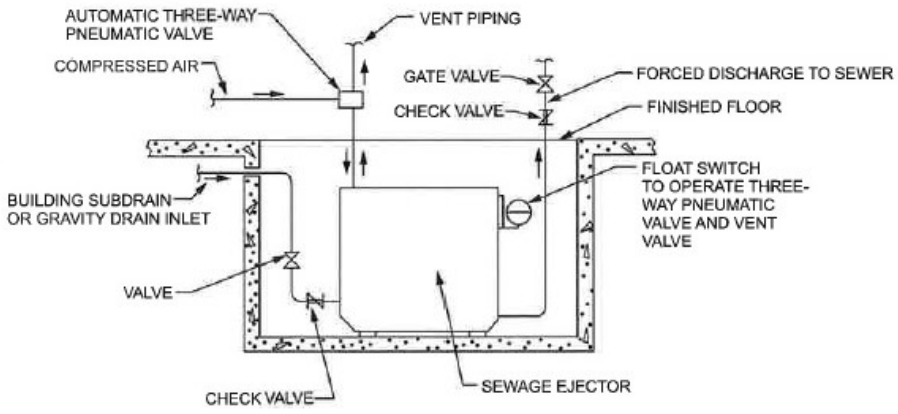
Where the drainage system or portions of it cannot dis-charge by gravity to the sewer, the drainage is collected in a tightly sealed and vented sump and pumped to a gravity sewer or drain. The sump must be sized to pro-vide adequate holding capacity and to limit the retention period of the waste. Though not specifically required by the code, the intent is that the capacity of the sump must not exceed one-

half of a day's (12 hours) discharge load from the piping system connected to the sump under normal use. The intent is to keep the waste reten-tion period short to prevent the sump from acting as a waste decomposition (septic) tank.

The minimum capacity of the sump must be such that the pumping equipment operates for at least 15 sec-onds per pumping cycle to prevent short cycling, thereby extending the life of the equipment.

The cover for the sump must be gas tight to prevent the escape of sewer gas into the building (see commen-tary, Section 916.5). Sumps, other than pneumatic ejec-tors, must be vented in accordance with Section 916.5.1.

Sumps receiving water closet and urinal discharge use a sewage ejector to pump the soil and waste to a gravity drain. Quite often, the pumping equipment is referred to as a sewage pump by technical standards.



Commentary Figure 712.1(1)
PNEUMATIC SEWAGE EJECTOR

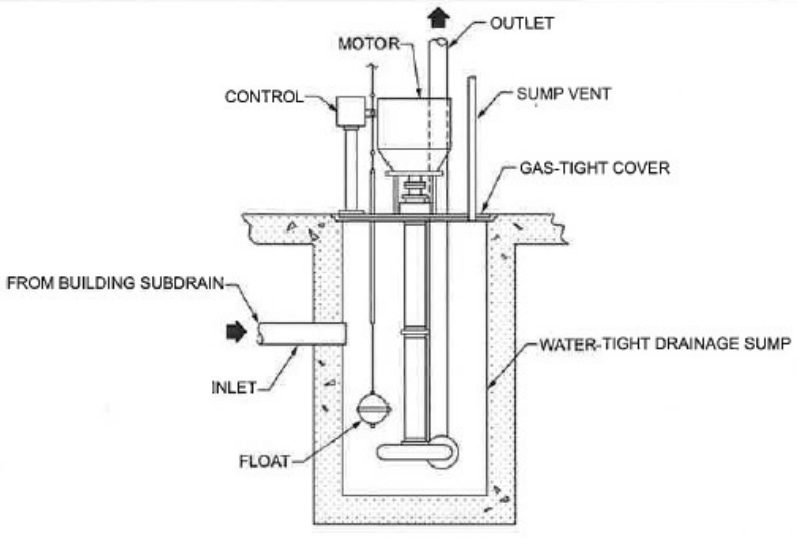


Figure 712.1(2)
VERTICAL SUSPENDED WET PIT SEWAGE PUMP

OPC 712.3.2 Sump pit

The sump pit shall not be less than 18 inches in diameter and not less than 24 inches in depth, unless otherwise approved. The pit shall be accessible and located such that all drainage flows into the pit by gravity. The sump pit shall be constructed of tile, concrete, steel, plastic, or other approved materials. The pit bottom shall be solid and provide permanent support for the pump. The sump pit shall be fitted with a gas tight removable cover that is installed flush with grade or floor level, or above grade or floor level. The cover shall be adequate to support anticipated loads in the area of use. The sump pit shall be vented in accordance with Chapter 9.

OPC 712.3.4 Maximum effluent level

The effluent level control shall be adjusted and maintained to at all times prevent the effluent in the sump from rising to within 2 inches of the invert of the gravity drain inlet into the sump.

TABLE 712.4.2
MINIMUM CAPACITY OF SEWAGE PUMP OR SEWAGE EJECTOR

DIAMETER OF THE DISCHARGE PIPE (inches)	CAPACITY OF PUMP OR EJECTOR (gpm)
2	21
$2^1/_2$	30
3	46

For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m.

- Table 712.4.2 specifies sewage pump capacity in gallons per minute with respect to the pump's discharge opening size. This relationship between pipe size and pump capacity will maintain flow velocity in the piping to help prevent blockage and restriction.

OPC 712.3.5 Pump connection to the drainage system

Pumps connected to the drainage system shall connect to a building sewer, building drain, soil stack, waste stack or horizontal branch drain. Where are the discharge line connects into horizontal drainage piping, the connection shall be made through a wye fitting into the top of the drainage piping and such wye fitting shall be located not less than 10 pipe diameters from the base of any soil stack, waste stack or fixture drain.

File Attachments for Item:

ER-6 Western Section IAEI Annual Meeting (Conference/IAEI Western)

All certifications (18 hours)

Staff Notes: Two-and-a-half day 18-hour conference like the "Special Meeting" last spring (BBS2023-645) but with different courses. There are ten courses (mostly an hour or 90 minutes long) and three Q&A sessions. The submission does not include slides.

Committee Recommendation:

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *	Organization	Email *	Phone Number *
Thomas Edward Moore	Western Section IAEI	tmoore1767@gmail.com	(330) 289-7932

Address *	City *	State *	Zip Code *
3462 Brunk Rd	Akron	Ohio	44312

Website	Conference Sponsor (if applicable)	Conference Email
http://iaei-westernsection	Western Section IAEI 119th A	tmoore1767@gmail.com

- [x] Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429)

BBS2023-641

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title

Western Section IAEI 119th Annual Meeting

Course instructor

Tom Moore

Course description

The course is part of the Western Section IAEI 11th annual meeting consisting of 17 Midwest states that are approved for education CEU.s. There are a total of 13 different ppt presentations, all of which have copy right protection. The Code Q & A session consist of 85 questions that promotes attendee interaction, with questions answered by nationally recognized NEC code experts who set on the various NEC code panels.

Instructional hours per session	Number of Sessions	Course Date	Course Location
18	13	2023-09-18	Oglebay Resort, Wheeling WV

Special Content

- [ ] Code Administration
- [ ] Existing Buildings
- [ ] Electrical Instruction
- [ ] Plumbing Instruction

Conference Course	Conference Name	Conference location

Course to be offered online?

- [ ] Yes
- [x] No

- [ ] On Demand
- [ ] Webinar

Course Website

109

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

See Outline Attached

Course applicable for the following certifications *

- [ ] Residential Certifications Only
- [ ] Administrative Course, All Certifications
- [x] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [ ] Assessment Materials (for online courses)
- [x] Presenter Bio
- [x] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
New Compressed (zipped) Folder.zip	433.50 kB

Applicant Full Name *

Thomas Moore

Date of Submission

08/06/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

Tom Moore

Tom Moore, Akron Ohio, is past President of the IAEI Western Section, Ohio Chapter and Akron Division and past IAEI IO Board of Directors, Assistant Secretary/Treasurer of the Western Section and Ohio Chapter IAEI, President and Membership Chair of the Akron Division IAEI. Tom presently serves as Chairman of the NFPA Electrical Inspection Section. He has been involved in the inspection industry since 1987 and the electrical industry for over 39 years. He has been a journeyman training and apprenticeship instructor the past 25 years for IBEW Local 306. Tom is retired as the Assistant Building Commissioner with the City of Beachwood Ohio.

Tom has represented the IAEI on CMP 5 for the 2002 Code Cycle, CMP 11 for the 2005, 2008, and 2011code cycles, Chair of CMP 16 for the 2014, 2017 and 2020 code cycles and currently Chair of CMP 8 for the 2023 and 2026 Code cycles. Tom recently served on NFPA 915 Standard for Remote Inspections.

2023 Western Section meeting

Start Time	9/17/2023	9/18/2023	9/19/2023	9/20/2023
	Sunday	Monday	Tuesday	Wednesday
7:30 AM				Borgie
8:00 AM		Business Meeting	Reconditioned Equip	Charlie Trout Code
8:15 AM			Panel	
8:30 AM		1 Hour	1 Hour	Breakfast
8:45 AM				
9:00 AM		**15 Minutes Break**	NEC Structure / Future	
9:15 AM		726 Class 4		
9:30 AM				
9:45 AM			1 Hour	2.5 Hours
10:00 AM		1 Hour	**15 Minutes Break**	**15 Minutes Break**
10:15 AM		Electric Vehicles	NEC Case Study	Article 512 Cannibus
10:30 AM				
10:45 AM		.75 hr	0.75 Hour	0.75 Hour
11:00 AM		Code Q&A	Code Q&A	Code Q&A
11:15 AM				
11:30 AM		1 Hour		
11:45 AM			1 Hour	1 Hour
12:00 PM		**Lunch**	**Lunch**	
12:15 PM				
12:30 PM				
12:45 PM		**1 Hour**	**1 Hour**	
1:00 PM		Mobile Data Centers	Business meeting	
1:15 PM			NEC 1&2 Family	
1:30 PM				
1:45 PM			Significant Changes	
2:00 PM				
2:15 PM		1.5 hour	1.25 Hours	
2:30 PM	**Vendor**	**15 Minutes Break**	**15 Minutes Break**	
2:45 PM		PV, ESS, Generator	Residential Services	

3:00 PM	**Vendor**	Application 1.25 Hour	(1.25 Hour)
3:15 PM			
3:15 PM	**Vendor**		
3:45 PM			
4:00 PM	**Vendor**	Code Q&A	Code Q&A
4:15 PM			
4:30 PM	**Vendor**		
4:45 PM		1 Hour	1 Hour
5:00 PM	**Vendor**		
5:15 PM			
5:30 PM	**Vendor**		
6:00 PM			

Break / Lunch	1	1		
Technical Program Hours	6.5	7.25	4.25	18
	8.5	8.25	4.25	21

726 Class 4	Kyle Krueger & Don Iverson
Electric Vehicles	Brian Baughman
Mobile Data Centers	Tom Lichtenstein
PV, ESS, Generator Application	Gerry O'Connor
Reconditioned Equipment Panel	manufact / labs / inspectors
NEC CC Report	Larry Ayer
Case Study	David Williams / Dean Hunter
NEC 2023 1&2 Fmaily Sig Changes	Tim McClintock / Vince Della Croce
NEC 2023 Resi Services	Ryan Jackson
Article 512 Cannibus	Chris Papp tom blevins

Domitrovich proctor Recondtioned Equipment
Della Croce
Porter
Evangelista
Fahey

Code Panel 1
Tim McClintock Moderator *
Bob Fahey * 1
Ray Horner 1
Tom Moore * 1
Dean Hunter 1
Christine Porter 2
Jeff Fecteau * 2
David Williams 2
Don Iverson * 1

Steve Froemming 2
Jack Jamison * 2
Joe Pavia 2
Weaver * 1
Johnston Moderator *

119th Annual IAEI

Western Section Meeting

September 17-20, 2023

1. Sections 300.4(A) & 300.4(D) permit nonmetallic conduit to protected cables that are within 1 ¼" of the stud's face, but 334.15 requires it to be Schedule 80 if protecting NM cables from physical damage. Does this apply to the requirements in 300.4?

2. Are there any restrictions that prohibit 2 electrical meters on one single family dwelling if they are fed from a single service? What about (2) separate meters on the same single family dwelling property?

3. I am adding a new bathroom in our house. I plan on using the 210.11(C)(3) exception. My question is this. Can the 20-ampere rated branch circuit also serve the hydromassage tub if the hydromassage tub load does not exceed 10-amperes?

4. I am installing a whole house generator on a single-family dwelling that is 18 months old. I am not removing or changing the meter base, only installing a main breaker/ ATS between the meter base and the existing main breaker panelboard. The inspector is requiring (2) new ground rods. I've never heard of this. Are they correct?

5. At a gas log fireplace in the wall, it comes with a 3-plug power strip as part of the system. All the components plug into the strip. Do you need a switch on the wall?

6. I changed a 200A service to a 400A service. After installing the 400A meter enclosure, the existing conductors to the existing 200A panel will not reach the lugs. Am I allowed to splice pieces to conductors in the meter enclosure or am I required to create the splice outside the enclosure?

7. When installing a residential generator, and the transfer switch is installed between the generator and the existing service, the existing service is a meter main combo, can the meter main combo be field converted from a main service enclosure to now a sub panel without voiding the listing of the meter main combo?

8. Can ENT (smurf tubing) be used as a UF cable sleeve under a slab from a wall to the kitchen island in a single-family dwelling?

9. There is a utility sink installed in a laundry room of a single-family dwelling. The dryer receptacle is installed 4' from that sink. There is also a Home Automation Control Cabinet with a duplex

outlet install in that cabinet. The cabinet door has a latch and capable of being screwed closed. Is the dryer receptacle and or the cabinet receptacle required to be GFCI protected?

10. In an owner's bathroom, there are 2 vanities. Those vanities are 48" apart. Can a duplex receptacle be installed in between those vanities and meet the spacing requirements?

11. In an in-law's suite, there is a kitchenette. There is a refrigerator, sink, dishwasher, and a microwave. Are two small appliance circuits required?

12. A dwelling has a walk-up attic area that is designed for future use as habitable space. Is a smoke detector required to be installed at time of certification of occupancy, or is a junction box with the smoke detector circuit that can be connected to when completed in the future required? Can the reinforcing steel in a residential attached garage floor be used as a concrete encased electrode?

13. Can a dishwasher and garbage disposer both be served by the same 15 amp branch circuit? The nameplate on the dishwasher is 6.2 amps and the nameplate on the garbage disposer is 4.0 amps.

14. Is there a maximum amount of receptacles that I can install on a 15-amp branch circuit for bedrooms and living rooms?

15. Are NM cables installed to under cabinet lights in kitchens beneath the cabinets considered subject to physical damage?

16. Does a receptacle mounted at 60" AFF, behind a flat screen TV, but still within 6 ft of the edge of a sink in my recreational room need to be GFCI protected?

17. 314.16 (B)(2) When calculating box fill on a typical residential installation, NM entering a non-metallic box, should a single volume allowance be counted for the holes the wires pass through when the hole is constructed with a means of retaining the wire in the box? Are these taken into account when the manufacturer produces the box and labels the box volume?

18. I have to replace 15 amp receptacles in an old single family home. I opened one of the receptacle boxes and found 14-2 NM cable with a reduced ground which looked like a #16. The reduced ground wire was back-wrapped on the cable sheath and then put under the cable clamp of the box. Can I unwrap this ground and use this for a ground for the receptacle? I assume I would need AFCI in certain areas but is it better to use a GFCI and not use the ground or is it better to use the undersized ground?

19. Is there a section in the NEC that prohibits utilizing a common or "shared" neutral with ungrounded conductors of the same phase?

20. Is the area outside a spray booth door considered hazardous where interlocking prevents the spray operation when the door is open?

21. When connecting a PV system supply side as permitted per 230.82(6), how would an AHJ enforce the barrier requirement per 230.62(C), when the power source conductors from the point of connection to the first OCPD terminate on the load end of a fused safety switch? The labeling per the exception to 404.6(C) has been applied. Is there a manufactured safety switch with a "SUSE" rating with barriers on the load terminals, and would the blades be considered a service bus bar?

22. If I am calculating the load for 11 dryers in a multi unit building. There is a dryer on each floor to accommodate the many tenants on that floor. Can I take advantage of Table 220.54 which is for household dryers?

23. I have a 2hp, 220-volt, single phase, code letter K fire pump, how do I determine the ampere rating of the OCPD?

24. I have been hired to install and provide the branch circuit for a duct heater. The duct heater will be above the suspended ceiling of a large conference room. Is it okay for me to install the service receptacle (required per 210.63) above the suspended ceiling close to the duct heater, or must it be installed below the suspended ceiling?

25. Is a separately derived system grounded conductor permitted to also be the supply side bonding conductor where the system bonding jumper is installed at the first disconnecting means and not the source enclosure? Follow up question; if metallic raceways are utilized between the source and first disconnecting means metallic enclosures, could this be considered a path for objectionable current?

26. 310.12(A) permits service conductors to have an ampacity less than the service rating where all conditions are met. When utilizing a PCS connected in accordance with 705.11, is it permissible to set the PCS current limitations at a value equal to the service rating or should this value not exceed the ampacity of the service conductors? Example 4/0 Al service conductors for a 200-ampere one family dwelling service, PCS is set at 200-amperes.

27. Can the manufacturers instruction override the NEC. I know the manufacture can make us go beyond the NEC but can they make us do less than what is required. For instance, if the NEC requires GFCI and the manufacturer says not to use GFCI then what do we do?

28. When using a metallic raceway to sleeve a transformer, MDP, or switchgear grounding electrode conductor, is it required to bond one end of the raceway, or both ends of the raceway?

29. There is a 400-amp meter and a 400-amp fusible disconnect (service disconnect) installed under a metal wireway. The power company connects to the metal wireway mounted above the meters and disconnects. The EC installed a grounding conductor (green) from the fusible

disconnect (service disconnect), back through the meter enclosure and into the metal wireway and connected this grounding conductor to a lug mounted to the wireway. Is this required or even permitted?

30. What is the maximum number of receptacles permitted on a small appliance circuit?

31. Are meter mounted transfer switches permitted for use as the transfer equipment for an optional standby system? The standby source is capable of supplying all the standby loads.

32. What is the minimum required separation in a trench between direct buried conductors of system voltages over 1000 volts and less than 1000 volts? Follow up, is a trench considered a raceway?

33. What is the proper wiring method for a standalone diesel fuel dispenser? Can standard underground raceways be used along with standard nonmetallic or metallic flex be used for connections?

34. There is a 30amp, 120/208volt, 3phase, twist-lock receptacle installed in a brewery processing area. This outlet powers a product-transfer pump. Is this outlet required to be GFCI protected?

35. The maximum height of a breaker handle or disconnect switch handle has been exceeded. A working/service platform is going to be built to get the handles to an approved height. Is there a minimum size for this working/service platform?

36. I recently failed an inspection for overhead service conductors (not drops) being less than 8' above a 3:12 roof. I explained to my inspector the roof is not readily accessible and I meet exception 5 to 230.24(A) where the nominal system voltage is 120/208. Who is correct in this instance?

37. Will a Class A GFCI device perform as intended and open where utilized with balanced loads that do not require a neutral? Follow up, can a two-pole MCCB with integral Class A GFCI protection perform as intended where only supplying a single line to neutral circuit and one pole remains unused?

38. I'm estimating an addition for an RV park, can I have a reduced size neutral conductor where I am only running two of the ungrounded conductors and the feeders originate from a 120/208-volt, 3-phase service?

39. I am reviewing the service load calculation for a proposed major repair commercial garage building. The engineer has utilized an energy management system to minimize the size of the service. One of the managed loads is the ventilation system removing hazardous vapors from working areas below grade, is this permissible?

40. I have a 200-foot-long warehouse. The electrical service is at one end of the building and the sprinkler riser, and the copper water main enters the warehouse at the opposite end. Can the building steel be used as a raceway and bond the two water lines?

41. The engineer requested a disconnecting means within sight of a school dishwasher. The code now requires marking on the disconnect that gives the identification of the circuit source. Let's say the dishwasher branch circuit overcurrent device is located in Panel LPA. Am I also required to provide information denoting where panel LPA is located in the building?

42. I have a 70-amp branch circuit serving a motor. The branch circuit conductors are 10 AWG copper. Table 250.122 of the NEC requires a minimum of an 8 AWG copper equipment grounding conductor. Why is the equipment grounding conductor required to be larger than the ungrounded conductors?

43. Are loads supplied by a micro grid interconnect device (MID), required to meet the requirements of 702.4(B) (2) or 710.15(A)?

44. I wired up a 112.5 KVA 3-phase transformer. The primary voltage is 480. The derived secondary voltage is 120/208. My derived secondary conductors are 500 KCMIL THHN copper. They terminate directly to a 400-amp main breaker panelboard located adjacent to the transformer. My inspector "red tagged" it and said my 500 KCMIL conductors are undersized. 500 KCMIL copper conductors have an ampacity of 380 and we know that 380 is not a standard size OCP device. 240.4(B) allows me to round up. I used to do this all the time. What happened? If he is correct, what are my options for a code compliance job?

45. Are EMT set-screw connectors allowed in a commercial parking garage?

46. A 480/277 volt service is installed to supply only 3-phase utilization equipment and motor loads, is a grounded (Neutral) conductor required at the service?

47. Section 700.10 requires that exposed raceways or cables containing emergency circuits be labeled every 25' if no boxes are encountered. Are these wiring methods located above an accessible ceiling considered exposed?

48. Are SO type cables allowed as a means for permanent wiring in a grocery store from the ceiling structure to permanently mounted display cases?

49. I have an installation that requires flexible cords to be sleeved in a raceway for protection from physical damage. Is there a maximum length required for this application and should a reduction in conductor ampacity be considered?

50. If a critical circuit in a hospital patient room is installed in the same switch box as a normal circuit, each entering in a separate raceway, and a divider is installed between them, is this a code violation?

51. 210.65 of the NEC states that the required number of receptacle outlets for a meeting room shall be determined in accordance with 210.52(A) (1) through (A) (4). If it is determined that 10 receptacle outlets are required, can I install 5 boxes with each having a duplex receptacle in them to meet this requirement?

52. I have a motor that is within 30 ft of a MCC that controls it, and there is a glass partition in front of the MCC. Does this meet the disconnecting means required by the NEC? The MCC is clearly visible from the motor through the glass.

53. I have installed a 60 amp 208 volt circuit to serve a dishwasher in an elementary school. Is GFCI protection required for this appliance? My supply house has never seen a 3 pole GFCI circuit breaker.

54. Is a building used to store tractors, implements and tools on a farm considered an agricultural building?

55. I recently failed an inspection for not having an individual circuit for the receptacle outlets required per 210.52(E) at a one-family dwelling, is this really a thing or is the inspector sniffing glue?

56. I am a PV installer who recently failed an inspection because my insulation piercing type wire connectors utilized for a supply side type connection were not marked as suitable for use as service equipment. Please help me, I'm so lost, where is this in the NEC?

57. Do EVSE loads need to be included for service calculations where an automatic load management system can remove the EVSE load anytime the total monitored current on the service conductors exceeds their ampacity?

58. A pool has concrete installed around it. The contractor has the ability to install either rebar, metal wire mesh, or a #8AWG solid copper conductor within the concrete but chooses to install the #8 AWG conductor 6" in the subgrade? Doesn't this reduce the protection of the equipotential plan around the pool?

59. I'm installing a swimming pool panel remote from the main building. Instead of GFCI protecting each individual branch circuit for the motors, may I install a Class A GFCI breaker to protect the feeder, instead of each individual branch circuit?

60. I'm installing receptacles for a large island, how should I space the required receptacle outlets around the island? Follow up; where two duplex receptacles are installed in a two gang box, would this be considered four receptacle outlets?

61. Where installed in metal wireways or gutters, why are there specific requirements to consider when installing single cables for each phase, neutral, or grounded conductor of an AC system? Why are there no considerations for DC systems?

62. A residential generator that comes from the factory with a 100-amp breaker can you feed to the transfer switch with #2 aluminum?

63. I have installed a PV system on the roof of a dwelling unit and the system utilizes microinverters. I have installed “WARNING PHOTOVOLTAIC POWER SOURCE” labels on the raceways. Is this a violation?

64. Is there any language in the NEC that requires the metal raceways containing line-side tap conductors of a PV system to be bonded the same as a service?

65. What is the maximum rating in amperes under all load conditions for power supply output circuits of Low Voltage Lighting systems operating at no more than 30volts ac or 60volts dc?

66. Is there a NEC Section in chapter three that requires wiring methods installed in corrosive environments to be suitable for the environment?

67. I recently failed an inspection for using wire nuts to terminate SO cable and THWN conductors supplying a grocery store display case. The Inspector stated the connectors used were not listed for Type K fine strand. Where is this stated in the code?

68. I will be wiring a small garage performing minor repair. Is the office area adjacent required to be a classified location and what code sections would I find classification information?

69. Where live parts are not accessible, what is the maximum permitted voltage DC between conductors or to ground for an ESS installed in a one and two-family dwelling?
    The generator I ordered came from the factory with a 125-amp circuit breaker. My calculated load is only 91 amps. Am I permitted to use #2 THWN copper conductors (rated at 115 amps) or am I required to use conductors rated at least 125 amp?

70. A new subdivision is built, and the local power company has not been able to install the electrical infrastructure to keep up. There is a model home that the builder wants to use to show potential buyers around and use as their office, and a generator is installed as the only power to the structure at this time. Is this considered an optional standby system, a legally required standby system, or something else?

71. Is it permitted to supply a fire alarm system branch circuit through a GFCI or AFCI circuit breaker? Is it permitted to supply smoke and CO detection devices from a GFCI or AFCI circuit breaker?

72. What are the minimum intervals for conductor and cable AWG markings along the insulation or outer covering?

73. Can a type one cabinet be used for a panelboard in a pool pump room if ventilation is provided?

74. Will the installation of Meter Collar Adapters used with parallel power production sources be defined as “Supply Side Equipment” per NEC section 230.82 and installed per NEC section 705.12?

75. Due to supply shortages in the industry is it acceptable to use different lugs or connectors to terminate parallel conductors of each phase, polarity, neutral, grounded circuit conductor, equipment grounding conductor, or equipment bonding jumper?

76. Is the equipment grounding conductor of a non-separately derived portable type generator required to be bonded to the system grounding electrode, where installed to provide power to optional standby system loads?

77. Does the NEC permit multiple lay in luminaires to be interconnected with the manufacturer fixture whips? This particular installation has 4 luminaires “daisy chained” with 18 AWG fixture wire via a luminaire multi-port quick disconnect. The quick disconnect is suitable for use with 18 AWG conductors and has a 600-volt, 6-ampere rating, and the total current of four luminaires is .8 amperes.

78. Is a separately derived system grounded conductor permitted to also be the supply side bonding conductor where the system bonding jumper is installed at the first disconnecting means and not the source enclosure? Follow up question; if metallic raceways are utilized between the source and first disconnecting means metallic enclosures, could this be considered a path for objectionable current?

79. Does the NEC require lighting and panic hardware for rooms containing Energy Storage systems?

80. What are the primary differences between Class C, D, & E SPGFCI’s?

81. I have installed a self-contained spa for aboveground use; the top rim of the hot tub is 1’ above an adjacent concrete patio. The inspector has failed me for never having a perimeter surface bonding inspection per 680.26(B)(2) for the adjacent concrete patio. What gives, is this really necessary for a self-contained spa?

82. Do floor box type receptacle outlets require special covers, or can I just simply install a wet location gasket type cover and call it good? This would prevent any possible moisture, and dirt intrusion, wouldn’t any AHJ of sane mind agree?

83. Where energy storage systems can function in parallel with a utility and also supply power to a building while being isolated from the utility through transfer equipment, should I the AHJ be utilizing NEC Articles 702 or 710? Follow up; if I only have multiple sources that can operate in parallel supplying stand-alone loads via a stand-alone hybrid type inverter, (there is no service for this building), which NEC Articles would need to be applied to the installation, 702 or 710?

84. Does the NEC require unused or abandoned cabling with high flame spread, or smoke development index numbers such as NM cable to be removed, or identified for future use?

85. It is common practice for PV installers to replace the main service circuit breaker with a breaker with a smaller ampere rating, allowing more power source current to be interconnected to the bus bar. There are no labeling requirements for installations like this, why? Another electrician can unknowingly replace the main with a larger size creating an overload hazard for the bus bar. Have there been any public inputs in the past in regards to this?

Class 4 power systems
This session will help the attendee understand the proper installation and application of class 4 power systems. This new technology is entering the electrical industry with associated product standards being developed and installation requirements being developed to ensure the safe installation of these solutions. The student will understand what this technology is
Instructors: Kyle Krueger & Don Iverson

Electric Vehicles Installations
This session will help the attendee understand the installation requirements for electric vehicle transfer systems to ensure safety and proper application. The attendee will understand the installation codes and product standards for the technologies for electric vehicles. Infrastructure load calculations will be discussed to understand how to leverage load management and energy management technologies for efficient power distribution systems. The student will understand the items related to interfacing the EVSE equipment with existing and new power distribution systems for residential, commercial and industrial applications.
Instructors: Brian Baughman

Mobile Data Centers
This session will help the attendee understand the complicated systems associated with mobile data centers. Mobile data centers are seen across the country and can present unique applications for the installer, maintainer and inspector. The student will gain an understanding of the installation requirements and product standards to ensure proper installation of equipment for these applications.
Instructors: Tom Lichtenstein

PV, ESS, Generator Applications
This session will review common configurations seen in residential and commercial applications that seek to integrate Photovoltaic, energy storage systems and generator equipment into the power system. The attendee will understand all of the components associated with these applications as well as the proper way they must be connected to perform their functions safely. The applicable installation requirements of the national Electrical Code and UL standards will be reviewed. The attendee will understand details of installation requirements for load and line side of the service connection for this equipment.
Instructors: Gerry O'Connor

Reconditioned Equipment Panel
This session will be a panel of experts including manufacture, national recognized testing laboratory, and inspector to discuss the challenges and solution for reconditioned equipment. The panel will take questions from the audience and entertain a structured discussion around what can and cannot be reconditioned, the difference between reconditioning and maintaining, and NEC requirements over the last few code cycles that seek to address the use of reconditioned equipment.

NEC CC Report

This session will review the activities of the correlating committee including the future of a restructured NEC. The correlating committee activities help the attendee understand not only the process of development of the NEC but also information on why changes occur to help reinforce for the user of the NEC reasons why requirements are included in the NEC.
Instructors: Larry Ayer

Case Study
This session will review a real world case study through the eyes of an electrical inspector. The objective of this session is to help the attendees understand how common problems / situations can be navigated to success. The attendees will gain skills in their day to day experience of working with the NEC and other installation requirement codes and standards to ensure the proper installation of equipment for safe and functional power distribution systems. The skills learned during this session will be important for the attendees in their day to day application of electrical safety, codes, and standards in the industry.
Instructors: David Williams / Dean Hunter

NEC 1&2 Family Sig Changes
This One- and Two-Family Dwelling Electrical Systems session is for those involved in design, installation, or inspection of electrical systems in new and existing dwellings. This session covers the subject of residential electrical construction in detail and provides information relative to application of not only the National Electrical Code, but also Part VIII of the International Residential Code.
Instructors: Tim McClintock / Vince Della Croche

NEC Resi Services
This session will review details associated with proper residential services that meet requirements of the NEC and use equipment per their installations instructions and listing requirements. The attendee will understand the details of grounding and bonding, equipment ratings, available fault current, Short-circuit current ratings, interrupting ratings and more.
Instructors: Ryan Jackson

Article 512 Cannabis
This session will help the attendee understand installation requirements of grow facilities. The attendee will understand the unique characteristics of grow facilities that make them unique applications for which proper installation requirements of the National Electrical Code must be followed. The attendee will understand elements of hazardous locations and load characteristics unique to these applications.

Instructors: Chris Papp Tom Blevins

File Attachments for Item:

EC-1 2021 IEBC Essentials (International Code Council)

All certifications (6 hours)

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 Flossmoor Road

City *: Country Club Hills

State *: Illinois

Zip Code *: 60478

Website: iccsafe.org

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: 2021 IEBC Essentials

Course instructor: Jerry Flanik

Course description:

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.

Instructional hours per session: 6

Number of Sessions:

Course Date: 2023-08-17

Course Location: Cincinnati, OH

Special Content

- ☐ Code Administration
- ☑ Existing Buildings
- ☐ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☐ No

☐ On Demand ☐ Webinar

Course Website:

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- [ ] Residential Certifications Only
- [x] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [ ] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
2021 IEBC Essentials (1).pdf	1.05 MB

Applicant Full Name *

Laura Morris

Date of Submission

07/20/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

1

Introductions

- Instructor
- Participants

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Description

- Discusses the development history of the IEBC
- Discusses critical concepts of the 2021 International Existing Building Code® (IEBC ®).
- Provides a basis for the correct use and application of the code.
- Builds an understanding of the intent of the code through detailing:
  - Basic tables
  - Categorizations
  - Case study
  - Real world applications

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Goal

- To identify and describe key provisions of the 2021 IEBC.
- To assure an understanding of the intent of these key provisions of the 2021 IEBC.

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Objectives

Upon completion, participants will be better able to:

- Recognize the limitations and extent of the codes related to existing buildings.
- Recognize how the IEBC offers alternatives and incentives to building owners to maintain their buildings and to continue to initiate upgrades towards compliance with more contemporary editions of the codes.
- Identify the three different compliance methods offered by the IEBC.
- Recognize the classifications of work associated with existing buildings.
- Identify fire protection systems that need to be upgraded.
- Recognize vertical openings that need partial or complete enclosure.

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Objectives, Cont.

Upon completion, participants will be better able to:

- Identify unsafe interior finishes that need to be replaced.
- Determine adequate means of egress.
- Identify needed accessibility improvements.
- Identify improvements to structural systems.
- Describe the compliance alternative tabular method of evaluating existing buildings.
- Identify thresholds that trigger additional requirements for the existing building

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Part I

Code Administration and Enforcement

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Part 1

- Chapter 1 – Introduction to Building Codes
- Chapter 2 – Legal Aspects, Permits, and Inspections
- Chapter 3 – History of Rehabilitation Codes

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Chapter 1 – Introduction to Building Codes

- History of the Codes
- Code Development
- Construction Codes
- Existing Building
- Using the IEBC

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History of the Codes

- 1760 BC - First Known Building Code, “Code of Hammurabi” – six rules
  - Payment – two shekels for each SAR built
  - Poor Quality of Construction, i.e., work is not sound and has fallen:
    - If owner is killed, builder put to death;
    - If owner’s son is killed, builder’s son put to death;
    - If slave of the owner is killed, builder shall give slave for slave;
    - If caused the loss of goods, builder shall render back what was destroyed and shall re-build the house at at his own cost.
    - If builder has not keyed his work, and wall has fallen, builder shall make wall firm at his own expense.

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History of Codes

- One of the first modern building codes – “The Building Code”, recommended by the National Board of Fire Underwriters
  - Provided uniform language from respected organization
  - Provided a “Model Code” that could be adopted without having to write a “home grown” code
- Starting in 1920’s, several organizations started to develop model codes
- By the end of twentieth century there were three model code groups, each with their family of codes: BOCA, ICBO, SBCCI

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History of Codes

- BOCA, ICBO and SBCCI agreed to develop one model code for the U.S.
  - The first International Building Code was published in 2000
  - The three model code organizations consolidated, creating the International Code Council in 2002.
  - The ”I” Codes are used in every state in the U.S. and many countries.

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Code Development

- The family of "I" Codes is revised, updated and new editions published every three years:
  - To keep updated with construction technology, methods, materials, equipment and processes that are constantly evolving
  - Revised through an open "Governmental Consensus Process" which provides for:
    - Openness
    - Transparency
    - Balance of Interests
    - Due Process
    - Appeals Process
    - Consensus

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Code Development

The ICC Code Development Process:

- Committees Created – CSC recommend to ICC Board
- Code Change Submission and Review – Anyone can submit
- Committee Action Hearings (CAH) – approve, approve/mod, or disapprove
- Public Comment Submission and Review – Anyone can submit a public comment on the results of the CAH.
- Public Comments Hearings (PCH) – Eligible voters discuss and vote on code change proposals. Only Government officials can vote.
- Online Governmental Consensus Vote – Only eligible voters - Validation Committee reviews and ICC Board confirms
- Appeals
- New Edition Published

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Construction Codes

The International Building Code

- Applies to the construction, alteration, movement enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building, or structure, or appurtenances connected to such buildings or structures. Section 101.2 Scope
- Establishes the minimum requirements to provide for safety, public health and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire, explosion and other hazards attributed to the built environment. Section 101.3 Intent

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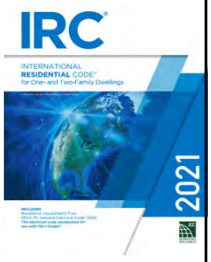
Construction Codes

International Residential Code

- Designed to be a completely stand-alone code including building, m.e.p's, fuel gas, and energy.
- Scope and Intent is similar to the IBC but applies only to one and two family dwellings and townhouses:
  - not more than three stories above grade plane in height, and;
  - with a separate means of egress and;
  - their accessory structures not more than three stories above grade plane in height.
  - Group I-1(custodial care), I-2(medical care), E, ≤5 occupants classified as R-3 with Fire Suppression.



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Construction Codes

The International Fire Code

- Developed to provide for a reasonable level of life safety and property protection from the hazards of fire, explosion, or dangerous conditions in new and existing buildings and construction
- It also provides regulations for the safety of firefighters and emergency responders.

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Construction Codes

- **The International Plumbing Code** – provides regulations for the design, installation, alteration and maintenance of plumbing systems. It governs materials, sizing and installation of potable water systems and d.w.v. systems.
- **The International Mechanical Code** – provides regulations for the design, installation, alteration and maintenance of mechanical systems. It covers all H.V.A.C systems installed in buildings.
- **The International Fuel Gas Code** – Is intended to be a companion code to the IMC specifically for fuel gas systems and appliances. It regulates the design, installation, alteration and maintenance of appliance utilizing natural gas, gaseous hydrogen systems and related accessories
- **The International Swimming Pool and Spa Code** – provides regulations for the design, installation of aquatic recreation facilities, swimming pools and spas that are either permanent or temporary and include those connected to a circulation system, **intended** for swimming, bathing, or wading.

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Construction Codes (Environmental)

The International Energy Conservation Code

- Has been developed to regulate the energy use in all buildings that are heated or cooled.

The International Green Construction Code

- Is considered to be an "above code" code intended to safeguard the environment, public health, safety and general welfare through regulations that reduce the negative impact on the natural environment and building occupants

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Maintenance Codes

The International Property Maintenance Code

- This code is intended solely for the purpose of providing regulations for the maintenance of existing buildings. It provides minimum requirements for and standards for premises, structures, equipment and facilities for light, ventilation, space, heating, sanitation, protection from elements, life safety and safety from fire and other hazards and for safe and sanitary maintenance.

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Introduction to the IEBC

- Each of the legacy building codes had a separate chapter that dealt with existing buildings
- In 2003, the International Existing Building Code (IEBC) was introduced as a member of the ICC family of Codes
- At the time, existing buildings included in scope of both codes

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Introduction to the IEBC

- Intent to have a comprehensive set of regulations for existing buildings consistent with and inclusive of the scope of the existing legacy codes.
- Technical content from the legacy codes, as well as other rehabilitation codes, was used as the basis for the development

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Introduction to Existing Building Codes

- The IEBC is founded on the following principles"
  - To encourage the use and reuse of existing buildings that adequately protect public health, safety and welfare;
  - Do not unnecessarily increase construction costs;
  - Do not restrict the use of new materials, products, or methods of new construction;
  - Do not give preferential treatment to particular types of classes of materials, products or methods of construction

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Introduction to the IEBC

- Is a regulatory model code in the family of I-Codes, which is maintained and promulgated by the International Code Council® (ICC®).
- This code, as well as the rest of the family of I-Codes, was developed and is maintained using ICC's Governmental Consensus Process that allows all interested parties to participate in the ongoing process to enhance and maintain the document.

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Introduction to Existing Building Codes

- The Legacy Codes each had a single chapter dealing with existing buildings
- The International Existing Building Code was introduced into the ICC family of codes in 2003
- Technical content of legacy codes promulgated by BOCA, ICBO, and SBCCI, as well as other rehab codes, was utilized as the basis for the development

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Using the IEBC

- Most Existing Buildings do not comply with the most currently published codes for new construction
- The IEBC is intended as an alternative approach to repairs, alterations, additions and changes in occupancy to existing buildings.
- To expect compliance with the codes for new construction is unreasonable from both a physical perspective and is cost prohibitive.

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Introduction to Existing Building Codes

- ***"If a building was code compliant when initially constructed, received an occupancy permit or was legally approved and has been properly maintained, it does not become non-compliant or unsafe just because an alteration, an addition, a change of occupancy, or a repair is being initiated."***

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Using the IEBC

- Regulating construction within existing buildings presents opportunities to ensure that new construction complies with currently adopted building codes and:
- At a minimum, the current level of compliance is maintained or are improved, incrementally, to meet basic safety levels
- To accomplish this, the IEBC allows for options for controlled departure from full compliance with the "I" Codes for new construction

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Using the IEBC

- The Code provides for three main options for the owner/designer when dealing with alterations of existing buildings:
  - Option #1 – Prescriptive Compliance Method – Chapter 5 – This was formerly Chapter 34 of the IBC (2012 and earlier editions)
  - Option #2 – Work Area Compliance Method – Chapters 6-12
  - Option #3 – Performance Compliance Method – Chapter 13 – Was a provided in former chapter 34 of the IBC (2012 and earlier editions)
- Section 301 provides a summary of these options and will be discussed in more detail later in the presentation.

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Using the IEBC

Section 301.3 Exception

- Allows alterations to be done under the code adopted at the time of the original construction of the building or portion of the building
  - New Structural members must comply with IBC
  - Does not apply to alterations that constitute substantial improvement in flood hazard areas
  - Does not apply to structural alterations in the Prescriptive Compliance Method or the Work Area Compliance Method.

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Arrangement and Format

Chapters	Subjects
1-2	Administrative Requirements and Definitions
3	Provisions for all Compliance Methods
4	Repairs
5	Prescriptive Compliance Method for Existing Buildings
6-12	Work Area Compliance Method for Existing Buildings
13	Performance Compliance Method for Existing Buildings
14	Relocated Buildings
15	Construction Safeguards
16	Referenced Standards
Appendix A	Guidelines for Seismic Retrofit of Existing Buildings
Appendix B	Supplementary Accessibility Requirements for Existing Buildings
Appendix C	Guidelines for Wind Retrofit of Existing Buildings
Appendix D	Board of Appeals
Resource A	Guidelines on Fire Ratings of Archaic Materials and Assemblies

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Chapter 2 – Legal Aspects, Permits, and Inspections

- Code Adoption
- Authority
- Permits – Submittal and Plan Review
- Inspections
- Board of Appeals

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Code Adoption

Adoption

- The IEBC is a “model” code
  - Can be adopted by a governmental agency and become law
  - Adopted by federal, state and local government agencies
  - Adopted through legislation or delegate to a board or state agency
  - Adopting legislation or ordinance is required to go through a public hearing process
  - Most if not all jurisdictions develop amendments to the code

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Code Adoption

- A sample adoption ordinance is included in the front of the 2021 IEBC.
- The jurisdiction must adopt a specific edition of the code.
- Any appendix must specifically be adopted.
- The code official is responsible for assuring substantial compliance with the adopted code and any state laws dealing with construction issues.

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Code Adoption

- U.S. Constitution creates:
  - States that have constitutions that create:
  - Legislatures that pass laws signed by the governor that create:
  - Local governments that pass ordinances
- The Tenth Amendment to the U.S. Constitution.
  - States are granted authority to adopt laws to protect health, safety, morals and general welfare of its citizens. These are known as our ***"Police Powers"***

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Standards Used in the IEBC

- The Family of International Codes references over 1400 Standards
- Standards developed by other agencies other than ICC
- Since standards are referenced by the code, once the code is adopted, the standards are part of the code as identified in Section 102.4
- What is the difference between a code and a standard?

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Standards used by the IEBC

- The IEBC References approximately 30 separate standards and are contained in Chapter 16
  - Includes Section numbers where the specific standard is referenced
- Where there are conflicts between the code and standard, the code applies in accordance with Section 102.4.1

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Standards used by the IEBC

NOTE

- Use Referenced standard example and graphic used in IBC Essentials book, page16

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Authority

- When IEBC is adopted through a governance process:
  - It becomes a law
  - Like any other law, the building code needs to be enforced
- The IEBC establishes the Department:
  - Section 103.1 – Department of Building Safety is established
    - Section 103.2 - Code official is appointed – executive official in charge of department and enforcement
    - Section 103.3 - Can appoint deputy, plans examiners, inspectors, permit techs, etc.

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Authority

- Section 104 – Duties and Powers of Code Official is established – Directed to Enforce the provisions of the code which includes:

  Section 104.1 – To interpret, adopt policies and procedures
  - Must be in compliance with the "intent" and "purpose" of the code
  - Cannot waive requirements

  Section 104.2 – Receive applications, review construction documents and issue permits, conduct inspections to determine and assure compliance.

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Duties and Powers of Code Official—Section 104

Section 104.2.2 – Preliminary meeting

- This section mandates that the code official and permit applicant meet if one or the other requests such a meeting, and the work is not a repair or Level 1 alteration.

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Authority

- **Section 104.10 -** Instances when there are practical difficulties with complying with the code so IEBC allows for modifications
  - Based on individual cases – does not set precedent
  - Owners or authorized agents must apply for modification with explanation of practical difficulty
  - Must provide information as to how their modification is in compliance and intent of the code.
  - Modification does not lessen health, accessibility, life and fire safety or structural safety
  - The Code Official must review and decide if modification is granted

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Authority

- **Section 104.11-**Alternate materials and methods of construction
- The IEBC is not intended to prohibit any type of material or design
- Responsibility to approve is with the Code Official
  - Must comply with the purpose and intent of code
  - Must be determined to be equivalent to the code in quality, strength, effectiveness, fire resistance, durability, and safety.
  - Accomplished by reviewing testing information and research reports
  - ICC Evaluation Services

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Permits

Section 105 – Permits

- A building permit must be obtained when a property owner wants to repair, make alterations relocate, build an addition to, demolish or change the occupancy of any building.
- Further, to repair, install, add, alter, remove, convert, or replace any electrical, gas, mechanical, or plumbing system, which is regulated by the IEBC, an application for a permit must be obtained.

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Permits

- The Application for a permit initiates the process for code compliance:
  - Application is made Section 105.3
  - Plan review is initiated Section 106.3
  - Permit is issued
  - Inspections are scheduled Section 109
  - Certificate of Occupancy is issued Section 110

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Permits

- The Building Permit:
  - Is the legal license to initiate construction
  - Ensures the work is completed properly and to the requirements of the code, which,
  - Ensures the safety of the occupants of the building
  - Work executed and completed without a permit jeopardizes the safety of the occupants of the building
  - Working without the proper permits may subject individuals to criminal prosecution and the work to be corrected or removed
  - Section 105.2 – The code exempts small projects and minor maintenance from obtaining a permit.

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Permits

- Submittal Requirements
  - Must include the application, set of construction documents and specifications.
  - Construction documents and specifications must show how the project will comply with the applicable portions of the codes
  - Section 106.1 Requires two or more sets of construction documents, must be sealed by licensed design professional and, at a minimum, must show:
    - Fire Protection Systems
    - Exterior Wall Envelope
    - walking surfaces
    - Site Plan
    - Means of Egress
    - Exterior Balconies and elevated
  - Construction documents can be submitted in digital format

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Permits

Plan Review

- **Section 106.3** – The Code requires plans be reviewed for compliance with the code and in with applicable laws of the jurisdiction.
- **Section 106.2.1** – The plans must show the designated ”work areas”.
- If discrepancies are found during the review, a report is generated and provided to the applicant; corrections are made and plans resubmitted
- If changes are made after the permit is issued, revisions must be submitted for approval.

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Inspections

- Once the permit is issued, the work is required to be inspected for compliance with the IEBC in accordance with Section 109.
- **Section 109.3 -** The Code requires the following specific inspections in accordance with Sections 109.3.1 – 109.3.10:
  - Footing and/or foundations
  - Concrete Slab or under floor resistant
  - Lowest Floor elevation
  - Frame
  - Lath or gypsum
  - Weather-exposed balconies
  - Fire and smoke-penetrations
  - Special Inspections
  - Final Inspections

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Inspections

Section 109.3.10 – Flood Hazard Documentation

- Documentation of flood elevation of lowest floor to be submitted to code official
- Per IBC or IRC
- Prior to final inspection

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Inspections

Section 109.4 – Third party inspections.

- The Code Official can accept such inspections provided the agency conducting the inspections satisfies the qualifications and reliability requirements.

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Certificate of Occupancy

- In whole or in part
- Do not give authority to violate or cancel code or ordinances
- Not required for work exempt from permits
- Certificate must contain 12 specific items

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Board of Appeals

- **Section 112**
  - Code Official is responsible for interpreting the code and as such are subject to challenge
  - A hearing can be requested
  - The Board of Appeals is usually made up of professionals in the construction industry and appointed by the local authority and is a quasi-judicial entity
  - Shall render all decisions and findings in writing to the appellant
  - The Board can hear:
    - An Appeal – disagreement on code interpretation
    - A variance – An alternative as been advanced and the code official has denied it
    - The Code Does not apply

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Definitions

- Chapter 2 of the IEBC Contains all definitions
- Defined terms are italicized in the text of the code

New or Amended Definitions
- Change of Occupancy
- Change of Use
- Dangerous
- Emergency Escape and Rescue Opening
- Exterior Wall
- Exterior Wall Envelope

Other Definitions
- Existing Building
- Historic Building
- Roof Replacement
- Substantial Damage
- Substantial Improvement
- Substantial Structural Damage
- Technically Infeasible
- Work Area

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Chapter 3 – History of Rehabilitation Codes

- The origin of the IEBC started with the “Code for Rehabilitation of Existing Buildings” developed by the State of New Jersey
- Much reliance in developing the New Jersey code was placed on
  - Article 32 of the Massachusetts building code
  - The Uniform Code for Building Conservation (ICBO)
  - Chapter 34 of the BOCA National Building Code

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History of Rehabilitation Codes

In developing the code in New Jersey there was three criteria:

- Timeliness (few projects handled as special cases)
- Predictability (due process-no surprises-people need to know the law applicable to them and free of arbitrary treatment)
- Reasonableness (provide a reasonable level of safety without imposing excessive additional costs)

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History of Rehabilitation Codes

- H.U.D. publishes the Nationally Applicable Recognized Rehabilitation Provisions (NARRP) in 1997
- NARRP used by many states in the development of their rehab codes
- NARRP used as one of the source documents for the IEBC

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History of Rehabilitation Codes

- Intent is to clarify requirements when different types if work is performed
- The work is initiated voluntarily by owner and by enforcement
- Additional improvements required as work increases proportionally.
- Expanded the term ”alteration” into multiple categories

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History of Rehabilitation Codes

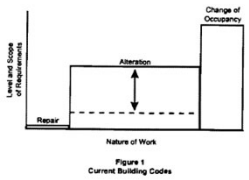

Figure 1
Current Building Codes

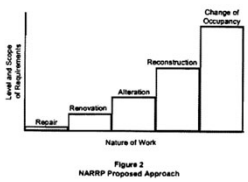

Figure 2
NARRP Proposed Approach

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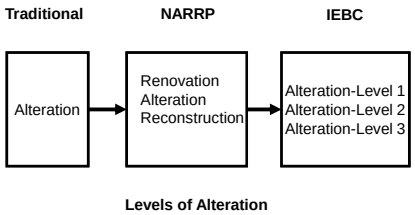
Classification of Work



Levels of Alteration

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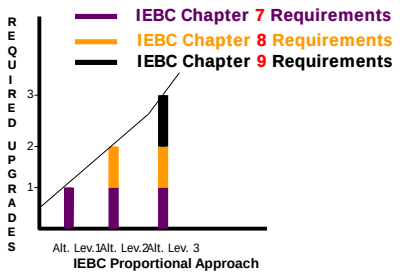
Classification of Work



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Administration

- Read the following scenarios. Determine if a permit is required or not required" box, whichever is applicable.

Scenario 1

- A technician is installing a temporary system required to service electrical equipment.

Scenario 2

- A contractor is installing a window awning supported by an exterior wall of a Group R-3 occupancy.

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Administration

Scenario 3

- A contractor is installing a driveway that is a slab-on-grade, is not over a basement or story below and is not part of an accessible route.

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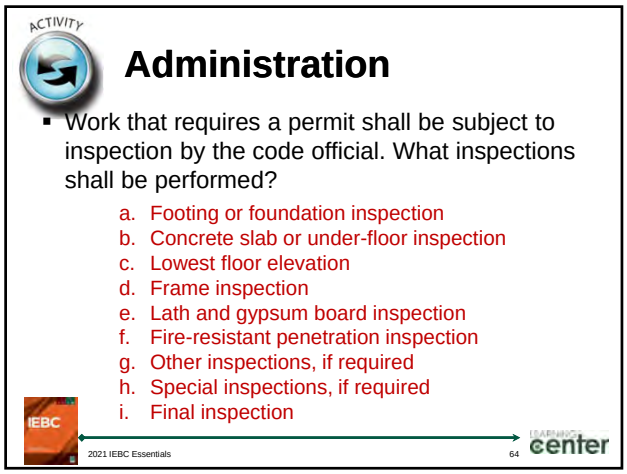

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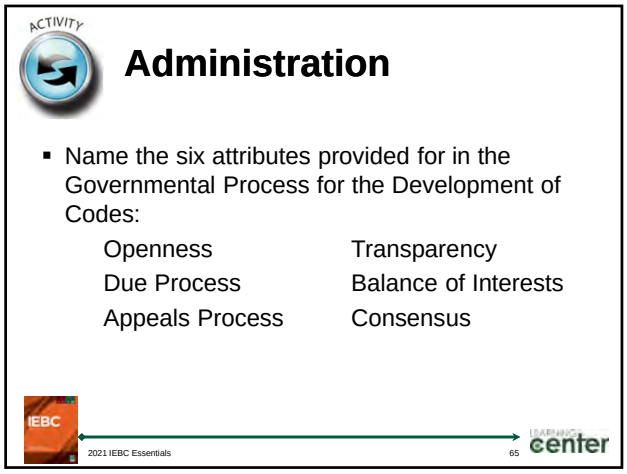

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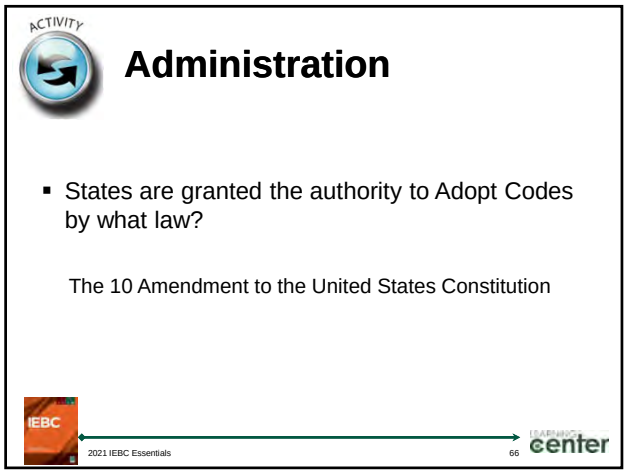

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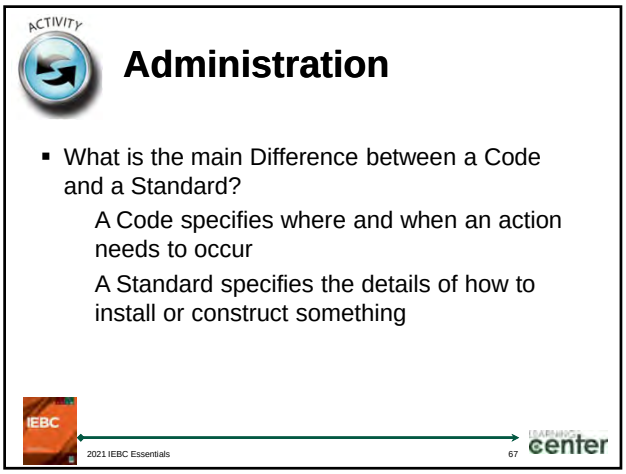

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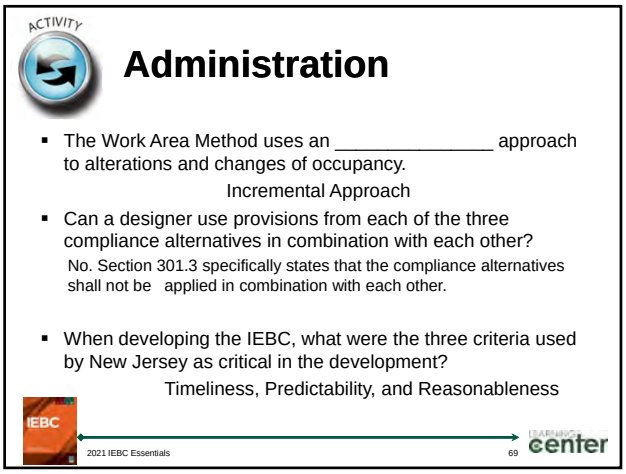

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Part Two

General

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General

- **Chapter 4 – Compliance Alternatives**
- **Chapter 5 – Essentials**

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Chapter 4 - Compliance Alternatives

- General Considerations
  - The IEBC is to be used only for buildings, or portions thereof, that have been previously used for its intended purpose – Section 104.4.1
  - A fundamental premise of the IEBC is that the building is in compliance with the IFC and the IPMC. – Section 101.7
    - Any existing violation of the IFC or IPMC should not hold up a permit being issued under the IEBC. Corrections should be handled separately

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Compliance Alternatives

- General Considerations
  - Structural Considerations are treated in more detail due to the fact that most jurisdictions do not address existing structural conditions
  - For example: Alterations Level 1 has no specific requirements for fire protection and means of egress other than maintaining the current level of safety. However, there are substantial provisions that address various structural items including re-roofing

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Compliance Alternatives

- General Considerations
  - In addition to the specific compliance options addressed in the IEBC, owners and design professionals always have the option of the using the IBC

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Compliance Alternatives

- The Code Official can allow the Building Code, in existence at the time the building, or portion thereof, was originally built, to be used to determine compliance, in accordance with the exception to Section 301.1.
  - When using the option, it needs to be determined what code, if any, was in effect at the time of the original construction
  - The building is still required to comply with the current IFC and IPMC
  - If the owner chooses to do nothing, the building is acceptable
  - Any new work must comply with the IBC
  - Like materials are permitted to be used except for those no longer permitted by the current building code

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Compliance Alternatives

- Of the five options allowed by the IEBC, the exception to Section 301.1 allowing the use of the code in effect at the time the building as constructed could be the most problematic.
  - The building would still be required to be in compliance with the current editions of the IFC or IPMC.
  - Continued use of materials not permitted by current code.
  - Be aware that Occupancy Classifications have changed with newer editions of the codes.

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Compliance Alternatives

- **Section 306.7.16 Historic Structures–** This section gives general guidance for Historic Buildings when dealing with alterations or changes of occupancy.
  - If it is determined that the proposed alteration or change in occupancy will threaten or destroy the historical significance of the facility related to accessible routes, entrances or toilet facilities, alternatives are granted.
- The IEBC contains a specific chapter (Chapter 12) that applies to Historic Buildings related to the Work Area Method.

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Compliance Alternatives

- A further option applies only to Historic Buildings
  - Chapter 12 is included in the work area compliance method
  - Additional compliance options which recognize the need to maintain the historical aspects of the building as identified in reports required by Section 1201.2

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Compliance Alternatives

- Options for the Owners and their design team
- **Section 301.3 –** of the IEBC directly allows for three options for the building owners and their designers when proposing alterations, additions, or changes of occupancy;
  - Prescriptive Compliance Method – Chapter 5
  - Work Area Compliance Method – Chapters 6-12
  - Performance Compliance Method – Chapter 13
- **Section 301.3, Exception** – Allows for a fourth option, i.e. alterations can be made under the code as adopted at the time of the building's original construction

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Compliance Alternatives

- No specific methodology for choosing compliance alternative however the following considerations may assist in choosing best approach for a given project:
- Is the building a relatively new building? If so, the Prescriptive Compliance Method may be applicable due to the requirements are based on more recent editions of the IBC/IRC
- Is the proposed work limited to specific areas in the building? If so and there are items in the building that are not in compliance with recent editions of IBC/IRC the Work Area Compliance method may be more appropriate. It more prescriptively identifies what extent the building must comply with the IBC/IRC and the extent of compliance is proportional to the work proposed.

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Compliance Alternatives

- Are there significant areas that do not comply with current building code requirements? Of the three options in the IEBC, the Performance Compliance Method may be desirable since it generally highlights more options for compliance.

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Compliance Alternatives

Section 301.3

- Clearly identifies that the applicant (owner or owner's representative) has the choice of methods: not the code official
- Prohibits the use of various methods to be used in combination with each other.

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General Provisions-Chap.3

Section 301.1.1- Bleachers, Grandstands, and folding and telescopic seating

- Must comply with ICC 300
- **Section 302.2- Additional Codes** -Alterations, repairs, additions and changes of occupancy shall comply with the IEBC or all other ICC codes respectively
- **Section 302.2.1 – Additional Codes in Health Care** – Must also comply with NFPA 99

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General Provisions-Chap.3

Section 303 – Storm Shelters

- Not triggered with a change of occupancy or alterations
- Required with an addition to E occupancies w/≥50 occupants
- In an area w/shelter design speed for tornadoes is ≥250mph
- Provisions added in the code if voluntarily constructed
- Must Comply with the ICC 500.

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Structural Provisions

- **Section 304** – Structural Conditions are evaluated where additions or alterations take place regardless of the compliance option
  - **Section 304.2** – Snow Loads in accordance with ASCE 7
  - **Section 304.3.1** – Reference is made to ASCE 7 and ASCE 41 Tier 3 where specific projects trigger compliance with full seismic forces, reference Table 303.3.1

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Structural Provisions

[BS] TABLE 304.3.1
PERFORMANCE OBJECTIVES FOR USE IN ASCE 41 FOR COMPLIANCE WITH FULL SEISMIC FORCES

RISK CATEGORY (Based on IBC Table 1604.5)	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-1N EARTHQUAKE HAZARD LEVEL	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-2N EARTHQUAKE HAZARD LEVEL
I	Life Safety (S-3)	Collapse Prevention (S-5)
II	Life Safety (S-3)	Collapse Prevention (S-5)
III	Damage Control (S-2)	Limited Safety (S-4)
IV	Immediate Occupancy (S-1)	Life Safety (S-3)

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Structural Provisions

- **Section 304.3.2** – Where reduced seismic forces are allowed, conditions must comply with:
  - 75% of IBC prescribed forces
  - IEBC Appendix A (A-1 through A-5)
  - ASCE 41, using the performance objective in Table 303.3.2 for the applicable risk category

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Structural Provisions

[BS] TABLE 304.3.2
PERFORMANCE OBJECTIVES FOR USE IN ASCE 41 FOR COMPLIANCE WITH REDUCED INTERNATIONAL BUILDING CODE-LEVEL SEISMIC FORCES

RISK CATEGORY (Based on IBC Table 1604.5)	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-1E EARTHQUAKE HAZARD LEVEL	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-2E EARTHQUAKE HAZARD LEVEL
I	Life Safety (S-3) See Note a	Collapse Prevention (S-5)
II	Life Safety (S-3) See Note a	Collapse Prevention (S-5)
III	Damage Control (S-2). See Note a	Limited Safety (S-4). See Note b
IV	Immediate Occupancy (S-1)	Life Safety (S-3). See Note c

For Risk Categories I, II and III, the Tier 1 and Tier 2 procedures need not be considered for the BSE-1E earthquake hazard level.
For Risk Category III, the Tier 1 screening checklists shall be based on the Collapse Prevention, except that checklist statements using the Quick Check provisions shall be based on MS-factors that are the average of the values for Collapse Prevention and Life Safety.
For Risk Category IV, the Tier 1 screening checklists shall be based on Collapse Prevention, except that checklist statements using the Quick Check provisions shall be based on MS-factors for Life Safety.

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Accessibility

- The various provisions for accessibility has been consolidated into Section 306.
- **Section 306.3.1** – **Prohibited reduction in accessibility** Cannot reduce the current level of accessibility in the existing building below the requirements for new construction.
- **Section 306.4** – It is not the intent of the IEBC to: require more accessibility than is required for new buildings

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Change of Occupancy

Section 306.5 Change of Occupancy – must comply with Sections 306.7. Alterations, 306.7 Alterations affecting an area containing a primary function, and scoping for alterations and must have all of the following:

- At least one accessible route and;
- At least one accessible route from building entrance to primary function areas and;
- Signage complying with Section 1111 of the IBC and;
- Accessible parking where parking is provided and;
- At least one accessible passenger loading zone, where such zones are provided and;
- At least one accessible route connecting accessible parking and accessible passenger loading zones to an accessible entrance.

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Accessibility

Section 306.6 – Additions

- An addition is a new building and must comply totally with the accessibility requirements for new buildings in accordance with the IBC.
- If an addition impacts an area of primary function to the existing building, then the primary route to that primary function must be made accessible in accordance with Section 306.7.1

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Scoping for Alterations

- **Section 306.7 Scoping for Alterations –** Identifies accessibility requirements for 15 separate elements:

Entrances
Platform Lifts
Ramps
Type A Dwelling or Sleeping Units
Jury Boxes and Witness Stands
Additional Toilet and Bathing Facilities
Fuel Dispensers
Amusement Rides
Elevators
Stairways and Escalators
Accessible Dwelling or Sleeping Units
Type B Dwelling or Sleeping Units
Toilet Rooms
Dressing, Fitting and Locker Rooms
Thresholds

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Accessibility

Section 306.7 – Alterations

- Must comply with chapter 11 of the IBC, ICC A117.1 and Sections 306.7.1 and 306.7.16 unless technically infeasible. If determined to be technically infeasible, must comply to the maximum extent that is technically feasible.

Section 306.7.1 – Primary Function must maintain a primary route.

- Exceptions:
  - The cost are not required to exceed 20% of the costs of the alterations affecting the area of primary function.
  - Alterations to windows, doors, hardware, M.E.P. systems, fire protection systems, etc.
  - Alterations undertaken for the sole purpose of increasing accessibility to the facility
  - Abatement of hazardous materials
  - Alterations undertaken for the primary purpose of increasing accessibility
  - Altered areas limited to Type B dwelling and sleeping units

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Accessibility

- **Alterations, cont.**
- **Section 306.7.2 – Accessible means of Egress** – as required by Chapter 10 of the IBC; are not required to be added in existing facilities
- **Section 306.7.3 – Alteration of Type A units –** Individually owned dwelling units in R2 occupancies are permitted to meet Type B dwelling unit provisions
- **Section 306.7.4 – Type B Units –** or sleeping units are not required in existing buildings where the work area is ≤50% of aggregate area of the building.

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Provisions for All Compliance Methods

Section 307 – Smoke Alarms – Smoke alarms are required to be provided throughout existing buildings in accordance with IFC and Section 314 of IRC, when alterations, additions, change of occupancy or a relocation are made in Group R or I-1 occupancies

Ex: Level 1 alterations

Section 308 – Carbon Monoxide Detection – Carbon Monoxide detection is required throughout existing buildings in accordance with the IFC and Section 315 of the IRC, when alterations, additions, change of occupancy or a relocation are made to Group I-1, I-2, I-4 and R occupancies and classrooms of Group E occupancies.

Ex: Work involving exterior surfaces of buildings, addition or replacement of windows or doors, or the additions of decks/porches

Ex: Installation, alterations or repairs of plumbing and mechanical systems, other than fuel-burning appliances

Ex: Level 1 alterations

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Provisions for All Compliance Methods

Additions and Replacements of Exterior Wall Coverings and Exterior Wall Envelopes – Section 309

- As part of an alteration, addition, repair, relocation of structure or changes of occupancy,
- Regardless of specific compliance method,
- Materials and methods must comply with Chapters 14 and 26 of the IBC
- Requirements are triggered exterior wall covering or exterior wall envelope being replaced or added includes ≥2 stories and >15% of total wall area on any one side

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Chapter 5 – Essentials

- Prescriptive Compliance Method
- Changes of Occupancy Classification
- Construction Safeguards

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Essentials

Prescriptive Compliance Method – Chapter 5

- Not included in original rehabilitation codes
- Was originally contained in Chapter 34 of the IBC
- ICC Board of Directors decided to delete Chapter 34
- Was retained as an optional compliance method in IEBC
- Was not coordinated with Work Area Compliance method

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Essentials

- Prescriptive Compliance Method
  - When using this method, the level of work being performed is critical when choosing this option
  - The following areas are addressed with this method
    - Additions – Section 502
    - Alterations – Section 503
    - Fire Escapes – Section 504
    - Windows and Emergency Escape Openings – Section 505
    - Changes of Occupancy – Section 506
    - Historic Buildings – Section 507

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Essentials

Prescriptive Compliance Method

Additions

- Existing Structural elements carrying gravity loads, increase in design dead, live or snow load of >5% shall comply with IBC
- Existing Structural elements carrying lateral loads- if addition is structurally independent of existing structure, structural elements can remain unaltered.
- If not, must comply with IBC

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Essentials

Additions to existing buildings

- In R or I-1 occupancies - Smoke alarms shall be provided in existing building in accordance with IFC or IRC
- In R or I-1, I-2, or I-4 occupancies – Carbon Monoxide Alarms must be provided in accordance with IFC or IRC.
- Exceptions
  - work involving exterior surfaces of the building
  - Installation, alterations or repairs to M.E.P. systems

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Essentials

- **Prescriptive Compliance Method**
  - All alterations shall comply with the IBC – Section 503.1
  - The question is to what extent does the alteration need to comply with the IBC.
  - This question can be more clearly determined if using the work area method.
  - Changes of Occupancy requirements of the IBC apply to the extent the code official determines the level of safety – Section 506.1
  - Whereas the Work Area Compliance method utilizes the concept of risk and not all changes of occupancy classification need comply with the IBC.

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Essentials

Work Area Method

- Incorporates the concept of ”work area” – reference Definition in Chapter 2
- Work area is that portion of the building which the owner desires to do the work:
  - Must be clearly identified on the construction documents
  - No requirements applied outside of work area (except for supplemental requirements for Alterations level 2 and Alterations level 3)
  - Incidental work outside work area does not trigger additional requirements but work has to comply with IBC

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Essentials

Work Area Method

Supplemental Requirements Threshold is when the work area exceeds 50% of the floor area on which alterations are being executed and include:

- Shaft and Floor Openings
- Stairway Enclosures
- Interior Finish
- Fire Alarm Systems
- Door Swing
- Door Closing
- Panic Hardware
- Corridor Openings
- Means of Egress lighting
- Exit Signs

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Essentials

- Changes of Occupancy Classification
- Not a new concept from the legacy codes
- What is new is the concept of determining the level of risk associated with the various occupancy classifications

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Essentials

- Chapter 10 contains three risk categories:
- **Means of Egress – (Table 1011.4)** – Relative hazard was primarily based on travel distance; further distinction between levels 3 and 4 based on certain characteristics such as density, familiarity with surroundings, being aware or asleep, age, and potential impairments
- **Heights and areas – (Table 1011.5) –** original table published in NARRP based on BOCA National Building Code for type 2A construction – Now has five hazard levels

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Essentials

- **Exterior Walls – (Table 1011.6) –** relative hazard based on the exterior wall requirements contained in Chapter 6 of the IBC
  - based on a comparable table in NARRP
  - was based on the fire resistance ratings in the BOCA National Building Code at a fire separation distance of 5 feet.

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Essentials

- Applying Chapter 10 Change of Occupancy
- Must understand the concepts of “Change of Use” (Section 1001.2.1) vs. ”Change of Occupancy Classification” (Section 1001.2.2)

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Essentials

- Construction Safeguards
- Regulated by both IBC and IFC
- The IEBC contains same requirements as the IBC
- Construction safeguards during rehab projects are more complex due to the fact that portions of the building are occupied.

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General

When using the exception to Section 301.3 and alterations are being allowed under the code which was being enforced at the time of the original construction, would the alterations still have to comply with the current IFC and IPMC?

- Only those requirements of the IFC and IPMC which are retroactive such as the provisions of chapter 11 of the IFC. It needs to be understood that the exception to 301.3 states "the laws in existence" at the time the building was built which would also include any fire and property maintenance codes. The code official would still have to approve the proposal

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General

Name the options that the IEBC makes available to the designer when proposing to make alterations to a building or structure:

Prescriptive Compliance Method
Work Area Compliance Method
Performance Compliance Method
The Codes that were in use at the time the building was originally constructed if approved by the Code Official
The Codes for new construction i.e., the IBC or IRC

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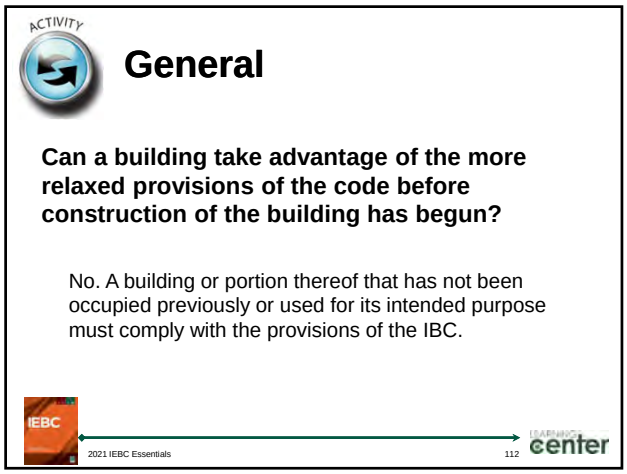

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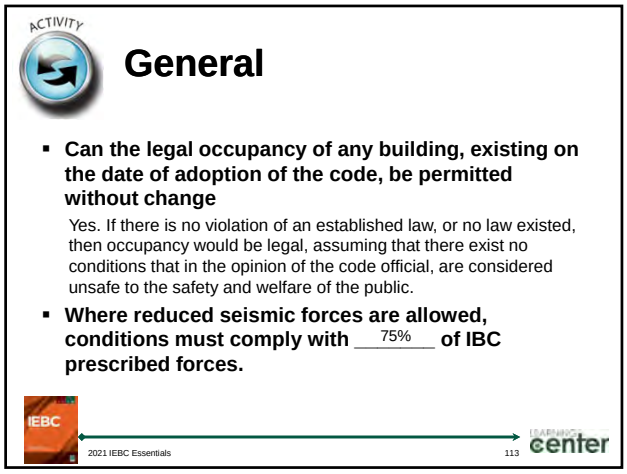

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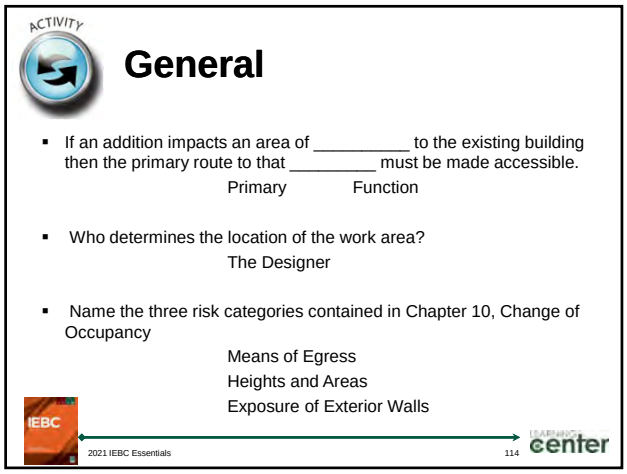

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Part IV

Compliance Methods

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Compliance Methods

General

- Previous Editions of the IEBC provided for three methods of building rehabilitation
  - Prescriptive Compliance
  - Work Area Compliance
  - Performance Compliance

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Compliance Methods

General, Cont.,

- The Prescriptive compliance method utilizes requirements of the IFC and requires all aspects of the existing building to be in full compliance with the IFC.
- It is the most conservative of the compliance methods and used by most jurisdictions prior to the publication of the IEBC
- Any new construction associated with this method must comply with the IBC/IRC

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Compliance Methods

General Cont.,

- The Performance Method:
  - Is a point-based system
  - Evaluates 21 safety parameters for equivalency to the IBC
  - Was included in Chapter 34 of the IBC
  - Was removed in the 2015 Edition of the IBC
  - Dates back to BOCA National Building Code and incorporated in the 2000 IBC when the three legacy organizations merged into ICC

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Compliance Methods

General, Cont.,

- The Work Area Compliance Method:
  - Did not exist prior to the creation of the building Rehabilitation Code
  - Follows an incremental approach to gaining compliance
  - Usually, the greater percentage of building being rehabilitated, the more requirements of the IBC that are triggered.
  - In some cases the requirements of the IBC are lessened while at the same time enhancing the safety of the existing building.

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Compliance Methods

- Repairs
- Alteration Level 1
- Alteration Level 2
- Alteration Level 3
- Change of Occupancy
- Additions
- Relocated or Moved Buildings

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Compliance Methods

General, Cont.,

- ”Work Area” is a legal term and, as such, is defined in the Chapter 2 Definitions of the IEBC.
  - “That portion or portions of a building consisting of all reconfigured spaces as indicated on the construction documents. Work area excludes other portions of the building where incidental work entailed by the intended work must be performed and portions of the building where work not initially intended by the owner is specifically required by this code. ”

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Compliance Methods

General, Cont.,

- A key word in the definition is “reconfigured”.
- Either a space, component or system is being reconfigured in order to apply the work area method.
- Any lack of clarity in defining the Work Area can have significant impacts on the level of overall compliance with new construction requirements of the IBC.

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Compliance Methods

General, Cont.,

- Accessibility requirements have now been removed from the various Work Area Level chapters and relocated to Section 305 of Chapter 3, “Provisions for All Compliance Methods”.
- The relocation makes it clear that Accessibility requirements universally apply to each of the methods of building rehabilitation.

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Repairs

- Previous editions of the IEBC included Repairs as a part of the Work Area Compliance Method.
- In the 2018 edition of the IEBC, Repairs are now an independent chapter, Chapter 4, attached to none of the compliance methods.
- Chapter 4 defines when “Repairs” can be made with like materials and methods or must comply with the IBC/IRC.

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Repairs

General

- **Section 401.2** – A guiding principle when making repairs is the work cannot make the building less compliant than it was before the repair was made.

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Repairs

- **Section 402.1 –** Replacement glazing must comply with Section 2406 of the IBC
- **Section 403.1 –** Fire Protection – repairs must be done in a manner that maintains the level of fire protection provided
- **Section 404.1 –** Repairs must maintain the level of means of egress provided by in the building.

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Repairs

- **Structural –** structural damage to a building can occur to buildings for a number of reasons, i.e., wind, earthquake, fire, flooding, falling trees, cars running into the building, etc.
- **Section 405.2.1 –** Repairs to buildings with less than substantial structural damage can restore structural elements to pre-damaged condition
- **Section 405.2.1.1 –** damage due to snow loading must be repaired in accordance with Section 1608 of the IBC

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Repairs

- **Substantial Structural Damage –** anyone of three conditions as defined in Chapter 2
- **Vertical Elements of Lateral Force Resisting System –** Section 405.2.3
  - Building in SDC D, E, or F that experience " disproportionate earthquake damage" must be evaluated by a registered design professional.
  - Buildings in SDC A, B, C or One and Two family dwellings do not require evaluation or retrofitted for load combinations that include earthquake effects

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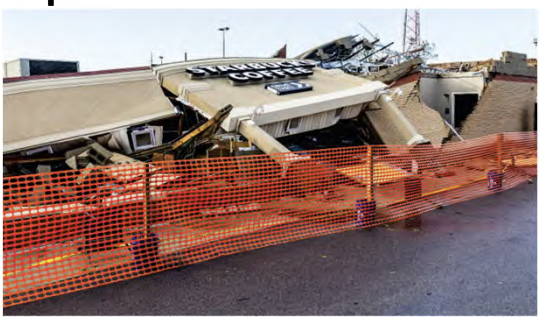
Repairs



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Repairs

- Evaluation by Design Professional determines:
- Building complied with load combinations of the IBC, damaged structural elements can be restored to pre-damaged condition, Section 405.2.3.2

- Building did not comply with the load combinations of IBC, then entire building must be retrofitted to comply, Section 405.2.3.3

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Repairs

- **Section 405.2.3.3 – Repairs for non-compliant buildings**
  - Wind loads for the repair and retrofit must comply with the building code in effect at the time of the original construction except if damage was caused by wind, then must comply with IBC
  - Seismic loads for retrofit design shall be those in effect at the time of the original construction but cannot be less than the reduced seismic forces

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Repairs

Substantial Structural Damage to Gravity Load-Carrying Components – Section 405.2.4

- Structural damage to gravity load-carrying components must be rehabilitated to comply with dead and live loads of the IBC.
- If damage caused by or related to snow load effects, snow load requirements of the IBC must be incorporated into rehabilitation
- If damage caused by wind or seismic effects, an evaluation must be executed by design professional and submitted to Code Off. Except for buildings in SDC A, B or C where damage was not caused by earthquakes – Section 405.2.4.1

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Repairs

- **Section 405.2.4.1 Lateral force-resisting system**
  - If substantial structural damage to gravity load-carrying components them building must be evaluated in accordance with Section 405.2.3.1
  - If evaluation determines non-compliance them must comply with Section 405.2.3.3

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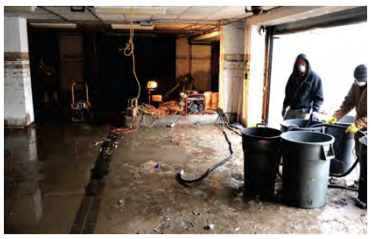
Repairs



- **Flood Hazard Areas**
  - As defined by chapter 2
- Buildings that have sustained substantial structural damage must be brought into compliance with flood loads of the IBC Section 1612.

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Repairs

- **Section 406.1 – Existing electrical wiring and equipment can be repaired or replaced with like material**
  - **Section 406.1.1 –** Receptacles shall comply with Section 406.4 (D) of NFPA 70 – indicates the various types of receptacles that must be used where mandated by the NEC
  - **Section 406.1.2 –** Plug Fuses
  - **Section 406.1.3 –** Non-grounding-type receptacles
  - **Section 406.1.4 –** Group I-2 receptacles
  - **Section 406.1.5 –** Grounding of Appliances

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Repairs

Section 407 – Mechanical

- Repairs cannot make the building less compliant
- Mechanical Draft system used with manually fire appliances and fireplaces:
  - Draft device must be listed and installed per manufacturer's instructions
  - Must provide audible and visible warning upon loss of power or failure of the system. Battery Back-up required on warning device
  - Smoke detector or smoke alarm must be installed in the room containing the appliance or fireplace and detection device must have battery backup

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Repairs

Section 408 – Plumbing

- Materials and supplies prohibited by IPC cannot be used
- Replacement water closets must have a maximum water consumption of 1.6 gallons per flushing cycle
  - Except for blow-out design water closets having a maximum water consumption of 3.5 gallons per flushing cycle

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Work Area Method

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Alterations – Level 1

- Work areas that involve removal and replacement or the covering of existing materials, elements, equipment or fixtures using new materials, elements, equipment or fixtures that serve the same purpose.
- Requirements for Level 1 Alterations are found in Chapter 7

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Alterations – Level 1

General Requirements for Level 1 Alterations

- The Guiding Principle – Work cannot make building less compliant – Section 701.2
- Differs from other levels of Alterations - only involves replacement of components
- Does not include reconfiguration of rooms or spaces
- No area limitations
- Alterations, typically, must comply with new construction requirements of IBC/IRC

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Alterations – Level 1

General Requirements, Cont.

- In flood areas, if alteration constitutes substantial improvement, all work must comply with Section 1612 if the IBC or Section R322 of IRC – Section [BS] 701.3
- **Section 701.4 – Emergency Escape and Rescue Openings (EERO),** when required:
  - Must be openable from the inside and;
  - Security features must be openable from the inside and;
  - Require no greater force or tool for normal operations and;
  - Such features shall not reduce opening dimensions of EERO

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Alterations – Level 1

Section 702 – **Building Elements and Materials**

- Newly installed interior finish materials and trim must comply with Chapter 8 of IBC.
- Materials must comply with ASTM E84 or UL 723
- Three Categories
  - Class A: Flame spread index –25; Smoke Developed index of 0-450
  - Class B: Flame spread index 26-75; smoke developed index of 0-450
  - Class C: Flame spread index 76-200; smoke developed index of 0-450
-

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Alterations – Level 1

- **Foam Plastics, textiles, vinyl, HDPE, polypropylene require additional testing or have additional requirements:**
  - Some foam plastics cannot be used as an interior finish except as met additional testing of NFPA 286, FM 4880, UL 1040, tested on a foam plastic assembly
  - Some textiles can only be used where sprinkler systems are installed

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Alterations Level - 1

Floor Finishes

- Evaluated using a radiant panel in accordance with NFPA 253
- Traditional floor coverings are exempt from testing requirements
- If building has NFPA 13 or 13R sprinkler system, floor finishes with a reduced rating are approved.

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Alterations – Level 1

- **Floor finishes are categorized into three levels of radiant flux:**
  - **Class I:** Critical radiant flux of 0.45 watts/cm2 or greater – required in most Group "I" Occupancies unless suppressed.
  - **Class II:** Critical radiant flux of 0.22 watts/cm2 or greater - required in all other occupancies except for F, R-3, R-4 and U
  - **DOC FF-1** "pill test" (CPSC 16 CFR Part 1630)

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TABLE 803.11
INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY[a]

GROUP	SPRINKLERED[c]			NONSPRINKLERED		
	Interior exit stairways, interior exit ramps and exit passageways[d,e]	Corridors and enclosure for exit access stairways and exit access ramps	Rooms and enclosed spaces[f]	Interior exit stairways, interior exit ramps and exit passageways[d,e]	Corridors and enclosure for exit access stairways and exit access ramps	Rooms and enclosed spaces[f]
A-1 & A-2	B	B	C	A	A[g]	B[g]
A-3[j], A-4, A-5	B	B	C	A	A[g]	C
B, E, M, R-1	B	C	C	A	B	C
R-4	B	C	C	A	B	B
F	C	C	C	B	C	C
H	B	B	C[h]	A	A	B
I-1	B	C	C	A	B	B
I-2	B	B	B[h,i]	A	A	B
I-3	A	A[i]	C	A	A	B
I-4	B	B	B[h,i]	A	A	B
R-2	C	C	C	B	B	C
R-3	C	C	C	C	C	C
S	C	C	C	B	B	C
U	No restrictions			No restrictions		

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929m².

a. Class C interior finish materials shall be permitted for wainscoting or paneling of net more than 1,000 square feet of applied surface area in the grade lobby where applied directly to a noncombustible base or over furring strips applied to a noncombustible base and fireblocked as required by Section 803.12.1.

b. In other than Group I-3 occupancies in buildings less than three stories above grade plane, Class B interior finish for nonsprinklered buildings and Class C interior finish for sprinklered buildings shall be permitted in interior exit stairways and ramps.

c. Requirements for rooms and enclosed spaces shall be based upon spaces enclosed by partitions. Where a fire-resistance rating is required for structural elements, the enclosing partitions shall extend from the floor to the ceiling. Partitions that do not comply with this shall be considered enclosing spaces and the rooms or spaces on both sides shall be considered one. In determining the applicable requirements for rooms and enclosed spaces, the specific occupancy thereof shall be the governing factor regardless of the group classification of the building or structure.

d. Lobby areas in Group A-1, A-2 and A-3 occupancies shall not be less than Class B materials.

e. Class C interior finish materials shall be permitted in places of assembly with an occupant load of 300 persons or less.

f. For places of religious worship, wood used for ornamental purposes, trusses, paneling or chancel furnishing shall be permitted.

g. Class B material is required where the building exceeds two stories.

h. Class C interior finish materials shall be permitted in administrative spaces.

i. Class C interior finish materials shall be permitted in rooms with a capacity of four persons or less.

j. Class B materials shall be permitted as wainscoting extending not more than 48 inches above the finished floor in corridors and exit access stairways and ramps.

k. Finish materials as provided for in other sections of this code.

l. Applies when protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

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Alterations – Level 1

Glazing

- Replacement Glazing in hazardous locations – Comply with IBC Section 2406 – Section 702.6
  - Doors and sidelights
  - Guards and Railings
  - Rooms or areas with wet surfaces
  - Adjacent to stairs

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Alterations – Level 1

Replacement Windows

- **Section 702.4** – Must include opening control devices complying with ASTM F2090 where all of the following apply:
  - Window is operable, and
  - Replacement includes replacement of the sash and frame, and
  - In R-2 and R-3 occupancies, top of the sill of the window opening is <36" above the finished floor; in 1 & 2 family, sill is <24" above finished floor
  - Window will allow a 4" sphere to pass to pass through when window is in largest opened position
  - Height of top of the sill of the window opening above exterior grade immediately outside of window is >72"

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Alterations – Level 1

- **Section 702.4, Exceptions**
  - Operable windows with fall protection complying with either ASTM F2006 or ASTM F2090
- **Section 702.5 – Replacement Window EERO's**
  - In R-2, R-3, 1 & 2 family dwellings and townhouses, replacement window must be the largest standard size window that will fit within the exiting frame or rough opening
  - Replacement window is not part of a change of occupancy

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Alterations – Level 1

Section 702.6-Bars, grilles, covers or screens

- Are permitted over eero's, bulkhead enclosure or window wells serving such openings provided:

1. Minimum net clear opening complies with code in effect at time of construction and,
2. Devices must be releasable or removable from inside without use of key, tool, or force greater than needed for normal operation and,
3. Where such devices shall not reduce net clear opening of the eero and,
4. Smoke alarms are required to be installed per Section 907.2.11 of IBC

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Alterations – Level 1

Section 702.7 – **Materials and Methods**

- All new work must comply with the applicable "I" Codes related to material standards, installation details , connections, penetrations, joints and continuity
- IEBC limits level of compliance with IFGC to:
  - Chapter 3, General Requirements except 303.7 & 306
  - Chapter 4, Gas Piping, except 401.8 and 402.3
  - Chapter 5, Chimneys and Vents
  - Chapter 6 Specific Appliances

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Alterations – Level 1

- **Section 703** – **Fire Protection –** Any alterations must maintain level of protection provided
- **Section 704 – Means of Egress –** Any alterations must maintain level of protection provided for means of egress

152

Alterations - Level 1

Reroofing – Section 705

- Recovering or replacement of existing roof coverings must comply with Chapter 15 of the IBC
  - Minimum slope requirements are not required to meet the 2% slope requirement provided they have positive roof drainage
  - Existing secondary drainage and scuppers acceptable if they have been properly maintained; if replaced they must comply with Section 1502 of IBC
  - Structural roof components must be capable of supporting replacement covering system and material and equipment loads during installation

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Alterations – Level 1

- **Roof Replacement –** typically includes removal of all existing layers of coverings, exposing roof deck, except for existing ice barrier. Such ice barrier must be covered with a new ice barrier membrane
- New Roof Covering over an existing roof covering is permitted where any of the following conditions are present:
  - New covering is installed per the manufacturer's instructions, or
  - Complete and separate roofing systems designed to transmit loads directly to building's structural system, or
  - Metal panels, metal shingles, concrete and clay tile installed over existing wood shakes in accordance with 705.4, or
  - Roof protective coatings

154

Alterations – Level 1

Section 705.3.1.1 –
A roof cover is not permitted were any of the following conditions exist:

- The existing roof or covering is water soaked or deteriorated to such a point it will not function as the base for additional covering, or
- The existing roof covering is slate, clay cement, or asbestos-cement tile, or
- The existing roof has two or more layers of any type of roof covering

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Alterations – Level 1

Section 705.4 – Roof Recovering

- Where application of a new roof covering occurs over an existing wood shingle or wood shake creates a concealed combustible space:
  - Existing roof covering surface must be covered with approved noncombustible material securely fastened in place prior to application of new roof covering
  - Can be gypsum board, mineral fiber, glass fiber or similar product

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Alterations - Level 1

Structural – **Section 706**

- **Section 706.2** – Structural elements shall be replaced in accordance with IBC if any alteration increases design dead, live or snow load >5%, except:
  - Buildings of R occupancies with not more than 5 dwelling or sleeping units that complies with conventional light frame construction in accordance with IBC or IRX
  - Where increased dead load is due entirely to the addition of a second layer of roof covering weighing < 3lbs/sq.ft.

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Alterations – Level 1

Structural, Cont.

- **Section [BS] 706.3 –** Additional Requirements for reroof permits
- **Section 706.3.1 –** Additional analysis is required to evaluate unbraced parapets in SDC D, E, or F:
  - Where > 25% of roof covering is replaced and parapets are unreinforced masonry, work shall include installation of bracing
  - Reduced seismic forces are permitted

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Alterations - Level 1

- **Section [BS] 706.3.2 – Roofing materials must be replaced or strengthened in accordance with IBC where:**
  - > 50% of roofing materials are removed from the roof diaphragm, and
  - The building is located where the ultimate wind design is >115 mph, and
  - The diaphragm and building connections are not capable of resisting 75% of those wind loads

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Alterations – Level 1

Energy Conservation

- IEBC does not require entire building to comply with IECC when level 1 alterations are being conducted.
- The work associated with level 1 alterations must comply with IECC if applicable such as replacing windows or replacement of light fixtures.

Electrical

- In health care, I-2 & ambulatory care facilities; outpatient clinics;
- Electrical alterations must comply with NFPA 99 per Federal Req.

160

Alterations – Level 2

- This level alteration are work areas that involve reconfiguration of rooms or areas
- The aggregate area of work areas of level 2 alterations must be < 50% of the overall building area.
- Requirements for Alteration level 2 are found in Chapter 8 of the IEBC

161

Alterations – Level 2

General

- **Section 801.2** – Requirements of level 1 alterations are to be complied with when conducting level 2 alterations (incremental approach)
- **Section 801.1, ex.** Reconfiguration work that is solely for accessibility compliance only need comply with level 1 alterations

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Alterations – Level 2

801.3 System Installations

Requirements related to work area do not apply where alterations are solely for:

- Mechanical, electrical, fire protection systems and abatement of hazardous materials
- Windows, hardware, operating controls, electrical outlets and signs
- Alterations undertaken for the primary purpose of increasing accessibility

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Alterations - Level 2

General, Cont.

- **Section 801.4 –** The Guiding Principal for Level 2 Alterations is that new work will comply with the IBC, except:
  - Where windows are added-not required to meet light and ventilation
  - Newly installed electrical equipment shall comply with Section 807
  - Length of dead-end-corridors only required to meet Section 805.7
  - Ceiling height of newly created habitable areas and corridors can be 7'
  - Newly installed escalators in below-grade transportation stations can have a clear width of 32"
  - New Structural members and connections shall be permitted to comply with Section 302

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Alterations – Level 2

- **Section 802** – **Building** – **Elements and Materials**
- **Section 802.2.1** – **Vertical Openings**
- All existing vertical openings connecting two or more floors must be enclosed with approved assemblies of one-hour fire-resistance-rated construction and approved protected openings.
- Includes 14 exceptions:
  - When not required by IBC
  - Most exceptions for installation of fire protections systems; height and area limitations, etc.
  - One and two family dwelling and open parking garages and ramps

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Alterations – Level 2

Section 802.2.2 – Supplemental Shaft and Floor Opening Enclosure Requirements

- Work area on any building story exceeds 50 percent of that gross floor area,
- Enclosure requirements of IEBC Section 803.2 apply to all vertical openings throughout the entire floor
- Apply only to portion of vertical openings on the floor where work area is located
- Does not apply to Stairways or vertical openings in tenant spaces entirely outside the work area.

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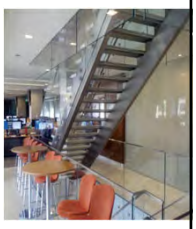
Alterations – Level 2



Section 802.2.3 – Supplemental Stairway Enclosure Requirements

- When the work area on any building story exceeds 50 percent of that gross floor area, stairways serving mean of egress for the work area must:
  - Be enclosed with smoke tight construction.
  - Must be enclosed on highest work area story and all stories below.
  - Openings must be smoke protected assemblies but not fire protection rated.
  - Such Protectives must be self closing upon activation of fire alarm system.

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Alterations – Level 2

Section 802.3 – Smoke Compartments

- I-2 Occupancies - long term health care occupancies work areas
- Work area is located on a building story used for sleeping rooms
- More than 30 patients
- Story must be divided into at least two smoke compartments
- Must be divided with smoke barriers in accordance with Section 407.5 of the IBC

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Alterations – Level

Smoke Compartments, cont.

- Area limitations
  - 22,500 gsf for Group I-2 Condition 1 (long term care)
  - 40,000 gsf for Group I-2 Condition 2 (acute care facilities)
  - 200 ft travel distance limitation to an exit access door in accordance with IBC

169

Alterations – Level 2

Section 802.4 – Interior Finish on walls and ceilings within exits and corridors in any work area must:

- Comply with interior finish requirements of the IBC.
- Materials that do not comply shall be permitted to be treated with an approved fire-retardant coating.
- Treatment must comply with the manufacturer's instructions.
- Compliance shall be demonstrated by testing the fire retardant coating on same or similar material

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Alterations – Level 2

Section 802.4.1 – **Supplemental Interior Finish Requirements**

- Aggregate of work areas on any building story >50\% of the gross floor area of that story.
- Interior finish requirements of Section 803.4 apply to all exits and corridors, throughout the entire story containing the work area.
  - Except for interior finish within occupied tenant spaces on that story that are entirely outside of the work areas.

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Alterations – Level 2

Section 802.5 – Guards

- Requirements for guards are found in Section 802.5 & 805.11 (means of egress)
- **Section 802.5.1 –** Guards shall be provided where portions of a Level 2 Alterations work area:
  - Are more than 30 inches above the floor or exterior grade, and
  - Do not have a guard, or
  - The existing guards are considered to be in danger of failure

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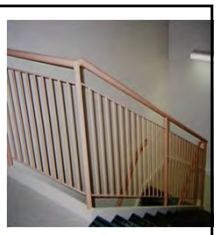
Alterations – Level 2



Guards, Cont.

- **Section 802.5.2 –** Guards must comply with the prescriptive requirements of the IBC for new guards, including height, baluster spacing and impact resistance
- **Section 805.11 – Guards –** requirements of 802.5 are extended to all means of egress paths leading from all work areas to, and including the level of exit discharge

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Alterations – Level 2

Section 802.6 – Fire Resistance Ratings

- Where a complete automatic, supervised sprinkler system installed in accordance with NFPA 13 or NFPA 13R, as applicable, has been added;
  - Where approved by the code official.
  - Required fire-resistance ratings of the existing structural elements of the building are deemed to meet the requirements of the current building code.
  - Construction documents shall be submitted to indicate which building elements and materials that the applicant wants the code official to evaluate for compliance with the fire resistance requirements of the IBC.

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Alterations – Level 2

Section 803 – **Fire Protection** – **General**

- **Section 803.2.4** – Where fire suppression systems are installed for level 2 alteration projects, they must be supervised by one of the following methods in accordance with NFPA 72:
- Approved central station, or
- Approved proprietary system, or
- Approved remote station system of the jurisdiction, or
- Approved local alarm service where approved by the code official

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Alterations – Level 2

Exceptions to Section 803.2.4

- Supervision is not required for the following systems since these systems are not required to be supervised by the IBC:
  - Underground gate valve with roadway boxes
  - Halogenated extinguishing systems
  - CO2 extinguishing systems
  - Dry and wet-chemical extinguishing system

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Alterations – Level 2

Section 803.1.1 – **Corridor Rating**

- Rating of the corridor can be reduced in accordance with IBC if an automatic fire sprinkler system is installed throughout the floor.
- Sprinkler coverage throughout the story must also extend coverage to the stairway landings at the floor and intermediate landing immediately below.

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Alterations – Level 2

Section 803.2.1 – **Automatic Sprinkler Systems in High-Rise Buildings**

- Automatic Sprinkler System shall be added where work areas:
  - Have exits or corridors shared by more than tenant
  - Having exits or corridors serving an occupant load of more than 30
  - Are located on a building story that has an adequate water supply from an existing standpipe or sprinkler riser serving that story
- **Section 803.2.1.1** – **Supplemental Requirements**
  - Work Area >50% of aggregate area of floor
  - Sprinkler protection must be provided throughout the entire story
  - Occupied Tenant Spaces outside work area are exempt

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Alterations – Level 2

Section 803.2.2 – Groups A, B, E, F-1, H, I-1, I-3, I-4, R-1, R-2, R-4 and S occupancies – Automatic Fire Sprinkler System required for Alterations level 2, where the work area:

- Includes Work areas involving exits and corridors shared by multiple tenants and having an occupant load of >30
- Work area is required to have automatic sprinkler protection where required by the IBC for new construction, and
- The work area or aggregate of the work areas exceeds 50 percent of the gross floor area of that specific story

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Alterations – Level 2

- **Exception to Section 803.2.2**
  - The building does not have adequate water supply available without the installation of a fire pump
  - If an automatic fire suppression system cannot be installed, the work area must be provided with a complete automatic smoke detection system
  - The automatic smoke detection system must be installed throughout all occupiable spaces except for sleeping units or individual dwelling units

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Alterations – Level 2

803.2.3 Group I-2

- Automatic Sprinkler system required per IFC in the following:

1. Group I-2, Condition 1, throughout work area
2. Group I-2, Condition 2, throughout work area where work area is ≤50% of smoke compartment
3. Group I-2, Condition 2, throughout smoke compartment where work occurs and work area >50% of the smoke compartment

181

Alterations – Level 2

- **Section 803.2.2.1 –** Automatic Sprinkler systems in Mixed Occupancies
- Work areas with different occupancies and one or more are required to be protected with automatic fire sprinkler system in accordance with Section 803.2.2:
  - Protection is not required throughout the work areas provided the protected occupancies are separated from the other occupancies not protected with a 1 hour fire resistance rated construction (2 hr for H occupancies)

182

Alterations – Level 2

Section 803.2.4 – Windowless stories

- Work areas in windowless stories that are required to be protected in accordance with the IBC, must be sprinklered provided the building has sufficient water supply without the installation of a fire pump.

Section 803.2.5 – Other required Automatic sprinkler systems

- Previous references to IBC table 903.2.11.6, deleted in 2018 IEBC, have been reintroduced in 2021

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Alterations – Level 2

Section 803.3 – Standpipes

- Standpipe systems are required where work areas:
  - Involve exits or corridors shared by multiple tenants
  - Are located on a building story more than 50 ft (15.24 m) above or below the lowest level of fire department vehicular access
  - The standpipe system must have hose connections from the highest story containing a work area down to the lowest level of fire department access
  - Conversely the standpipe system must have hose connections from the lowest story containing a work area up to the lowest level of fire department access where work areas are more than 50 ft. below lowest level of fire department access

184

Alterations – Level 2

Standpipe design

- Fire pump is not required provided the standpipe installed can:
  - accept the delivery by fire department apparatus of not less than 250 gpm at 65 psi to the topmost floor in buildings equipped with an automatic fire sprinkler system, or
  - Not less than 500 gpm at 65 psi to the top most floor in all other buildings
  - Interconnection of multiple risers shall not be required

185

Alterations – Level 2

Section 803.4 – Fire Alarm and Detection

- Fire alarm systems are driven by type of occupancy
- Requirements of alterations level 2 are limited to work areas but may extend beyond the work areas
- General – Smoke detectors must be used unless prohibited by their listing – boiler rooms
- Must be installed in accordance with NFPA 72

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Alterations – Level 2

Section 803.4.1 – Occupancy Requirements

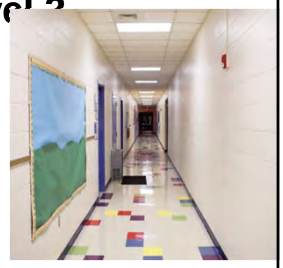
- Existing previously approved fire alarm systems are allowed to remain.
- That portion of an existing fire alarm system within the Level 2 Alterations work areas must comply with current requirements of the IBC and NFPA 72.
- Existing alarm-notification devices shall be automatically activated throughout the building
- When the existing building is not provided with a fire alarm system, but the requirements of IEBC Section 803.4.1 require occupant notification within the work area, alarm notification devices shall be provided.

187

Alterations – Level 2

Sections 803.4.1.1 – Section 803.4.1.6

- Group E, I-1, I-2, I-3, R-1, and R-2 – *"Automatic"* Fire Alarm Systems shall be installed in work areas in accordance with the International Fire Code.
- The International Fire Code contains retro active requirements of Chapter 11 of that code



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Alterations – Level 2

Section 803.4.2 – Supplemental Fire Alarm System Requirements

- When a fire alarm system is required, and
- The aggregate of Level 2 Alterations work areas on a floor exceed 50 percent of the gross area of that specific floor, then
- The fire alarm system must be provided throughout that entire story
  - Except for occupied tenant spaces located entirely outside of the work area.

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Alterations – Level 2

Section 804 – Means of Egress

- Means of egress are driven by the type of occupancy.
- These requirements are limited to Level 2 Alterations work areas that include exits or corridors shared by more than one tenant
- **Section 804.2 General**
  - IEBC allows provisions of NFPA 101 Life Safety Code as an alternative
  - Where permitted by the local code official, means of egress complying with the requirements of the building code under which the building was constructed is permitted

2021 IEBC Essentials 190

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Alterations – Level 2

804.3 Group I-2

- Corridors used for movement of care care recipients in beds, the clear width of ramps and corridors shall be ≥48 inches

2021 IEBC Essentials 191

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Alterations – Level 2

Section 804.4 – Number of Exits

- # of Exits in every story where work areas are located must comply with IBC Chapter 10:
  - Based on Occupancy, and
  - Occupant Load of that story
  - Existing conditions outside of work area can remain provided it is an existing approved condition

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Alterations – Level 2

- **Section 804.4.1.1 – Single Exit Buildings** – can be permitted spaces, any story, or any occupied roof the following exists:
  - Compliance with Tables 804.3.1.1(1) and 804.3.1.1 (2)
  - In R-1 or R-2 non-sprinklered occupancies, individual single-story dwelling or sleeping units where:
    - Occupant load is <10 and exit access travel distance within unit is <75 feet
    - The Building is not more than three stories
    - All third story space is part of dwelling unit with an exit access doorway on second story
    - The portion of the exit access travel distance from door to any habitable room within the unit to the unit entrance doors is <50'

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Alterations – Level 2

- Group R-2 Occupancy, a single exit is permitted from the basement, first or second story above grade provided every sleeping room has an EERO of:
  - At least 5 sq. ft. with
  - A minimum height of 24 inches with
  - A minimum width of 20 inches
  - A maximum sill height of 44 inches above finished floor
  - Travel distance not to exceed 50 ft.

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Alterations – Level 2

Section 804.4.1.1 – Single Exit Buildings, cont.

- R-2 occupancies of any number of stories with ≤4 dwelling units/floor
- Served by an interior stairway
- With a smokeproof enclosure or an exterior stairway as an exit in accordance with Sections 909.2 and 1023.12 of the IBC
- Where the portion of of the exit access travel distance from the dwelling unit entrance door to the exit is < 20 feet

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Alterations – Level 2

Section 804.4.1.2 – Fire Escapes

- Fire escapes are allowed for means of egress except for health care occupancies – only when two or more exits are required
- Not permitted for new construction/have not been in IBC since its creation
- Newly constructed fire escapes only allowed when an exterior stair cannot be constructed due to existing alleys, sidewalks or property lines

196

Alterations – Level 2

Section 804.4.2 – Mezzanines

- Located in work areas and having an occupant load of >50 people or where travel distance >75'
- Must have access to at least two remotely located means of egress
- Travel distance can be increased to 50' where a sprinkler system is installed per NFPA 13 or 13 R where applicable
- IEBC does not have different thresholds for different occupancies like IBC

197

Alterations – Level 2

- **Section 804.4.3 – Main Entrance – Group A occupancies**
- Assembly occupancy with >300 occupant load
- Main entrance must be capable of providing 50% of total occupant load
- If main exit is not defined, exits must be distributed around perimeter of building and must provide 100% of required total capacity

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Alterations – Level 2

Section 804.5 - Egress Doorways

- Includes requirements when two exits are required
- Limited to work areas that include exits or corridors shared by more than one tenant
- Section 804.5.1.1 - Two exits required when works areas include rooms or spaces with an occupant load of more than 50 people or where the travel distance to reach an exit exceeds 75 ft
- Storage rooms only require one exit when occupant is <10

199

Alterations – Level

Section 804.5.1.2 – Group I-2 –

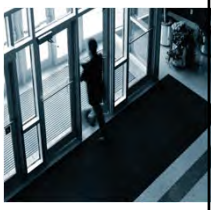
- Condition 2,work areas that include altered care suites shall:
- comply with Sections 407.4.4 - 407.4.4.6.2 of the International Building Code.

200

Alterations – Level 2

Section 804.5.2 – Door Swing

- Any doors located in level 2 Alterations work area and along the path of travel from the work areas to the exit discharge, serving an occupant load >50 people, must swing in the direction of egress
- Section 804.5.2.1 – Supplemental Requirements



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Alterations – Level 2

Section 804.5.3 – Door Closing

- Any doors located within a Level 2 Alterations work area and opening into an exit enclosure (exit passageway, exit ramp, or exit stairway) must be self-closing or automatic-closing by listed closing devices.
  - Except occupied tenants outside work area
- **Section 804.5.3.1 – Supplemental Requirements**

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Alterations – Level 2

Section 804.5.4 – Panic and Fire Exit Hardware

- Egress doors in Assembly occupancies with latching devices in level 2 Alterations work area, in the path of travel to the exit discharge, with an occupant load >100 must have panic hardware in accordance with section 1010.2.9 of the IBC
- **Section 804.5.4.1 - Supplemental Requirements and exception**

203

Alterations – Level 2

Section 804.6 – Openings in Corridor Walls

- Requirements are triggered where work areas include exits or corridors shared by more than one tenant
  - **Section 804.6.1 –** Doors shall not be constructed of hollow core wood and shall contain louvers
  - Doors to dwelling units and sleeping units in work areas in residential occupancies (Group R-1 and R-2) and large assisted living facilities (Group I-1) must not be less than 1 3/8-inch (35 mm) thick solid wood core door or equivalent construction.
  - Glazing must be approved glazing or wired glass in metal frames
  - Doors must be self closing

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Alterations – Level 2

- Doors, cont.
  - Any replacement corridor doors must not be less than 1 ¾-inch (44 mm) thick solid wood core door or equivalent construction unless the existing door frame can only accept a 1 3/8-inch (35 mm) thick door.
  - Doors having a minimum 20-minute fire protection rating are considered equivalent construction
  - Except:
    - Existing corridor doors that provide fire protection rating of not less than 15 minutes
    - Existing corridor doors when building protected with automatic sprinkler system
    - In small group homes, self closing doors not required when protected by automatic smoke detection system

2021 IEBC Essentials 205

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Alterations – Level 2

Section 804.6.2 – Transoms –

- In shared exit access corridors, existing transoms in work areas in R-1 and R-2 occupancies and large assisted living facilities of I-1 and health care occupancies of I-2 occupancies:
- Must have fixed glazing with the same fire protection rating as required for corridors, or
- Transom opening must be sealed with materials consistent with the corridor construction

2021 IEBC Essentials 206

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Alterations – Level 2

Section 804.6.3 – Other Corridor Openings

- In any work area, unless protected in accordance with Section 716 of the IBC, any other sash, grille, or opening in a corridor shall be sealed with materials consistent with the corridor construction

- Supplemental requirements with exception

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Alterations – Level 2

Section 804.7 – Dead end corridors – in Level 2 Alterations work areas:

- Cannot exceed 35 feet unless permitted by IBC
- Group I-2 cannot exceed 30 feet
- Except: In other than A, H and I-2 occupancies:
  - Greater length in accordance with the IBC
  - An existing dead-end corridor can be a maximum of 50 ft if building is equipped with throughout with an automatic fire alarm system installed in accordance with the IBC
  - An existing dead corridor can be a maximum of 75 ft (21.36 m) if the building is equipped throughout with an automatic sprinkler system installed in accordance with the IBC.
  - Newly constructed or extended dead end ≤50 feet with automatic sprinkler system in accordance with IBC

208

Alterations – Level 2

Section 804.8 – Means of Egress lighting - Level 2
Alterations work areas must have means of egress lighting in accordance with the IBC for new construction

- Supplemental Requirements with exception

- Section 804.9 – Exit Signs - Level 2 Alterations work areas must have exit signs in accordance with the IBC for new construction
- Supplemental Requirements with exception

209

Alterations – Level 2

- **Section 805.10 –** Handrails - Every existing exit stairway that serves as a means of egress to a Level 2 Alterations work area and has at least three risers must have a minimum of one handrail.
- Where existing stairways do not have a handrail or the existing handrails are considered to be in danger of failure, not less than one handrail complying with the prescriptive requirements of the IBC for new handrails must be provided.

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Alterations – Level 2

Section 804.11 – Refuge Areas – Alterations

- Capacity of refuge area or horizontal exit shall not be reduced lower than required by Section 1026.4 of IBC.
- Where horizontal exit forms a smoke compartment, capacity of the refuge area for I-1, I-2, I-3 and Group B ambulatory care facility occupancies, shall not be reduced lower than required by IBC Sections 407.5.3, 408.6.2, 420.6.1, and 422.3.2.

211

Alterations – Level 2

Section 805 – Structural

- Section 805.3-Existing Structural Elements Resisting Lateral Loads - The Building Structure must meet Section 1609 and 1612 of the IBC when level 2 Alteration work areas causes:
  - An increase in design lateral loads, or
  - The alteration creates prohibited structural irregularity as defined in ASCE 7, or
  - Where the alteration decreases the existing capacity of any lateral load-carrying structural element,
  - Reduced seismic loads are allowed using the evaluation of the demand-capacity ratios

212

Alterations – Level 2

Section [BS] 805.4 – Voluntary Lateral Force-Resisting System Alterations

- Voluntary structural work intended to improve existing lateral force-resisting system, is not required to meet the IBC provided:
- The capacity of existing structural systems is not reduced, and
- Any new structural elements, whether connecting to existing or new structural elements, must comply with the IBC for new construction, and
- New or relocated non-structural elements, whether connecting to existing or new structural elements, must comply with the IBC for new construction, and
- The alterations cannot create a structural irregularity as defined by ASCE 7 or make any existing structural irregularity more severe

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Alterations – Level 2

Section 806 – Electrical

- New electrical equipment and wiring related to Level 2 Alteration work areas must comply with the applicable requirements of the NEC (NFPA 70)
- Existing wiring in A-1, A-2, A-5, H, and I occupancies shall be upgraded to comply with Chapter 7 requirements for materials and methods
- Requirements for certain residential occupancies (Group R-2, R-3 and R-4) that are regulated by the International Residential Code (IRC); kitchens, laundry areas, lighting outlets, utility rooms and equipment clearance

214

Alterations – Level 2

Section 806.3 Health Care Facilities

- Group I-2 and ambulatory care facilities, and outpatient clinics;
- Any added portion of an existing electrical system shall be required to meet installation and equipment requirements;
- In accordance with NFPA 99

215

Alterations – Level 2

Section 807 – Mechanical

- Alteration level 2 work areas where spaces are reconfigured into habitable or occupiable spaces must provide natural or mechanical ventilation in accordance with the IMC

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Alterations – Level 2

Section 808 – Plumbing

- Health care facilities – any added portion of a medical gas system must comply with NFPA 99

217

Alterations – Level 2

Section 809 – Energy Conservation

- Level 2 Alterations to existing buildings do not require the entire building to comply with the energy requirements of the International Energy Conservation Code (IECC) or IRC.
- The work associated with the Level 2 Alteration project must comply with the IECC for new construction

218

Alterations – Level 3

General

- Alterations Level 3 – Work areas that are > 50% of the overall building area,
- Requirements are found in Chapter 9,
- Additional Building Features are triggered beyond the actual work areas and other parts of the building where no alterations are planned,
- Guiding principle is that level 3 Alterations will comply with the IBC but remainder of the building can remain as it,

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Alterations – Level 3

General, Cont.

- It is presumed that the existing building is an approved structure

Section 901.2 – Compliance

- The requirements of Level 1 Alterations (Chapter 7 of the IEBC) and Level 2 Alterations (Chapter 8 of the IEBC) are also required to be met, as applicable
- The requirements of IEBC Sections 802 (Building Elements and Materials), 803 (Fire Protection) and 804 (Carbon Monoxide Detection) apply within all Level 3 Alterations work areas regardless if they share means of egress with other tenants and regardless of occupant load.

220

Alterations – Level 3

Section 902 - Special Use and Occupancy

- **Section 902.1 – High Rise Buildings –** Recirculating air or exhaust systems with a capacity of >15,000 CFM shall be equipped with smoke or heat detection devices in accordance with the IMC
- **Section 902.1.2 –** Elevators for public use serving work areas – with a travel distance in excess of 25', above or below main floor or the level for emergency response and access-shall be provided with emergency operations in accordance with ASME A17.3.
- New Elevators shall be provided with Phase I and Phase II operations

221

Alterations – Level 3

Special Use and Occupancy, Cont.

Section 902.2 – Boiler and Furnace Equipment Rooms

- Must be enclosed with a minimum of 1hr. rated fire resistance construction in I-1, I-2, I-4, R-1, R-2 and R-4 occupancies, except:
- Steam boiler equipment operating at pressures of 15 psig or less (103.4 kPa) is not required to be enclosed, or
- Hot water boilers operating at pressures of 170 psig or less (1171 kPa) are not required to be enclosed, or
- Furnace and boiler equipment with capacity of 400,000 Btu (4.22 x 108 J) per hour input rating is not required to be enclosed, or
- Furnace and boiler rooms protected with automatic sprinkler system are not required to be enclosed.

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Alterations – Level 3

Section 903 – Building Elements and Materials

- **Section 903.1 – Existing Shafts and Vertical Openings**
  - Existing stairways that are part of the building means of egress must be enclosed as required by IEBC Section 802.2.1 (Existing Vertical Openings) from the highest story containing a work area down to, and including, the level of exit discharge and all floors below the level of exit discharge.

223

Alterations – Level 3

- **Section 903.2 – Fire Partitions in Group R-3**
  - Where work area is in any attached dwelling unit or multiple single-family dwelling (townhouse)
  - Walls separating dwelling units that are not continuous from foundation to underside of roof sheathing
  - Shall be constructed to provide such separation using construction materials consistent with existing wall or must comply with requirements for new construction
  - Work shall be performed on the side of the dwelling unit wall

224

Alterations – Level 3

Section 904 – Fire Protection

Section 904.1.4 – Automatic Sprinkler Systems

- Alteration Level 3 requirements are similar to Level 2 Section 803.2.2 but more stringent
- Requirements are triggered when there is sufficient water supply to the site versus a floor
- Exception allows the installation of an automatic smoke detection system

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Alterations – Level 3

Section 904.1.5 Group I-2

- automatic sprinkler systems required
  - Throughout work areas of Condition 1 and
  - Throughout work area of condition 1, where work area is ≤50% of smoke compartment and;
  - Throughout entire smoke compartment of condition 2 where the work area is >50% of smoke compartment

226

Alterations – Level 3

Section 904.1.6 – Windowless stories

- Alterations, located in windowless stories shall be sprinklered
- As would be required for newly constructed buildings

227

Alterations – Level 3

- **Section 904.2 – Fire Alarm and Detection**
  - Fire alarm and detection systems must be provided in compliance with IBC 907 (Fire Alarm and Detection Systems) as required for new construction.
  - **Section 904.2.1 – Manual Fire Alarm Systems** – Where required by the IBC for a specific occupancy, must be provided throughout the work areas.
  - The fire alarm system is not required to be extended into existing occupied tenant spaces on those floors that are located entirely outside of the work areas

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Alterations – Level 3

Section 904.2.2 – Automatic fire detection

- When required by the IBC for new construction, automatic fire detection must be provided throughout the work area

229

Alterations – Level 3

Section 905 – Means of Egress

- The means of egress in a Level 3 Alterations project must comply with IEBC Section 805 (Means of Egress) for Level 2 Alterations and apply within all Level 3 Alterations work areas
  - regardless if they share means of egress with other tenants and regardless of occupant load

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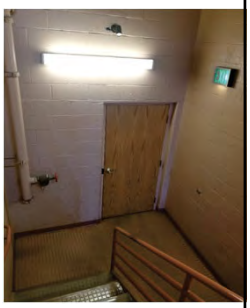
Alterations – Level 3

- **Section 905.2 – Means of Egress Lighting**
  - Is required from the highest work area floor to the floor of exit discharge within the exit enclosure in accordance with IBC.
- **Section 905.3 – Exit Signs**
  - Is required in the Means of Egress from the highest work area floor to the floor of exit discharge in accordance with IBC.
- **Section 905.4 – Two-way Communication**
  - Buildings with elevator service shall provide two-way communication in accordance with IBC Section 1009.8



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Alterations – Level 3

- **Structural – Section 906.2 – Existing Structural Elements resisting lateral loads**
  - When Substantial Structural Alterations are being made, the lateral load-resisting system of the altered building must be evaluated and shown to comply with IBC Sections 1609 (Wind Loads) and 1613 (Earthquake Loads). Reduced seismic forces are allowed to be used as part of the design. Except:
    - Residential buildings where <5 dwelling or sleeping units are altered using the light-frame construction methods of the IBC or complying with the provisions of the IRC.
    - If the intended alteration only involves the lowest story of a building, only the lateral load-resisting components of this story and below need to comply. The remaining upper portion of the building can remain as is.

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Alterations – Level 3

- **Section 906.3 – SDC F –** is the most severe seismic classification and consequently, buildings are at a high risk for damage in a seismic event.
  - the lateral load-resisting system of the altered building must be evaluated and shown to comply with IBC Sections 1609 (Wind Loads) and 1613 (Earthquake Loads). Reduced seismic forces are allowed to be used as part of the design.

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Alterations – Level 3

Section 906.4 – Anchorage for Concrete and Masonry Buildings

- Alteration Level 3 work areas in buildings located in SDC D, E, or F, and the building has a structural system incorporating concrete or reinforced masonry walls with a flexible roof diaphragm, must include installation of additional anchors at the roof line and floor lines

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Alterations – Level 3

- **Section 907 – Energy Conservation**
- Level 3 Alterations to existing buildings do not require the entire building to comply with the energy requirements of the International Energy Conservation Code (IECC).
- The work associated with the Level 3 Alteration project must comply with the IECC for new construction.

235

Change of Occupancy

Chapter 10 – Change of Occupancy – General

- The requirements of Chapter 10 are typically in addition to the requirements of Chapters 7, 8, and 9 (Incremental Approach)
- **Section 1001.2.1** – Change of Use is typically repurposing a space within the same occupancy group or classification – Must Comply with Sections 1002 - 1010
- **Section 1001.2.2** – Change of Occupancy Classification or Group is usually easier to comprehend. It is a change in either classification or group – Must Comply with Sections 1002 - 1011

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Change of Occupancy

General, Cont.

- **Section 1001.2 – Change of Occupancy** within a building that results in a different fire protection system requirement of Chapter 9 of the IBC – Requires Approval of the Code Official and a new Certificate of Occupancy issued once requirements are met
- **Section 1001.3 –** A new certificate of occupancy shall be issued once requirements associated with the new change of occupancy classification have been met.

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Change of Occupancy

Section 1002.1 – Special Use and Occupancy –

- The IEBC requires compliance with the IBC for any building or portion of a building that undergoes a change of occupancy to one of the special uses identified in Chapter 4 of the IBC.

Section 1002.2 – Incidental Uses

- Any change of occupancy to an incidental use shall comply with Section 509 of the IBC

Section 1002.3 – Change of Occupancy in Health Care

- Change of Occupancy to I-2 or I-1 must comply with IBC, Except:

1. Group I-2, Condition 2 to Group I-2 Condition 1
2. Group I-2 to ambulatory healthcare
3. Group I-2 to I-1
4. Group I-1, Condition 2 to Group I-1 Condition 1

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Change of Occupancy

Section 1002.4. Storage

- Group I-2, change in occupancy to a storage room shall comply with the following:
  - Have an existing automatic sprinkler system throughout per IBC, Section 903.3.1.1
  - Existing room is ≤250 square feet
  - Room is separated by construction capable of resisting smoke in accordance with Section 509.4.2 of IBC

239

Change of Occupancy

- **Section 1003.1 – Building Elements and Materials –** Buildings or portions thereof, undergoing a Change of Occupancy Classification must comply with Section 1011.
- **Section 1004.1 – Fire Protection – Buildings or Portions** thereof, undergoing a Change of Occupancy Classification, must comply with Section 1011 or
- Where there is a change of occupancy within a space where there is a different fire protection threshold of chapter 9 of the IBC, must comply with Section 1011

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Change of Occupancy

Section 1005.1 – Means of Egress

- A building or a portion of a building undergoing a Change of Occupancy classification must comply with IEBC Section 1011 (Change of Occupancy Classification

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Change of Occupancy

- **Section 1006 – Structural –** For purposes of Structural Requirements, Change of Occupancy Classification is considered a Change of Occupancy
- **Section 1006.1 – Live Loads**
  - Structural Elements carrying live loads must comply with design live loads of the IBC Section 1607 for new occupancy
  - Design Live loads for remainder of building not included in the Change of Occupancy can continue as previously approved
  - Structural elements whose demand-capacity ratio based on the Change of Occupancy is <5 percent greater than the demand-capacity ration based on the previously approved design live loads are allowed to remain as is and do not need to comply with IBC Section 1607.

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Change of Occupancy

Section [BS] 1006.2 – Snow and Wind Loads

- When a Change of Occupancy results in the building being assigned to a higher risk category (Section 1604.5 of IBC), the building structure must comply with IBC Section 1608 (Snow Loads) and Section 1609 (Wind Loads) based on the new risk category.
  - There is an exception for when the area of the new occupancy is less than 10 percent of the building area; the existing building structure is allowed to remain as is.

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Change of Occupancy

Section [BS] 1006.3 Seismic Loads

- When a Change of Occupancy results in the building being assigned to a higher risk category, or where change is from a Group S or U to any other occupancy, the building structure must comply with IBC Section 1613 (Earthquake Loads) based on the new risk category. Except:
  - When Change of Occupancy results in the building being reclassified from Risk Category I or II to Risk Category III and the seismic coefficient SDS is less than 0.33,
  - The area of the new occupancy is <10% of building area, the occupancy is not changing to from an S or U, and new occupancy isn't assigned a risk category IV, existing building can remain as is
  - Unreinforced masonry bearing wall buildings assigned to Risk Category III and Seismic Design Category A or B can use Appendix A1 of the IEBC
  - Where change is from an S or U, no change of risk category; Reduced seismic forces are permitted

244

Change of Occupancy

Section 1007 – Electrical

- The IEBC requires compliance with the applicable requirements of the NEC (NFPA 70) for a building or a portion of a building that changes to one following special use or occupancy categories:

1. Hazardous Locations
2. Commercial Garages, repair and storage
3. Aircraft Hangers
4. Gasoline Dispensing and Service Stations
5. Bulk Storage plants
6. Spray Applications, dipping and coating processes
7. Health Care Facilities, including I-2, ambulatory health care facilities and outpatient clinics
8. Places of Assembly
9. Theaters, audience areas of motion picture and television studios and similar locations
10. Motion picture and television studios and similar locations
11. Motion picture projectors
12. Agricultural Buildings

Health Care Facilities, including I-2, ambulatory health care facilities and outpatient clinics shall comply with NFPA 99

245

Change of Occupancy

- **Section 1007.2 Unsafe conditions –** Whenever the occupancy of a building is changed all unsafe electrical conditions shall be corrected in accordance with NFPA 70
- **Section 1007.3 – Service Upgrades –** Whenever the occupancy of a building is changed, the service shall be upgraded to meet the requirements of NFPA 70
- **Section 1007.4 – Number of Electrical Outlets** – Whenever the occupancy of a building is changed, the number of electrical outlets shall comply with NFPA 70 for the new occupancy

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Change of Occupancy

- **Section 1008.1 – Mechanical –** A building or a portion of a building undergoing a Change of Occupancy classification or undergoing a Change of Occupancy where there is an increased kitchen exhaust requirement or an increased mechanical ventilation requirement must comply with the respective chapters of the IMC based on the new occupancy.

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Change of Occupancy

- **Section 1009 – Plumbing –** When the plumbing fixture account is increased or the water supply requirements are increased due to a change in occupancy or change in occupancy classification, the new occupancy shall comply with the IPC
  - Ex: when the occupancy load of the story is increased by more than 20 percent, plumbing fixtures for the story shall be provided in the quantities in accordance with the IPC
- **Section 1009.2 – Food Handling occupancies –** If the new occupancy is a food-handling facility, all existing sanitary waste lines located above preparation or storage areas must be panned or otherwise protected to prevent leaking or condensation from contaminating the food and/or drink.

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Change of Occupancy

Section 1009.2 – Food Handling occupancies, cont.

- New drainage lines must not be installed above preparation or storage areas and must be protected per the IPC for new construction. I
- **Section 1009.3** – If the facility will produce grease or oil-laden wastes, interceptors must be provided in compliance with the IPC.
- **Section 1009.4 – Chemical Waste –** piping must be compatible with the chemical waste or waste must be neutralized prior to entering the drainage system

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Change of Occupancy Classification

Section 1011.1 - Change of Occupancy Classification

- Change of Occupancy classification in this section includes:
  - A change of occupancy classification within a group
  - A change of occupancy classification to from one group to another group
  - A change of occupancy within a space where there is a different fire protection system threshold requirement in Chapter 9 of the IBC

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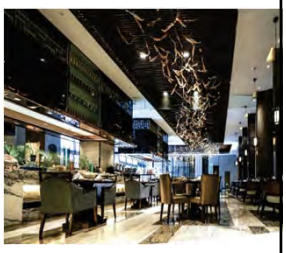
Change of Occupancy Classification

- **Section 1011.2 – Fire Protection Systems –** A building or portion of a building undergoing a change of occupancy classification must comply with the fire protection thresholds for the new occupancy as required by Chapter 9 of the IBC and installed throughout the new occupancy



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Change of Occupancy Classification

Section 1011.2.1 – Fire Sprinkler system

- The automatic sprinkler system must be installed within the area of the change of occupancy and all areas not separated vertically and horizontally by one of the following:

1. Non-rated permanent partition and horizontal assemblies
2. Fire partition
3. Smoke Partition
4. Smoke Barrier
5. Fire Barrier
6. Fire Wall

Exceptions: Automatic Sprinkler Systems are not required:

- in 1&2 family dwellings and townhouses constructed in accordance with the IRC and
- townhouses separated in accordance with Section R302.2 of the IRC

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Change of Occupancy Classification

Section 1011.2.2 – Fire Alarm and detection

- Where there is a change of occupancy classification, and there is a different threshold for the new occupancy in accordance with Chapter 9 of the IBC for fire alarm and detection systems to be added, such system shall be provided throughout the area where there is a change of occupancy.
- Any existing fire alarm appliances must be automatically activated throughout the building

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Change of Occupancy Classification

- **Section 1011.3 – Interior Finish** – In areas of a building undergoing a Change of Occupancy classification, the interior wall and ceiling finishes and floor finishes must comply with interior finish requirement Chapter 8 of the IBC based on the new occupancies.

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Change of Occupancy Classification

Section 1011.5 – Means of Egress – General

- All of the occupancy classifications are grouped based on their relative risk with regards to the requirements for means of egress and must comply with IEBC Table 1011.5
- Occupancies with hazardous materials and defend-in-place protocols are the greatest risk
- Non-residential occupancies with minimal fuel loads are and low density occupant loads are considered the lowest risk

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Change of Occupancy Classification

Means of Egress Hazard Categories

Relative Hazard	Occupancy Classification
1 (Highest Hazard)	H
2	I-2, I-3, I-4
3	A, E, I-1, M, R-1, R-2, R-4 Condition 2
4	B, F-1, R-3, R-4 Condition 1, S-1
5	F-2, S-2, U

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Change of Occupancy Classification

Means of Egress – Change of Classification to a Higher Hazard

- **Based on Table 1011.5 –** Means of egress requirements must comply with chapter 10 of the IBC for the new occupancy, except
  - Enclosure of Stairways is permitted to comply IEBC Sect. 903.1
  - When approved by Code Official – Existing Stairways, including guards and handrails, complying with Chapter 9 of IEBC can continue
  - New stairways slope and pitch, rise and tread, when restricted by existing construction, can remain as previously constructed
  - Existing corridor walls of wood lath and plaster can remain or ½" gypsum wallboard
  - Existing Corridor openings can remain where permitted by IEBC Section 805.5
  - Existing dead-end corridors only need to meet requirements of IEBC Section 805.6
  - Operable windows Complying with Section 1011.5.6

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Change of Occupancy Classification

Section 1011.5.2 – Means of Egress for a change of use to an equal or lesser hazard – Based on Table 1011.4

- The existing means of egress components that are proposed to remain must meet the requirements of IEBC Section 905 for the new occupancies.
- Newly constructed or reconfigured means of egress for the new occupancy areas must comply with Chapter 10 of the IBC for new construction.
- Exception: where the pitch and slope cannot be made code compliant with new requirements due to the existing building construction is not required to comply with the IBC. The stair riser heights and tread depths can remain as is and are not required to meet requirements for new stair construction

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Change of Occupancy Classification

- **Section 1011.5.3 – Egress Capacity –** Egress capacity for the building must meet or exceed the calculated occupant load of the new occupancies and the existing occupancies based on the requirements of the IBC

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Change of Occupancy Classification

Section 1011.5.6 - Existing Emergency Escape and Rescue Openings

- A change of occupancy requires and EERO in accordance with the IBC Section 1031 operable windows shall comply with:

1. Existing operable window net clear opening of ≥4 sq. ft. of clear opening and opening height and width of ≥22" and ≥20" respectively can continue as an EERO
2. Replacement window complies with both of the following:
    1. Replacement window meets the size requirements of Item #1 and;
    2. Replacement window is the manufacturers largest standard size that will fit with in existing frame: can be the same operating style

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Change of Occupancy Classification

- **Section 1011.6** – **Height and Areas –** Hazard categories due to height and area shall be in accordance with Table 1011.6.

TABLE 1011.6
Heights and Areas Hazard Categories

RELATIVE HAZARD	OCCUPANCY CLASSIFICATION
1 (Highest Hazard)	H
2	A-1, A-2, A-3, A-4, I, R-1, R-2, R-4, Condition 2
3	E, F-1, S-1, M
4 (lowest hazard)	B, F-2, S-2, A-5, R-3, R-4, Condition 1, U

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Change of Occupancy Classification

- **Section 1011.6.1 – Height and Area for a change to a higher hazard category**
- The building height and area requirements for the new occupancy areas must comply with Chapter 5 (General Building Heights and Areas) of the IBC for new construction

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Change of Occupancy Classification

- **Section 1011.6.1.1 – Fire Wall Alternative**
- In occupancies other than H, F-1, and S-1, Fire Barriers and horizontal assemblies constructed in accordance with Sections 707 and 711 respectively of the IBC are permitted in lieu of a structurally independent fire walls to create building separations where all of the following are conditions are met:
  - The buildings must be completely sprinkler protected per NFPA 13 as referenced by IBC Section 903.3.1.1, and
  - Maximum areas between rated fire barriers or horizontal assemblies cannot exceed allowable area of chapter 5 of the IBC
  - The fire resistance ratings of the fire barriers and horizontal assemblies must not be less than that required for fire walls in the IBC

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Change of Occupancy Classification

Section 1011.6.2 – Height and Area for a Change to an Equal or Lesser Hazard

- When a Change of Occupancy classification to an equal or lesser hazard occurs based on IEBC Table 1011.6, the existing height and area of the building is considered code compliant

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Change of Occupancy Classification

Section 1011.6.3 – Fire Barriers

- Change of Occupancy Classification to a higher hazard based on Table 1011.6 , Fire Barriers in separated mixed occupancies must comply with the fire resistance requirements of the IBC
- When fire barriers are required to have a 1 hour fire resistance rating, existing wood lath and plaster, in good condition or existing ½ inch thick gypsum wallboard are permitted

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Change of Occupancy Classification

Section 1011.7 – Exterior wall fire-resistance ratings

- Hazard Categories in regard to fire resistance ratings of exterior walls shall be in accordance with Table 1011.7

TABLE 1011.7
EXPOSURE OF EXTERIOR WALLS HAZARD CATEGORIES

RELATIVE HAZARD	OCCUPANCY CLASSIFICATION
1 (Highest Hazard)	H
2	F-1, M, S-1
3	A, B, E, I, R
4 (Lowest Hazard)	F-2, S-2, U

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Change of Occupancy Classification

Section 1011.7.1 – Exterior Wall Rating Change of Occupancy to a Higher-Hazard Category – based on Table 1011.7

- Exterior wall fire-resistance rating requirements for the new occupancy areas must comply with IBC.
- Includes Openings in exterior walls

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Change of Occupancy Classification

Section 1011.7.2 - Exterior Wall Rating for a Change of Occupancy to an Equal or Lesser Hazard:

- The existing exterior walls, including openings within those walls, is considered code compliant.

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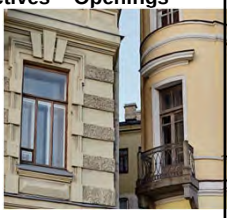
Change of Occupancy Classification

- **Section 1011.7.3 – Opening Protectives – Openings in Exterior Walls:**
- Shall be protected as required by IBC Section 705.8 when there is a change of occupancy classification to a higher hazard category
- When openings are required to be protected because of their fire separation distance, the sum of the opening areas must not exceed 50 percent of the respective wall area on a per story basis



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Change of Occupancy Classification

- **Exceptions to Section 1011.7.3 – Opening Protectives**
  - Where IBC Table 705.8 allows openings in excess of 50 percent, the percentage of protected openings is allowed to match the percentage permitted by the IBC for new construction, or
  - In residential buildings that are three stories or less in height and are located 3 feet (0.91 m) or more from a lot line, or
  - In buildings protected throughout with an automatic sprinkler system complying with NFPA 13, or
  - When the Change of Occupancy classification is to an equal or lower hazard classification per IEBC Table 1011.6.

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Change of Occupancy Classification

Section 1011.8 – Enclosure of Vertical Shafts

- Vertical Shafts shall be designed to meet the IBC for atriums or requirements of Section 1011.8.1 of the IEBC
- Section 404 of the IBC provides requirements for Atriums
- Section 1011.8.2 of the IEBC provides requirements for interior stairways or Section 1011.8.3 for other shafts

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Change of Occupancy Classification

Section 1011.8.2 – Stairways

- When a change of occupancy classification is made to a higher-hazard category as shown in Table 1011.5, interior stairways shall be enclosed in accordance with the IBC, Section 1023

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Change of Occupancy Classification

- **Exceptions to Section 1011.8.2 – Stairways**
  - Stairways connecting <2 stories so long as the stairway is not open to corridors or stairways on other floors: Does not apply to "I" occupancies
  - Existing unenclosed stairways are not required to be enclosed in a continuous vertical shaft if each story of the building is separated from other stories by minimum 1-hour fire-resistance rated construction or approved wired glass set in steel frames and all exit access corridors are sprinkler protected. Openings between corridor and occupant spaces must have a sprinkler head above each opening on the tenant side
  - Existing penetrations of stairway enclosures can remain so long as they are protected in accordance with the applicable subsections of IBC Section 714 (Penetrations).

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Change of Occupancy Classification

Section 1011.7.3 – Other Vertical Shafts

- When there is a change of occupancy to higher hazard category identified in Table 1011.4 vertical shafts such as elevator hoistways, and utility shafts shall be enclosed in accordance with the IBC, except:
  - In other than institutional occupancies (Group I), a shaft enclosure is not required for an existing vertical opening connecting not more than five stories so long as the entire building is provided with an automatic sprinkler system complying with NFPA 13, or
  - Existing 1-hour fire-resistance rated shaft enclosures are allowed to remain as is, even when a higher rating is otherwise required

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Change of Occupancy Classifications

Section 1011.8.4 – Openings

- Openings in existing shaft enclosures must be protected by minimum 1-hour fire protection rated assemblies.
- These opening protectives must be self-closing or automatic-closing upon actuation of a local smoke detector.
- Except for stairway enclosures, existing fusible link-type automatic door-closing devices are permitted to remain so long as the fusible link rating does not exceed 135°F

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Additions

General Requirements for Additions are found in Chapter 11 of the IEBC

- Additions being constructed must comply with the IBC except as provided in the IEBC
- The Existing building can remain without any alterations provided the addition does not impact the existing building.
- The guiding principal for Additions is that an Addition project cannot create or extend any code deficiency in the existing building

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Additions

Section 1102 – Height and Areas

- An Addition cannot increase the height of an existing building beyond that permitted by Chapter 5 of the IBC.
- An Addition cannot increase the area of an existing building beyond that permitted by the IBC for new construction unless fire separation is constructed in accordance with the IBC.
- in-filling of existing floor openings and non-occupiable appendages, such as elevator hoistways and stairway shafts, is permitted beyond the area limitationst allowed by the IBC

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Additions

- **Example: The Church in the picture was constructed in 1972 and exceeds the height and area limitations of the IBC.**
- The addition in the picture was allowed due to the fact that it is only an exit stairway connecting the sanctuary on the upper level to the parish hall on the lower level.

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Additions

Section 1102.3 - Fire Protection Systems

- Where existing fire areas are increased by an Addition, the resulting fire area must comply with the fire protection requirements of IBC Chapter 9 (Fire Protection Systems) as applicable

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Additions

Section 1103.1 – Structural

- When Addition work includes alterations that cause an increase in design dead, live or snow load, including snow drift effects, of >5%, the existing affected gravity load-carrying element(s) must be replaced or modified to carry the gravity loads required by the IBC for new construction.
- Any existing gravity load-carrying element(s) whose load-carrying capacity is decreased as part of the Addition work is considered an altered structural element and is subject to the requirements of IEBC Section 806.2.

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Additions

Section 1103.1 – Structural, Cont.

- Any existing gravity load-carrying element(s) that will form part of lateral load path for any of the Addition work is considered an existing lateral load-carrying structural element and is subject to the requirements of IEBC Section 1103.3
- There is an exception for existing Group R occupancies with 5 or less dwelling or sleeping units designed to comply with conventional light-frame construction of the IBC.

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Additions

Section 1103.2 – Lateral Force-Resisting Systems

- If the Addition is structurally independent of the existing building, the existing lateral load-carrying elements can remain as is.
- When the Addition is not structurally independent of the existing building, the existing building and the Addition acting as a single structure must meet IBC Sections 1609 (Wind Loads) and 1613 (Earthquake Loads) using of full seismic forces.

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Additions

- **Exceptions to Section 1103.2**
  - Existing Group R occupancies with <5 dwelling or sleeping units designed to comply with conventional light-frame construction of the IBC, or
  - Existing lateral load-carrying structural elements whose demand-capacity ratio with the Addition included is <10 percent greater than its current condition without the Addition, can remain as is.

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Additions

- Section [BS] 1103.3 – Flood Hazard Areas – Additions and foundations in flood hazard areas must comply with the following requirements as applicable:
  - Horizontal additions, structurally connected, that meet the definition of substantial improvement by itself must comply with IBC Section 1612 (flood loads)
  - Horizontal additions, not structurally connected, meeting the definition of substantial improvement, the existing building and addition must comply with Section 1612

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Additions

Section [BS] 1103.3 – Flood Hazard Areas –

- Additions and foundations in flood hazard areas must comply with the following requirements as applicable: (cont.)
  - For vertical Additions and all other proposed work, when combined, constitute substantial improvement as defined in IEBC Chapter 2, than the existing building must comply with IBC Section 1612, or
  - For a raised or extended foundation, if the foundation work and all other proposed work, when combined, constitute substantial improvement as defined in IEBC Chapter 2, than the existing building must comply with IBC Section, or
  - For a new or replacement foundation, the foundation must comply with IBC Section 1612.

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Additions

Section 1104 – Energy Conservation

- Additions to existing buildings must comply with the energy requirements of the International Energy Conservation Code (IECC) for new constru

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Relocated Buildings

Requirements for Relocated Buildings are found in Chapter 14

- **Section 1401.1.1-** Bleachers, Grandstands and folding and telescopic seating shall comply with ICC 300
- **Section 1401.2** – The Building shall comply with the IFC and IPMC
- Any field fabricated construction must comply with the IBC or IRC as applicable

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Relocated Buildings

Section 1402 Requirements

- **Section 1402.1 –** Location on the lot & Section [BS] 1402.2 – Foundation – The location of the building and new foundation, including connections between the foundation and relocated structure, all must comply with the IBC or IRC as applicable
- **Section [BS] 1402.3 Wind loads –** The relocated buildings must comply with the IBC or IRC as applicable, except for:
  - 1 & 2 family dwellings and group U where wind loads at new location less than or equal to those at the previous location
  - Structural elements whose stress is not increased by >10%

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Relocated Buildings

- **Section [BS] 1402.4 – Seismic Loads**
- Relocated buildings or structures must comply with the seismic provisions of the IBC as applicable, except for:
  - Structures in SDC's A and B and 1 & 2 family dwelling in SDC's A, B, and C, where seismic loads at new location are not higher than the previous location
  - Structural elements whose stress is not increased by >10%

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Relocated Buildings

Section [BS] 1402.5 Snow Loads

- Relocated buildings or structures must comply with the snow provisions of the IBC as applicable where snow loads at the new location are greater than the snow loads at the previous location, except:
  - Existing buildings or structures of any occupancy type where the new location does not increase the snow load stresses by more than 5 percent.

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Relocated Buildings

Section [BS] 1402.6 – Flood Hazard Areas

- Any building or structure relocated or moved into a flood hazard area must comply with IBC Section 1612 (Flood Loads) as applicable

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Relocated Buildings

Section [BS] 1402.7- Required Inspection and Repairs

- The IEBC allows the code official to have additional inspection of the structural elements of the relocated building conducted to ensure that no structural elements or connections have been damaged as a result of the relocation.
- Any structural repairs needed as a result must be completed prior to Use & Occupancy is granted.

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ACTIVITY

General

Which is the most conservative compliance method used by most jurisdictions?

The Prescriptive Compliance Method

What is the number of safety parameters identified in the Performance Compliance Method?

21

What is the key word within the definition of Work Area?

Reconfigured

All of the general accessibility requirements have be relocated to what section of the IEBC?

Section 305

One of the guiding principles of the IEBC is that any alterations, additions, repairs or change of occupancy cannot make the building _____ than it was before the work was done.

less safe

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ACTIVITY

General

Replacement water closets must have a maximum water consumption of _____ gallons per flushing cycle.

1.6

To be considered an alteration level 2, the aggregate area of work areas must be ____ of the overall building area.

< 50%

Reconfiguration work that is solely to meet accessibility compliance only need to comply with _____.

level 1 alterations

Supplemental Requirements only apply to which level of alterations?

Alterations level 2

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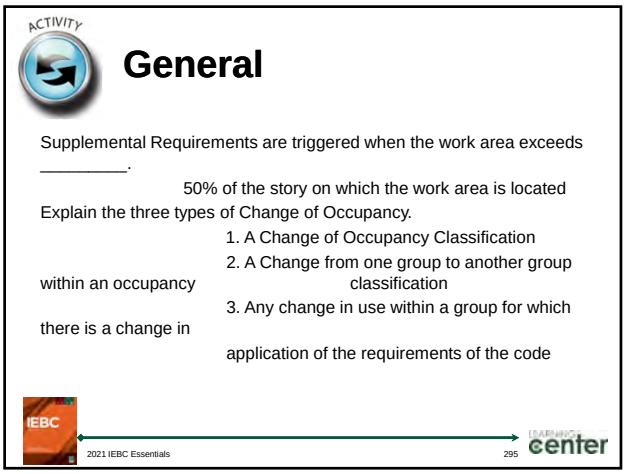

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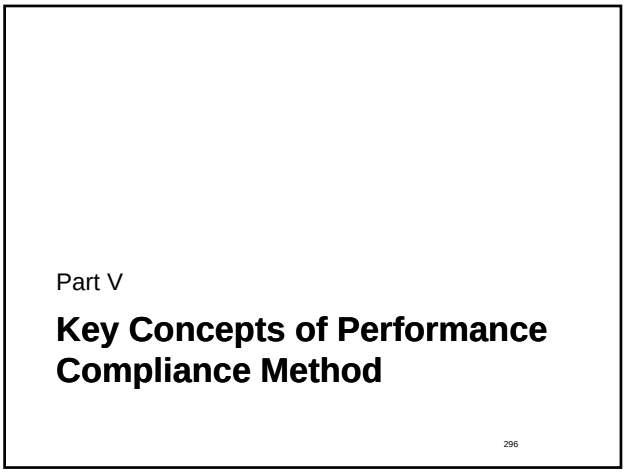

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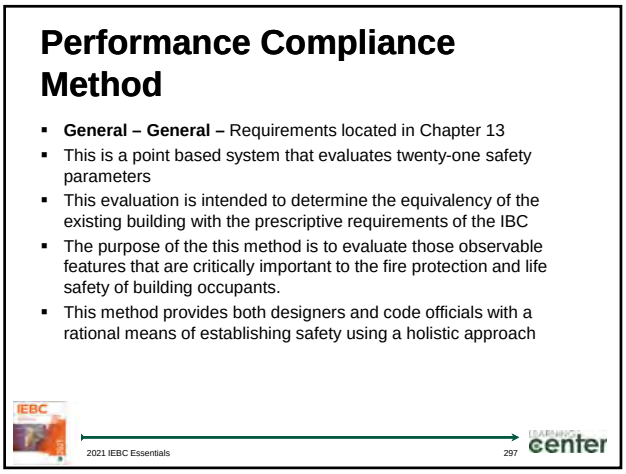

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Performance Compliance Method

- **General, Cont.**
  - **Section 1301.1 – Scope –** This method is applicable to alterations, additions, change of occupancy, including historic buildings.
  - It is intended that this method will maintain or increase the current degree of the building when permitting alterations, additions, or change of occupancy, while not requiring full compliance with chapters 6-12

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Performance Compliance Method

Section 1301.2 – Applicability

- Work involving additions, alterations, or changes of occupancy shall conform to the Performance area requirements or the Work Area method identified in chapters 6-10
- The provisions of the Performance Compliance Method cannot be applied to H, I-1, I-3, or I-4 occupancies

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Performance Compliance Method

General, Cont.

Section 1301.2.2 – Partial change in occupancy

- With proper separation , only the changed portion shall comply with the Performance Compliance Method
- Without proper separation, the entire building must comply with the Performance Compliance Method using the most stringent requirement of the occupancies involved.

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Performance Compliance Method

Section 1301.2.3 – Additions

- Must comply with the IBC
- When a fire wall is constructed in accordance with the IBC Section 706, the addition is considered a separate building
- If fire wall is not provided the total area of both the existing building and addition must comply with the height and area calculations of the IBC Sections 504 and 506 respectively.

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Performance Compliance Method

Section 1301.2.4 – Alterations

- A guiding principle is that alteration cannot reduce the current levels of safety and sanitation provided in the existing building.
- If any alteration is proposed to reduce the level of safety, such alteration shall comply with the IBC

Section 1301.2.6 – Plumbing Fixtures

- Provided in accordance with Section 1009 and Section 808 and comply with IPC

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Performance Compliance Method

Section 1301.3 – Acceptance

- Any building or structure being evaluated using the Performance Compliance method shall:
  - Shall Comply with the IFC and IPMC in accordance with Section 2301.3.2
  - Abate any unsafe condition, accordance with Section 115, as required per Section 1301.3.1
  - Comply with Section 1612 of the IBC as applicable if the building is located in a flood hazard area and if the work amounts to substantial improvement

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Performance Compliance Method

Section 1301.4 – Investigation and Evaluation

- **[BS] 1301.4.1 -** A structural analysis of the existing building or structure must be completed. The building or structure ,with the work completed, must be capable of resisting the applicable loads specified in IBC Chapter 16.
- **Section 1301.4.2 –** Results of evaluation, with compliance alternatives, must be submitted to the Code Official
- **Section 1301.4.3 –** The Code Official determines compliance

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Performance Compliance Method

Section 1301.5 – Evaluation – Composed of three safety categories as follows:

- **1301.5.1 -Fire Safety (FS**) – Included within the fire safety category are the structural fire-resistance, automatic fire detection, fire alarm, automatic sprinkler system and fire suppression system features of the facility.
- **1301.5.2 - Means of Egress (ME)** – Included within the means of egress category are the configuration, characteristics, and support features for means of egress in the facility.
- **1301.5.3 - General Safety (GS)** – Included within the general safety category are the fire safety parameters and means of egress parameters

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Performance Compliance Method

TABLE 1301.7
SUMMARY SHEET—BUILDING CODE

Existing occupancy: _____ Proposed occupancy: _____

Year building was constructed:_____ Number of stories: _____ Height in feet:_____

Type of construction: _____ Area per floor: _____

Percentage of open perimeter increase: _____ %

Completely suppressed: Yes_____ No_____ Corridor wall rating:_____

Type:_____

Compartmentation: Yes _____ No _____ Required door closers: Yes_____ No_____

Fire-resistance rating of vertical opening enclosures:_____

Type of HVAC system:_____ serving number of floors: _____

Automatic fire-detection: Yes_____ No_____ Type and location: _____

Fire alarm system: Yes_____ No_____ Type:_____

Smoke control: Yes_____ No_____ Type:_____

Adequate exit routes: Yes _____ No_____ Dead ends: _____ Yes _____ No _____

Maximum exit access travel distance: _____ Elevator controls: Yes _____ No _____

Means of egress emergency lighting: Yes _____ No _____ Mixed occupancies: Yes _____ No _____

Standpipes: Yes_____ No_____ Patient ability for self-preservation: _____

Incidental use: Yes_____ No_____ Patient concentration: _____

Smoke compartmentation: lessthan 22,500 sq. feet (2092 m²): Yes_____ No_____ Attendant-to-patient ratio: _____

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Performance Compliance Method

SAFETY PARAMETERS	FIRE SAFETY (FS)	MEANS OF EGRESS (ME)	GENERAL SAFETY (GS)
1301.6.1 Building height 1301.6.2 Building Area 1301.6.3 Compartmentation			
1301.6.4 Tenant and dwelling unit separations 1301.6.5 Corridor walls 1301.6.6 Vertical openings			
1301.6.7 HVAC Systems 1301.6.8 Automatic fire detection 1301.6.9 Fire alarm system			
1301.6.10 Smoke Control 1301.6.11 Means of Egress 1301.6.12 Dead Ends	**********		
1301.6.13 Maximum exit access travel distance 1301.6.14 Elevator Control 1301.6.15 Means of Egress emergency lighting	********** **********		
1301.6.16 Mixed Occupancies 1301.6.17 Automatic Sprinklers 1301.6.18 Standpipes 1301.6.19 Incidental use 1301.6.20 Smoke Compartments 1301.6.21.1 Patient Ability for self-preservation 1301.6.21.2 Patient Concentration (a) 1301.6.21.3 Attendant-to-patient ratio (a)	**********	**********	
Building Total Value			

* * * *No applicable value to be inserted.
a. Only applicable to Group I-2 occupancies.

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Performance Compliance Method

Section 1301.6 – Evaluation Process

- A single occupancy building not requiring smoke compartmentation may only need a single evaluation.
- A mixed occupancy building with fire-resistance rated occupancy separations will have multiple evaluations, but not less than one evaluation per occupancy type.

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Performance Compliance Method

Section 1301.6, Cont.

- Mandatory Safety scores are based on occupancy classification
- In order for the building to pass the Performance Compliance method, each of the three safety factors must be equal to or greater than the respective mandatory safety score

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Performance Compliance Method

- **Section 1301.6.1.1 – Building Height**
- There are two formulas used to determine the point value used for this safety parameter:
  - Height value in ft = (IBC allowable height – existing building height) 125
  - Height value in stories = (IBC allowable stories – existing building stories) x CF
- The lesser of the two values is used for this safety parameter, and the maximum point value permitted is 10. The point value is assigned to each of the three safety categories in IEBC Table 1301.7 on the Building height row

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Performance Compliance Method

Section 1301.6.2.2 – Area Formula

Equation 13-4 for single occupancy

$$\text{Area value}_i = (\text{Allowable area} - \text{Actual area})/1200 \text{ square feet}$$

Equation 13-5

$$\text{Area value}_i = \frac{\text{Allowable area}_i}{1200 \text{ square feet}}\left[1 - \left(\frac{\text{Actual area}_i}{\text{Allowable area}_i} + \ldots + \frac{\text{Actual area}_n}{\text{Allowable area}_n}\right)\right]$$

- Where
- *i=Value for an individual separated occupancy on a floor*
- *Number of separated occupancies on a floor*

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Performance Compliance Method

- **Section 1301.6.2.2 – Area Formula, cont.**
- Non-Separated Mixed Occupancies calculation is based on the smallest fraction of actual area/allowable area of the occupancies present in the building and that value is used for the entire building, consistent with the non-separated mixed-use approach of the IBC
  - Area value = IBC allowable area/1200 x [1 – (actual area/IBC allowable area)]
  - If the area value is positive, it cannot be more than 50 percent of the mandatory fire safety score in IEBC Table 1301.8 for the respective occupancy type

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Performance Compliance Method

Section 1301.6.3 – Compartmentation – Creating fire areas is beneficial and limit the spread of the fire

- Compartmentation is based on the use of minimum 2 hr. rated walls and floors complying with IBC sections 707 and 711 respectively.
- The integrity of the compartments includes protection of openings as required by the IBC.
- The smaller the fire area, the greater the benefit of compartmentation, which results in a larger point value that can be used for this safety parameter.
- 2021 IEBC now includes an I-2 Category

313

Performance Compliance Method

Section 1301.6.4 – Tenant and dwelling unit separations

- Separation between patient sleeping rooms in health care Occupancies are evaluated
- Recognizes fire separation with <2 hr. rated assemblies to slow the spread of fires between tenant and dwelling units
- Openings must be protected

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Performance Compliance Method

Section 1301.6.5 – Corridor Walls

- Fire-resistance rated corridor walls is paramount for safe and protected egress for occupants egressing from a building.
- Protected openings meeting requirements of the IBC
- The penalty for having no fire-resistance rated enclosure of exit access corridors is significant
- Note a is to ensure that all building occupants have reasonable access to existing substantially constructed corridors that otherwise exceed the corridor requirements for new construction.

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Performance Compliance Method

Section 1301.6.6 – Vertical Openings

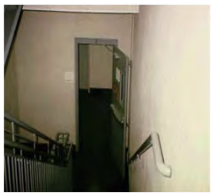
- Vertical openings include stairs, multi-story ramps, hoistways, escalators, atria, and other shaft enclosures.
- Safety Parameter addresses the enclosure including a multiplying factor based on construction type
- The penalty for having no fire-resistance rated enclosure (un-enlcosed) of vertical openings is significant, i.e., (-2 value x no. of connected stories)
- Enclosed with <1 hr. rating are assessed a 1 value x no. of connected stories

316

Performance Compliance Method

Section 1301.6.6.1 – Vertical Opening Formula

- VO(vertical openings 0 = PV(protection value) x CF (Construction type factor)



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Performance Compliance Method

Section 1301.6.7 – HVAC Systems

- Safety parameter addresses limiting the spread of smoke and fire to remainder of building
- This section does not evaluate smoke control systems
- Must be appropriately protected
- When an existing building has multiple HVAC system arrangements, they are evaluated separately and the lower point value must be used.

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Performance Compliance Method

Section 1301.6.8 – Automatic Fire Detection

- Addresses the location and operation of smoke detectors
- Detectors are required to be connected to audible alarms installed in accordance with IBC Section 907 and IMC Section 606
- Emphasis on the presence of complete smoke detection throughout the building
- Emphasis on higher occupancy concentrations such as A & R occupancies and higher fuel loads such as F, M, and S occupancies

319

Performance Compliance Method

Section 1301.6.9 – Fire Alarm Systems

- Addresses the capability of a fire alarm system.
- Includes manual initiation of an alarm and dedicated circuits for notification appliances i.e., horns, bells, speakers and strobes.
- Must be installed in accordance with IBC.
- Emphasis on emergency voice/alarm communication systems, particularly in occupancies with higher fuel load (Group F, M, S).
- Penalty for Groups A, B, E, R with no fire alarm system.

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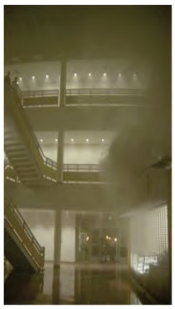
Performance Compliance Method

Section 1301.6.10 – Smoke Control



- Addresses the ability of natural or mechanical venting, exhaust or pressurization system to control the movement of smoke
- Due to the defend-in-place nature of health care facilities, there is a practical need to vent or exhaust smoke
- Emphasis is placed on the need for sprinkler protection to limit fire growth and associated smoke production

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Performance Compliance Method

Section 1301.6.11 – Means of Egress Capacity and number

- Does not address any other aspects of means of egress, i.e., dead-end-corridors, common path of travel, or travel distance
- Emphasizes increases above the minimum requirements of the IBC for higher occupant load densities (Groups A, E, and I-2)
- Penalizes the use of fire escapes even though recognized by IEBC

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Performance Compliance Method

Section 1301.6.11 – Means of Egress Capacity and number, cont.

- In order to take credit for exits in Category d, they must meet the remote requirements of the IBC, which is not less than half the distance of the greater diagonal dimension of the building story they are located on.
- In existing buildings that are sprinkler protected, the remoteness of the exits in Category d can be reduced to not less than 1/3 the distance of the greater diagonal dimension of the building story.

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Performance Compliance Method

Section 1301.6.12 – Dead Ends

- Addresses the presence of and length of dead-end corridors.
- Places equal emphasis on dead-end corridors regardless of occupancy type in most instances.
- Penalizes the presence of excessively long dead-end corridors, especially for health care occupancies (Group I-2).

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Performance Compliance Method

Section 1301.6.13 – Maximum exit access travel distance to an exit

- Addresses the length of exit access travel to reach an exit
- Places equal emphasis on travel distance regardless of occupancy type
- Penalizes exit access travel distance that exceeds that allowed in the IBC for the applicable occupancy types present in the existing building or structure

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Performance Compliance Method

Section 1301.6.13 – Maximum exit access travel distance to an exit, cont.

- The following equation is used to determine the value used for exit access travel distance based on the maximum allowable travel distance as indicated in IBC Table 1017.1:
  - Points = 20 x (IBC maximum allowable travel distance – maximum actual travel distance) / IBC maximum allowable travel distance

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Performance Compliance Method

Section 1301.6.14 – Elevator Control

- Specifically addresses the presence of Phase I emergency elevator recall and Phase II emergency in-car operation for passenger elevators.
- Freight elevators are not evaluated since they may not be in locations readily accessible by emergency responders.
- The Performance compliance method does not allow elevators with a travel distance of 25 ft (7.62 m) or more above or below the primary level of elevator access for emergency responders to be without Phase I and Phase II emergency operation.

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Performance Compliance Method

Section 1301.6.14 – Elevator Control, cont.

- The Performance compliance method penalizes multi-story buildings with no elevators and emphasizes the presence of at least one elevator complying with new construction requirements if it serves all floors of the building.
- Baseline value for elevators with < 25' of travel distance to reach the primary level for emergency responder access is category b.
- Baseline value for elevators with ≥ 25' of travel distance to reach the primary level for emergency responder access is category c.

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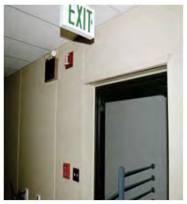
Performance Compliance Method

Section 1301. 6.15 – Means of Egress emergency lighting



- Addresses the presence of emergency power for illumination of the means of egress and exit signs within an existing building or structure.
- Emphasizes the need for emergency power for illumination of the means of egress and exit signs when the required number of exits per story of a building is two or more.

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Performance Compliance Method

Section 1301. 6.15 – Means of Egress emergency lighting, cont.

- For buildings permitted to have a single exit, the base line value is Category a.
- For buildings requiring two or more exits, the base line value is Category b.

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Performance Compliance Method

Section 1301.6.16 – Mixed Occupancies

- Specifically addresses the presence of rated vertical and horizontal separation between different occupancy types
- Emphasizes the need for fire-resistance rated separation that is twice the rating required by the IBC when multiple occupancy types are present in an existing building.
- Penalizes a building with fire-resistance rated occupancy separations that are only 1-hour rated.

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Performance Compliance Method

Section 1301.6.17 – Automatic Sprinklers

- Addresses the ability to suppress a fire due to the presence of an automatic sprinkler system.
- Is based on the applicable occupancy type requirements of IBC §903.2 as well as the building height and area requirements in Chapter 5 of the IBC (General Building Heights and Area).
- Positive point values are given to an existing building to promote the installation of complete building sprinkler protection.

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Performance Compliance Method

- As indicated by the significant negative and positive point values associated with the lack of or presence of complete building automatic sprinkler protection, the IEBC strongly encourages the installation of complete building automatic sprinkler protection per NFPA 13 for overall building safety.

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Performance Compliance Method

Section 1301.6.18 – Standpipes

- Addresses the ability to initiate interior firefighting operations by providing a readily available source of water in accordance with NFPA 14
- Note a for Category a – the standpipe system is limited to Categories b-d

2021 IEBC Essentials 334

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Performance Compliance Method

Section 1301.6.19 – Incidental uses

- Addresses the protection, whether passive (enclosure) or active (automatic sprinkler) or a combination of both, of incidental use areas
- No positive points are possible with this safety parameter due to the fact that incidental use areas are generally, considered more hazardous than the occupancy types present in the existing building.

2021 IEBC Essentials 335

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Performance Compliance Method

Section 1301.6.20 – Smoke compartments

- Addresses the presence of smoke barriers on each story of an existing building or structure and to provide 1-hour rated barriers to restrict the passage of smoke per the IBC.
- The only occupancy type requiring smoke compartments is health care occupancies (Group I-2) due to their defend-in-place nature.
  - This performance compliance method does not permit an I-2 occupancy without smoke compartments.
  - The IEBC will not permit smoke compartments exceeding 22,500 ft^2 (2,092 m^2) in health care occupancies.

2021 IEBC Essentials 336

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Performance Compliance Method

Section 1301.6.21 – Patient Ability, Concentration, Smoke compartment location and ratio to attendant

- To determine the safety factor:
  - Enter the values of each of the safety parameters into Table 1301.7
  - Multiply the three safety factors together
  - If the sum is ≥ 9, compliance has failed

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Performance Compliance Method

Section 1301.6.21.1 – Patient ability for self preservation

- Patient ability is broken down into the following three categories:
  - Category a – Patients are capable of self-preservation without assistance (1 point)
  - Category b – Patients rely on assistance for evacuation or relocation (2 points)
  - Category c – Patients that cannot be evacuated or relocated (3 points)

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Performance Compliance Method

Section 1301.21.2 – Patient Concentration

- Patient concentration is broken down into the following three categories:
  - Category a – Smoke compartment has 1 – 10 patients (1 point)
  - Category b – Smoke compartment has 11 – 40 patients (2 points)
  - Category c – Smoke compartment has more than 40 patients (3 points)

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Performance Compliance Method

Section 1301.6.21.3 – Attendant-to-Patient Ratio

- Attend-to-patient ratio is broken down into the following three categories:
  - Category a – Attend-to-patient ratio is 1:5 (1 point)
  - Category b – Attend-to-patient ratio is 1:10 (2 points)
  - Category c – Attend-to-patient ratio is greater than 1:10 or no patients (3 points)

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Performance Compliance Method

Section 1301.7 – Building Score

- Scores from the 21 Safety Parameters are entered into the summary sheet
- The point values for each safety category are added to provide for an overall building safety score for Fire Safety, Means of Egress, and General Safety

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Performance Compliance Method

TABLE 1301.8
MANDATORY SAFETY SCORES(a)

OCCUPANCY	FIRE SAFETY (FS)	MEANS OF EGRESS (MME)	GENERAL SAFETY (GS)
A-1	20	31	31
A-2	21	32	32
A-3	22	33	33
A-4, E	29	40	40
B	30	40	40
F	24	34	34
I-2	19	34	34
M	23	40	40
R	21	38	38
S-1	19	29	29
S-2	29	39	39

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Performance Compliance Method

Section 1301.9 – Evaluation of Building Safety

- The finals scores are determined using the evaluation formulas in IEBC Table 1301.9 as follows:
  - Fire Safety FS – MFS
  - Means of Egress ME – MME
  - General Safety GS – MGS

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Performance Compliance Method

- If the final score fails, the designer or owner can choose one or more of the 21 safety parameters to bring into compliance to achieve a positive score without bringing the remainder of the building into compliance with the IBC or IEBC chapters 5-12.

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Performance Compliance Method

Section 1309.1 – Mixed Occupancies

- No rated separation present in accordance with Section 1301.6.16, the mandatory safety scores for the occupancy with the lowest MGS in table 1301.8 must be used.
- Occupancy separation in accordance with Section 1301.6.16 is present;
  - The mandatory safety scores for each occupancy must be used. A total building score for each occupancy must be calculated using the formulas in Section 1301.9
  - Each occupancy must receive a passing total building score
- An evaluation is not required for areas with separated occupancies in accordance with Table 508.4 of the IBC and no alterations or change of occupancy occur.

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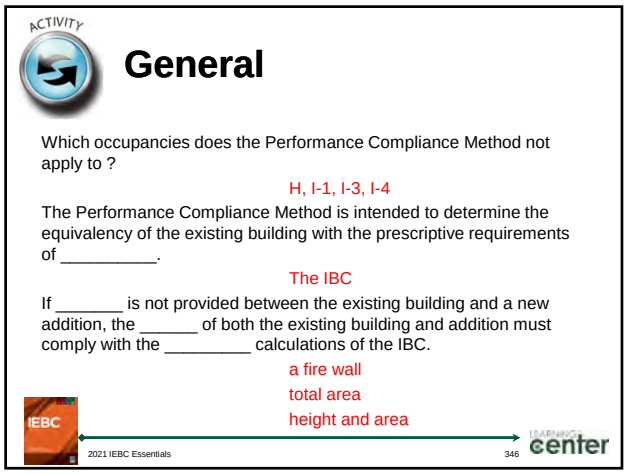

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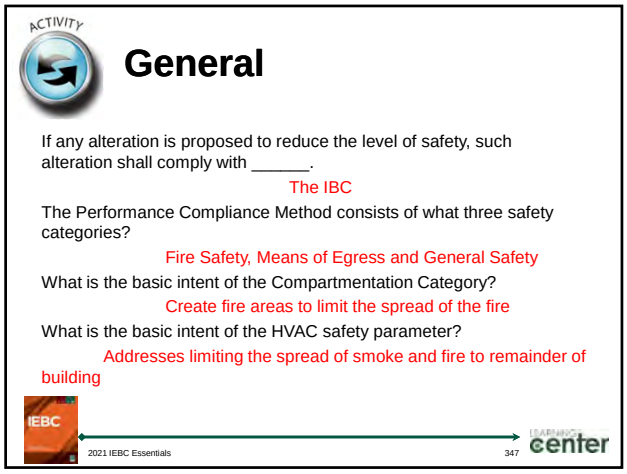

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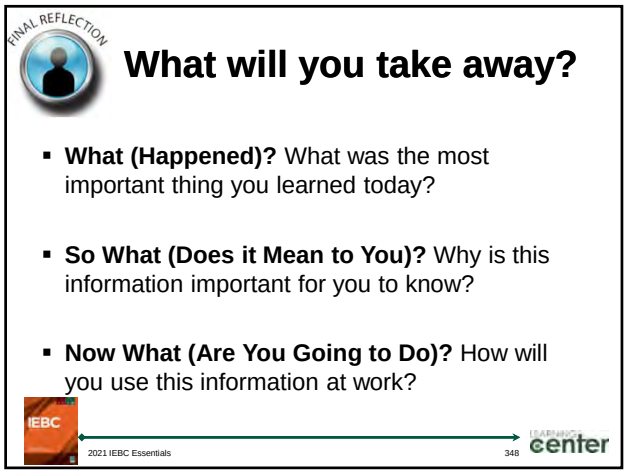

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- You will obtain full CEUs for this course, if you actively participate in the training activities and stay for the entire session. Evidence of this will be the sign out sheet.

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2018 IEBC® Essentials

Based on the 2018 Existing Building Code® (IEBC®)

Length:	1 Day (6 Contact Hours)
Applicable Codes:	2018 IEBC
Product Type/Status:	Seminar/Update
Level:	Entry

Project Team	
Instructional Designer	Valerie Pang
Subject Matter Expert	Beth Tubbs

(For in-house use only)

Background Information

Description

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.

Goal

Participants will be able to identify and describe key provisions of the 2018 IEBC.

Objectives

Upon completion of this seminar, participants will be better able to:

- Recognize the limitations and extent of the codes related to existing buildings.
- Recognize the classifications of work associated with existing buildings.
- Identify fire protection systems that need to be upgraded.
- Recognize vertical openings that need partial or complete enclosure.
- Identify unsafe interior finishes that need to be replaced.
- Determine adequate means of egress.
- Identify needed accessibility improvements.

- Identify improvements to structural systems.
- Describe the compliance alternative tabular method of evaluating existing buildings.

Target Audience

Architects, building inspectors, building officials, contractors, engineers and plans examiners

Prerequisites

Participants are at the **Entry** Level, which means they should be able to do or know the following before they participate or use this product.

- Has limited knowledge of construction codes and their application.
- Knows basic construction terminology, techniques, methods and materials.
- Reads basic construction documents.

Participants are at the **Intermediate** level, which means they should be able to do or know the following before they participate or use this product.

- Has construction work experience.
- Has at least one year in code enforcement.
- Computes basic mathematical calculations.
- Reads and interprets construction documents.
- Enforces, applies and interprets model codes.

Participants are at the **Advanced** Level, which means they should be able to do or know the following before they participate or use this product.

- Have extensive knowledge of construction codes and their application.
- Has at least five years' experience in code enforcement.
- Computes complex mathematical calculations.
- Reads, understands and interprets drawings, tables and charts.
- Has more than 10 years in code enforcement.

Instructional Concept

The **Seminar** hour length will be **6** contact hours, delivered in **1 day** training day(s), and will provide the following:

- Practice of concepts.
- Visual representation of examples to aid in learning.
- A reference workbook for participants to use after the seminar.
- Activities structured to encourage interaction with the content and with other learners.

Instructor Preparation

Course materials: For this course, the instructor will need the following materials:

1. Workbook
2. Instructor Abstract: This document originates from the course Design Development Brief, contains a course outline with timings with facilitation notes for activities.
3. PowerPoint Presentation, (CD) in Microsoft 2007.

Source documents or other resources here that will be helpful for instructors to review.

- 2018 International Existing Building Code
- 2018 IEBC Update may also be helpful since it contains information about key code changes from the 2012.

Instructor Responsibilities

1. **The instructor is expected to prepare adequately for the training event.**

    - Be familiar with the local building concerns.
    - Specific needs of the registrants.
    - Be acquainted with local and national news events that effect building safety and energy efficiency.
    - Be prepared to share any resources that may be used to help the participants.

2. **Become familiar with the content of this course.**

    - Add some examples to the training to help the learner.
    - Direct the leaner to the page in the workbook that correlates with what is listed on the slide.
    - Ask the learners questions that will elicit more than yes and no answers, provide feedback to them about their answers and encourage discussion and other opinions.

3. **Lead classroom activities to enforce learning.**

    - These activities are designed to enhance learning.
    - It is critical that these activities take place so that you have an opportunity to provide feedback to the participants and facilitate in the learning and reinforcement of concepts that may be new to the learner.

4. Facilitate lively discussions and provide your experience.

- Ask questions that will elicit more than a yes or no answer.
- Encourage those who are interpreting the code differently to participate in the discussion. This activity is where the learning happens.
- Talk from personal experience and encourage others to do so too.
- Thank participants for their comments and answers.

5. Provide feedback to all participants as they work during the course.

- Provide the learner with feedback and direct them to the answers to their questions in the code books. Provide examples to them and encourage the participants to consult the code to find answers.
- Know that participants will be asked if they can achieve the objectives of this class and that you have provided them with constructive feedback in the surveys, this will serve as evidence to our accreditation agency.

Timed Outline

Outline of Seminar (6 hours = 360 minutes)

I. Welcome and Essentials (10 minutes)
II. Administration (25 minutes)
- a. General
- b. Applicability
- c. Duties and powers of code official (
- d. Permits
- e. Construction documents
- f. Board of appeals
- g. Administration Activity

III. Compliance Method (25 minutes)
- a. Compliance Methods Activity

IV. Prescriptive Compliance Method (25 minutes)
- a. Additions, alterations or repairs
- b. Fire escapes
- c. Change of occupancy
- d. Historic buildings
- e. Moved structures
- f. Accessibility for existing buildings

V. Classification of Work (25 minutes)
- a. Classification of Work Activity

VI. Repairs (25 minutes)
- a. General
- b. Building elements and materials
- c. Fire protection
- d. Means of egress
- e. Accessibility
  - i. Structural
  - ii. Electrical
- f. Repairs Activity

VII. Alterations-Level 1 (25 minutes)
- a. General
- b. Building elements and materials
- c. Fire protection and means of egress
- d. Fire protection and means of egress
- e. Accessibility
- f. Structural
- g. Alternation Level 1 Activity

VIII. Alterations-Level 2 (25 minutes)
- a. General
- b. Building elements and materials
- c. Fire protection

- d. Means of egress
- e. Accessibility
- f. Structural
- g. Electrical
- h. Mechanical
- i. Plumbing
- j. Alternation Level 2 Activity

IX. Alterations-Level 3 part 1 (25 minutes)

- a. General
- b. Special use and occupancy
- c. Building elements and materials
- d. Means of egress
- e. Structural
- f. Change of Occupancy
  - i. General
  - ii. Special use and occupancy
  - iii. Structural
  - iv. Electrical
  - v. Mechanical
  - vi. Plumbing
  - vii. Change of occupancy classification

X. Alterations-Level 3 part 2 (25 minutes)

- a. Additions
- b. Heights and areas
- c. Structural
- d. Smoke alarms in occupancy Groups R-3 and R-4
- e. Accessibility
- f. Alternation Level 3 Activity

XI. Change of Occupancy (25 minutes)

- a. General
- b. Fire safety
- c. Change in Occupancy Activity

XII. Additions (25 minutes)

- a. Height and Area Activity

XIII. Historic Buildings

XIV. Relocated or Moved Buildings

- a. Activity

XV. Performance Compliance Alternatives (25 minutes)

- a. General (10 min)
- b. Construction Safeguards

XVI. Case Study Multi-Use Building (25 minutes)

XVII. Summary/Q & A (25 minutes)

Please allow time for breaks at natural intervals.

The Seminar At-A-Glance

Objectives	Topics	Instructional Strategy	Length	Time	Active or Passive
Welcome and Essentials	Welcome and Essentials	Before starting right into the content, ask participants to introduce themselves and answer one of the following questions: • **How long have you been working with the Existing Building code?** • **How many years experience do you have?** • **What do you want to learn about the Existing Building Code?** • **What is your current job title?** These questions will give you an idea of the experience level of the class so that as you work through the day, you can point out things that people said they wanted to know. You can also use the more experienced learners to give opinions and help those less experienced with the code.	**10 min.**	**8:00-8:10**	**Active/ Passive**
Module 1 Chapter 1 Administration	General Applicability Duties and powers of code official Permits Construction documents Board of appeals	Lecture **Activity:** Questions and Answer. Administration Questions. Participants complete questions. Debrief answers. (5)	**25 min**	**8:10-8:35**	
Module 2 Chapter 3 Compliance Methods		Lecture **Activity:** Compliance Methods Activity Participants complete questions. Debrief answers. (5)	**5 min**	**8:35-8:40**	

Module 3 Chapter 4 Prescriptive Compliance Method	Additions, alterations or repairs Fire escapes Change of occupancy Historic buildings Moved structures Accessibility for existing buildings Classification of Work	Lecture	**25 min**	**8:40-9:05**	
Module 4 Chapter 5 Classification of Work		Lecture **Activity:** Classification of Work Activity. Participants complete questions. Debrief answers. (5)	**5 min**	**9:05-9:10**	
Module 5 Chapter 6 Repairs	General Building elements and materials Fire protection Means of egress Accessibility Structural Electrical	Lecture **Activity:** Questions and Answer. Repairs Activity. Participants complete questions. Debrief answers. (5)	**25 min**	**9:10-9:35**	
Module 6 Chapter 7 Alteration Level 1	General Building elements and materials Fire protection and means of egress Fire protection and means of egress Accessibility Structural	Lecture **Activity:** Questions and Answer. Alternation Level 1 Activity. Participants complete questions. Debrief answers. (5)	**30 min**	**9:35-10:05**	
Module 7 Chapter 8 Alteration Level 2	General Building elements and	Lecture	**60 min**	**10:05-11:05**	

	materials Fire protection Means of egress Accessibility Structural Electrical Mechanical Plumbing	**Activity:** Discussion Alternation Level 2 Activity. Participants complete questions. Debrief answers. (5)			
Module 8 Chapter 9 Alteration Level 3	General Special use and occupancy Building elements and materials Means of egress Structural Change of Occupancy General Special use and occupancy Structural Electrical Mechanical Plumbing Change of occupancy classification Additions Heights and areas Structural Smoke alarms in occupancy Groups R-3 and R-4	Lecture **Activity:** Discussion, Accessibility Alternation Level 3. Participants complete questions. Debrief answers. (5)	**75 min**	**111;05-12:20**	
Lunch			1 hour	**12:20-1:20**	

Module 9 Chapter 10 Change in Occupancy	General Fire safety	Lecture **Activity:** Change in Occupancy Activity. Participants complete questions. Debrief answers. (5)	**10 min**	**1:20-1:30**	
Module 10 Chapter 11 Additions	Height and Area Activity	Lecture **Activity:** Additions Activity Participants complete questions. Debrief answers. (5)	**10 min**	**1:30-1:40**	
Module 11 Chapter 12 Historical buildings		Lecture	**5 min**	**1:40-1:45**	
Module 12 Chapter 13 Relocated or Moved buildings	Activity	Lecture **Activity:** Activity Participants complete questions. Debrief answers. (5)	**10 min**	**1:45-1:55**	
Module 13 Chapter 14 Performance Compliance Alternatives	General	Lecture	**10 min**	**1:55-2:05**	
Module 14 Chapter 15 Construction Safeguards		Lecture	**10 min**	**2:05-2:15**	
Case Study Multi Use Building		Lecture **Activity:** Select 2-3 individuals and form a team. Read the information. Participants complete questions. Debrief answers. (5)	**35 min**	**2:15-2:55**	
Summary Q and A			**10 min**	**2:55-3:00**	

Gerald C. Flanik

Gerald C. Flanik is an ICC-Certified Master Code Professional (MCP) holding over 30 various certifications and licenses. Mr. Flanik has conducted numerous energy analyses regarding commercial buildings in the areas of new construction and existing building energy utilization. Gerald has been responsible for a diverse array of design build projects throughout his career, Jerry provides energy code (commercial and residential) technical training for ICC chapters, ICC Annual Conferences, and home builder groups throughout the country as well as the U.S. Virgin Islands. He is also a LEED BD+C Accredited Professional with special focus on Energy and Atmosphere.

Mr. Flanik serves as the Chief Building Official for the County of Lake, State of Ohio Building Department and is an adjunct faculty instructor at Lakeland College in the Civil and Electrical Engineering Departments. Gerald holds a Bachelor of Science Degree in Mechanical Engineering from Cleveland State University, Bachelor of Science Degree in Electrical Engineering from Cleveland State University, as well as a degree in Civil Engineering Technology.

Jerry teaches multi-disciplinary courses for Lakeland College, Ohio Building Officials Association, State of Ohio Board of Building Standards, and the International Code Council. He teaches structural and non-structural IBC, all IRC, IMC, IFGC, IECC, ASHRAE, IPC, Accessibility, Green Building, LEED (Leadership in Energy and Environmental Design), and administrative topics.

File Attachments for Item:

EC-2 Authority-Having-Jurisdiction Seminar (Koorsen Fire and Security)

All certifications (7 hours)

APPLICATION FOR CONTINUING EDUCATION APPROVAL
COURSE CONDITIONS AND GUIDELINES

The Ohio Board of Building Standards is committed to the ongoing education and professional development of board-certified personnel through the delivery of high-quality, accurate and engaging professional continuing education content. To this end, the Board reviews and approves Continuing Education Courses for building department personnel.

Board approval is granted for course instruction on current codes and standards, including the OBC, OMC, OPC, and RCO, and any other content areas directly related to the responsibilities of the certification for which credit is being requested.

Promotion: Any person or organization promoting an approved course is required to make full and accurate disclosure regarding course title, course approval number, number of credit hours, categories for which the BBS has approved the class, and fees in promotion materials and advertising. ***The Board does not grant retroactive approval. It is recommended that courses be submitted for approval well in advance of any scheduling of classes and advertising.*** Advertising may not falsely state BBS approval before approval is granted. Course providers may state that BBS approval is pending.

Application Submission: All Applications and associated materials shall be submitted by email in .pdf format. Instructions for completing the application are attached.

Certificate of Completion: Course providers shall provide participants a certificate of completion containing the following information:

- Name of participant
- Title of approved courses
- BBS approval #
- BBS approved certifications
- Date of the continuing education program
- Number of approved credit hours awarded, and
- Signature of authorized sponsor or instructor.

Any person or organization administering an approved course shall return a completed BBS Course Attendance form by email.

Participants: Participants must attend the complete course as presented by the instructor to receive credit hours approved by the Board. The organization or instructor of online courses shall plan and execute methods to verify the individual's attendance and completion of the course. No partial credit will be given to any participant who failed to complete the entire course as approved.

Board approval: All courses are approved for the calendar year in which application is made. Courses may be renewed so long as the referenced code is in effect, and the CEUs, certification and content remain unchanged. When the referenced code is updated, courses must be updated, and new approvals obtained.

Facility/training area: BBS Course may be delivered in person or online, or both, at the sponsor's option.
Course facilities shall include the following:

In Person Classes:
- Sufficient seating capacity
- ADA accessible facilities
- Appropriate Audio/Visual devices for delivery
- Writing surfaces for participants

Online Classes:
- Web-accessible
- ADA accessible delivery
- Tech support available
- Live and recorded courses permitted

In-person facilities shall comfortably and safely seat at least the number of attendees present in the room and shall be climate controlled, non-smoking, and sound controlled so that outside noise will not interfere with the training.

Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Tyler Rice

Organization: Koorsen Fire and Security

Address: 8090 North Dixie Dr., Dayton, OH 45414

E-mail: tyler.rice@koorsen.com Telephone: (317) 225-6464

Website: Koorsen.com

Conference Sponsor (if applicable)_____ Conference Email:_____

Check here if Course Renewal:_____ Prior course number _____ *(i.e. BBS2018-429)*

Renewals will only be granted for identical content and certifications, within the current code cycle.
Attach a copy of prior course approval letter for confirmation. No further information is required.

New Course Information:

Course title: AUTHORITY HAVING JURISDICTION (AHJ) SEMINAR

Course instructor: JD Burden, Aaron Gearhart, Nick Rojowski, David Thompson

Course description: Course will educate and make AHJs aware of technology and codes pertinent to the fire industry. Presentations will include discussions of Sprinkler System inspections (wet, dry, pre-action and deluge), Fire Pump, Kitchen Hood systems, Fire Alarm systems, and Emergency Responder Communication Enhancements (BDA, DAS, ERRCS).

Instructional hours per session: 7 Number of Sessions: 1

Course Date(s) and Location: JULY 20TH, 2023

Special Content:

Code Administration: ☑
Existing Buildings: ☑
Electrical Instruction: ☐
Plumbing Instruction: ☐

Conference Course: _____
Conference Name: AHJ SEMINAR
Conference location: DAYTON, OH

Course to be offered online? ☐ **On Demand** ☐ **Webinar** ☐

Course Website: _____

Detail online course participation confirmation method *(i.e. test, quizlets, participant activity confirmation)*:

_____

Course applicable for the following certifications

Residential Certifications Only: ☐ Commercial Certifications: ☑
Administrative Course, All Certifications: ☐

Application materials included:

☑ Course Outline or Course Learning Objectives
☑ Presentation Materials/Slides (not required for roundtable courses)
☐ Assessment Materials (for online courses)
☑ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least on commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review. Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content. Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

Course applicable for the following certifications

This section represents a major change from previous BBS course approval forms.

1. If the course is only for residential certifications, check 'Residential Certifications Only'. The course, if approved, will be approved for all residential certifications.
2. If the course is appropriate for any commercial certifications, check Commercial Certifications. The course, if approved, will be approved for all commercial certification **AND** all residential certifications.
3. If the course is intended to meet required instruction in Code Administration (Chapter 1) or Existing Buildings (commercial or residential) check 'Administrative Course, All Certifications'.

Application Materials Included

This is a checklist for the course submitter's use, to be sure all materials necessary for review are included with the application. All materials should be submitted in .pdf format, along with the application, via email to Michael.Lane@com.ohio.gov or BBS@com.ohio.gov

SPEAKERS

JD Burden, Corporate Trainer Water Suppression, Koorsen Fire & Security

JD has been in the fire protection industry for over 20 years. He joined Koorsen Fire & Security as a System Service Technician in 2003 servicing restaurant and sprinkler systems. In 2004 he became the Systems Service Manager taking responsibility for all sprinkler, backflow, and fire pump service and repair. He was also responsible for the design and installation of restaurant suppression systems, assisted in CAD drawings, and helped service technicians. Today he trains Koorsen associates on Sprinkler System Inspection and Repairs, and a variety of other topics in addition to providing technical support as needed. JD is NICET Level I certified in Special Hazards and Water-Based Systems Layout and NICET Level III certified in Inspection & Testing of Water-Based Systems. He graduated from Oklahoma State University's Fire Pump, Inspection, & Testing School, is certified in Ansul Foam Fire Fighting Systems and Backflow Inspector, and is an Emerging Leader graduate.

Aaron Gearhart, Account Manager, Accurex

Aaron began his career as a facilities engineer, first in shipbuilding and then in the automotive industry, with responsibilities including life safety/loss prevention, HVAC, industrial ventilation, and construction management, among many others. In 2019, he transitioned to a technical sales role with Accurex, where he has specialized in the design, application, and installation of kitchen ventilation systems. He has a Bachelor of Science degree in mechanical engineering from The Ohio State University.

Nick Rojowski, Corporate Trainer Systems, Koorsen Fire & Security

Nick began his career at Koorsen in 2008. He has fifteen years of experience in the low voltage troubleshooting field including home medical products, hospital equipment, and handicap vehicles to name a few. He also has six years of management experience and has spent twelve years in the fire alarm department. He most recently held the position as District Systems Manager for the Central Indiana District at Koorsen. Previously, he held the positions of Fire Alarm and Sprinkler Inspections, Fire Alarm Service, Service Project Manager, and Systems Service Manager. Today, he trains Koorsen associates in Fire Alarm, Sprinklers and Nurse Call Systems. Nick is NICET Level III certified in Fire Alarm, Level II in Fire Alarm Inspections, and Level I in Inspection and Testing of Water Based Systems.

David Thompson, Corporate Director of Engineered Systems, Koorsen Fire & Security

David has been in the life safety world since 1997. Starting with Simplex he has worked for JCI (prior to Simplex acquisition) spending a few years with a small life safety company in Evansville, IN. He began his time with Koorsen Fire and Security in 2004 until 2016 doing System Sales including Security, Fire Suppression (Clean Agent) Security, Access Control CCTV, and Sound / Intercom. In 2016 David went to Honeywell as a Regional Manager for the Midwest managing Gamewell FCI Fire Alarm. In 2019 Honeywell tasked him as Nation Business Development for the new BDA product line they introduced and he was in that role until coming back to Koorsen in November 2021 to help grow the BDA business and manage overall Fire Alarm sales.

COURSE OBJECTIVES:

a. **Sprinkler Systems**
   i. Sprinkler System components and application of NFPA 13 and NFPA 25
   ii. Compare and contrast Wet Systems and Dry Systems
   iii. Explain Antifreeze Systems
   iv. Discuss Pre-action /Deluge Systems
   v. Explain Foam Systems
   vi. Discuss Control Valves
   vii. Discuss Fire Department Connections
   viii. Explain Fire Pumps
   ix. How to visually inspect Sprinkler types, mounting, and operability
   x. Questions and Concerns to follow: 1.5 hours

b. **Hood Listings**
   i. Discuss related codes and standards.
   ii. Explain IMC Section 507.
   iii. Discuss Type I and Type II hoods and allowed configurations.
   iv. Explain UL listing and how it applies.
   v. Define IMC Chapter 2
   vi. Discuss Duty Ratings for appliances and airflows.
   vii. Discuss protection of extra heavy duty and solid fuel.
   viii. Explain exhaust fan and make up air requirements
   ix. Discuss grease duct requirements
   x. Questions and Concerns to follow: 1.5 hours

c. **Fire Alarm Systems**
   i. Types of Fire Alarm systems
   ii. Conventional vs. Addressable/Intelligent
   iii. System components
   iv. Testing equipment
   v. Testing procedure/requirements
   vi. Panel use
   vii. False alarm causes
   viii. Common troubles
   ix. Questions and Concerns to follow: 1.5 hours

d. **Emergency Responder Communication Enhancement Systems (BDA)**
   i. BDA 2022: Bi-Directional Amplifier
   ii. Discuss the evolution of code requirements: NFPA 72, NFPA 1221 / 1225 and IBC/IFC code along with UL 2524 requirements.
   iii. How and When to perform Signal Testing per NFPA & IFC; and if BDA is required, how would that be deployed.
   iv. Explore "Predictive Signal or Heat Map" design and the Software used to create them.
   v. Explore and Discuss related Conduit issues and 2 Hour requirements.
   vi. Questions and Concerns to follow. 1.5 Hours

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FIRE ALARM SYSTEMS

Presented By: Nick Rojowski
Corporate Trainer, Systems

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TRAINERS

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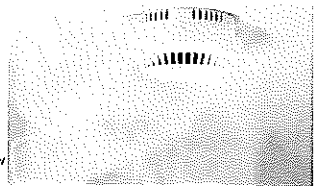
Nick Rojowski
Corporate Trainer, Systems



- Started at Koorsen in 2008.
- 20 years of experience in the low voltage troubleshooting field.
- Previously worked as District Systems Manager for the Central Indiana District at Koorsen.
- Currently trains Koorsen associates in Fire Alarm, Sprinklers and Nurse Call Systems.
- NICET Level III

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Fire Alarm Systems

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Course Overview

- Types of fire alarm systems
- System components
- Testing equipment
- Testing procedure/requirements
- Panel use
- False alarm causes

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Fire Alarm Systems

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Fire Alarm Systems

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Fire Alarm Systems

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Purpose of a fire alarm System

- Initiate an alarm, trouble, or supervisory.
- Notify occupants of an emergency
- Activate fire safety controls
- Contact Emergency Personnel

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Fire Alarm Control Panels

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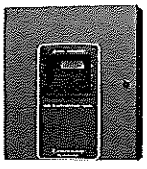
Conventional

- Normally found in smaller or older buildings.
- Multiple zones, where a number of devices are connected.



Addressable or Intelligent

- Can be used in any sized facility.
- Can be modified to "grow" with the building.

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Fire Alarm System Components

- Control Panel
- Power Supplies
- Initiating Devices
- Notification Devices
- Fire Safety Control Functions

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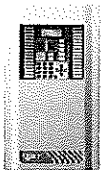
Control Panel

- Logic to map inputs to outputs
- Monitors power supplies and circuits
- Indicates status of system- Alarm, Trouble, or Supervisory
- Acts as a Person- Machine Interface
- Can communicate to monitoring station



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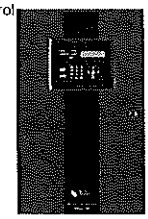
Conventional

- Uses initiating device circuits (IDC) or zones to annunciate where the issue is.
- Can also be used as a "specialized" control panel (i.e. elevator recall).
- Limited expansion capability, and limited control functions.



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CONVENTIONAL SYSTEMS

- Limited number of zones, usually separated by floor, or device type (i.e. Smoke detectors, sprinkler, pull stations)
- Need zone description to determine general location of issue.
- May be zone list at fire alarm panel.
- Some conventional panels have LCD displays.

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Addressable or Intelligent

- Utilizes a Signaling Line Circuit (SLC) to communicate with devices.
- Most are limited to 252 intelligent devices per loop, some panels allow additional loops to be added.
- Addressable initiating devices must be listed with panel.
- Provides a location of event, based on programming.

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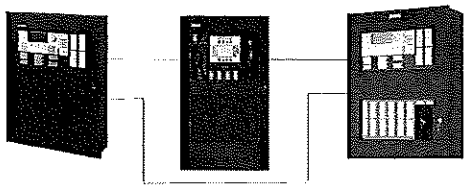
Multiplex Systems

- Intelligent panels networked together through an SLC.
- Often found in large facilities or campuses.



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Document Cabinet

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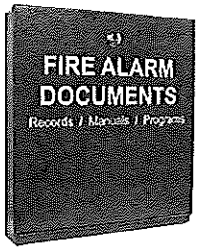
NFPA 72 (2016)

7.7.2.1- With every new system, a documentation cabinet shall be installed at the system control unit or at another approved location at the protected premises.



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Fire Alarm Systems

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Primary power supplies

- Usually 120 volt commercial light and power.
- Dedicated branch circuit.
- Accessible only to authorized personnel.
- Clearly marked in red "Fire Alarm".
- Location of disconnecting means shall be permanently identified at the fire alarm control unit.
- An approved breaker lock shall be installed.

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Primary Power Supply

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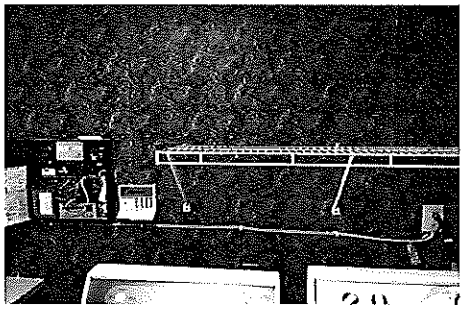

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Power Supplies

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Primary power supply:

- Can be generator (a person trained in the operation of the generator must be present at all times.)
- Must be a dedicated circuit.

Secondary power supply:

- Usually batteries (2 12v).
- Can be a generator, still require batteries.

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Fire Alarm Systems

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Initiating Devices:

Manual pull station

- Provides a means of manual activation.
- Required on all fire alarm systems that have automatic detection.

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Initiating Devices

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Smoke detectors

- Conventional 2-wire detectors must be listed with panel.
- Photoelectric:
  - Most common
  - Works best on smoldering fires
- Ionization:
  - Works best on fast burning, flaming fires or black smoke

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Fire Alarm Systems

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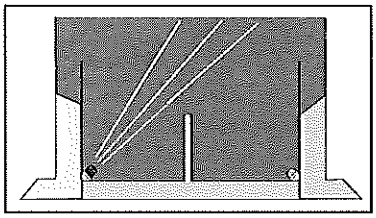
PHOTOELECTRIC SMOKE DETECTORS

Photoelectric smoke detectors use light reflection and diffraction to sense smoke.



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Fire Alarm Systems

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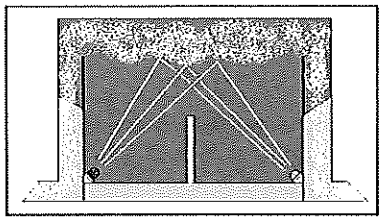
Photoelectric smoke detectors use light reflection and diffraction to sense smoke.



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Fire Alarm Systems

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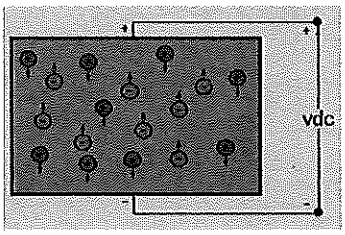
IONIZATION SMOKE DETECTORS

Ionization smoke detectors use voltage drop to sense smoke.



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Fire Alarm Systems

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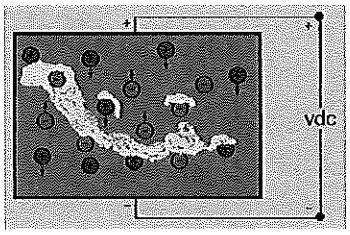

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Fire Alarm Systems

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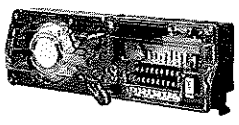
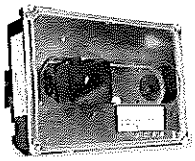
DUCT DETECTORS

- Smoke detectors that sense smoke in HVAC systems.
- Used for HVAC shutdown or smoke control.
- If fire alarm system present, they must be connected and report a supervisory signal.
- Not life safety devices.





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Fire Alarm Systems

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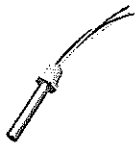
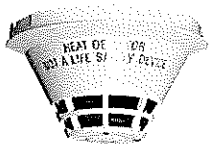
HEAT DETECTORS:

- Fixed Temperature
- Rate of Rise
- Rate compensate





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Fire Alarm Systems

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HEAT DETECTORS:

Heat Detectors are not considered life safety devices.

Should only be used in areas not normally occupied or environments not suitable for smoke detectors.

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Fire Alarm Systems

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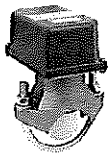
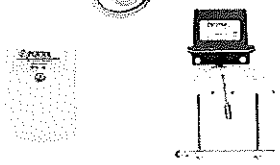
SPRINKLER DEVICES:

- Waterflow switches
- Valve tamper switches
- Other supervisory switches





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Fire Alarm Systems

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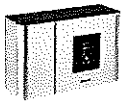
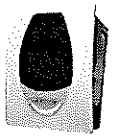
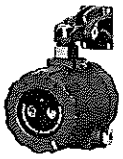
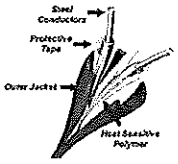
OTHER INITIATING DEVICES:

- Beam detectors
- Linear heat detection
- Aspirating smoke detectors
- UV/IR detectors
- Video flame detectors









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Signal Activation

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Signal Operating Time

NFPA 72 2016:

10.9 Fire Alarm Signals: within 10 seconds after initiating device activated

10.11 Supervisory signals: indicated within 90 seconds

10.12 Trouble signals: Indicated within 200 seconds

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Fire Alarm Systems

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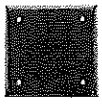
Notification devices:

- Notify occupants of an emergency.
- Devices must be compatible with the panel and other devices.
- Horn
- Strobe
- Speaker
- Bell



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Fire Alarm Systems

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NOTIFICATION DEVICES:

Sound level needs to be 15 dB above the average ambient sound level or 5 dB above the maximum sound level lasting more than 60 seconds, whichever is greater.

Measured 5 feet above the floor using the A-weighted scale on a Type 2 dB meter.

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Fire Alarm Systems

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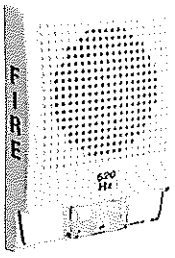
NOTIFICATION DEVICES:

Sleeping Areas

- Must be a minimum of 75dBA
- Have a frequency of 520 Hz
- Measured at pillow level



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Fire Alarm Systems

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NOTIFICATION DEVICES:

Visible devices need to be used when sound level exceeds 105 dB.

Mounting height not less than 80 in. And not greater than 96 in. above finished floor.

Per ADA laws, visible notification devices need to be used in all public areas.

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Fire Alarm Systems

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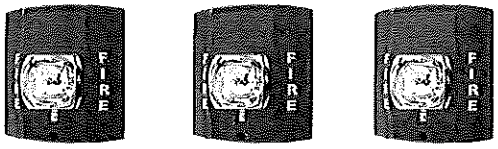
NOTIFICATION DEVICES:

If more than 2 visible devices are visible, the strobes need to be synced.



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Fire Alarm Systems

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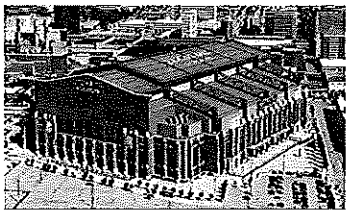
SPEAKERS:

Voice evacuation systems are used in high-rise buildings or large facilities where total evacuation may not be practical and specific instructions may need to be given.



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Fire Alarm Systems

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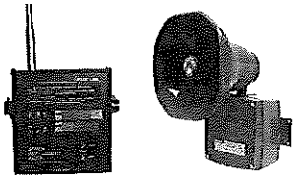
NOTIFICATION DEVICES:

When speakers are used, minimum dB requirements only apply to the preannouncement tone. Voice intelligibility test may need to be performed.



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Fire Alarm Systems

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CONTROL FUNCTIONS:

Control functions interface with other equipment to prevent the spread of smoke and fire, and to aid in evacuating occupants and or life preservation.

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Fire Alarm Systems

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CONTROL FUNCTIONS:

- Door holders
- HVAC shutdown
- Fire doors
- Elevator recall
- Access control
- Exhaust fans
- Stairwell pressurization

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Fire Alarm Systems

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Test Equipment

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VISUAL INSPECTIONS

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- Visual inspections must be performed in accordance with Table 14-3.1.
- Visual inspections ensure there have not been any changes that could affect the operation of the equipment.
- A good visual inspection is the first step in reducing false alarms.

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VISUAL INSPECTIONS

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Good visual inspections should ensure that:

- Devices such as manual stations, beam detectors and strobe lights are not obstructed.
- Smoke detectors are clean and not dirty*.
- Devices are mounted securely and are not missing.
- Outdoor devices have watertight connections and covers.
- Free of loose or broken connections.
- Heat detectors are not painted**.

** Any smoke detectors found dirty should be cleaned per the manufacturers instructions or replaced.*
*** Any heat detectors found painted should be replaced.*

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Fire Alarm Systems

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Fire Alarm Systems

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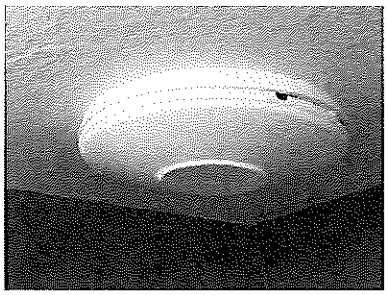

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Acceptance Testing

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NFPA 72 (2016)

7.5.8 Verification of Compliant Installation:

7.5.8.3 Verification shall ensure that:

1. All components and functions are installed and operate per the approved plans and sequence of operation.
2. All required system documentation is complete and is archived on site.
3. For new supervising station systems, the verification shall also ascertain proper arrangement, transmission, and receipt of all signals required to be transmitted off-premises and shall meet the requirements of 14.4.1 and 14.4.2
4. For existing supervising station systems that are extended, modified, or reconfigure, the verification shall be required for the new work only, and reacceptance testing in accordance with Chapter 14 shall be acceptable
5. Written confirmation has been provided that any required corrective actions have been completed.

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Battery Tester

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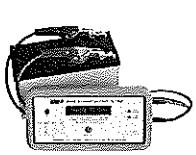
- Used to measure simulated load voltage and Amp-hours of batteries
- Batteries in fire panel and NAC panels are tested annually, as well as the chargers.



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Decibel Meter

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- Used to measure sound pressure levels
- Use "A" weighting scale

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Function Testing

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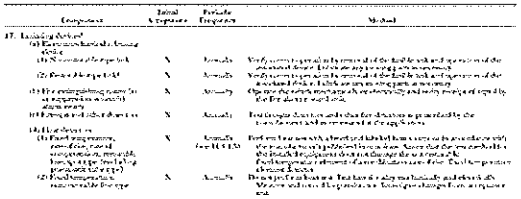
NFPA 72 (2016)

Table 14.4.3.2 establishes the test frequency and test methods for the function testing of all devices on a fire alarm system.



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Smoke Detector Tester

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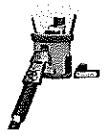
- Used for testing smoke detectors
- Sabre used for initial acceptance testing and in low airflow areas
- Solo No-Climb can be used for all other smoke detector testing
- Testifire can used for multi-criteria devices and heat detector testing.



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Heat Detector Testers

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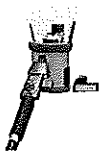
- Used to test restorable heat detectors

- Prefer Solo No-Climb



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Sensitivity Testing

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NFPA 72 2016

Chapter 14 Inspection, Testing, and Maintenance

14.4.4.3.1- Sensitivity shall be checked within 1 year after installation.

14.4.4.3.2- Sensitivity shall be checked every alternate year thereafter unless otherwise permitted by compliance with 14.4.4.3.3.

14.4.4.3.3- After the second required calibration test, if sensitivity tests indicate that the device has remained within its listed and marked sensitivity range, the length of time between calibration tests shall be permitted to be extended to a maximum of 5 years.

14.4.4.3.3.1- If the frequency is extended, records of nuisance alarms and subsequent trends of these alarms shall be maintained.

14.4.4.3.3.2- In zones or in areas where nuisance alarms show any increase over the previous year, calibration tests shall be performed.

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Sensitivity Testers

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- TruTest
  - Used to test sensitivity of conventional smoke detectors on flat ceilings when there is not a manufacturer's device that will work.
  - Slow but accurate.
  - Will give approximate alarm point.

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Sensitivity Testers

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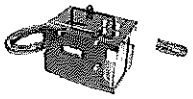
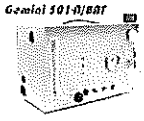
Gemini 501A / B

- Used on conventional smoke detectors that do not have and manufacturer's device.
- Can be used on sidewall, sloped ceilings, and duct detectors.
- Can only test if sensitivity is within range, not an alarm point.





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Sensitivity Testers

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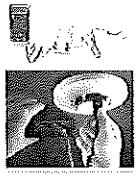
Approved manufacturers devices

- Refer to detector data sheet to find out how to test.
- Must provide customer with data sheet for these devices.
- Some devices are self testing.
- Some panels will provide detector sensitivity ranges.



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Manometer

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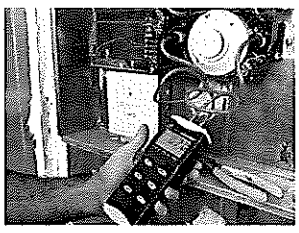
- Used to measure pressure differential across sampling tubes of duct detectors.
- Not used every year unless required by AHJ.
- Used when installing new unit, randomly, or when suspecting clogged sampling tube.



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Fire Alarm Systems

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Using a Fire Alarm Panel

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Fire Alarm Systems

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USING A FIRE ALARM PANEL:

- Main display
- Will show device activation and description.

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Fire Alarm Systems

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USING A FIRE ALARM PANEL:

- Acknowledge
- Silences a beeping panel

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Fire Alarm Systems

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USING A FIRE ALARM PANEL:

- Alarm Silence
- Silences the notification devices.

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Fire Alarm Systems

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USING A FIRE ALARM PANEL:

- Reset
- Resets alarms and latching supervisory devices.

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Fire Alarm Systems

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USING A FIRE ALARM PANEL:

- Scroll buttons
- Allows user to scroll to see additional information

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Fire Alarm Systems

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Common False Alarms & Troubles

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Leading Causes of Failures

- Lack of maintenance is the leading cause of failures of fire alarm systems.
- Without proper maintenance and testing, fire alarm systems may not operate when they are needed.

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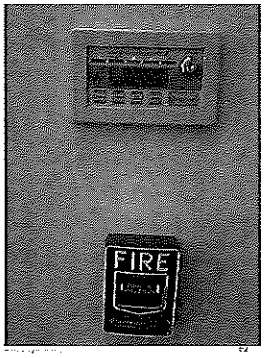
COMMON FALSE ALARMS

- Someone pulls a manual pull station.



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COMMON FALSE ALARMS

- Dirt or debris in a smoke detector.

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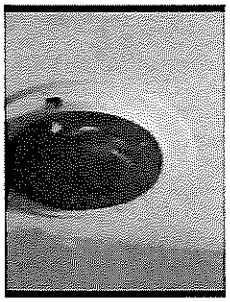
COMMON FALSE ALARMS

- Moisture – steam, condensation, roof or pipe leaks.



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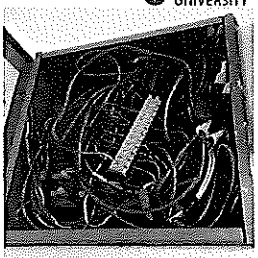
COMMON FALSE ALARMS

- Electrical interference



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Fire Alarm Systems

COMMON TROUBLES:

- Battery Trouble

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Common Troubles

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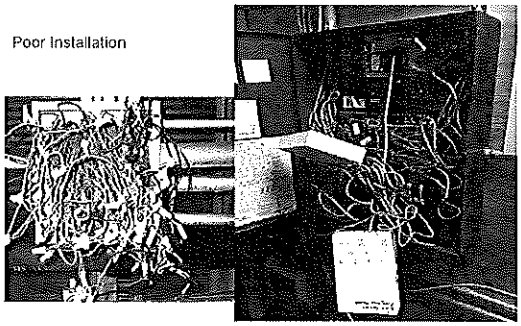
Poor Installation



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Common Troubles

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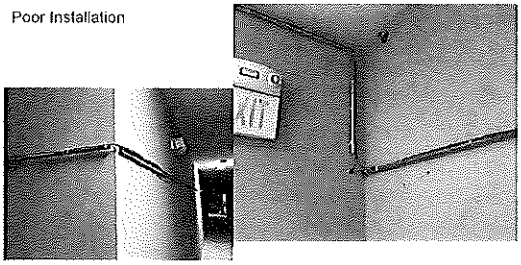
Poor Installation



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Common Troubles

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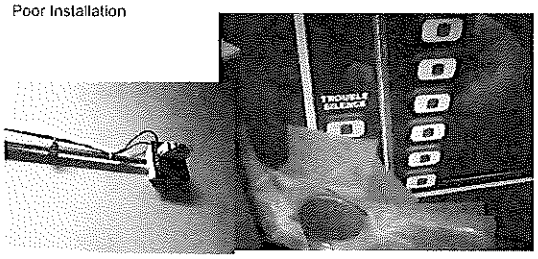
Poor Installation



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Common Troubles

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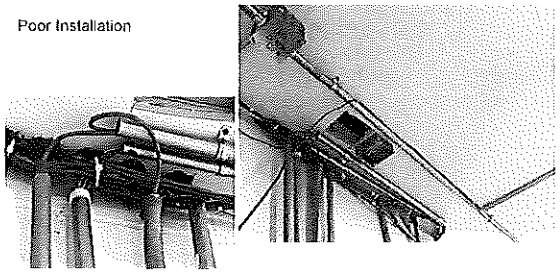
Poor Installation



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Common Troubles

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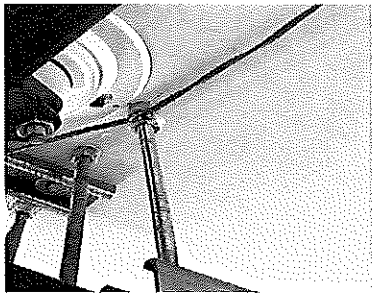
SLC short
Ground fault



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Common Troubles

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Missing Device

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Fire Alarm Systems

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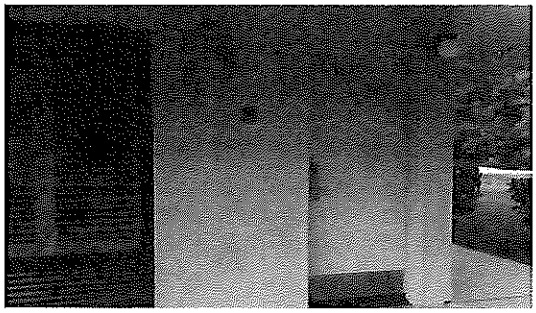

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Fire Alarm Systems

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Who has the 1st Question?

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Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

3/31/2023

Koorsen Fire and Security
ATTN: David Thompson

Dear Mr. Thompson:

Thank you for submitting applications for continuing education course credit with the Ohio Board of Building Standards (Board). The following courses have been approved for the 2023 calendar year. See attached page(s).

Course sponsors are required to provide a certificate of completion to participants which shall include the name of participant, course title as approved, date, approved credit hours, approved certification categories, and approved course ID number. After completion of a course, the course sponsor shall file with the Board a list of the names of participants with their certification number. Course sponsors shall formulate a method to verify the individual's attendance and completion of the course. No partial credit shall be given to any participant who failed to complete the entire course as approved.

Approval numbers are good from the date of Board approval until December 31st of the calendar year. At the end of the calendar year, you may reapply for a new approval number. If the course content has not changed or if the code has not been updated, the application will be processed administratively. When applying for a new approval number, please state on the application whether the course content has changed, along with the date the course is to be held.

Course instructors should be knowledgeable of the currently adopted codes and standards and should promote the uniform application of these codes and standards to the extent possible. Additionally, because courses are often approved for both residential and nonresidential certifications, the course instructor shall highlight during the course any differences in the application of code requirements when necessary.

Please contact us with any questions you may have, and thank you for providing effective continuing education courses for code officials in Ohio.

Sincerely, for the Board of Building Standards,

Regina S. Hanshaw
Executive Secretary

RSH/mkl

Ohio Board of Building Standards
6606 Tussing Road
Reynoldsburg, OH 43068-9009

614-644-2613
Fax 614 -644-3147
TTY/TDD 800-750-075
com.ohio.go

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Course Number	Course Name	Certifications (Hours)
BBS2023-636	Understanding Emergency Responder Communication Enhancement Systems Codes and Technology	BI(1.0), BO(1.0), BPE(1.0), EPE(1.0), ESI(1.0), FPI(1.0), FPPE(1.0), MPE(1.0), MI(1.0), MechPE(1.0), NRIUI(1.0), PI(1.0), PPE(1.0), RBI(1.0), RBO(1.0), RIUI(1.0), RMI(1.0), RPE(1.0)

COURSE OBJECTIVES:

- **Sprinkler Systems**
  a. Sprinkler System components and application of NFPA 13 and NFPA 25
  b. Compare and contrast Wet Systems and Dry Systems
  c. Explain Antifreeze Systems
  d. Discuss Pre-action /Deluge Systems
  e. Explain Foam Systems
  f. Discuss Control Valves
  g. Discuss Fire Department Connections
  h. Explain Fire Pumps
  i. How to visually inspect Sprinkler types, mounting, and operability
  j. Questions and Concerns to follow: 1.5 hours

- **Hood Listings**
  a. Discuss related codes and standards.
  b. Explain IMC Section 507.
  c. Discuss Type I and Type II hoods and allowed configurations.
  d. Explain UL listing and how it applies.
  e. Define IMC Chapter 2
  f. Discuss Duty Ratings for appliances and airflows.
  g. Discuss protection of extra heavy duty and solid fuel.
  h. Explain exhaust fan and make up air requirements
  i. Discuss grease duct requirements
  j. Questions and Concerns to follow: 1.5 hours

- **Fire Alarm Systems**
  a. Types of Fire Alarm systems
  b. Conventional vs. Addressable/Intelligent
  c. System components
  d. Testing equipment
  e. Testing procedure/requirements
  f. Panel use
  g. False alarm causes
  h. Common troubles
  i. Questions and Concerns to follow: 1.5 hours

- **Emergency Responder Communication Enhancement Systems (BDA)**
  THIS PORTION OF THE PROGRAM HAS PREVIOUS BBS CEU APPROVAL
  (COURSE NUMBER BBS2023-636)
  a. BDA 2022: Bi-Directional Amplifier
  b. Discuss the evolution of code requirements: NFPA 72, NFPA 1221 / 1225 and IBC/IFC code along with UL 2524 requirements.
  c. How and When to perform Signal Testing per NFPA & IFC; and if BDA is required, how would that be deployed.
  d. Explore "Predictive Signal or Heat Map" design and the Software used to create them.
  e. Explore and Discuss related Conduit issues and 2 Hour requirements.
  f. Questions and Concerns to follow. 1.5 Hours

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We will be starting shortly

Thank you for joining us!

Koorsen FIRE & SECURITY

BDA / ERCES Systems

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Corporate Fire Alarm &
Communications Sales Manager

May 2022

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Fire Code Terminology NFPA 72 / 1221 IBC-- Commonly Used

Emergency Radio (Responder) Communication Enhancement Systems - ERCES
In-Building Emergency Responder Radio Systems - IBERRS
In-building public safety radio signal booster - IBPSRSB
In-building radio system -IBRS
In-building emergency communication radio enhancement systems – IBECRES
In-building emergency responder radio enhancement system – IBERRES
In-Building Public Safety Communication Systems - IBPSCS

Auxiliary Radio Communication | ARC Systems (in New York City & Long Island)

Public safety signal booster – PSSB
Public safety in-building communications systems – PSIBCS
Public safety bi-directional amplifier – PSBDA
Public safety radio enhancement system – PSRES

Emergency radio coverage system - ERCS
Emergency Communications Radio System – ECRS
Emergency responder radio coverage systems – ERRCS

Signal booster system – SBS
Distributed antenna system – DAS
2-way radio communication enhancement systems – RCES

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BDA Life Safety Benefits of BDA Systems

Codes & Standards

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Code-Driven Requirement

IBC 2015 - Section 916 NFPA 1 – Section 11.10
Refers to IFC section 510 or the state recognized fire code

IFC Section 510 Emergency Responder Radio Coverage

First appeared in the appendix of the 2009 IFC, the provision was moved to the body of the code in 2012

All of the States Koorsen Covers use IBC / IFC

Section 1103.2 of IFC specifies the requirements for emergency responder radio coverage in existing buildings

NFPA 72 National Fire Alarm and Signaling Code
2010 / 2013 Edition, section 24.5.2
The 2016 / 2019 edition of NFPA 72 relocated the requirements to NFPA 1221
NFPA 1221, Section 9.6 is a Life Safety Code
NFPA 1225 2022 Edition. Standard for Emergency Services Communication

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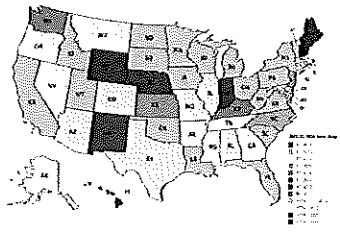
Required by code in most states



Enforcement is Growing as AHJs Learn about Life-Saving Benefits of BDAs

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ERCES / BDA System Codes & Standards

Code Requirements	NFPA*		IFC	
	NFPA 72 - 2013	NFPA 1221 - 2016	IFC 510 - 2015	IFC 510 - 2018
In Building Solution Required	Section 24.5.2	Section 9.6	Section 510.1	Section 510.1
Level 1, Level 2 or Level 3 Pathway Survivability	2 Hour for Riser Coaxial Cable Section 24.5.8.6.1	2-Hour for Riser Coaxial Cable Section 9.6.2.1.1	Not Addressed in Section 510 Referenced in 24.5.8.6.1 of NFPA 72-2013	Yes, Section 510.4.2. Reference to NFPA 1221
Plenum Rated Coaxial Cable Required	Yes, Riser & Feeder Coaxial Cable Section 24.3.6.8.11	Yes, Riser & Feeder Coaxial Cable Section 9.6.2.4.5.1	Not Addressed in Section 510 Referenced in 24.3.6.8.11 of NFPA 72-2013	Yes, Section 510.4.2. Reference to NFPA 1221
Lightning Protection Required	Not Addressed in Section 24.5.2	Yes, in accordance with NFPA 780 Section 9.6.5	Not Specifically Addressed in Section 510	Yes, Section 510.4.2.2 per NFPA 780 as Referenced in NFPA 1221
Isolation of Donor Antenna Required	Yes, 15 dB Section 24.5.2.3.3	Yes, 20 dB Section 9.6.9	Not Specifically Addressed in Section 510	Yes, 20 dB - Section 510.4.2.4(6)
Secondary Power Source	12 Hours Section 24.5.2.5.5.2	12 Hours Section 9.6.12.2	24 Hours - Section 510.4.2.3	12 Hours - Section 510.4.2.3 or 2-Hours Battery w/ Emergency Generator
Signal Strength & Area Coverage Required	-95 dBm - Section 24.5.2.3 90% General - Section 24.5.2.2.2 99% Critical - Section 24.5.2.2.1	DAQ 3.0 - Section 9.6.8 90% General - Section 9.6.7.5 99% Critical - Section 9.6.7.4	-95 dBm - Section 510.4.1 95% General - Section 510.4.1 99% Critical - Not Specifically Addressed in Section 510	DAQ 3.0 - Section 510.4.1.1 95% General - Section 510.4.1 99% Critical - Section 510.4.2 Reference to NFPA 1221
Monitoring By Fire Alarm Required	Yes - Section 24.5.2.6	Yes - Section 9.6.13	Yes - Section 24.5.2.6 NFPA 72-2013	Yes - Section 9.6.13 NFPA 1221-2016
Cabinets for Equipment & Battery Backup Required	Yes, NEMA 4/NEMA 4X -Section 24.5.2.5.2	Yes, NEMA 4/NEMA 4X - Section 9.6.11.2	Yes, NEMA 4 - Section 510.4.2.4(3) & (2)	Yes, NEMA 4/NEMA 4X - Section 510.4.2.4(3) & (2)
Monitor Antenna Malfunction Required	Yes, Donor Antenna - Section 24.5.2.6(2)(a)	Yes, [illegible] Section 9.6.13.2(2)(a)	Yes, Section 24.5.2.6(2)(a) NFPA 72-2013	Yes, Donor Antenna - Section 510.4.2.5
System Acceptance/Testing	Section 24.5.2.5.2	Section 9.6.4, 11.3.8 & 11.3.9.1	Section 510.5.5	Section 510.5.3

[illegible]

Always Verify *EXACT* AHJ BDA System Requirements for *Each Jurisdiction!*

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Indiana Amendment IBC 915

(jjj) Delete Section 915, Emergency Responder Radio Coverage, without substitution. *(Fire Prevention and Building Safety Commission; 675 IAC 13-2.6-10; filed Aug 1, 2014, 11:12 a.m.: 20140827-IR-675130339FRA, eff Dec 1, 2014; errata filed Aug 7, 2014, 8:54 a.m.: 20140827-IR-675130339ACA)*

Indiana is the only state to delete this section of International Building Code

However it can be enforced by local jurisdiction

Indiana is on a Code Cycle based on 2018 IFC

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IFC 2015 / 2012 Requirements New Buildings

510.1 Emergency responder radio coverage in new buildings.
All new buildings shall have approved radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building. This section shall not require improvement of the existing public safety communication systems.

Exceptions:
Where *approved* by the building official and the *fire code official*, a wired communication system in accordance with Section 907.2.13.2 shall be permitted to be installed or maintained instead of an *approved* radio coverage system.

Where it is determined by the *fire code official* that the radio coverage system is not needed.

In facilities where emergency responder radio coverage is required and such systems, components or equipment required could have a negative impact on the normal operations of that facility, the *fire code official* shall have the authority to accept an automatically activated emergency responder radio coverage system.

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IFC 2015 / 2012 Requirements Existing Buildings

1103.2 Emergency responder radio coverage in existing buildings.
Existing buildings that do not have approved radio coverage for emergency responders within the building, based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building, shall be equipped with such coverage according to one of the following:

1. Where an existing wired communication system cannot be repaired or is being replaced, or where not approved in accordance with Section 510.1, Exception 1.

2. Within a time frame established by the adopting authority.

Exception: Where it is determined by the fire code official that the radio coverage system is not needed.

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2015 IFC 510 / NFPA Coverage Requirements

510.4.1 Radio signal strength.
The building shall be considered to have acceptable emergency responder radio coverage when signal strength measurements in 95 percent of all areas on each floor of the building meet the signal strength requirements in Sections 510.4.1.1 and 510.4.1.2.

510.4.1.1 Minimum signal strength into the building.
A minimum signal strength of -95 dBm shall be receivable within the building.

510.4.1.2 Minimum signal strength out of the building.
A minimum signal strength of -95 dBm shall be received by the agency's radio system when transmitted from within the building.

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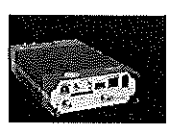
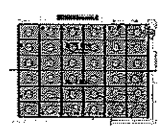
Downlink Signal Test using the PC Tel

Radio signal strength as measured by RSSI / BER / SNR

This test is conducted using the PC Tel tool per each Grid of the building floors. Technicians in each branch have been trained to use this tool and perform this test.

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2016 / 2019 NFPA 1221 Coverage Requirements

Radio signal strength.
The building shall be considered to have acceptable emergency responder radio coverage when signal strength measurements in 90 percent of all areas on each floor of the building meet the signal strength requirements

9.6.8.1 Minimum signal strength into the building.
A minimum signal capability of DAQ 3.0 shall be receivable within the building.

9.6.8.2 Minimum signal strength out of the building.
A minimum signal capability of DAQ 3.0 shall be receivable within the building.

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DAQ	Description
1	Unusable. Speech present but not understandable.
2	Speech understandable with considerable effort. Requires frequent repetition due to noise or distortion.
3	Speech understandable with slight effort. Requires occasional repetition due to noise or distortion.
3.4	Speech understandable without repetition. Some noise or distortion present.
4	Speech easily understandable. Little noise or distortion.
4.5	Speech easily understandable. Rare noise or distortion.
5	Perfect. No distortion or noise discernible.

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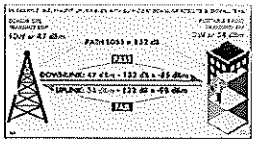
Code-Required Inbound and Outbound Signal Strength

Q: If signal strength readings are not performed at the donor site, how can you ensure a minimum outbound signal strength of -95 dBm?

A: Calculate outbound signal strength based on the inbound signal strength.

1. Determine the signal strength difference between the donor site ERP (effective radiated power) and the portable radio's ERP, typically 34 dBm.
2. Then subtract the signal strength difference from our in-building signal strength reading to determine the outbound signal strength



-88 dBm is the inbound signal strength and 13 dB is the signal strength difference (47 dBm – 34 dBm = 13 dB).
We can calculate the outbound signal strength as -82 dBm (-95 dBm - 13 dB = -82 dBm)
Although the minimum inbound signal strength is met, the site survey will fail since the outbound signal strength is below the required -95 dBm minimum

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NFPA Coverage Requirements

Critical Area Coverage – 99% (NFPA 2013 / 2016) coverage required in Critical areas:

- **Emergency Command Center(s)**
- **Fire Pump Room(s)**
- **Exit Stairs**
- **Exit Passageways**
- **Elevator Lobbies**
- **Standpipe Cabinets**
- **Sprinkler Sectional**
- **Valve Locations**
- **Elevator Cabs 2022**

General Area Coverage – General building areas should have **90%**

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NFPA Requirements

Dedicated Monitoring Panel
A dedicated monitoring panel shall be provided within the emergency command center to annunciate the status of any signal booster(s). The monitoring panel shall provide visual and labeled indication of the following for each signal booster:

- •Normal AC power
- •Signal booster trouble
- •Loss of normal AC power
- •Failure of battery charger
- •Low-battery capacity
- •Antenna failure
- **•THESE SAME POINTS SHALL ALSO BE SUPERVISED BY FIRE PANEL!**

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How do you know that the product was Listed for the Intended Purpose?

NFPA 1221 → NFPA 72 Chapter 10.3.1
NEC → 110.2 AND 110.3

"The equipment constructed and installed in conformity with this code shall be listed for the purpose for which it is used."
"Equipment shall only be approved if it is listed"
Listed is different than complies with, meets requirements of and certified to. AHJ should contact any lab that is not UL.

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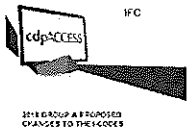
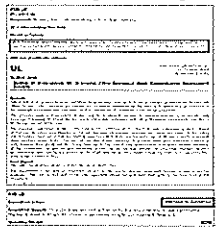
2021 ICC Requires UL 2524

2021 IFC, IBC, and NFPA 1 will all require BDA Systems to comply with UL 2524 & listed by an OSHA-accredited Nationally Recognized Testing Laboratory (NRTL)





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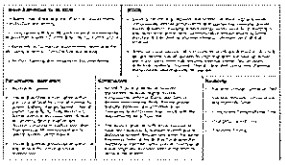
UL 2524 PERFORMANCE STANDARD FOR BDA SYSTEMS



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UL 2524 - Listed ERCES / BDA System

UL requires Oscillation Prevention

BDA Detects Oscillation & Reduces Gain in 5dB steps until no further oscillation

BDA Sends Trouble Signal to Fire Alarm Control Panel

BDA Indicates Trouble on Remote Annunciator / Monitor

BDA Continues normal operation with the maximum allowable gain

Address key concerns of AHJs

Zero Noise Squelch

Most BDAs normally generate a small amount of noise when idle.

The cumulative effect of all this noise raises the "noise floor" on a frequency.

Honeywell BDAs operate in "stand-by mode" and do not transmit any noise when idle.

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What is the UL 2524 Product Standard?

"The UL 2524 Creates a Product Performance Standard that allows manufacturers to design and list BDA systems to"

"UL 2524 Assures AHJs, A&Es, Building Owners & Occupants that Honeywell's BDA Systems Perform the First Time and Every Time—exactly as prescribed in IFC 510.5.3 and NFPA 1221."

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Public Safety Radio

"Reliable Radio Coverage is a Necessity! Lives Depend on It!"

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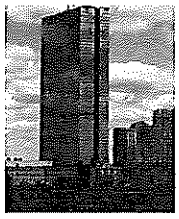
The PROBLEM:
In-Building Radio Signal Degradation

Radio signals are attenuated by:

- Concrete, Metal & Other Materials
- Low-E Glass
- Below-Ground Structures
- Other Obstructions
- Radio Frequency Interference

The consequence:

- Poor in-building Fire Fighter radio signal coverage and "dead spots"
- Emergency responders lose communications



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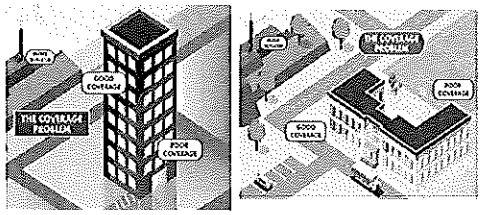
The Coverage Problem



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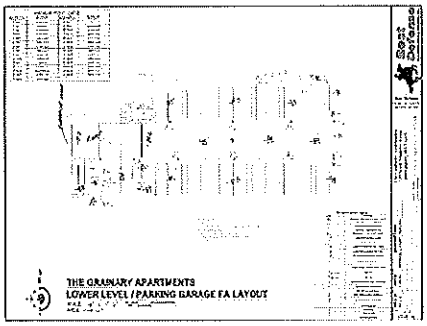

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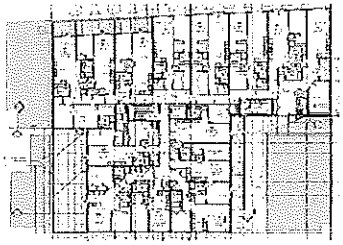
Radio Signal Survey – The "Coverage Map"



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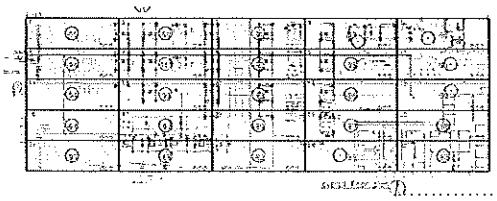

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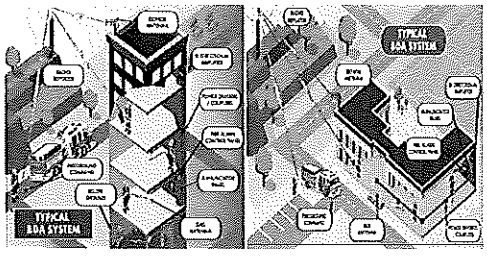
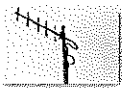
ERRCES / BDA - The Coverage SOLUTION:



BDA System Components

Donor Antenna
- Installed on the Roof of the building
- Pointing to the public safety radio repeater site
- High gain, high directivity
- Does not need line of sight



Coaxial Cable
- Typically Plenum Rated, ½" diameter
- Low insertion loss is required
- Red cable
- Some AHJs have special labeling requirements

Honeywell Passive DAS Devices

- Cable from RFS
- Complete line of passive components for Public Safety ISW systems.
- Full 136 – 870MHz frequency range for Public Safety
- Power Splitters: 2, 3 and 4 ways (DPS Series)
- RF Couplers: 6, 8, 10, 15, 20 & 30dB (DC Series)
- 3dB hybrid coupler (HC Series)
- Dual band combiner: 136-174MHz & 350-520MHz (DBC Series)
- Dual band combiner: 136-520MHz & 698-2700MHz (DBC Series)
- Triple band combiner: 136-174MHz & 350-520MHz & 758-865MHz (TMBC Series)
- Attenuators (AT Series)
- 50ohms Loads (LD Series)
- Isolators (LTB Series)
- N(f) connectors as standard
- BTS Duplexers, Filters, TX Combiners, RX Multi-couplers and more...

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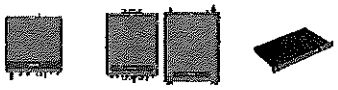
HONEYWELL BDA PORTFOLIO



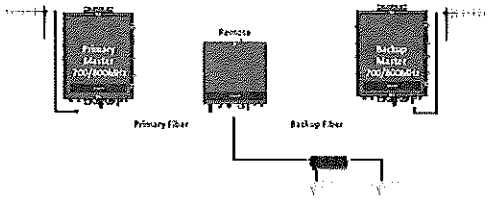
DH7S
700/800 + FirstNet
BDA
Fiber DAS Master
Fiber DAS Remote

DH14
VHF/UHF
BDA
Fiber DAS Master
Fiber DAS Remote

Rack Chassis
700/800 + FirstNet
Fiber DAS Master

Four Flexible Chassis Formats ...

HONEYWELL FIBER DAS REDUNDANCY



HONEYWELL MASTER REDUNDANCY

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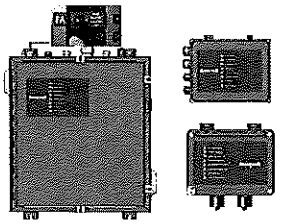
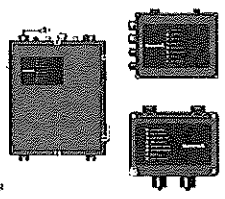
Honeywell Battery Backup Units & annunciators



Honeywell Battery backup Specifications

Models:
BTTY-100055 (12Hrs)
BTTY-100100 (24Hrs)
BTTY-ANN xxx (Remote Annunciator)

Standard Features:
- UL2524 2nd Edition listing
- Batteries included - Capacity: 55Ah or 100Ah
- 55Ah provides 12 hours backup time for 100W BDA
- 100Ah provides 24Hrs/100W BDA OR 12Hrs/200W BDA
- MAX load 270W
- NFPA 72 compliant
- Built-in annunciator
- Up to 4 remote annunciators can be connected in parallel
- 120VAC input / +24VDC output
- IP67 / NEMA 4 enclosure
- Tamper proof with lock and key accessibility
- Graphical user interface for easy setup
- Dimensions: 24 x 20 x 10 in.
- Weight – 55Ah: 150 lbs; 100Ah = 210 lbs.



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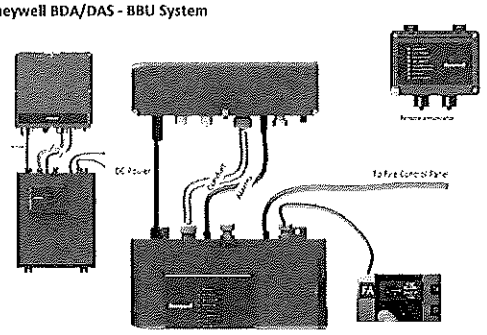
Honeywell BDA/DAS - BBU System



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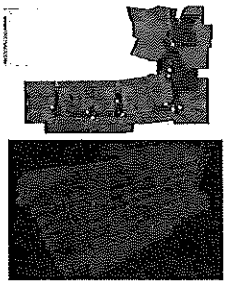
IB-Wave Design

- Benefits of IB-Wave Modeling
  - Signal Prediction for new construction.
  - Design layout for installers.
  - Submittal documentation for AHJ's and A&E's.



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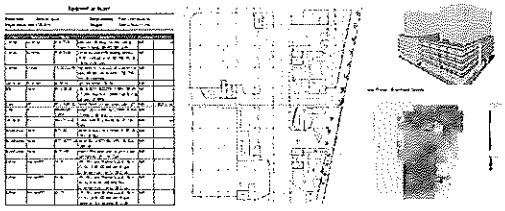
IBWAVE Design and support of AHJ package



COMPLETE TURNKEY OFFERING – DESIGN TO EQUIPMENT

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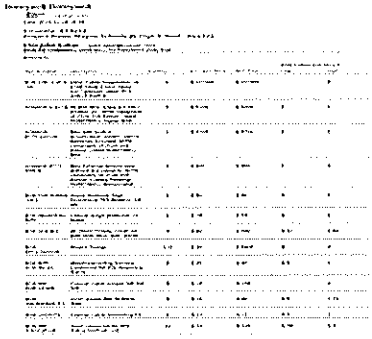
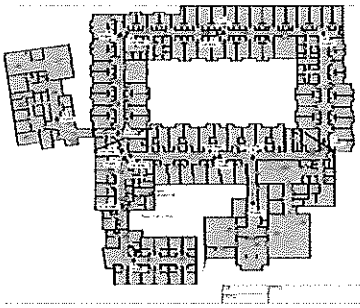
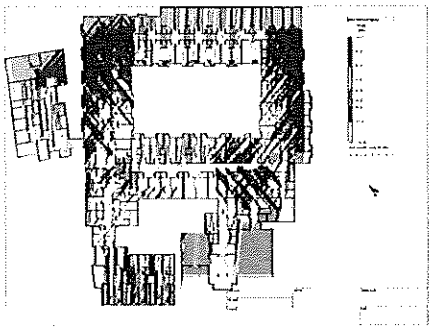
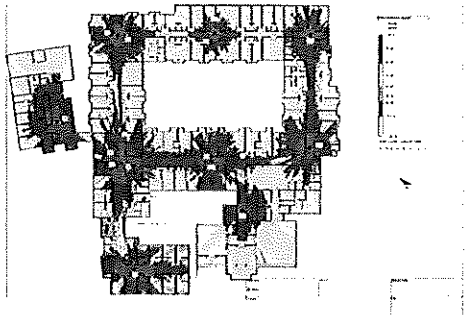


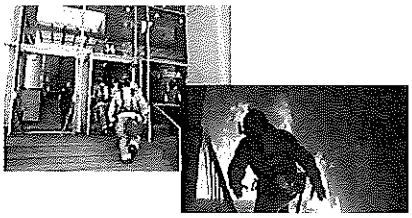
Typical Signal Survey Report







Going into the UNKNOWN:
Will My Radio Work In This Building?



44

Radio Signal Survey

Determines if a building has sufficient radio signal coverage or if it needs a signal enhancement (ERRCES) system.

It is a responsibility of the building owner or construction company to perform survey and to certify signal coverage on a 100% completed building. Survey report needs to be submitted to the AHJ.

AHJ Should have signal surveys for all buildings in the jurisdiction.

Signal enhancement (ERRCES) is required for building with insufficient coverage.

Final survey / signal coverage certification is done upon building completion.

Surveys are done by FCC GROL certified technicians. Minimum 20 readings per floor. Test all critical areas. Report submitted to AHJ.

AHJ CONCERNS ABOUT ERCES

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Polling Question

Which of these is your biggest concern about ERCES?

1.) Impact of Improper Installation
2.) Noise Floor Concerns
3.) Component Failure
4.) Competency of Designer & Installer
) 5.) Oscillation

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Concerns About ERCES Systems

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

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

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

"Competency" of System Designer & Installer

How do AHJs **specify & ensure compliance?**

48

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THE SOLUTION

49

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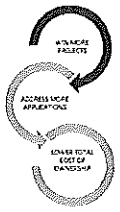
WIN MORE PROJECTS



Communications Integrity and Reducing Infrastructure requirements

- UL2524 2nd Edition Listing, Country of Origin USA
- Addressable (including FACP monitor modules) & Non-Addressable Models
- Platform performance reduces cabling, antenna and power requirements
- Drives competitive bid outcomes
- Better performing more efficient designs
- DC & UL coverage stability and non-fire communications preservation
- DL/UL Automatic Gain Control per channel & per time slot
- Outstanding noise performance that protects the jurisdictions macro network
- DL/UL Squelch per channel & per time slot along with UL PA OFF feature
- Automatic & mandatory isolation measurement and isolation alarm
- Oscillation prevention with unique "Action After Alarm" feature
- Powerful built-in Spectrum Analyzer on all active platform components
- Extreme Temperature Action to extend the life during extreme conditions
- Redundant Bias and Master

MORE COMPETITIVE SOLUTION

50

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UL 2524 Listed ERCES BDA

Oscillation Suppression

BDA Detects Oscillation & Reduces Gain in 5dB steps until no further oscillation

BDA Sends Trouble Signal to Fire Alarm Control Panel

BDA Indicates Trouble on Remote Annunciator / Monitor

BDA Continues normal operation with the maximum allowable gain

Noise Suppression

Most BDAs normally generate a small amount of noise when idle.

The cumulative effect of all this noise raises the "noise floor" on a frequency.

Honeywell BDAs operate in "stand-by mode" and do not transmit any noise while idle.

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Compliance, Safety and Reliability = UL 2524

- IFC & NFPA Compliance
  - Supervision & Monitoring
  - UL-Listed Power Supplies
  - Battery Backup (12 or 24 hrs @ 20% derated)
  - Monitoring of Secondary Power Supply
  - Type 4 Enclosure (certified as an assembly)
  - Supervised dedicated monitoring panel
- Electric Shock & Fire Safety (UL 60950)
- Product Reliability (UL 2524 2nd Edition)
- FCC Compliance
- Oscillation Suppression

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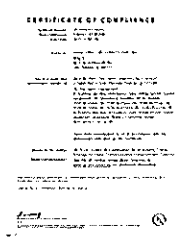
CERTIFICATE OF COMPLIANCE

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Elements of a TRUE Life Safety ERCES / BDA System

Each UL2524 Listed BDA is installed by Factory-Certified Life Safety Systems Technicians with F.C.C. G.R.O.L. Licenses as required by IBC/IFC.

Standardized Training, Tools & Equipment, Standardized Design Process (using iBwave software)

Each ERCES system design is either certified or done by the manufacturer

Proficiency ensures that the entire system meets Honeywell's Quality Standards

UL 2524

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Are In-Building ERCES Regulated?

NEW UL 2524 Product Performance Listing ensures safe, reliable equipment as required by code

- Until 2017, there was no certification process for ERCES systems.
- UL has created a product standard by publishing an Outline of Investigation (OOI) in December 21, 2017.
- Honeywell BDA now complies with and is listed to this new UL Standard as of June 11, 2018.

UL 2524

FCC-Certified

- Signal Boosters must be FCC certified (manufacturer product brochures and product labels must include FCC ID number)
- The end-user must ensure that all equipment is FCC-certified.
- *FCC will not approve a BDA for both Cellular & Land Mobile Radio.*

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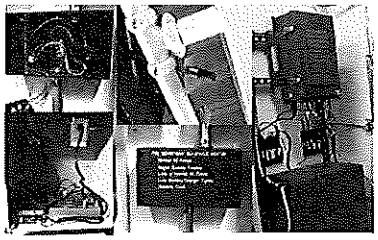
Should ERRCES products be regulated. Is this what you want installed!!!!!!



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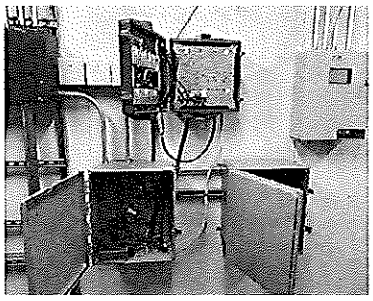

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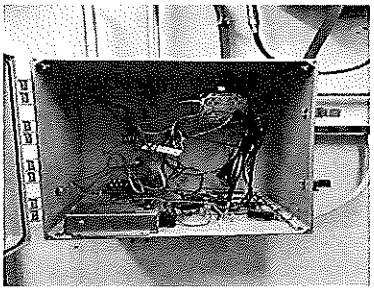

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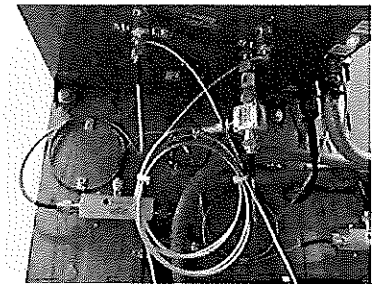

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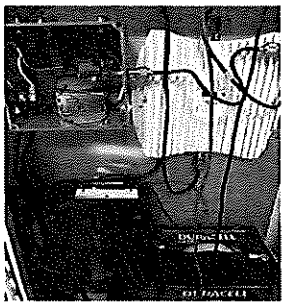

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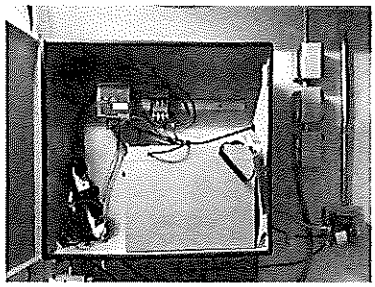

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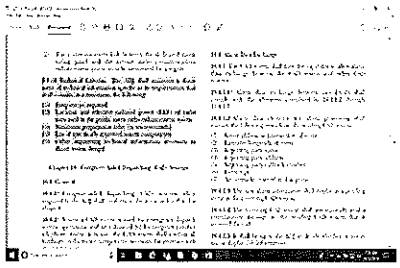
How do AHJs specify & ensure compliance

62



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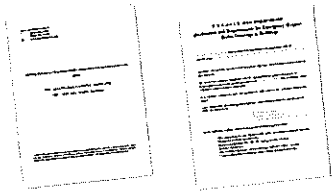
AHJ ERCES SPECIFICATION DEVELOPMENT



Koorsen can help you develop your specifications!

Editable AE and AHJ Specifications and Sample AHJ Specifications from around the US

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Elements of the AHJ ERCES Specification

Technical
Frequency Coverage
Radio Site Locations
Permitting Process
Testing & Acceptance
UL Listing, Regulatory Requirements
It's a Performance-Based Specification, "no need to over-specify"

Administrative
AHJ Contact Information
Permitting & Certification Forms
Submittal Documentation Requirements
Maintenance Contract Requirements & Certifications
Applicable Code References
Installer Qualification Requirements

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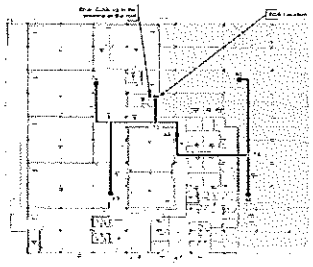
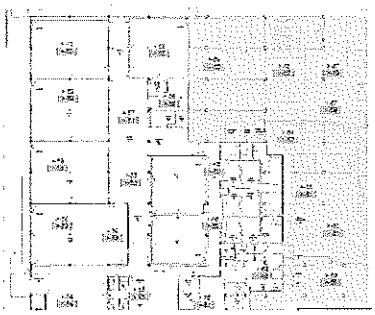
BDA Floor Plan Design



Typical Signal Survey Report



FCC Certification and Registration Requirements

Signal Boosters must be FCC certified (manufacturer product brochures and product labels must include FCC ID number)

BDAs are FCC certified to operate on the licensee's frequencies

FCC Requires frequency licensees (FD, PD, municipality, etc.) to register all signal boosters that operate on their frequencies

Registration is free and FCC has a simple on-line registration tool:
https://signalboosters.fcc.gov/signal-boosters

Registration should be done by the AHJ (frequency licensee) because it requires the licensee FRN (federal registration) number and FCC password.

BDA vendor can assist if needed

Signal Booster
Class A vs Class B?

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Signal Boosters – Class A or Class B?
What is the difference? Which one is better?

FCC classifies signal boosters as either Class A or Class B.

FCC Definitions per 47CFR90.219 rule:
Class A signal booster: "A signal booster designed to retransmit signals on one or more specific channels. A signal booster is deemed to be a Class A signal booster if none of its passbands exceed 75 kHz."

Class B signal booster: "A signal booster designed to retransmit any signals within a wide frequency band. A signal booster is deemed to be a Class B signal booster if it has a passband that exceeds 75 kHz."

Note: This classification is different from Class A and Class B fire alarm circuit wiring.

Signal Boosters – Class A vs Class B

Class A	Class B
Maximum Passband is 75KHz. Intended to amplify no more than one channel at one time	Maximum Passband is more than 75KHz. It can amplify more than one channel at the same time it can either be broadband or band-selective.
Mobile use allowed	Fixed use only
Introduces signal delay (aka "group delay") of over 50 microseconds resulting in signal distortion and interference in signal overlap areas	Very low to negligible signal delay (usually less than 2 us). Does not introduce signal distortion and interference in signal overlap areas.
Higher power consumption, higher heat dissipation = lower efficiency	Lower power consumption, less heat dissipation = higher efficiency

Class A and B Signal Boosters – Myth Vs Fact

Myth # 1: Class A signal boosters are better because they only amplify the select channels, thus eliminating unwanted interference to the BDA.

Fact # 1: Using Class B signal boosters ensures that radios will work for all public safety users, regardless of what frequency channels they use within the 700MHz and 800MHz public safety frequency bands. Class A signal boosters have a limited number of channels that can be amplify and it is usually 32 or less.

Myth # 2: Class B signal boosters can oscillate and produce harmful interference, and that is not the case with class A signal boosters

Fact: BDA oscillation can happen with either class A or class B signal boosters equally, there is no difference based on the class of the signal booster. What does makes a difference is the Oscillation Prevention Function of the signal booster.

Myth # 3: Class A signal boosters are less prone to intermodulation interference. Class B signal boosters can produce inter-modulation interference because they allow multiple carriers.

Fact: Intermodulation interference can equally happen with either class A or class B signal boosters, all it takes is two or more RF carriers. What does make a big difference is the quality of the design and the immunity of the LNA (low noise amplifier) stage to high RF signals.

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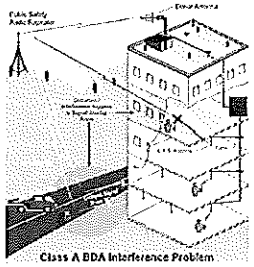
Myth # 4: Class A signal boosters do not create interference

Fact: Probably the least understood, yet the biggest shortcoming of class A signal boosters is the fact that they distort the radio signal by delaying it by more than 50 microseconds, which degrades the signal in the overlap areas and creates harmful interference.



Class A BDA Interference Problem

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Fire Marshall
Architect and Engineer Considerations

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Did You Know?

Many design professionals are not aware of the requirements for Emergency Responder Radio Coverage even if required by code

If ERRS Levels are not referenced on a building submittal or construction documents, the fire official should immediately notify the building official and design professional that the signals levels must be evaluated; and if the existing radio coverage has not been met, then ERRCES must be provided.

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2016 NFPA 1221 BDA Pathway Survivability Requirements

9.6.2.1.1* Where a two-way radio communications enhancement system is used in lieu of a two-way in-building wired emergency communications system, it shall have a pathway survivability of Level 1, Level 2, or Level 3.

9.6.2.1.1.1 The feeder and riser coaxial cables shall be rated as plenum cables that match the building's fire rating and pathway survivability.

9.6.2.1.3* Riser coaxial cables shall be rated as riser cables and routed through a 2-hour-rated enclosure.

9.6.2.1.4 The connection between the riser and feeder coaxial cables shall be made within an enclosure matching the building's fire rating and pathway survivability, and passage of the feeder cable in and out of the enclosure shall be fire-stopped to the building's fire rating and pathway survivability.

9.6.3* Systems shall have lightning protection that complies with NFPA 780.

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2019 NFPA 1221 BDA Pathway Survivability Requirements

The Backbone (Riser) Cable shall have a pathway survivability of Level 1, Level 2, or Level 3 to match the buildings rating.

The feeder and riser coaxial cables shall be rated as plenum cables that match the building's fire rating and pathway survivability.

The connection between the riser and feeder coaxial cables shall be made within an enclosure matching the building's fire rating and pathway survivability, and passage of the feeder cable in and out of the enclosure shall be fire-stopped to the building's fire rating and pathway survivability.

Systems shall have lightning protection that complies with NFPA 780.

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Design Challenges and Solutions

It is difficult for design professionals to design and project total costs for BDA when the testing to determine requirements must be done on the substantially completed structure.

Our Koorsen Engineers can use predictive modeling software (iBWave) and floor plans assuming they can determine the signal strength of the public safety frequency at the building site to determine BDA requirements pre bid or construction.

A Radio Signal Survey cost and specification should be included in the construction bid requirements in section 28 since this is a life safety system. This will ensure survey cost is covered when construction is substantially completed.

In most cases it would be cost effective to include an allowance or alternate for a BDA system and possibly make provisions for wiring in Section 28.

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Design Challenges and Solutions

The building can be prewired assuming that a signal booster will be required or predictive analysis shows it will most likely be needed.

Our Koorsen Sales Staff can also assist with specifications for UL listed BDA systems and survey specifications.

The design professional should reach into the Fire Official with Jurisdiction and ask for local BDA requirements or if they have an AHJ Specification for BDA.

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SUMMARY

SITUATION
Emergency Responders -Firefighters, EMS and Law Enforcement Officers rely on two-way radios for communications in every day operations
PROBLEM
Radio signals in-building are weakened by structures such as concrete, windows, metal, underground, etc., Emergency responders lack in-building radio coverage
SOLUTION
Enhance in-building radio frequency signal coverage with Honeywell's UL 2524 listed Bi-Directional Amplifier (signal booster) and Distributed Antenna System

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Additional Resources

https://www.saferbuildings.org

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QUESTIONS & ANSWERS?

Thank You for Your Time

David Thompson
david.thompson@koorsen.com

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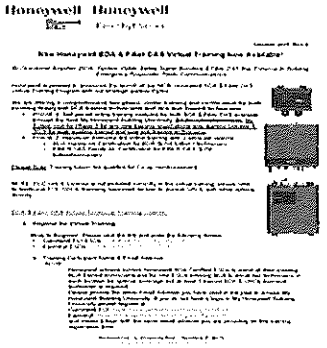

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Additional FCC GROL Licensing Resources:
NOTE: FCC does not require FCC GROL license for installation of commercial two-way radio equipment, including BDAs; however, IBC and IFC do. Consequently, state building codes and most AHJ jurisdictions do as well
• Recommended Website: Previously used by other ESDs, training and licensing was accomplished within one week! https://usceptatraining.com/
• Elkins Training Classes: http://www.elkinstraining.com/courses.asp
• Recommended Study Book: "GROL+RADAR book & software" by Gordon West, Pete Trotter, Eric Nichols. Available on Amazon: https://www.amazon.com/GROL-RADAR-book-software-Gordon/dp/0345503514 Please note this book also includes software that produces sample tests, and if the user answers a question wrong, it directs you back to that subject matter.
• ETA Testing Sites – locate Proctored test facilities by zip codes: https://www.cta-it.org/test_sites.html
• FCC Web page with info: https://www.fcc.gov/wireless/bureau-divisions/mobility-division/commercial-radio-operator-license-program
• You can download question pools from here: https://www.fcc.gov/wireless/bureau-divisions/mobility-division/commercial-radio-operator-license-program/exam-materials?tab-menu-block-4
• Testing locations: https://www.fcc.gov/wireless/bureau-divisions/mobility-division/commercial-radio-operator-license-program/commercial
• NOTE: You only need elements 1 & 3 for GROL

File Attachments for Item:

EC-3 Building Code Enforcement: Global Best Practices (Panel Discussion) (ICC)

All certifications (3 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

Website: https://www.iccsafe.org/edu

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: Building Code Enforcement: Global Best Practices

Course instructor: Imad Eldurubi

Course description:

This session will explore what has worked well and what has proven challenging in different jurisdictions around the world as they have developed their building regulatory ecosystems. The session will be comprised of three panel discussions with representatives from around the world addressing key elements in building regulatory implementation and enforcement. Each panel discussion will be followed by ample time for audience participants to offer their own examples, pose questions, and engage in dialogue. An opportunity for networking and additional information exchange will follow the third panel and discussion session.

Instructional hours per session: 3

Number of Sessions: 1

Course Date: 2023-10-09

Course Location: St. Louis, MO

Special Content

- ☐ Code Administration
- ☐ Existing Buildings
- ☐ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

302

Course to be offered online? ☐ On Demand ☐ Webinar

Course Website:

- [ ] Yes
- [x] No

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- [ ] Residential Certifications Only
- [x] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [x] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PPT - Building Code Enforcement_ Insight Session.pdf	480.65 kB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

2023 Annual Conference Insight Session:
Building Code Enforcement: Global Best Practices

Sponsor: ICC Global Membership Council / ICC Global Services

Contact: Judy Zakreski, SVP, Global Operations & Solutions (jzakreski@iccsafe.org)

Description

This session will explore what has worked well and what has proven challenging in different jurisdictions around the world as they have developed their building regulatory ecosystems. The session will be comprised of three panel discussions with representatives from around the world addressing key elements in building regulatory implementation and enforcement. Each panel discussion will be followed by ample time for audience participants to offer their own examples, pose questions, and engage in dialogue. An opportunity for networking and additional information exchange will follow the third panel and discussion session.

Learning Objectives

1. How to maximize cost efficiency while ensuring a high degree of compliance and preventing conflicts of interest in an enforcement system that relies on third parties.
2. Successes and challenges of different approaches to third party enforcement systems.
3. Examples of successful approaches to regulation of alternative materials and methods to ensure compliance.
4. The importance of measuring and mandating the competency of practitioners in a building safety regulatory system.
5. Different approaches for developing a system of practitioner training, credentialing and licensing.

Instructor/Moderator

Imad Eldurubi

Timed Outline

WELCOME (5 minutes)

- Judy Zakreski, ICC Senior Vice President, Global Operations & Solutions
- Geoff Mitchell, Chair, ICC Global Membership Council

PANEL 1 (30 minutes): ***The use of third parties for plan review, permitting & inspections*** (examples of different regulatory frameworks)

- Australia's privatized surveyor system (10 minutes) (Geoff Mitchell)
- Hybrid model of in-house and third party inspectors, plan reviewers, special inspections – including discussion of oversight of third-party practitioners (10 minutes) (US speaker TBA)
- Germany's Proof Engineers (10 minutes) (suggested: Robert Hertle)

MODERATED AUDIENCE INTERVENTION/Q&A (20 minutes)

PANEL 2 (30 minutes): ***Product compliance, especially for innovative and vernacular products and designs*** (who enforces product compliance? What tools are used in the assessment of compliance?)

- Challenges/opportunities in product compliance in an open market system (10 minutes) (Nick Hill or Peter Laurenson, BOINZ, TBC)
- New system in Saudi Arabia to ensure product safety and code compliance (10 minutes) (SBCNC or MOMRA)
- Consideration for traditional construction (10 minutes) (suggested: David Jackson)

MODERATED AUDIENCE INTERVENTION/Q&A (20 minutes)

PANEL 3 (30 minutes): ***The role of practitioner competency in risk reduction***

- Establishing and supporting the achievement of requirements for credentialing & continuing education to ensure effective enforcement (10 minutes) (US speaker TBC)
- Practitioner competency and capacity building challenges in countries in the initial stages of establishing or improving their building code enforcement ecosystem (10 minutes) (suggested: Timo Bolotashvili, Republic of Georgia)
- New rules being developed for practitioner competency post-Grenfell (10 minutes) (David Gibson, UK)

MODERATED AUDIENCE INTERVENTION/Q&A (20 minutes)

CLOSING COMMENTS (5 minutes)

NETWORKING/INFORMAL INFORMATION EXCHANGE (20 minutes)

Imad Eldurubi, Hon. ICC, Fellow CABE, C Build E, CPM

Principal Architectural Engineer, Registered Engineer, International Architectural Consultant and Developer, IE Group USA MENA, Secretary, International Code Council Global Membership Council, Founding Member, ICC MENA Building Science Advisory Council, Affiliate, Royal Institute of British Architects. Board of Directors, Sterling International Council-Organizational Model for Performance Excellence. Former Building Code Advisor, Abu Dhabi Department of Municipalities and Transport, Former Coordinator, Zayed Higher Organization for People of Determination and the Department of Municipalities, UAE. Former Code Official, City of Phoenix, Arizona, Former Deputy Building Official, Willdan, Arizona, Past Chairman, Arizona Building Officials Association, Past President, Arizona Chapter of International Code Council, Past President, World Organization of Building Officials, Former International Code Council Coordinator to the Accessibility Technical Committee for New York City. Imad holds a Bachelor of Engineering, University of Arizona, Associate, Architectural Engineering with Honors, Harold Washington College, USA. A recipient of the ICC Global Award, Arizona Trueblood Building Official of the Year Award, Abu Dhabi Department of Municipalities and Transport Award of Appreciation for Outstanding Services. GCC Cooperation Council Standardization Organization/ Building Code Division Certificate of Merit, Egypt Housing and Building National Research Center Award of Excellence. City of Phoenix Development Services Award of Merit for Dedication to Building a Safer Phoenix.

Building Code Enforcement: Global Best Practices

2023 Annual Business Meeting | Insight Session

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INSTRUCTOR

Judy Zakreski

- ICC Senior Vice President, Global Operations & Solutions
- Staff Liaison, Global Membership Council
- Executive Director, International Building Quality Centre
- jzakreski@iccsafe.org

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Presented by ICC Global Membership Council

ICC GLOBAL MEMBERSHIP COUNCIL

The ICC Global Membership Council connects building safety professionals from outside the United States with US-based professionals who have an interest in advancing the cause of building safety internationally.

- Membership in ICC not required
- Initiatives include:
  - Webinar series
  - Annual Conference events
  - Networking opportunities

For more information visit www.iccsafe.org/membership/membership-councils/icc-global-membership-council

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INSTRUCTOR

Geoff Mitchell

- Managing Director, GMA Certification Group, Brisbane, Australia
- Licensed Building Surveyor
- Fellow, Royal Institute of Chartered Surveyors
- Life Fellow, Australian Institute of Building Surveyors
- Teaching Fellow, Bond University
- Chair, ICC Global Membership Council

6

INSTRUCTOR

Imad Eldurubi

- IE Group – USA-Jordan-UAE
- Principal Architectural Engineer
- Registered Building Engineer
- Sustainability Advocate
- Educator
- ICC Global Membership Council Governing Committee Member

7

GOAL & OBJECTIVES

This session will explore what has worked wll and what has proven challenging in different jurisdictions around the world as they have developed their building regulatory ecosystems. Participant takeaways will include:

1) How to maximize cost efficiency while ensuring a high degree or compliance and preventing conflicts of interest in enforcement systems that rely on third parties
2) Successes and challenges of different approaches to third party enforcement systems
3) Examples of successful approaches to regulation of alternative materials and methods to ensure compliance
4) The importance of measuring and mandating the competency of practitioners in a building safety regulatory system
5) Different approaches for developing a system of practitioner training, credentialing and licensing

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REALITY CHECK

Why Does This Matter?

- Regardless of the building regulation that is being enforced, jurisdictions around the world face common challenges in building safety regulation.
- Building safety professionals and regulators can learn a great deal by studying what has worked and what has not in other jurisdictions around the world.
- Today's session enables dialogue on three universal topics of interest.

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COURSE OUTLINE

- The use of third parties for plan review, permitting & inspections
  - Panel presentation
  - Moderated audience intervention/Q&A
- Product compliance, especially for innovative and vernacular products and designs
  - Panel presentation
  - Moderated audience intervention/Q&A
- The role of practitioner competency in risk reduction
  - Panel presentation
  - Moderated audience intervention/Q&A
- Closing remarks/Networking

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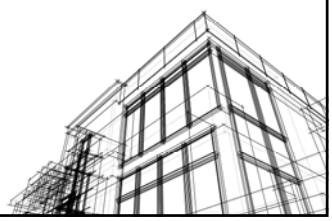
Third Party Providers

Examples of challenges and best practices from different types of regulatory systems that employ third parties in plan review, permitting & inspections

11

Presentation Topics

- Australia's Privatized Surveyor System
- A View from the U.S.: Hybrid System of Staff & Third Parties
- Germany's Proof Engineers



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Product Compliance

Regulating innovative products and ensuring safety in vernacular construction

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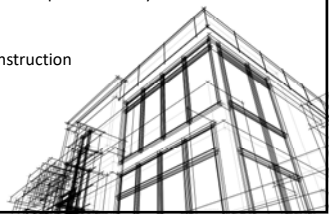
Presentation Topics

- Challenges/opportunities in product compliance in an open market system
- New system in Saudi Arabia to ensure product safety and code compliance
- Consideration for traditional construction



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Practitioner Competency

The role of practitioner training, credentialing and licensing in risk reduction

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Presentation Topics

- Establishing and supporting the achievement of requirements for credentialing & continuing education to ensure effective enforcement
- Practitioner competency and capacity building challenges in countries in the initial stages of establishing or improving their building code enforcement ecosystem
- New rules being developed for practitioner competency post-Grenfell

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Discussion

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File Attachments for Item:

EC-4 Evaluation Reports: Purpose and Criteria (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

Website: https://www.iccsafe.org/edu

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: Evaluation Reports - Purpose and Criteria

Course instructor: Michael Temesvary

Course description

This seminar is designed to provide building code officials, design professionals and builders with an overview of the ICC Evaluation Service (ICC-ES) product evaluation program including the importance of verifying compliance of building products with applicable codes and standards. The process for developing evaluation reports and listings to show a building product's compliance to codes and standards will be addressed, and a short demonstration will be given of an ICC-ES tool that helps building code officials, designer professionals and builders find code compliant products.

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

- ☐ Code Administration
- ☐ Existing Buildings
- ☐ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☑ No

☐ On Demand ☐ Webinar

Course Website:

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- [ ] Residential Certifications Only
- [x] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [x] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PPT- Approving and Selecting Building Products with Confidence.pdf	2.81 MB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

EVALUATION REPORTS – PURPOSE & CRITERIA

CREDIT HOURS: 90 minutes

COURSE DESCRIPTION: This seminar is designed to provide building code officials, design professionals and builders with an overview of the ICC Evaluation Service (ICC-ES) product evaluation program including the importance of verifying compliance of building products with applicable codes and standards. The process for developing evaluation reports and listings to show a building product's compliance to codes and standards will be addressed, and a short demonstration will be given of an ICC-ES tool that helps building code officials, designer professionals and builders find code compliant products.

LEARNING OBJECTIVES: The objectives are for the participants to:

1. Understand the importance of verifying code compliance of building products.
2. Describe the process for developing ICC-ES Evaluation Reports and Building Product Listings.
3. Identify the difference between ICC-ES Evaluation Reports and Building Product Listings.
4. Understand how to access and use the on-line ICC-ES code conformity tool.

COURSE OUTLINE TIMELINE:

Introduction	(10 MINUTES)
Introduction to ICC Evaluation Service (ICC-ES)	(5 minutes)
Organization and Purpose	(10 minutes)
PART I –	(25 MINUTES)
IBC Section 104.11	
Research Reports and Responsibility	
Compliance Verification	
Manufacturing Quality Control	
ICC-ES Acceptance Criteria (AC)	
PART II –	(25 MINUTES)
Evaluation Reports	
Test Labs	
Building Product Listings	
ICC-ES Code Conformity Tool	
ICC-ES Marks of Conformity: What To Look For	
ICC-ES Program Updates	
Closing	
QUESTIONS & EVALUATION	(15 MINUTES)
TOTAL COURSE TIME:	(90 MINUTES)

Michael Temesvary, P.E.
Vice President of Sales and External Relations
ICC Evaluation Service

Speaker Bio:

With 25 years of experience in engineering design, business planning and marketing, Mike's specialty is to educate new and existing evaluation report holders as well as building industry professionals on ICC Evaluation Service (ICC-ES) technical evaluations of building products and systems. Mike frequently speaks at industry events and interacts regularly with manufacturers, testing laboratories, building officials and other government entities. He also works with domestic and international manufacturers on a wide variety of building product evaluations. Mike earned his Bachelor of Science in Civil Engineering and his Bachelor of Arts in German from the University of California at Irvine. He maintains an active professional engineering license in the State of California. Mike travels frequently and is based out of the ICC Western Regional Office in Brea, California.

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Approving and Selecting Building Products with Confidence - What To Look for in Evaluation Reports

William Gould, P.E.

Michael Temesvary, P.E.

October 23, 2018

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Agenda

- The importance of verifying compliance of building products with applicable codes and standards
- The process for developing evaluation reports and building product listings to show compliance with codes and standards
- The difference between ICC-ES evaluation reports and building product listings
- ICC-ES tool that helps building code officials, designers and builders find code compliant products
- ICC-ES program updates
- Open discussion / Q & A

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Introduction to ICC-ES

The building codes cannot realistically include every possible product used in construction.

Introduction to ICC-ES

- The building codes would be unmanageable in size!
- Maintaining such a code would be impractical.

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Introduction to ICC-ES

Many new and innovative building products enter the construction marketplace every year. They cannot possibly be incorporated into the codes.

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Introduction to ICC-ES

If these products are not in the code, then…

…how are they approved?

ICC

- Introduction to ICC Evaluation Service
  - Establishment of ICC as part of the three legacy building code organizations, including ICBO, SBCCI and BOCA. This merger also established ICC Evaluation Service (ICC-ES) in 2003.
  - Code publisher and building code official membership
  - Along with IAS, SKGA and GC, ICC-ES is a subsidiary of the ICC non-profit parent organization

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About ICC Evaluation Service (ICC-ES)

- ISO 17065 accredited assessment body most widely recognized and accepted by building code officials
- Nonprofit, limited liability company
- Evaluation Service for innovative building products and code referenced building products
- Provides evidence of code compliance in accordance with Section 104.11 and code referenced standards
- Not every building product is referenced in the IBC, therefore there needs to be a mechanism for product evaluation to prove compliance with code requirements

ES ICC EVALUATION SERVICE
In Cooperation with Innovation RESEARCH LABS

ISO

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About ICC-ES

- Created as an extension of building code official's staff, and governed by a Board comprised of building code officials
- Serves as valuable resource to building departments across the United States
- Provides building departments and industry with technical support for its services
- An organization with a dedicated staff of:
  - Licensed design professionals
  - Product evaluation specialists

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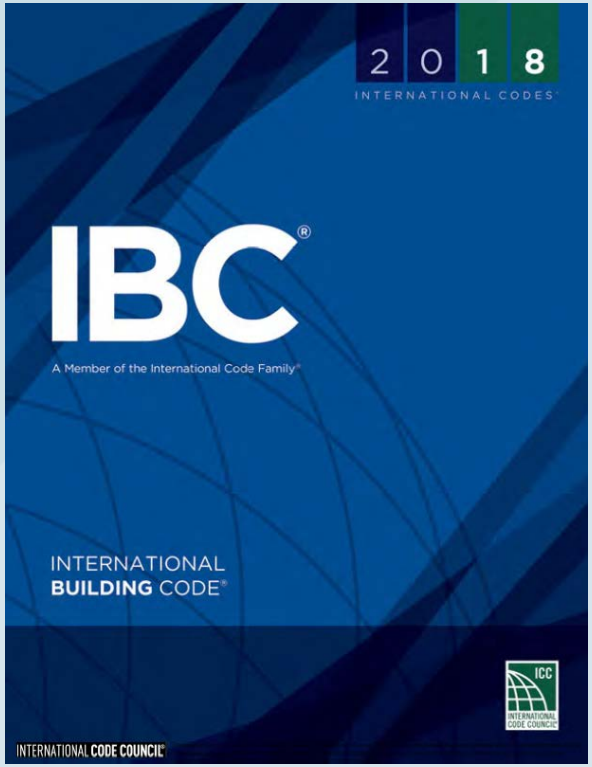
Alternative Materials, Design and Methods of Construction



IBC Section 104.11

Contains provisions which allows for products not specifically covered in the code, provided that the products are in compliance with the intent & purpose of the code.

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Section 104.11 Alternative materials, design and methods of construction and equipment

The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. ***An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.*** *Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved.*

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Section 104.11

104.11.1 Research reports.

Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

104.11.2 Tests.

Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the building official shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the building official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the building official for the period required for retention of public records.

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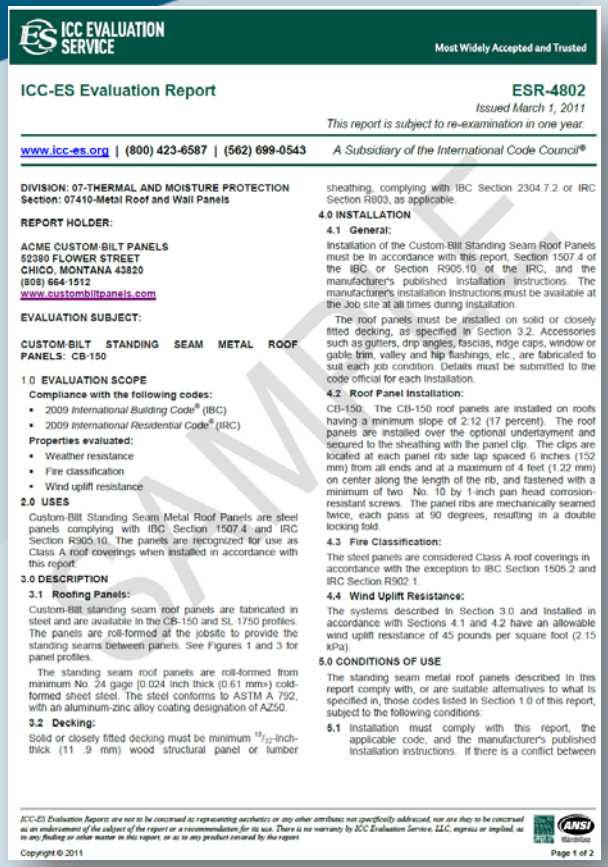
Research Reports

IBC Section 104.11.1

Research reports.

- Provide supporting data.
- Must come from approved sources.



ICC EVALUATION SERVICE — Most Widely Accepted and Trusted

ICC-ES Evaluation Report — **ESR-4802**

Issued March 1, 2011

This report is subject to re-examination in one year.

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DIVISION: 07-THERMAL AND MOISTURE PROTECTION
Section: 07410-Metal Roof and Wall Panels

REPORT HOLDER:

ACME CUSTOM-BILT PANELS
62380 FLOWER STREET
CHICO, MONTANA 43820
(808) 664-1512
www.custombiltpanels.com

EVALUATION SUBJECT:

CUSTOM-BILT STANDING SEAM METAL ROOF PANELS: CB-150

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2009 *International Building Code®* (IBC)
- 2009 *International Residential Code®* (IRC)

Properties evaluated:

- Weather resistance
- Fire classification
- Wind uplift resistance

2.0 USES

Custom-Bilt Standing Seam Metal Roof Panels are steel panels complying with IBC Section 1507.4 and IRC Section R905.10. The panels are recognized for use as Class A roof coverings when installed in accordance with this report.

3.0 DESCRIPTION

3.1 Roofing Panels:

Custom-Bilt standing seam roof panels are fabricated in steel and are available in the CB-150 and SL-1750 profiles. The panels are roll-formed at the jobsite to provide the standing seams between panels. See Figures 1 and 3 for panel profiles.

The standing seam roof panels are roll-formed from minimum No. 24 gage (0.024 inch thick (0.61 mm)) cold-formed sheet steel. The steel conforms to ASTM A 792, with an aluminum-zinc alloy coating designation of AZ50.

3.2 Decking:

Solid or closely fitted decking must be minimum $^{15}/_{32}$-inch-thick (11 .9 mm) wood structural panel or lumber sheathing, complying with IBC Section 2304.7.2 or IRC Section R803, as applicable.

4.0 INSTALLATION

4.1 General:

Installation of the Custom-Bilt Standing Seam Roof Panels must be in accordance with this report, Section 1507.4 of the IBC or Section R905.10 of the IRC, and the manufacturer's published installation instructions. The manufacturer's installation instructions must be available at the job site at all times during installation.

The roof panels must be installed on solid or closely fitted decking, as specified in Section 3.2. Accessories such as gutters, drip angles, fascias, ridge caps, window or gable trim, valley and hip flashings, etc., are fabricated to suit each job condition. Details must be submitted to the code official for each installation.

4.2 Roof Panel Installation:

CB-150. The CB-150 roof panels are installed on roofs having a minimum slope of 2:12 (17 percent). The roof panels are installed over the optional underlayment and secured to the sheathing with the panel clip. The clips are located at each panel rib side lap spaced 6 inches (152 mm) from all ends and at a maximum of 4 feet (1.22 mm) on center along the length of the rib, and fastened with a minimum of two No. 10 by 1-inch pan head corrosion-resistant screws. The panel ribs are mechanically seamed twice, each pass at 90 degrees, resulting in a double locking fold.

4.3 Fire Classification:

The steel panels are considered Class A roof coverings in accordance with the exception to IBC Section 1505.2 and IRC Section R902.1.

4.4 Wind Uplift Resistance:

The systems described in Section 3.0 and installed in accordance with Sections 4.1 and 4.2 have an allowable wind uplift resistance of 45 pounds per square foot (2.15 kPa).

5.0 CONDITIONS OF USE

The standing seam metal roof panels described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 Installation must comply with this report, the applicable code, and the manufacturer's published installation instructions. If there is a conflict between

ICC-ES Evaluation Reports are not to be construed as representing aesthetics or any other attributes not specifically addressed, nor are they to be construed as an endorsement of the subject of the report or a recommendation for its use. There is no warranty by ICC Evaluation Service, LLC, express or implied, as to any finding or other matter in this report, or as to any product covered by the report.

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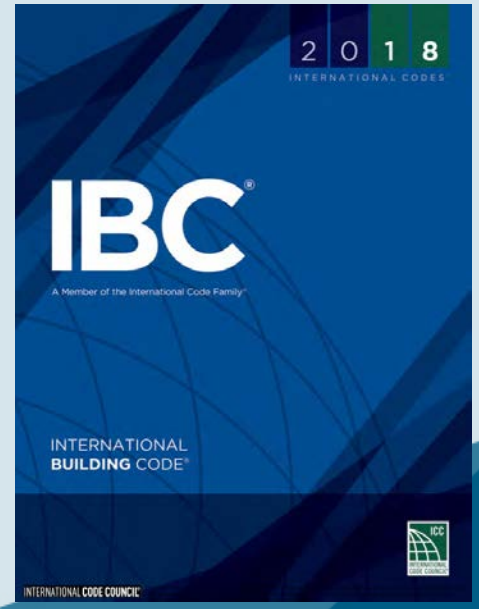
SAMPLE



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Who Has Responsibility?

Q: Who has the authority and responsibility to review and approve building materials, design or method of construction?

A: THE BUILDING CODE OFFICIAL

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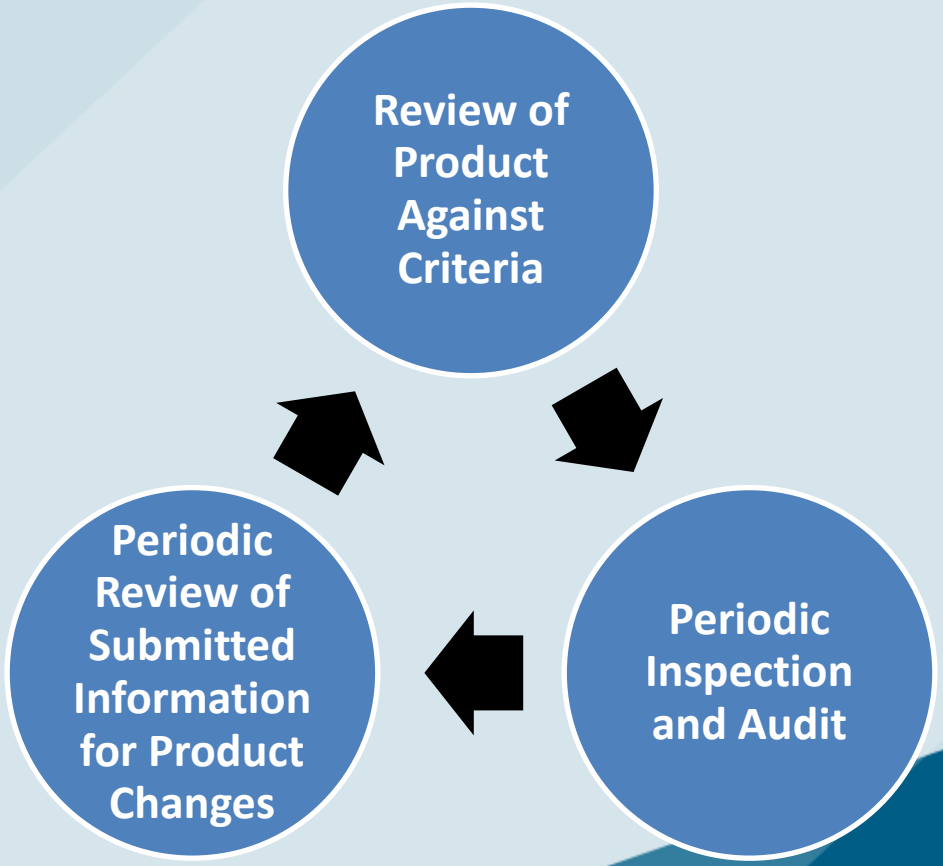
Code Compliance

- Importance of verifying compliance of building products with applicable codes and standards.
  - Streamlines review process for building code officials and design professionals
  - Provides independently assessed performance data
  - Levels playing field and allows for product innovation
  - Saves time and money

Continuous Compliance Process



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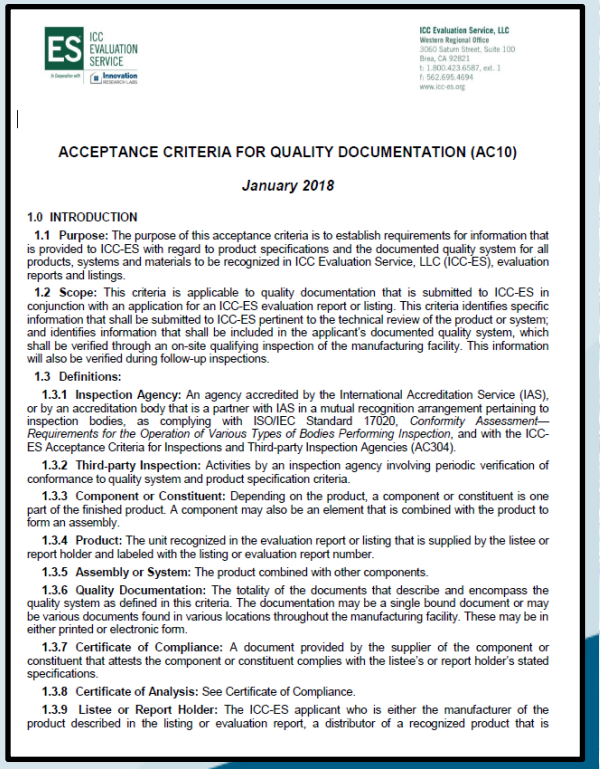
How is Compliance Verified?

- ICC-ES has hundreds of Acceptance Criteria (AC) that have been historically developed based on ESR applications from manufacturers.
- Approved AC are periodically reviewed to latest code requirements (IBC, IRC, etc.) and renewed.
- Manufacturers and other interested parties can propose revisions and contribute to AC development process.
- Once AC has been approved, manufacturers can apply for ESRs.

Manufacturing Quality Control

- Ensures product is manufactured in accordance with specifications consistent with the product tested and used on project site.
  - Qualifying inspections by ICC-ES or ISO 17020 accredited inspection agencies (MRA) to verify manufacturing quality programs prior to issuance of ESR
  - Periodic follow-up inspections for the life of ESR (annually or more frequently)
  - Acceptance Criteria for Quality Documentation (AC10)



ICC EVALUATION SERVICE

ICC Evaluation Service, LLC
Western Regional Office
3060 Saturn Street, Suite 100
Brea, CA 92821
t: 1.800.423.6587, ext. 1
f: 562.695.4694
www.icc-es.org

ACCEPTANCE CRITERIA FOR QUALITY DOCUMENTATION (AC10)

January 2018

1.0 INTRODUCTION

1.1 Purpose: The purpose of this acceptance criteria is to establish requirements for information that is provided to ICC-ES with regard to product specifications and the documented quality system for all products, systems and materials to be recognized in ICC Evaluation Service, LLC (ICC-ES), evaluation reports and listings.

1.2 Scope: This criteria is applicable to quality documentation that is submitted to ICC-ES in conjunction with an application for an ICC-ES evaluation report or listing. This criteria identifies specific information that shall be submitted to ICC-ES pertinent to the technical review of the product or system; and identifies information that shall be included in the applicant's documented quality system, which shall be verified through an on-site qualifying inspection of the manufacturing facility. This information will also be verified during follow-up inspections.

1.3 Definitions:

1.3.1 Inspection Agency: An agency accredited by the International Accreditation Service (IAS), or by an accreditation body that is a partner with IAS in a mutual recognition arrangement pertaining to inspection bodies, as complying with ISO/IEC Standard 17020, *Conformity Assessment—Requirements for the Operation of Various Types of Bodies Performing Inspection*, and with the ICC-ES Acceptance Criteria for Inspections and Third-party Inspection Agencies (AC304).

1.3.2 Third-party Inspection: Activities by an inspection agency involving periodic verification of conformance to quality system and product specification criteria.

1.3.3 Component or Constituent: Depending on the product, a component or constituent is one part of the finished product. A component may also be an element that is combined with the product to form an assembly.

1.3.4 Product: The unit recognized in the evaluation report or listing that is supplied by the listee or report holder and labeled with the listing or evaluation report number.

1.3.5 Assembly or System: The product combined with other components.

1.3.6 Quality Documentation: The totality of the documents that describe and encompass the quality system as defined in this criteria. The documentation may be a single bound document or may be various documents found in various locations throughout the manufacturing facility. These may be in either printed or electronic form.

1.3.7 Certificate of Compliance: A document provided by the supplier of the component or constituent that attests the component or constituent complies with the listee's or report holder's stated specifications.

1.3.8 Certificate of Analysis: See Certificate of Compliance.

1.3.9 Listee or Report Holder: The ICC-ES applicant who is either the manufacturer of the product described in the listing or evaluation report, a distributor of a recognized product that is

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Why Acceptance Criteria (AC)?

- ICC-ES ACs provides independent, third-party validation that products meet the minimum performance requirements of the IBC.
- ICC-ES develops ACs which serve as baselines against which innovative products can be objectively measured.
- AC may also be developed when codes are not clear in a particular area or on specific issues related to a product; when industry raises concerns regarding ESR requirements; or when a new AC is deemed necessary by the report applicant, ICC-ES staff, or the ICC-ES Evaluation Committee.

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Acceptance Criteria Hearing

- In person testimony given by interested parties and proponents to Evaluation Service Committee and ICC-ES staff

- ES Committee consists of 9 – 12 building code officials from throughout the U.S.

- ES Committee serves on a voluntary basis for a year. In person AC hearings are broadcast through ICC-ES website.

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Alternative AC Development Process

- AC revisions are posted on ICC-ES website for review.
- Nonstructural revisions, do not involve life safety and are already addressed in nationally recognized standards or generally accepted industry standards, or minor / noncontroversial.
- AC can also be approved by the ES Committee based on submission of electronic testimony through the ICC-ES webpage.
- If AC is not approved, then it may move to the primary AC process and then heard through in-person testimony

ICC INTERNATIONAL CODE COUNCIL

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INTERNATIONAL CODE COUNCIL 2018

Acceptance Criteria

- Open process. ICC-ES seeks public input.
- Postings held for 30 days on-line for submittal of comments by interested parties
- Building code officials, designers and manufacturers have opportunity to participate and share their technical expertise, experience and perspective

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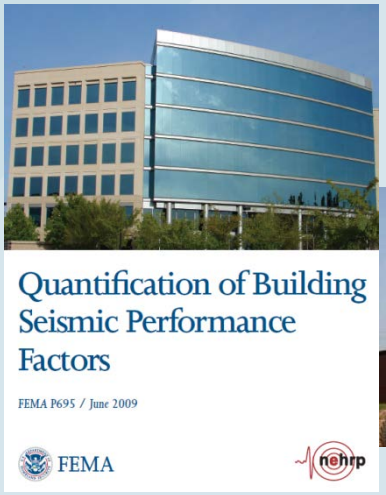
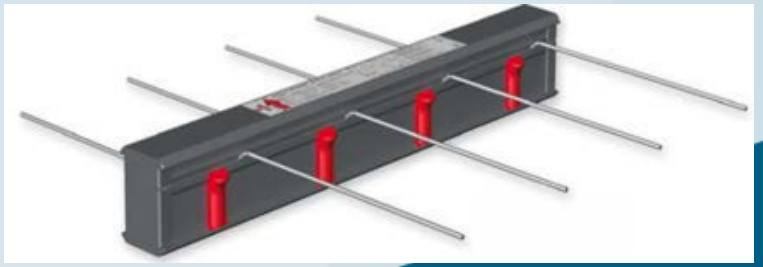
Acceptance Criteria

- Industry groups attend ICC-ES AC hearings and provide input
- Opportunity to get involved and provide technical input on seismic, wind, fire resistance and other areas of expertise
- Recently developed AC for innovative products





Evaluation Reports

- Internal technical staff review – test reports and manufacturing quality documents
- Examples of innovative product ESRs:
  - Concrete and masonry anchors
  - Fasteners
  - Reinforcing fibers
  - Cross-laminated timber panels
  - Joist hangers and cold-formed steel connectors
  - Metal deck, joists and framing
  - Diaphragm and shear wall systems
  - Suspended ceiling systems

ICC EVALUATION SERVICE — Most Widely Accepted and Trusted

ICC-ES Evaluation Report — **ESR-2262***

Reissued July 1, 2012

This report is subject to renewal August 1, 2014.

www.icc-es.org | (800) 423-6587 | (562) 699-0543 — *A Subsidiary of the International Code Council®*

DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

DIVISION: 05 00 00—METALS
Section: 05 05 19—Post-Installed Concrete Anchors

REPORT HOLDER:

HILTI, INC.
5400 SOUTH 122ND EAST AVENUE
TULSA, OKLAHOMA 74146
(800) 879-8000
www.us.hilti.com
HiltiTechEng@us.hilti.com

EVALUATION SUBJECT:

HILTI HIT-HY 150 MAX ADHESIVE ANCHORING SYSTEM IN UNCRACKED CONCRETE

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2009, 2006, 2003 and 2000 *International Building Code®* (IBC)
- 2009, 2006, 2003 and 2000 *International Residential Code®* (IRC)

Property evaluated:

Structural

2.0 USES

The Hilti HIT-HY 150 MAX Adhesive Anchoring System is used to resist static, wind, or earthquake (Seismic Design Categories A and B only) tension and shear loads in uncracked normal-weight concrete having a specified compressive strength, f'_c, of 2,500 psi to 8,500 psi (17.2 MPa to 58.6 MPa). The anchor system is an alternative to anchors described in Sections 1911 and 1912 of the 2009 and 2006 IBC and Sections 1912 and 1913 of the 2003 and 2000 IBC. The anchor systems may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the 2009, 2006 and 2003 IRC, or Section R301.1.2 of the 2000 IRC.

3.0 DESCRIPTION

3.1 General:

The Hilti HIT-HY 150 MAX Adhesive Anchoring System is comprised of the following components:

- Hilti HIT-HY 150 MAX adhesive packaged in foil packs.
- Adhesive mixing and dispensing equipment.
- Hole cleaning equipment.

The Hilti HIT-HY 150 MAX Adhesive Anchoring System may be used with continuously threaded rod, Hilti HIS-N and HIS-RN internally-threaded inserts or deformed reinforcing bar. The primary components of the Hilti Adhesive Anchoring System are shown in Figure 3 of this report.

Installation information and parameters, as included with each adhesive unit package, are shown in Figure 5 of this report.

3.2 Materials:

3.2.1 Hilti HIT-HY 150 MAX Adhesive: Hilti HIT-HY 150 MAX Adhesive is an injectable hybrid adhesive combining urethane methacrylate resin, hardener, cement and water. The resin and cement are kept separate from the hardener and water by means of a dual-cylinder foil pack attached to a manifold. The two components combine and react when dispensed through a static mixing nozzle attached to the manifold. Hilti HIT-HY 150 MAX is available in 11.1-ounce (330 ml), 16.9-ounce (500 ml), and 47.3-ounce (1400 ml) foil packs. The manifold attached to each foil pack is stamped with the adhesive expiration date. The shelf life, as indicated by the expiration date, applies to unopened foil packs that are stored in accordance with the Instructions for Use, as illustrated in Figure 5 of this report.

3.2.2 Hole Cleaning Equipment: Hole cleaning equipment comprised of steel wire brushes and air nozzles is illustrated in Figure 5 of this report.

3.2.3 Dispensers: Hilti HIT-HY 150 MAX must be dispensed with manual dispensers, pneumatic dispensers, or electric dispensers provided by Hilti.

3.2.4 Anchor Elements:

3.2.4.1 Threaded Steel Rods: The threaded steel rods must be clean, continuously threaded rods (all-thread) in diameters as described in Tables 2 and 3 of this report. Steel design information for common grades of threaded rod and associated nuts are provided in Tables 7 and 10, and instructions for use are shown in Figure 5. Carbon steel threaded rods must be furnished with a 0.0002-inch-thick (0.005 mm) zinc electroplate coating in accordance with ASTM B633 SC 1; or must be hot-dipped galvanized in accordance with ASTM A153, Class C or D. Threaded rods must be straight and free of indentations or other defects along their length. The ends may be stamped with identifying marks and the embedded end may be blunt cut or cut on the bias (chisel point).

*Revised August 2013

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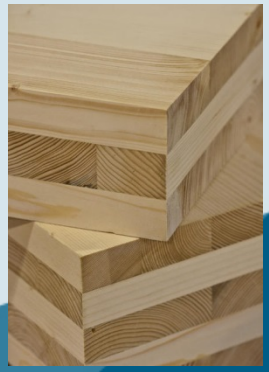

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INTERNATIONAL CODE COUNCIL 2018

What's in an ICC-ES Evaluation Report

ICC-ES Evaluation Reports from ICC Evaluation Service® are the most preferred resource used by code officials to verify that new and innovative building products comply with code requirements. The ICC-ES Evaluation Reports provide information about what code requirements or acceptance criteria were used to evaluate the product, how the product should be installed to meet the requirements, how to identify the product, and much more. ICC-ES Evaluation Reports are divided into eleven major areas.

1. **CSI Division Number**—ICC-ES Evaluation Reports, and the building products represented in them, are organized according to the Construction Specifications Institute's (CSI) Masterformat system.
2. **Report Holder**—The name and address of the company or organization that has applied for the ICC-ES Evaluation Report.
3. **Evaluation Subject**—The specific product(s) covered by the report.
4. **Evaluation Scope**—The code(s) that were used to evaluate the product.
5. **Properties Evaluated**—A brief description of the properties the product was evaluated against such as fire resistance and wind resistance. This section also shows if the product can be used for structural purposes.
6. **Uses**—Identifies the scope of the ICC-ES Evaluation Report and relates the product evaluated to code provisions.
7. **Description**—Provides a general description of the product and its features, such as length, thickness, etc.
8. **Installation**—Identifies general and often specific requirements to help the inspector ensure the product is installed properly according to the code requirements or acceptance criteria.
9. **Conditions of Use**—Statement that the product, as described in the ICC-ES Evaluation Report, complies with or is a suitable alternative to the requirements of the applicable code and a list of conditions under which the report is issued.
10. **Evidence Submitted**—Data (i.e. test reports, calculations, installation instructions) that was used in evaluating the product.
11. **Identification**—Information that can be used to identify the product, including the manufacturer's name, product code, ICC-ES Evaluation Report number, etc.

ICC EVALUATION SERVICE — Most Widely Accepted and Trusted

ICC-ES Evaluation Report — **ESR-4802**

Reissued March 1, 2012

This report is subject to renewal February 1, 2014.

www.icc-es.org | (800) 423-6587 | (562) 699-0543 — *A Subsidiary of the International Code Council®*

1 **DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION**
Section: 07 30 05—Roofing Felt and Underlayment

2 **REPORT HOLDER:**

ACME UNDERLAYMENTS UNLIMITED
52300 FLOWER STREET
CHICO, MONTANA 43829
(800) 664-1512
www.underlaymentunlimited.com

3 **EVALUATION SUBJECT:**

UU 100 UNDERLAYMENT FOR ASPHALT SHINGLE ROOF COVERINGS IN SEVERE CLIMATE AREAS

4 **1.0 EVALUATION SCOPE**

Compliance with the following codes:

- 2012 and 2009 *International Building Code®* (IBC)
- 2012 and 2009 *International Residential Code®* (IRC)

5 **Properties evaluated:**

Ice barrier

6 **2.0 USES**

UU 100 is a self-adhering, rubberized asphalt membrane, complying with ASTM D1970, that is used over plywood substrates as ice barriers as specified in Chapter 15 of the IBC and Chapter 9 of the IRC.

7 **3.0 DESCRIPTION**

The UU 100 has a granule surfacing. The membrane has a silicone-treated release paper on the back that is removed prior to attachment to plywood sheathing. The membrane is a minimum of 0.040 inch (1.02 mm) thick and is supplied in rolls 36 inches(914 mm) wide and 66.7 feet (20.3 m) long.

8 **4.0 INSTALLATION**

Installation of the UU 100 membrane must comply with this report and the manufacturer's published installation instructions. The manufacturer's published installation instructions and this report must be available at the jobsite at all times during the installation.

Prior to application of the membrane, the deck surface must be free of frost, dust and dirt, loose nails and other protrusions. Damaged sheathing must be replaced. Installation is limited to plywood substrates. The membrane is designed for applications when the ambient air temperature is above 40°F (4.4°C).

Vertical ends and horizontal edges must be overlapped a minimum, respectively, of 6 inches (152 mm) and 3½ inches (89 mm). Horizontal edge overlaps must run with the flow of water in a shingling effect. A minimum of two layers of the membrane must be applied, starting at the lower edge (eave) of the roof, and extend a minimum of 24 inches (610 mm) inside the exterior wall line of the building. Final coverage width must comply with the code.

Installation of the roof covering can proceed immediately following application of the membrane. The membrane must be covered by an approved roof covering as soon as possible. For reroofing applications, the same procedures apply after removal of the old roof covering and roofing fails to expose the plywood roof deck.

9 **5.0 CONDITIONS OF USE**

The UU 100 membrane described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 Installation must comply with this report and the manufacturer's published installation instructions. In the event of a conflict between the manufacturer's published installation instructions and this report, this report governs.

5.2 Installation is limited to use on plywood substrates on structures located in areas where nonclassified roof coverings are permitted.

5.3 Installation is limited to use with roof coverings that are mechanically fastened through the underlayment to the sheathing or rafters.

5.4 Installation is limited to roofs with ventilated attic spaces, in accordance with the requirements of the applicable code.

10 **6.0 EVIDENCE SUBMITTED**

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Self-adhered Roof Underlayment for Use as an Ice Barrier in Severe Climate Areas (AC48), dated February 2012.

6.2 Reports of testing in accordance with ASTM D1970.

11 **7.0 IDENTIFICATION**

The membrane is identified by labels on the rolls or packaging, displaying the Acme Underlayments Unlimited's name and address, the product name, the evaluation report number ESR-4802.

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SAMPLE

View current ICC-ES Evaluation Reports online: www.icc-es.org/Evaluation_Reports

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Evaluation Report Maintenance

- ESRs and listings are valid for a specific duration. Check the scope of the report!
- New ESRs are renewed one year after issuance. After first year, one- or two-year renewal options exist.
- Manufacturers must re-apply for product listings annually.
- An ESR or listing can undergo revisions at any time (Editorial, Technical).

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Test Labs

- ISO 17025, General requirements for the competence of testing and calibration laboratories
- IAS accreditation for ICC-ES AC and reference test standards
- Requires ongoing assessment of test lab for proficiency, quality control, calibrations, etc.
- ICC-ES AC85 Acceptance Criteria for Test Reports
  - Test labs and independent product sampling

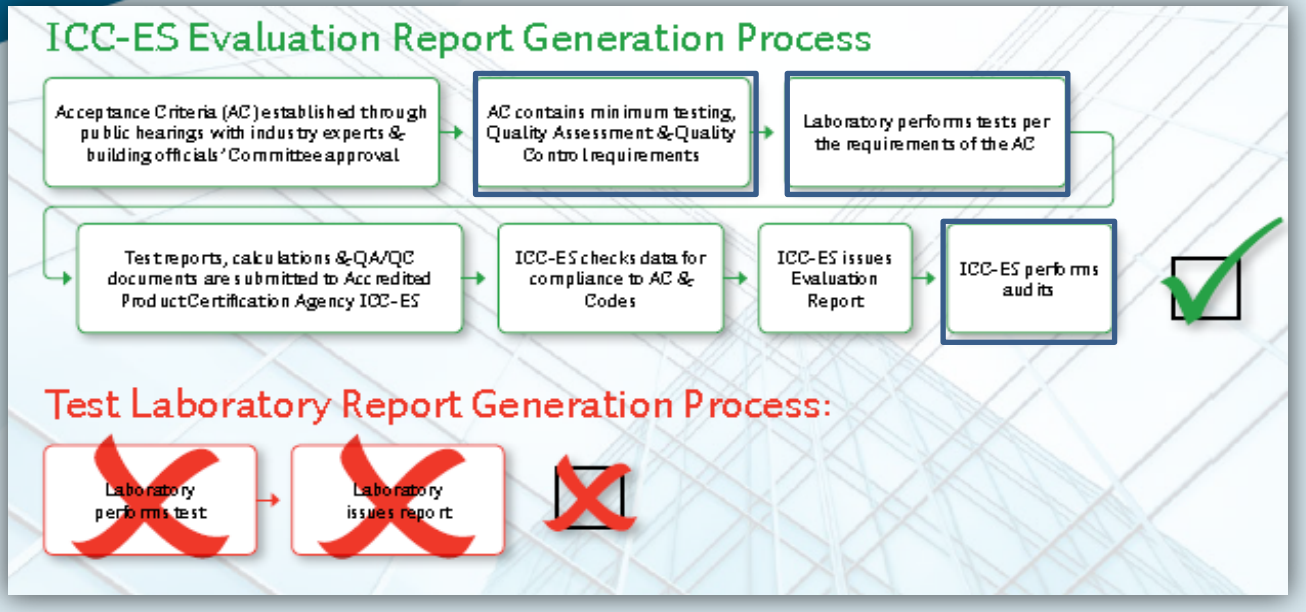
ES ICC EVALUATION SERVICE
In Cooperation with Innovation RESEARCH LABS

IAS INTERNATIONAL ACCREDITATION SERVICE®

ISO

ICC INTERNATIONAL CODE COUNCIL

Why not directly accept a test report?



- ICC-ES requires data from accredited or approved test labs.
- ICC-ES requires data based on a test standard or AC.
- ICC-ES ascertains continuous compliance through inspections.
- ICC-ES reviews data so you don't have to.

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Building Product Listings

- Different than ICC-ES Evaluation Reports
- Listings are intended for products referenced in the code
- Listings provide independent, third party evidence of compliance with code requirements in consensus standards (e.g. ASTM, ANSI, ACI, AISI, AISC, UL, NFPA).

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ICC-ES Listing

ESL-1004

ICC-ES | (800) 423-6587 | (562) 699-0543 | www.icc-es.org

Valid: 03/15 to 03/16

DIVISION: 13 00 00—SPECIAL CONSTRUCTION
SECTION: 13 48 53—MANUFACTURED SEISMIC CONTROL COMPONENTS
SECTION: 13 48 63—FABRICATED SEISMIC CONTROL ASSEMBLIES
DIVISION: 21 00 00—FIRE SUPPRESSION
SECTION: 21 05 48—VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPRESSION PIPING AND EQUIPMENT
DIVISION: 22 00 00—PLUMBING
SECTION: 22 05 48—VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

REPORT HOLDER:

LOOS & CO., INC.

901 INDUSTRIAL BOULEVARD
NAPLES, FLORIDA 34104

EVALUATION SUBJECT:

SEISMIC WIRE ROPE/CABLE™ BRACING SYSTEM COMPONENTS
(SEE TABLES 1 THROUGH 4)

Look for the trusted marks of Conformity!

"2014 Recipient of Prestigious Western States Seismic Policy Council (WSSPC) Award in Excellence"

A Subsidiary of

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ICC ES LISTED

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ESR vs. ESL

Evaluation Report (ESR)

- ✓ Proof of compliance to codes and acceptance criteria
- ✓ Safety
- ✓ Inspections
- ✓ Complex and innovative products
- ✓ Evaluation time varies according to complexity of the product

Listing (ESL)

- ✓ Proof of compliance to codes and standards referenced in codes
- ✓ Safety
- ✓ Inspections
- ✓ Traditional products
- ✓ Quick evaluation

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It's all Part of a Process!

Initial contact and estimation of capabilities and cost

Manufacturer submits application along with supporting documentation

Products tested at accredited testing lab

Initial inspection of manufacturing process

Successful evaluation and an ICC-ES evaluation report issued

<u>Continuous Compliance Process</u>:

Inspections to verify products are manufactured according to report or listing, and annual file review

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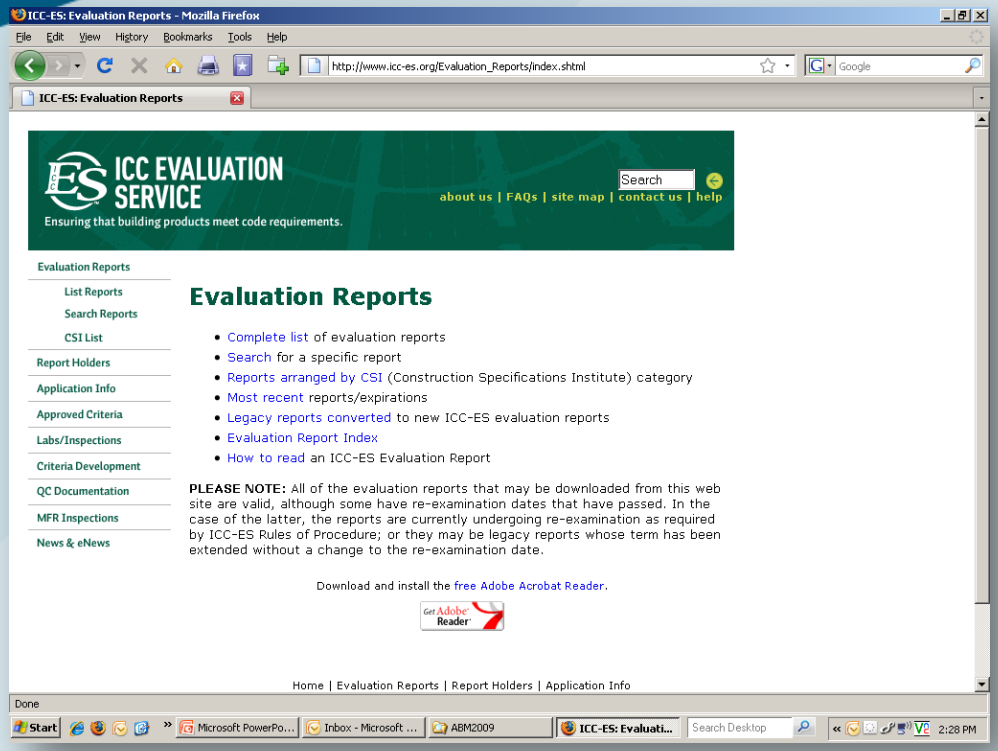
Code Conformity Tool



Evaluation reports and listings can be accessed for free at:

- www.icc-es.org
- www.icc-es.org/listing
- www.icc-es.org/pmg
- www.icc-es.org/ep
- Or, through e-Codes

ICC INTERNATIONAL CODE COUNCIL

Other ICC-ES Programs

- ICC-ES PMG Program – Plumbing, Mechanical and Gas products evaluated by ICC-ES. Separate evaluation reports are issued for these products

ICC ES C PMG

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The ICC-ES Mark of Conformity

- The ICC-ES Mark of Conformity means that products have undergone a rigorous evaluation.
- Look for the ICC-ES Marks of Conformity on building construction products and packaging before approving for installation.

ICC ES | ICC ES PMG | ICC ES LISTED

SCC Accredited CB-P/S OCPS Accrédité CCN

ICC INTERNATIONAL CODE COUNCIL

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Why obtain an ICC-ES Report?

ICC EVALUATION SERVICE — Most Widely Accepted and Trusted

ICC-ES Evaluation Report — **ESR-2252**

Reissued April 1, 2013

This report is subject to renewal April 1, 2015.

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DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION
Section: 07 25 00—Water-Resistive Barriers/Weather Barriers

REPORT HOLDER:

QINGDAO G & E BIO-POLYTEX COMPANY, LTD.
GONG YE YUAN QU, JIANG SHAN TOWN
LAIXI CITY, QINGDAO 2660603
CHINA
(86) 532-8788-1784
www.gyoha.com.cn

ADDITIONAL LISTEE:

PRIME SOURCE BUILDING PRODUCTS, INC.
1321 GREENWAY DRIVE
IRVING, TEXAS 75038-2504
(972) 999-8500

EVALUATION SUBJECT:

G & E WATER-RESISTIVE BARRIERS: G & E HOUSEGUARD, G & E HOUSEGUARD2, EASYGARD, EASYGARD2, AND CODEWRAP; PRIMESOURCE WATER-RESISTIVE BARRIER: GRIP RITE™ COMMERCIAL GRADE WEATHER BARRIER

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2009 and 2006 *International Building Code®* (IBC)
- 2009 and 2006 *International Residential Code®* (IRC)

Properties evaluated:

- Water resistance
- Surface-burning characteristics

2.0 USES

G & E Houseguard, G & E Houseguard2, EasyGard, EasyGard2, CodeWrap and Grip Rite® Commercial Grade Weather Barrier are used as water-resistive barriers on the exterior side of exterior walls of buildings of all construction types under the IBC and the IRC. The membranes are alternatives to the water-resistive barriers required in IBC Section 1404.2 and IRC Section R703.2. The products are also considered equivalent to a Grade D paper in accordance with IBC Section 2510.6 and IRC Section R703.6.3.

3.0 DESCRIPTION

The membranes are made of high-density polyethylene (HDPE) woven fabric that is coated on both sides with low-density polyethylene coating. The membranes have a nominal thickness of 0.005 inch (0.12 mm) and a basis weight of 2.9 oz/yd² (98 g/m²) for G & E Houseguard2, EasyGard2 and Grip Rite® Commercial Grade Weather Barrier; and 2.18 oz/yd² (74 g/m²) for G & E Houseguard, EasyGard, and CodeWrap. The membranes are available in rolls of varying sizes. The G & E membranes have a flame-spread index of 25 or less and a maximum smoke-developed index not exceeding 450, when tested in accordance with ASTM E84.

4.0 INSTALLATION

The membranes must be installed after wall framing and sheathing are installed in accordance with the applicable code, and before windows and doors are installed. The roll must be placed a minimum of 3 inches (76 mm) from the starting corner and fastened to wood framing with corrosion-resistant nails having 1-inch-diameter (25.4 mm) plastic head caps; or to steel framing with corrosion-resistant, minimum No. 7, Type S screws with 1-inch-diameter (25.4 mm) plastic washers. The membrane is unrolled around the building and fastened into each vertical stud line with fasteners spaced between 12 and 18 inches (305 to 457 mm); and into top and bottom sill plates with fasteners spaced 8 inches (203 mm) on center. The printed side must be installed facing the outside. A minimum overlap of 8 inches (203 mm) must be provided for vertical and 6 inches (152 mm) for horizontal seams. Inside and outside corners must be wrapped a minimum of 8 inches (203 mm) to create a double layer at all corners. When used over wood-based sheathing in exterior plaster applications, two layers of the product must be applied over sheathing or installation must be in accordance with the exception to IBC Section 2510.6 or IRC Section R703.6.3, as applicable.

For cementitious coatings or exterior insulation and finish systems, application must be in accordance with the ICC-ES evaluation report on the exterior coating.

5.0 CONDITIONS OF USE

The G & E Houseguard, G & E Houseguard2, EasyGard, EasyGard2, CodeWrap and Grip Rite® Commercial Grade Weather Barrier water-resistive barriers described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The manufacturer's published installation instructions and this report must be strictly adhered to. In the event of a conflict between this report and the manufacturer's published installation instructions, this report governs.

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- Evidence that product complies with code or code referenced standards
- Proof that new or innovative products can be used in construction projects
- ICC codes are used in all 50 states and internationally
- ICC-ES and ICC back code compliance of the evaluated product
- Reflect use of unique, easily identifiable listing marks

ICC INTERNATIONAL CODE COUNCIL

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Updates

- ✓ EPA recognition of ICC-ES as a third party certifier under the Formaldehyde Emission Standards for Composite Wood Products Rule

- ✓ Combined listing program with APA – The Engineered Wood Association to PRG-320 for Cross-Laminated Timber products

- ✓ LADBS recognition of ICC-ES reports as proof of compliance to seismic requirements of the California and City of Los Angeles building codes. ICC-ES now issuing Evaluation Report Supplements to the LABC and LARC.

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Updates

- ✓ ICC-ES received California Air Resources Board Approval to Conduct Third Party Certification Services for Composite Wood Products (CARB Approval)

- ✓ Cooperation with Twining, Inc. for Testing and Certification of Supplementary and Alternative Cementitious Materials to help contribute to reduction of CO_2 Emissions Enhancing Sustainability

- ✓ Continued cooperation with Innovation Research Labs for one-stop testing, listing and product evaluation service for Building, Energy and PMG product manufacturers

CALIFORNIA AIR RESOURCES BOARD

TWINING

ES ICC EVALUATION SERVICE
In Cooperation with Innovation RESEARCH LABS

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Closing Comments

- Visit the ICC-ES website and sign up for the mailing list. Stay informed of ES updates.
- Require ESRs from product manufacturers as part of enforcement in your jurisdiction
- Provide feedback to ICC-ES as part of the AC process or when questions arise regarding ESRs or AC.
- Questions?

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ICC-ES Contacts

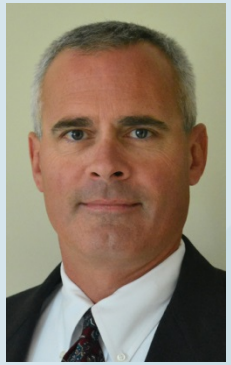
www.icc-es.org or link from

www.iccsafe.org

CONNECT + CUSTOMER CARE

1-800-423-6587

es@icc-es.org



Mike Temesvary, P.E.
William Gould, P.E.
ICC Evaluation Service, LLC
Western Regional Office
3060 Saturn Street, Suite 100
Brea, California 92821

ICC INTERNATIONAL CODE COUNCIL

File Attachments for Item:

EC-5 Commercial Energy 2021 IECC (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

Website: https://www.iccsafe.org/edu

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: Commercial Energy 2021 IECC

Course instructor: Jerica Stacey

Course description:

This seminar reviews key changes from the 2018 to the 2021 edition of the International Energy Conservation Code® (IECC®) for commercial projects. This course will assist code officials, plans examiners, inspectors, and design professionals in identifying the specific code changes that have occurred and understanding the reasoning behind the changes. In addition, the presentation will provide a broad overview of the IECC, including scope and application, to provide context to the topics under discussion.

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

- ☐ Code Administration
- ☐ Existing Buildings
- ☐ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☐ On Demand
- ☐ Webinar

Course Website:

358

☑ No

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- ☐ Residential Certifications Only
- ☑ Administrative Course, All Certifications
- ☐ Commercial and Residential Certifications

Application materials included *

- ☑ Course Outline or Course Learning Objectives
- ☑ Presentation Materials/Slides (not required for roundtable courses)
- ☑ Assessment Materials (for online courses)
- ☑ Presenter Bio
- ☐ Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PTT_2021 IECC Significant Changes_Commercial.pdf	8.85 MB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

Significant Changes to the 2021 International Energy Conservation Code – Commercial Provisions

Length: 90-minute course

Description

This seminar reviews key changes from the 2018 to the 2021 edition of the International Energy Conservation Code® (IECC®) for commercial projects. This course will assist code officials, plans examiners, inspectors, and design professionals in identifying the specific code changes that have occurred and understanding the reasoning behind the changes. In addition, the presentation will provide a broad overview of the IECC, including scope and application, to provide context to the topics under discussion.

Course Objectives

At the end of this presentation, attendees will be able to:

- Identify the importance of the energy code in reducing building energy use and providing other environmental benefits
- Explain the intent, scope and applicability of the 2021 IECC requirements for commercial building projects
- Identify the most significant administrative changes to the 2021 IECC and changes that increase the useability of the code
- Identify the most significant energy efficiency changes in the 2021 IECC commercial provisions and potential impact on the design, plan review and inspection communities

Timed Outline

Length	Topic
5 minutes	Course and instructor introductions
10 minutes	Overview of the IECC and energy efficiency improvements
10 minutes	Administrative changes (Chapter 1 and 2) and General changes (Chapter 3)
10 minutes	Commercial intro and general changes (Chapter 4, Section 401)
10 minutes	Commercial building envelope (Chapter 4, Section 402)
10 minutes	Commercial mechanical systems, service hot water (Chapter 4, Sections 403 and 404)
10 minutes	Commercial electrical power and lighting systems (Chapter 4, Section 405); Commercial additional efficiency requirements (Chapter 4, Section 407)
10 minutes	Commercial total building performance and commissioning, existing buildings, appendices (Chapter 4, Sections 407 and 408)
10 minutes	Code Council and partner resources
5 minutes	Closing

Jerica Stacey

Jerica Stacey is an Energy Code Specialist with the International Code Council's Business and Product Development Group. Within this position, she supports the Code Council's energy code initiatives and energy codes and standards technical content development as well as advances the Code Council's business interests related to energy codes and standards for both the national and international markets. Jerica has over 10 years of experience in the development, adoption and implementation of building energy codes.

Significant Changes to the 2021 *International Energy Conservation Code®* – Commercial Provisions

1

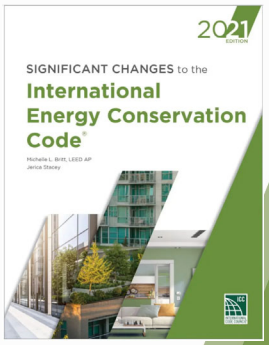
Jerica Stacey

Energy Code Specialist
Product Development
International Code Council
Ammon, Idaho
Tel: 888-422-7233 x7757
Email: jstacey@iccsafe.org

2

Course Description

- This seminar covers the significant changes to the commercial provisions of the *2021 International Energy Conservation Code® (IECC®)*



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Course Objectives

At the end of this presentation, you will be able to:

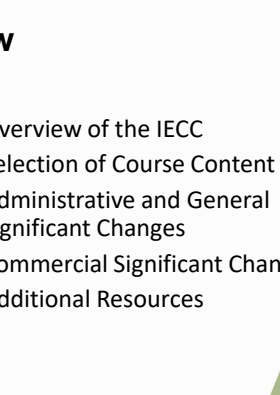
- Identify the importance of the energy code in reducing building energy use and providing other environmental benefits
- Explain the intent, scope and applicability of the 2021 IECC requirements for commercial building projects
- Identify the most significant administrative changes to the 2021 IECC and changes that increase the useability of the code
- Identify the most significant energy efficiency changes in the 2021 IECC commercial provisions and potential impact on the design, plan review and inspection communities

4

Course Overview

- Overview of the IECC
- Selection of Course Content
- Administrative and General Significant Changes
- Commercial Significant Changes
- Additional Resources

5


C403.4.2.3
Automatic Start and Stop

CHANGE TYPE: Modification

CHANGE SUMMARY: In addition to automatic start controls, HVAC systems with direct digital controls serving individual zones must have automatic stop controls.

2021 CODE: C403.4.2.3 Automatic start and stop (Mandatory). Automatic start and stop controls shall be provided for each HVAC system. The automatic start controls shall be configured to automatically adjust the daily start time of the HVAC system in order to bring each space to the desired occupied temperature immediately prior to scheduled occupancy. Automatic stop controls shall be provided for each HVAC system with direct digital control of individual zones. The automatic stop controls shall be configured to reduce the HVAC system's heating temperature set point and increase the cooling temperature setpoint by not less than 2°F (1.1°C) before scheduled unoccupied periods based upon the thermal lag and acceptable drift in space temperature that is within comfort limits.

CHANGE SIGNIFICANCE: The 2018 IECC established requirements for automatic start controls. These controls automatically adjust the start time for warm up or cool down of the zone prior to occupancy so that the zone is at the appropriate temperature when it is scheduled to be occupied. Automatic stop controls, sometimes referred to as an optimum stop, are now required for HVAC systems with direct digital controls serving individual zones. The controls must be capable of decreasing the heating temperature setpoint by 2°F and increasing the cooling setpoint by 2°F for some time period before the scheduled unoccupied period where the temperature can drift within the comfort range using the adjusted setpoints. Typically this results in little heating or cooling for 30 to 60 minutes at the end of the occupied period.

This new provision is applicable to both IECC compliance paths.

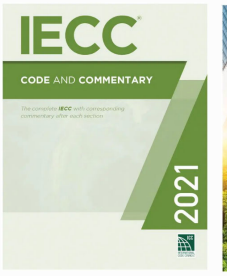
Automatic start and stop are both required.

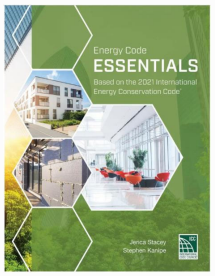
Selection of Topics

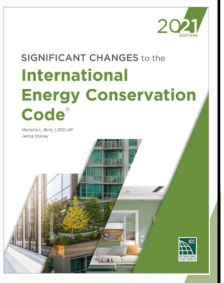
Provisions addressed based primarily on:

- Frequency of application
- Special significance
- Change in application

6







Useful Publications

Available on shop.iccsafe.org

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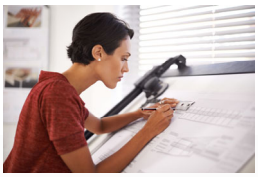
About YOU

Poll Question 1

Poll Question 2



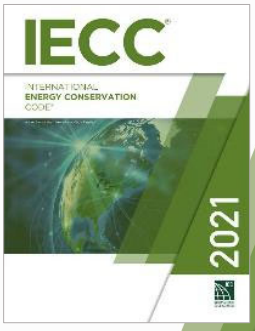
8

Overview of the IECC

9

About the IECC

- The IECC regulates the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.
- This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective.
- This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.



C/R101.3

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Family of I-Codes

- International Private Sewage Disposal Code
- International Property Maintenance Code
- International Zoning Code
- International Performance Code
- International Swimming Pool & Spa Code
- International Wildlife-Urban Interface Code
- International Fuel Gas Code
- International Mechanical Code
- International Green Construction Code
- International Existing Building Code
- International Energy Conservation Code
- International Plumbing Code
- International Fire Code
- International Building Code
- International Residential Code

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IECC in Your Jurisdiction

Poll Question 3

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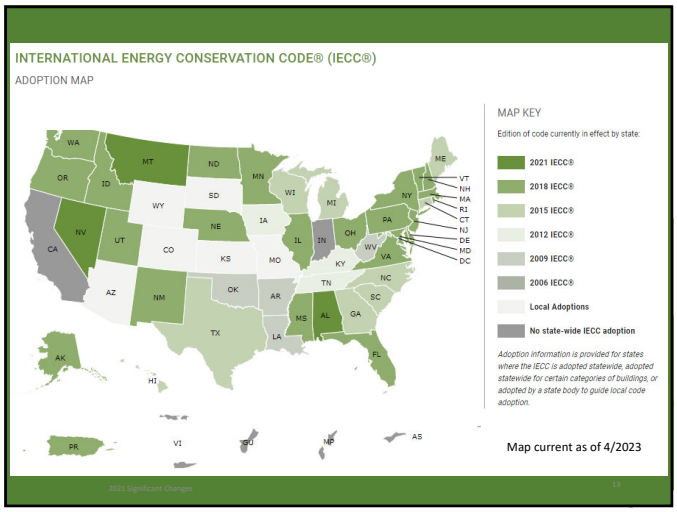

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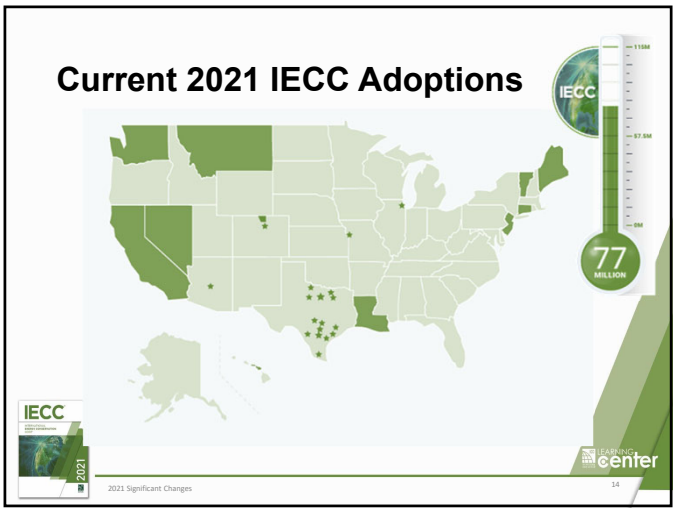

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The Case for Building Energy Codes

- Energy savings
- Emissions reductions
- Cost savings
- Enhanced occupant comfort
- Improved grid reliability
- Synchronicity with Suite of I-Codes

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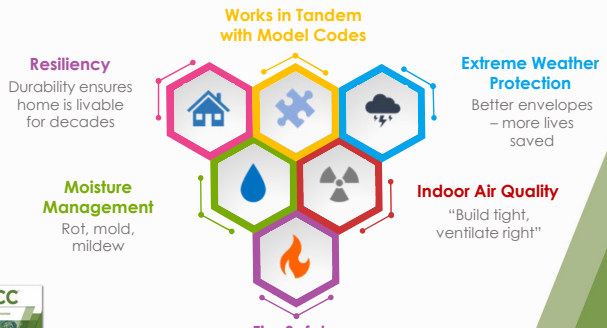
Energy as a Life Safety Code



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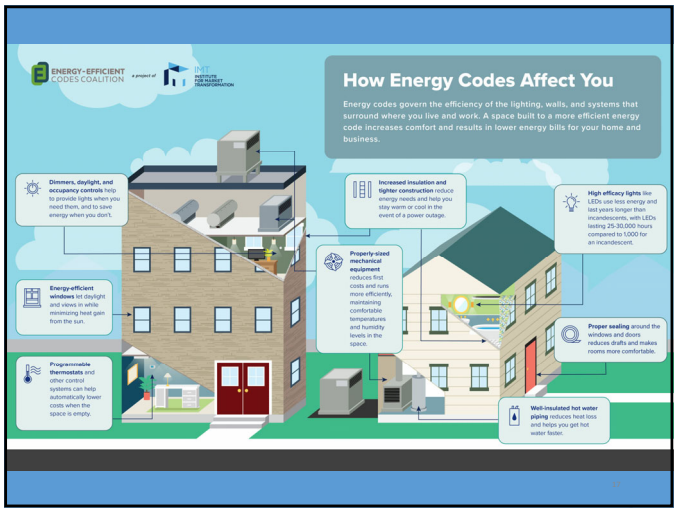

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How the Code is Organized

- There are two separate sets of provisions
  - **Commercial** and **residential** energy efficiency requirements that apply to the building thermal envelope, mechanical and service water heating systems, and lighting and electrical systems
  - Administrative provisions and definitions specific to each commercial and residential set of regulations are also included

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Commercial Energy Efficiency Improvements – ASHRAE 90.1

- Increased Efficiency – Commercial
  - ASHRAE 90.1 – 2019 ~ 5% greater energy efficiency

COMMERCIAL: ANSI/ASHRAE/IES STANDARD 90.1-2019

On July 28, 2021, DOE issued a determination that Standard 90.1-2019 will achieve greater energy efficiency in buildings subject to the code. DOE estimates national savings in commercial buildings of approximately:

- 4.7 percent site energy
- 4.3 percent source energy
- 4.3 percent energy cost
- 4.2 percent carbon emissions

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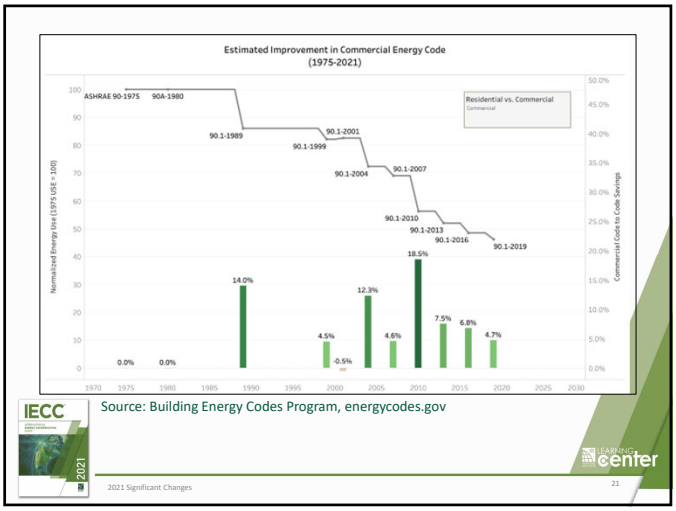

Source: Building Energy Codes Program, energycodes.gov

21

Commercial Energy Efficiency Improvements – IECC

- September 2022 DOE analysis of commercial provisions of the 2021 IECC
- Site energy savings of 12.1% at the aggregate national level compared to the 2018 IECC edition
- On a national weighted average basis, the 2021 IECC is 6.5% more efficient for site energy use than ASHRAE 90.1-2019
- Full report available at energycodes.gov

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Administrative and General Changes

Commercial and Residential Chapters 1 through 3

23

Chapter 1: Scope and Administration

- Chapter 1 is in two parts
- Establishes the limits of applicability of the code and describes how the code is to be applied and enforced
- Establishes authority and duties of the code official appointed by the authority having jurisdiction
- Establishes the rights and privileges of the design professional, contractor and property owner

CHAPTER 1 SCOPE AND ADMINISTRATION C1-1

PART 1—SCOPE AND APPLICATION C1-1
Section
C101 Scope and General Requirements C1-1
C102 Alternative Materials, Design and Methods of Construction and Equipment C1-1

PART 2—ADMINISTRATION AND ENFORCEMENT C1-1
Section
C103 Construction Documents C1-1
C104 Fees C1-3
C105 Inspections C1-3
C106 Notice of Approval C1-4
C107 Validity C1-4
C108 Referenced Standards C1-4
C109 Stop Work Order C1-4
C110 Board of Appeals C1-4

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Alignment with Other I-Codes

- Proposals by BCAC were introduced to better align Chapter 1 with the other I-Codes

Commercial

- Within C102 Alternative Materials, C106 Notice of Approval, C109 Stop Work Order

Residential

- Within R102 Alternative Materials, R106 Notice of Approval, R109 Stop Work Order, and R110 Means of Appeals

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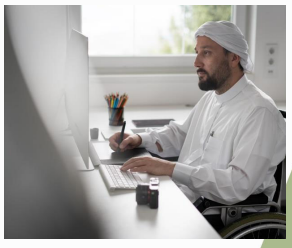
Digital Construction Documents

- Construction documents may be submitted in a digital format



C/R103.1

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Information on Construction Documents

- Information required on the construction documents has been expanded to include an indication of the energy compliance path used
- Clarifies requirements for air barrier and air sealing details and locations

C/R103.2

27

Information on Construction Documents Continued

1. Energy compliance path.
2. Insulation materials and their *R*-values.
3. Fenestration *U*-factors and solar heat gain coefficients (SHGCs).
4. Area-weighted *U*-factor and solar heat gain coefficient (SHGC) calculations.
5. Mechanical system design criteria.
6. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
7. Economizer description.
8. Equipment and system controls.
9. Fan motor horsepower (hp) and controls.
10. Duct sealing, duct and pipe insulation and location.
11. Lighting fixture schedule with wattage and control narrative.
12. Location of daylight zones on floor plans.
13. Air ~~sealing details~~ barrier and air sealing details, including the location of the air barrier.

C103.2

28

Chapter 2: Definitions

- IECC includes definitions for specific terms
- Most defined terms are *italicized* in code text
  - When definition is key to understanding a particular code provision
- Undefined terms
  - Other I-Code definitions apply
  - Common-use definitions apply

SECTION R202
GENERAL DEFINITIONS

ABOVE-GRADE WALL. A wall more than 50 percent above grade and enclosing *conditioned space*. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and *skylight* shafts.

ACCESS (TO). That which enables a device, appliance or equipment to be reached by *ready access* or by a means that first requires the removal or movement of a panel or similar obstruction.

ADDITION. An extension or increase in the *conditioned space* floor area, number of stories or height of a building or structure.

AIR BARRIER. One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the *building thermal envelope* and its assemblies.

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On-site Renewable Energy and Renewable Energy Resources

- **ON-SITE RENEWABLE ENERGY.** Energy ~~derived~~ from renewable energy resources harvested at the building project site. ~~solar radiation, wind, waves, tides, landfill gas, biogas, biomass or the internal heat of the earth. The energy system providing onsite renewable energy shall be located on the project site.~~

- **RENEWABLE ENERGY RESOURCES.** Energy derived from solar radiation, wind, waves, tides, landfill gas, biogas, biomass or extracted from hot fluid or steam heated within the earth.

C202

30

Biogas and Biomass

- **BIOGAS.** A mixture of hydrocarbons that is a gas at 60°F (15.5°C) and 1 atmosphere of pressure that is produced through the anaerobic digestion of organic matter.

- **BIOMASS.** Nonfossilized and biodegradable organic material originating from plants, animals and/or micro-organisms, including products, by-products, residues and waste from agriculture, forestry and related industries as well as the nonfossilized and biodegradable organic fractions of industrial and municipal wastes, including gases and liquids recovered from the decomposition of nonfossilized and biodegradable organic material.

C202

31

Fan Efficiencies

New definitions related to fans introduce and support the Fan Energy Index

- **FAN ENERGY INDEX (FEI).** The ratio of the electric input power of a reference fan to the electric input power of the actual fan as calculated in accordance with AMCA 208.
- **FAN, EMBEDDED.** A fan that is part of a manufactured assembly where the assembly includes functions other than air movement.
- **FAN ARRAY.** Multiple fans in parallel between two plenum sections in an air distribution system.
- **FAN NAMEPLATE ELECTRICAL INPUT POWER.** The nominal electrical input power rating stamped on a fan assembly nameplate.
- **FAN SYSTEM ELECTRICAL INPUT POWER.** The sum of the fan electrical power of all fans that are required to operate at fan system design conditions to supply air from the heating or cooling source to the conditioned spaces and/or return it to the source or exhaust it to the outdoors.

C202

32

High-Efficacy Light Sources

HIGH-EFFICACY LIGHT SOURCES. Any lamp with an efficacy of not less than 65 lumens per watt, or luminaires with an efficacy of not less than 45 lumens per watt.

R202

2021 Significant Changes 33

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Other New or Revised Definitions

- Commercial New
  - Data center, Data center systems
  - Direct Digital Control (DDC)
  - Enthalpy recovery ratio
  - Fault detection and diagnostics (FDD) system
  - Information technology equipment
  - Internal curtain system
  - Large diameter ceiling fan
  - Testing unit enclosure area
  - Thermal distribution efficiency (TDE)
  - Vegetative roofs
  - Visible transmittable, annual
- Commercial Revised
  - General lighting
  - Green houses
  - On-site renewable energy
  - Skylights
  - Wall, above-grade

C202

2021 Significant Changes 34

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Chapter 3: General Requirements

- Includes broadly applicable requirements not at home in other chapters having more specific coverage of subject matter
- Establishes climate zone by US counties and territories and includes methodology for determining climate zones elsewhere
- Contains product rating, marking and installation requirements for materials such as insulation, windows, doors and siding

2021 Significant Changes 35

35

Climate Zone Definitions

Climate zones updated

- New Climate Zone 0
- Align with ASHRAE 169, ASHRAE 90.1, 2018 IgCC
- 10% of US counties assigned new CZ

C/R301.3

2021 Significant Changes 36

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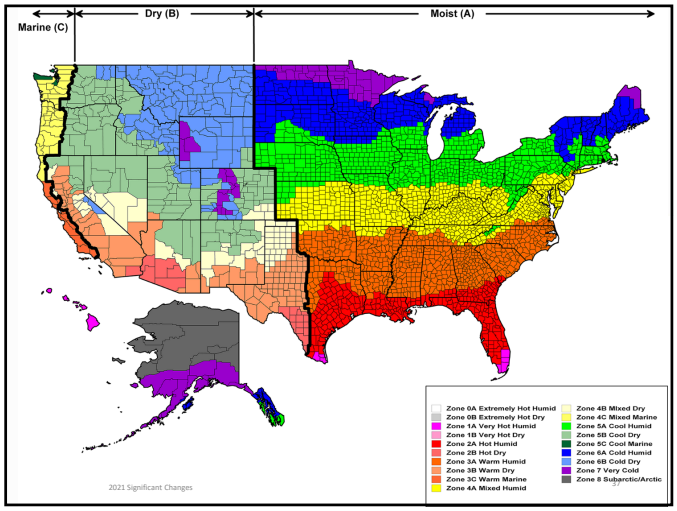

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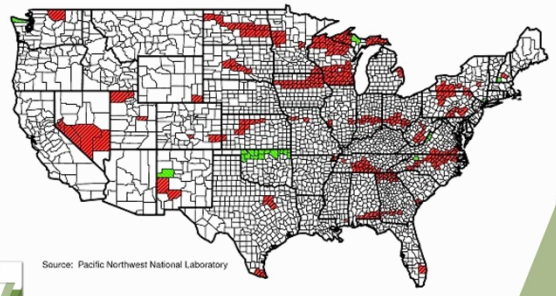
County-Level Climate Zone Changes



Source: Pacific Northwest National Laboratory

C/R301.3

38

C301.3 – Climate Zone Definitions

- CZ for locations not listed in this code
  - Determine thermal climate zone (0 – 8) from Table C301.3 using heating and cooling degree days (HDD and CDD)
  - Determine the moisture zone using temperature and precipitation data
    - Marine, Dry or Humid

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Climate Zone Definitions Continued

TABLE ~~R301.3~~(2) R301.3 Thermal Climate Zone Definitions

ZONE NUMBER	THERMAL CRITERIA	
	IP Units	SI Units
0	10,800 < CDD50°F	6000 < CDD10°C
1	9,000 < CDD50°F < 10,800	5000 < CDD10°C < 6000
2	6,300 < CDD50°F ≤ 9,000	3500 < CDD10°C ≤ 5000
~~3A and 3B~~ 3	~~4,500 <~~ CDD50°F ≤ 6,300 AND HDD65°F ≤ ~~5,400~~ 3,600	CDD10°C < 3500 AND HDD18°C ≤ ~~3000~~ 2000
~~4A and 4B~~ 4	CDD50°F ≤ ~~4,500~~ 6,300 AND 3,600 < HDD65°F ≤ 5,400	CDD10°C < ~~2500~~ 3500 AND 2000 < HDD18°C ≤ 3000
~~3C~~	~~HDD65°F ≤ 3,600~~	~~HDD18°C ≤ 2000~~
~~4C~~	~~3,600 < HDD65°F ≤ 5,400~~	~~2000 < HDD18°C ≤ 3000~~
5	CDD50°F < 6,300 AND 5,400 < HDD65°F ≤ 7,200	CDD10°C < 3500 AND 3000 < HDD18°C ≤4000
6	7,200 < HDD65°F ≤ 9,000	4000 < HDD18°C ≤5000
7	9,000 < HDD65°F ≤ 12,600	5000 < HDD18°C ≤ 7000
8	12,600 < HDD65°F	7000 < HDD18°C

For SI: °C = [(°F) – 32]/1.8.

C/R301.3

40

Improved Useability

Mandatory and *Prescriptive* labels removed in favor of mandatory tables
- Total Building Performance

2018 IECC

C402.5 Air leakage—thermal envelope (Mandatory). The *thermal envelope* of buildings shall comply with Sections C402.5.1 through C402.5.8, or the building *thermal envelope* shall be tested in accordance with ASTM E 779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft² (2.0 L/s • m²). Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

2021 IECC

C402.5 Air leakage—thermal envelope. The *building thermal envelope* shall comply with Sections C402.5.1 through Section C402.5.11.1, or the building *thermal envelope* shall be tested in accordance with Section C402.5.2 or C402.5.3. Where compliance is based on such testing, the building shall also comply with Sections C402.5.7, C402.5.8 and C402.5.9.

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Improved Useability

TABLE C407.2
REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION[a]	TITLE
	Envelope
C402.5	Air leakage—thermal envelope
	Mechanical
C403.1.1	Calculation of heating and cooling loads
C403.1.2	Data centers
C403.2	System design
C403.3	Heating and cooling equipment efficiencies
C403.4, except C403.4.3, C403.4.4 and C403.4.5	Heating and cooling system controls
C403.5.5	Economizer fault detection and diagnostics
C403.7, except C403.7.4.1	Ventilation and exhaust systems
C403.8, except C403.8.6	Fan and fan controls
C403.9	Large-diameter ceiling fans
C403.11, except C403.11.3	Refrigeration equipment performance
C403.12	Construction of HVAC system elements
C403.13	Mechanical systems located outside of the building thermal envelope
C404	Service water heating
C405, except C405.3	Electrical power and lighting systems
C408	Maintenance information and system commissioning

a. Reference to a code section includes all the relative subsections except as indicated in the table.

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Commercial Significant Changes
Chapter 4, Chapter 5, Appendices

43

Commercial Provisions

- Pertain to buildings not covered by the Residential Provisions of the IECC
- New and existing buildings
- Apply to the buildings' sites and associated systems and equipment

C101.2

44

Commercial Energy Efficiency, Chapter 4

- C401 General
- C402 Building Envelope Requirements
- C403 Building Mechanical Systems
- C404 Service Water Heating
- C405 Electrical Power and Lighting Systems
- C406 Additional Efficiency Requirements
- C407 Total Building Performance
- C408 Maintenance Information and System Commissioning

45

Compliance Path Options

- Compliance path options for the commercial provisions of the IECC are named and the sections required for each option are outlined
  - Prescriptive Compliance
  - Total Building Performance
  - ASHRAE 90.1

C401.2 Application. Commercial buildings shall comply with Section C401.2.1 or C401.2.2.

C401.2.1 International Energy Conservation Code. Commercial buildings shall comply with one of the following:

1. Prescriptive Compliance. The Prescriptive Compliance option requires compliance with Sections C402 through C406 and Section C408. Dwelling units and sleeping units in Group R-2 buildings without systems serving multiple units shall be deemed to be in compliance with this chapter, provided that they comply with Section R406.
2. Total Building Performance. The Total Building Performance option requires compliance with Section C407.

Exception: Additions, alterations, repairs and changes of occupancy to existing buildings complying with Chapter 5.

C401.2.2 ASHRAE 90.1. Commercial buildings shall comply with the requirements of ANSI/ASHRAE/IESNA 90.1.

C401.2

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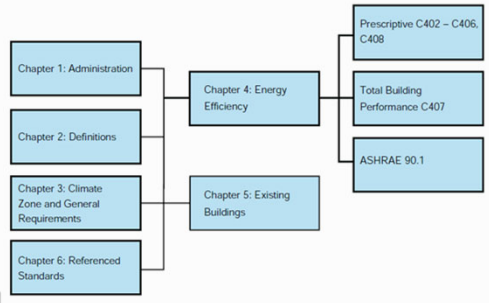
Compliance Path Options Continued



C401.2

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C401.2.2 – ASHRAE 90.1

Structure of ANSI/ASHRAE/IES Standard 90.1-2019

Section

5 Building Envelope
6 Heating, Ventilating, and Air Conditioning
7 Service Water Heating
8 Power
9 Lighting
10 Other Equipment
11 Energy Cost Budget
12 Method
Normative References
Appendices A – I
Annex

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Commercial Compliance Paths

Poll Question 4

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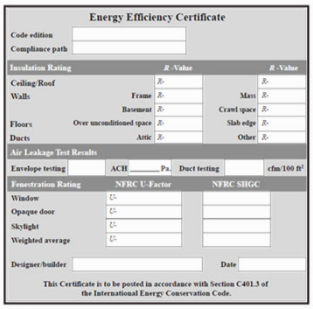
Thermal Envelope Certificate



Energy Efficiency Certificate

Code edition

Compliance path

Insulation Rating		R-Value		R-Value
Ceiling/Roof		R-		
Walls	Frame	R-	Mass	R-
	Basement	R-	Crawl space	R-
Floors	Over unconditioned space	R-	Slab edge	R-
Ducts	Attic	R-	Other	R-

Air Leakage Test Results

Envelope testing ACH ____ Pa. Duct testing cfm/100 ft²

Fenestration Rating	NFRC U-Factor	NFRC SHGC
Window	U-	
Opaque door	U-	
Skylight	U-	
Weighted average	U-	

Designer/builder Date

This Certificate is to be posted in accordance with Section C401.3 of the International Energy Conservation Code.

Sample thermal envelope certificate.

- Permanent thermal envelope certificate
  - R-values of insulation
  - U-factors and SHGCs of fenestration
  - Envelope air leakage test results
- Completed by approved party
- Posted in approved location and copy included in construction files for project

C401.3

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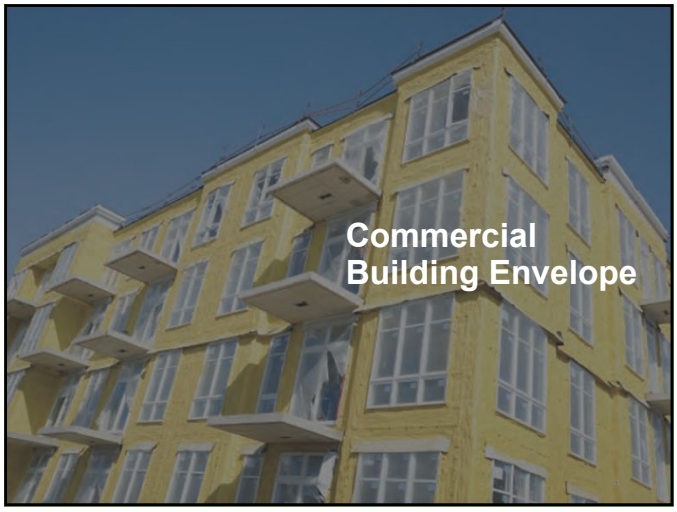

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Key Building Envelope Provisions

- Insulation: roofs, ceilings, above-grade walls, below-grade walls, floors
- Roof solar reflectance and thermal emittance
- Fenestration performance: windows, doors, skylights
- Air leakage and air barriers
- Some buildings exempt from building envelope requirements only

C402

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Exempt From Building Envelope Provisions

- Low energy buildings
  - Peak design rate < 3.4 Btu/h × ft²
  - Do not contain conditioned space
- Greenhouses mechanically heated or cooled
  + additional requirements to be considered exempt
- Equipment buildings
  - Separate buildings with floor area **not more than 1,200ft²**
  + additional requirements to be considered exempt

C402.1.1 and C402.1.2

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Increased Efficiency: R-Value and U-Factor Overview

- Incremental increases in efficiency for many roof, wall and floor components in CZs 4-8
- R-13 insulation for framed floors in CZs 0 and 1
- R-10 CI for unheated slabs in CZ 3 Group R
- Non-swinging opaque doors moved from R-Value to U-Factor table

Changes align IECC with ASHRAE 90.1-2016 and 2019 requirements

Tables C402.1.3 and C402.1.4

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Climate Zone 3 – Roof and Floors

IECC Edition	Roofs						Floors				Slab-on-grade Floors			
	Entirely Above Roof Deck		Metal Buildings		Attic and Other		Mass		Joist/ Framing		Unheated Slabs		Heated Slabs	
	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R	Oth	Grp R	Oth	Grp R	Other	Grp R
2009	20ci	20ci	13+13	19	38	38	6.3ci	8.3ci	19	30	NR	NR	10, 24" below	10, 24" below
2012	20ci	20ci	19+ 11 LS	19+ 11 LS	38	38	10ci	10ci	30	30	NR	NR	10, 24" below	10, 24" below
2015	25ci	25ci	19+ 11 LS	19+ 11 LS	38	38	10ci	10ci	30	30	NR	NR	10, 24" below	10, 24" below
2018	25ci	25ci	19+ 11 LS	19+ 11 LS	38	38	10ci	10ci	30	30	NR	NR	10, 24" below + R-5 slab	10, 24" below + R-5 slab
2021	25ci	25ci	19+ 11 LS	19+ 11 LS	38	38	10ci	10ci	30	30	NR	10, 24" below	10, 24" below + R-5 slab	10, 24" below + R-5 slab

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Climate Zone 3 – Walls

IECC Edition	Above Grade								Below Grade	
	Mass		Metal Building		Metal Framed		Wood Framed and Other		Below-grade wall	
	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R
2009	7.6ci	9.5ci	19	19	13+3.8ci	13+7.5ci	13	13	NR	NR
2012	7.6ci	9.5ci	13+ 6.5ci	13+13ci	13+7.5ci	13+7.5ci	13+3.8ci or 20	13+3.8ci or 20	NR	NR
2015	7.6ci	9.5ci	13+ 6.5ci	13+13ci	13+7.5ci	13+7.5ci	13+3.8ci or 20	13+3.8ci or 20	NR	NR
2018	7.6ci	9.5ci	13+ 6.5ci	13+13ci	13+7.5ci	13+7.5ci	13+3.8ci or 20	13+3.8ci or 20	NR	NR
2021	7.6ci	9.5ci	13+ 6.5ci	13+13ci	13+7.5ci	13+7.5ci	13+3.8ci or 20	13+3.8ci or 20	NR	NR

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CZ 4A and 4B – Roof and Floors

IECC Edition	Roofs						Floors				Slab-on-grade Floors			
	Entirely Above Roof Deck		Metal Buildings		Attic and Other		Mass		Joist/ Framing		Unheated Slabs		Heated Slabs	
	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R	Oth	Grp R	Other	Grp R	Other	Grp R
2009	20ci	20ci	13+ 13	19	38	38	10ci	10.4ci	30	30	NR	10, 24″ below	15, 24″ below	15, 24″ below
2012	25ci	25ci	19+ 11 LS	19+ 11 LS	38	38	10ci	10.4ci	30	30	10, 24″ below	10, 24″ below	15, 24″ below	15, 24″ below
2015	30ci	30ci	19+ 11 LS	19+ 11 LS	38	38	10ci	10.4ci	30	30	10, 24″ below	10, 24″ below	15, 24″ below	15, 24″ below
2018	30ci	30ci	19+ 11 LS	19+ 11 LS	38	38	10ci	10.4ci	30	30	10, 24″ below	10, 24″ below	15, 24″ below + R-5 slab	15, 24″ below + R-5 slab
2021	30ci	30ci	19+ 11 LS	19+ 11 LS	49	49	14.6ci	16.7ci	30	30	15, 24″ below	15, 24″ below	15, 24″ below + R-5 slab	15, 24″ below + R-5 slab

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Climate Zone 4A and 4B – Walls

IECC Edition	Above Grade								Below Grade	
	Mass		Metal Building		Metal Framed		Wood Framed and Other		Below-grade wall	
	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R
2009	9.5ci	11.4ci	19	19	13+7.5ci	13+7.5ci	13	13+3.8ci	NR	7.5ci
2012	9.5ci	11.4ci	13+13ci	13+13ci	13+7.5ci	13+7.5ci	13+3.8ci or 20	13+3.8ci or 20	7.5ci	7.5ci
2015	9.5ci	11.4ci	13+13ci	13+13ci	13+7.5ci	13+7.5ci	13+3.8ci or 20	13+3.8ci or 20	7.5ci	7.5ci
2018	9.5ci	11.4ci	13+13ci	13+13ci	13+7.5ci	13+7.5ci	13+3.8ci or 20	13+3.8ci or 20	7.5ci	7.5ci
2021	9.5ci	11.4ci	13+13ci	13+14ci	13+7.5ci	13+7.5ci	13+3.8ci or 20	13+3.8ci or 20	7.5ci	10ci

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CZ 5 and 4C – Roof and Floors

IECC Edition	Roofs						Floors				Slab-on-grade Floors			
	Entirely Above Roof Deck		Metal Buildings		Attic and Other		Mass		Joist/ Framing		Unheated Slabs		Heated Slabs	
	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R	Oth	Grp R	Other	Grp R	Other	Grp R
2009	20ci	20ci	13+13	19	38	38	10ci	12.5ci	30	30	NR	10, 24″ below	15, 24″ below	15, 24″ below
2012	25ci	25ci	19 + 11 LS	19 + 11 LS	38	49	10ci	12.5ci	30	30	10, 24″ below	10, 24″ below	15, 36″ below	15, 36″ below
2015	30ci	30ci	19 + 11 LS	19 + 11 LS	38	49	10ci	12.5ci	30	30	10, 24″ below	10, 24″ below	15, 36″ below	15, 36″ below
2018	30ci	30ci	19 + 11 LS	19 + 11 LS	38	49	10ci	12.5ci	30	30	10, 24″ below	10, 24″ below	15, 36″ Below + R-5 slab	15, 36″ Below + R-5 slab
2021	30ci	30ci	19 + 11 LS	19 + 11 LS	49	49	14.6ci	16.7ci	30	30	15, 24″ below	20, 24″ below	15, 36″ Below + R-5 slab	15, 36″ Below + R-5 slab

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Climate Zone 5 and 4C – Walls

IECC Edition	Above Grade								Below Grade	
	Mass		Metal Building		Metal Framed		Wood Framed and Other		Below-grade wall	
	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R
2009	11.4ci	13.3ci	13+5.6ci	13+5.6ci	13+7.5ci	13+7.5ci	13+3.8ci	13+3.8ci	7.5ci	7.5ci
2012	11.4ci	13.3ci	13+13ci	13+13ci	13+7.5ci	13+7.5ci	13+3.8ci or 20	13+7.5ci or 20+3.8ci	7.5ci	7.5ci
2015	11.4ci	13.3ci	13+13ci	13+13ci	13+7.5ci	13+7.5ci	13+3.8ci or 20	13+7.5ci or 20+3.8ci	7.5ci	7.5ci
2018	11.4ci	13.3ci	13+13ci	13+13ci	13+7.5ci	13+7.5ci	13+3.8ci or 20	13+7.5ci or 20+3.8ci	7.5ci	7.5ci
2021	11.4ci	13.3ci	13+14ci	13+14ci	13+10ci	13+10ci	13+7.5ci or 20 +3.8ci	13+7.5ci or 20 +3.8ci	7.5ci	10ci

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CZ 6 – Roof and Floors

IECC Edition	Roofs						Floors				Slab-on-grade Floors			
	Entirely Above Roof Deck		Metal Buildings		Attic and Other		Mass		Joist/ Framing		Unheated Slabs		Heated Slabs	
	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R	Oth	Grp R	Other	Grp R	Other	Grp R
2009	20ci	20ci	13+19	19	38	38	12.5ci	14.6ci	30	30	10, 24" below	15, 24" below	15, 24" below	20, 48" below
2012	30ci	30ci	25 + 11 LS	25 + 11 LS	49	49	12.5ci	12.5ci	30	30	10, 24" below	15, 24" below	15, 36" below	20, 48" below
2015	30ci	30ci	25 + 11 LS	25 + 11 LS	49	49	12.5ci	12.5ci	30	30	10, 24" below	15, 24" below	15, 36" below	20, 48" below
2018	30ci	30ci	25 + 11 LS	25 + 11 LS	49	49	12.5ci	12.5ci	30	30	10, 24" below	15, 24" below	15, 36" below + R-5 slab	20, 48" Below + R-5 slab
2021	30ci	30ci	25 + 11 LS	30 + 11 LS	49	49	16.7ci	16.7ci	38	38	20, 24" below	20, 48" below	15, 36" Below + R-5 slab	20, 48" Below + R-5 slab

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Climate Zone 6 – Walls

IECC Edition	Above Grade								Below Grade	
	Mass		Metal Building		Metal Framed		Wood Framed and Other		Below-grade wall	
	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R
2009	13.3ci	15.2ci	13+5.6ci	13+5.6ci	13+7.5ci	13+7.5ci	13+7.5ci	13+7.5ci	7.5ci	7.5ci
2012	13.3ci	15.2ci	13+13ci	13+13ci	13+7.5ci	13+7.5ci	13+7.5ci or 20+3.8ci	13+7.5ci or 20+3.8ci	7.5ci	7.5ci
2015	13.3ci	15.2ci	13+13ci	13+13ci	13+7.5ci	13+7.5ci	13+7.5ci or 20+3.8ci	13+7.5ci or 20+3.8ci	7.5ci	7.5ci
2018	13.3ci	15.2ci	13+13ci	13+13ci	13+7.5ci	13+7.5ci	13+7.5ci or 20+3.8ci	13+7.5ci or 20+3.8ci	7.5ci	7.5ci
2021	13.3ci	15.2ci	13+14ci	13+14ci	13+ 12.5ci	13+ 12.5ci	13+7.5ci or 20 +3.8ci	13+7.5ci or 20 +3.8ci	10ci	15ci

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CZ 7 – Roof and Floors

IECC Edition	Roofs						Floors				Slab-on-grade Floors			
	Entirely Above Roof Deck		Metal Buildings		Attic and Other		Mass		Joist/ Framing		Unheated Slabs		Heated Slabs	
	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R	Oth	Grp R	Other	Grp R	Other	Grp R
2009	25ci	25ci	13+19	19+10	38	38	15ci	16.7ci	30	30	15, 24" below	15, 24" below	20, 24" below	20, 48" below
2012	35ci	35ci	30 + 11 LS	30 + 11 LS	49	49	15ci	16.7ci	30	30	15, 24" below	15, 24" below	20, 24" below	20, 48" below
2015	35ci	35ci	30 + 11 LS	30 + 11 LS	49	49	15ci	16.7ci	30	30	15, 24" below	15, 24" below	20, 24" below	20, 48" below
2018	35ci	35ci	30 + 11 LS	30 + 11 LS	49	49	15ci	16.7ci	30	30	15, 24" below	15, 24" below	20, 48" Below + R-5 slab	20, 48" Below + R-5 slab
2021	35ci	35ci	30 + 11 LS	30 + 11 LS	60	60	20.9ci	20.9ci	38	38	20, 24" below	20, 48" below	20, 48" Below + R-5 slab	20, 48" Below + R-5 slab

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Climate Zone 7 – Walls

IECC Edition	Above Grade								Below Grade	
	Mass		Metal Building		Metal Framed		Wood Framed and Other		Below-grade wall	
	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R
2009	15.2ci	15.2ci	19+5.6ci	19+5.6ci	13+7.5ci	13+ 15.6ci	13+7.5ci	13+7.5ci	7.5ci	10ci
2012	15.2ci	15.2ci	13+13ci	13+ 19.5ci	13+7.5ci	13+ 15.6ci	13+7.5ci or 20+3.8ci	13+7.5ci or 20+3.8ci	10ci	10ci
2015	15.2ci	15.2ci	13+13ci	13+ 19.5ci	13+7.5ci	13+ 15.6ci	13+7.5ci or 20+3.8ci	13+7.5ci or 20+3.8ci	10ci	10ci
2018	15.2ci	15.2ci	13+13ci	13+ 19.5ci	13+7.5ci	13+ 15.6ci	13+7.5ci or 20+3.8ci	13+7.5ci or 20+3.8ci	10ci	10ci
2021	15.2ci	15.2ci	13+17ci	13+ 19.5ci	13+ 12.5ci	13+ 15.6ci	13+7.5ci or 20+3.8ci	13+7.5ci or 20+3.8ci	15ci	15ci

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CZ 8 – Roof and Floors

IECC Edition	Roofs						Floors				Slab-on-grade Floors			
	Entirely Above Roof Deck		Metal Buildings		Attic and Other		Mass		Joist/ Framing		Unheated Slabs		Heated Slabs	
	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R	Oth	Grp R	Other	Grp R	Other	Grp R
2009	25ci	25ci	11+19	19+10	49	49	15ci	16.7ci	30	30	15, 24" below	20, 24" below	20, 48" below	20, 48" below
2012	35ci	35ci	30 + 11 LS	30 + 11 LS	49	49	15ci	16.7ci	30	30	15, 24" below	20, 24" below	20, 48" below	20, 48" below
2015	35ci	35ci	30 + 11 LS	30 + 11 LS	49	49	15ci	16.7ci	30	30	15, 24" below	20, 24" below	20, 48" below	20, 48" below
2018	35ci	35ci	30 + 11 LS	30 + 11 LS	49	49	15ci	16.7ci	30	30	15, 24" below	20, 24" below	20, 48" Below + R-5 slab	20, 48" Below + R-5 slab
2021	35ci	35ci	25 + 11 + 11 LS	25 + 11 + 11 LS	60	60	23ci	23ci	38	38	20, 48" below	25, 48" below	20, 48" Below + R-5 slab	20, 48" Below + R-5 slab

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Climate Zone 8 – Walls

IECC Edition	Above Grade								Below Grade	
	Mass		Metal Building		Metal Framed		Wood Framed and Other		Below-grade wall	
	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R	Other	Grp R
2009	25ci	25ci	19+5.6ci	19+5.6ci	13+7.5ci	13+ 18.8ci	13+ 15.6ci	13+ 15.6ci	7.5ci	12.5ci
2012	25ci	25ci	13+13ci	13+ 19.5ci	13+7.5ci	13+ 17.5ci	13+ 15.6ci or 20+10ci	13+ 15.6ci or 20+10ci	10ci	12.5ci
2015	25ci	25ci	13+13ci	13+ 19.5ci	13+7.5ci	13+ 17.5ci	13+ 15.6ci or 20+10ci	13+ 15.6ci or 20+10ci	10ci	12.5ci
2018	25ci	25ci	13+13ci	13+ 19.5ci	13+7.5ci	13+ 17.5ci	13+ 15.6ci or 20+10ci	13+ 15.6ci or 20+10ci	10ci	12.5ci
2021	25ci	25ci	13+ 19.5ci	13+ 19.5ci	13+ 18.8ci	13+ 18.8ci	13+ 18.8ci	13+ 18.8ci	15ci	15ci

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TABLE C402.1.4 Opaque Thermal Envelope Assembly Maximum Requirements, *U*-Factor Method[a,b]

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	~~U-0.044~~ U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	~~U-0.031~~ U-0.029	U-0.029	U-0.029	~~U-0.029~~ U-0.026	~~U-0.029~~ U-0.026
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	~~U-0.027~~ U-0.021	~~U-0.027~~ U-0.021	~~U-0.027~~ U-0.021	U-0.021	U-0.021	U-0.021	~~U-0.021~~ U-0.017	~~U-0.021~~ U-0.017	~~U-0.021~~ U-0.017	~~U-0.021~~ U-0.017
Walls, above grade																
Mass[g]	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	~~U-0.061~~ U-0.037	~~U-0.061~~ U-0.037
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	~~U-0.052~~ U-0.050	~~U-0.052~~ U-0.050	~~U-0.052~~ U-0.050	~~U-0.052~~ U-0.050	~~U-0.052~~ U-0.050	~~U-0.052~~ U-0.044	U-0.039	~~U-0.052~~ U-0.039	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	~~U-0.064~~ U-0.055	~~U-0.064~~ U-0.055	~~U-0.064~~ U-0.049	~~U-0.064~~ U-0.049	~~U-0.064~~ U-0.049	~~U-0.064~~ U-0.049	~~U-0.052~~ U-0.042	~~U-0.064~~ U-0.037	~~U-0.045~~ U-0.037
Wood framed and other[c]	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	~~U-0.064~~ U-0.051	~~U-0.064~~ U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	~~U-0.036~~ U-0.032	~~U-0.036~~ U-0.032
Walls, below grade																
Below-grade wall[d]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-0.119	~~C-0.119~~ C-0.092	C-0.119	~~C-0.119~~ C-0.092	~~C-0.119~~ C-0.092	~~C-0.119~~ C-0.063	~~C-0.092~~ C-0.063	~~C-0.092~~ C-0.063	~~C-0.092~~ C-0.063	~~C-0.092~~ C-0.063
Floors																
Mass[g]	U-0.322[e]	U-0.322[e]	U-0.107	U-0.087	~~U-0.076~~ U-0.074	~~U-0.076~~ U-0.074	~~U-0.076~~ U-0.057	~~U-0.074~~ U-0.051	~~U-0.074~~ U-0.057	~~U-0.064~~ U-0.051	~~U-0.064~~ U-0.051	~~U-0.064~~ U-0.051	~~U-0.055~~ U-0.042	~~U-0.051~~ U-0.042	~~U-0.055~~ U-0.038	~~U-0.051~~ U-0.038
Joist/framing	U-0.066[e]	U-0.066[e]	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	~~U-0.033~~ U-0.027	~~U-0.033~~ U-0.027	~~U-0.033~~ U-0.027	~~U-0.033~~ U-0.027	~~U-0.033~~ U-0.027	~~U-0.033~~ U-0.027
Slab-on-grade floors																
Unheated slabs	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	~~F-0.73~~ F-0.54	~~F-0.54~~ F-0.52	~~F-0.54~~ F-0.52	~~F-0.54~~ F-0.52	~~F-0.54~~ F-0.51	~~F-0.54~~ F-0.51	~~F-0.52~~ F-0.434	~~F-0.48~~ F-0.51	~~F-0.48~~ F-0.434	~~F-0.48~~ F-0.434	~~F-0.48~~ F-0.424
Heated slabs[f]	~~F-1.02~~ 0.74 F-0.69	~~F-1.02~~ 0.74 F-0.69	~~F-1.02~~ 0.74 F-0.69	~~F-1.02~~ 0.74 F-0.69	~~F-0.90~~ 0.74 F-0.66	~~F-0.90~~ 0.74 F-0.66	~~F-0.86~~ 0.64 F-0.62	~~F-0.86~~ 0.64 F-0.62	~~F-0.79~~ 0.64 F-0.62	~~F-0.79~~ 0.64 F-0.62	~~F-0.79~~ 0.55 F-0.62	~~F-0.69~~ 0.55 F-0.602	~~F-0.69~~ 0.55 F-0.602	~~F-0.69~~ 0.55 F-0.602	~~F-0.69~~ 0.55 F-0.602	~~F-0.69~~ 0.55 F-0.602
Opaque doors																
Nonswinging door	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31
Swinging door[g]	~~U-0.61~~ U-0.37	~~U-0.61~~ U-0.37	~~U-0.61~~ U-0.37	~~U-0.61~~ U-0.37	~~U-0.61~~ U-0.37	~~U-0.61~~ U-0.37	~~U-0.61~~ U-0.37	~~U-0.61~~ U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Garage door ≤14% glazing[h]	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31

67

Doors (Table C402.1.4 Footnotes)

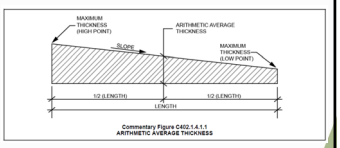
- Opaque doors considered part of the gross area of above-grade walls
  - Opaque swinging doors must comply with U-factor requirements in Table C402.1.4
  - Opaque nonswinging doors that are horizontally hinged sectional doors with a single row of fenestration must meet assembly U-factor maximums
    - 0.440 in Climate Zones 0-6
    - 0.360 in Climate Zones 7 and 8
    - Fenestration area must be between 14% and 25% of total door area
  - All other doors must comply with vertical fenestration provisions

IECC 2021 — 2021 Significant Changes — 68

68

Roof Assembly and Insulation

- R-value and U-factor options
- Maximum roof/ ceiling assembly U-factor specified in Table C402.1.4
  - Sloped roof insulation R-value contribution to that calculation must use the average thickness in inches along with the material R-value-per inch solely for U-factor compliance
- Insulation installed on removable ceiling tiles not included
- Continuous insulation board
  - Not less than 2 layers
  - Edge joints between each layer of insulation must be staggered



Commentary Figure C402.1.4.1.1
ARITHMETIC AVERAGE THICKNESS

C402.1.4.1 and C402.2.1

69

Fenestration U-Factor and SHGC Requirements

- Changes to the U-factor and SHGC requirements increase the energy efficiency of windows, doors and skylights
- Table is revised to classify SHGC on the operable/fixed properties of the fenestration rather than orientation

Table C402.4

70

Fenestration U-Factor and SHGC Requirements Continued

TABLE C402.4 Building Envelope Fenestration Maximum *U*-Factor and SHGC Requirements

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Vertical fenestration																
***U*-factor**																
Fixed fenestration	0.50		~~0.50~~ 0.45		~~0.46~~ 0.42		~~0.38~~ 0.36		~~0.38~~ 0.36		~~0.36~~ 0.34		0.29		~~0.29~~ 0.26	
Operable fenestration	~~0.65~~ 0.62		~~0.65~~ 0.60		~~0.60~~ 0.54		0.45		0.45		~~0.43~~ 0.42		~~0.37~~ 0.36		~~0.37~~ 0.32	
Entrance doors	~~1.10~~ 0.83		~~0.83~~ 0.77		~~0.77~~ 0.68		~~0.77~~ 0.63		~~0.77~~ 0.63		~~0.77~~ 0.63		~~0.77~~ 0.63		~~0.77~~ 0.63	
SHGC																
~~Orientation~~[a]	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable	SEW Fixed	N Operable
PF < 0.2	~~0.25~~ 0.23	~~0.33~~ 0.21	0.25	~~0.33~~ 0.23	0.25	~~0.33~~ 0.23	0.36	~~0.40~~ 0.33	0.38	~~0.51~~ 0.33	~~0.40~~ 0.38	~~0.53~~ 0.34	~~0.45~~ 0.40	NR 0.36	~~0.45~~ 0.40	N 0.36
0.2 ≤ PF < 0.5	~~0.30~~ 0.28	~~0.37~~ 0.25	0.30	~~0.37~~ 0.28	0.30	~~0.37~~ 0.28	0.43	~~0.53~~ 0.40	0.46	~~0.56~~ 0.40	~~0.48~~ 0.46	~~0.58~~ 0.41	NR 0.48	NR 0.43	NR 0.48	NR 0.43
PF ≥ 0.5	~~0.40~~ 0.37	~~0.40~~ 0.34	0.40	~~0.40~~ 0.37	0.40	~~0.40~~ 0.37	0.58	~~0.58~~ 0.53	0.61	~~0.61~~ 0.53	~~0.64~~ 0.61	~~0.64~~ 0.54	NR 0.64	NR 0.58	NR 0.64	NR 0.58
Skylights																
U-factor	~~0.75~~ 0.70		0.65		0.55		0.50		0.50		0.50		~~0.50~~ 0.44		~~0.50~~ 0.41	
SHGC	~~0.35~~ 0.30		~~0.35~~ 0.30		~~0.35~~ 0.30		0.40		0.40		0.40		NR		NR	

Table C402.4

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Air Leakage – Thermal Envelope Change Summary

- Dwelling unit testing required for Group R and Group I occupancies
- Building envelope testing required for occupancies other than Group R and I
- Buildings exempt from testing
  - Material or assembly
  - Performance verification

C402.5

72

Air Leakage

- **C402.5 Air leakage—thermal envelope.** The building thermal envelope shall comply with Sections C402.5.1 through Section C402.5.11.1, or the building thermal envelope shall be tested in accordance with Section C402.5.2 or C402.5.3. Where compliance is based on such testing, the building shall also comply with Sections C402.5.7, C402.5.8 and C402.5.9.
  - Air intakes, exhaust openings, stairways and shafts
  - Loading dock weather seals
  - Vestibules

This language picks up Section C402.5.1.2 Air barrier compliance
- Requires testing

73

Air Barrier Testing – Group R and I

- Buildings with Group R and I occupancies must be tested using the **dwelling and sleeping unit enclosure testing** method
  - Required in all CZ except 2B, 3C and 5C
  - Adds new definition of testing unit enclosure area
  - Building thermal envelope must be tested in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E1827 or an equivalent method
  - Air leakage limited to 0.30 cfm/ft^2 of testing unit enclosure area at 50 Pa

> **TESTING UNIT ENCLOSURE AREA.** The area sum of all the boundary surfaces that define the *dwelling unit*, *sleeping unit* or occupiable *conditioned space* including top/ceiling, bottom/floor and all side walls. This does not include interior partition walls within the *dwelling unit*, *sleeping unit*, or occupiable *conditioned space*. Wall height shall be measured from the finished floor of the *conditioned space* to the finished floor or roof/ceiling air barrier above.

74

Air Barrier Testing – Group R and I Continued

- Where multiple dwelling/sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, each unit must be tested separately with an unguarded blower door test
  - The building air leakage is the weighted average of all testing unit results, weighted by each testing unit's enclosure area
  - 8 or less units, test them all
  - 8 or more units, test the greater of 7 units or 20 percent of all units
    - Top floor unit, ground floor unit, unit with largest area
    - For each unit that exceeds maximum air leakage rate (fails), test two more

75

Air Barrier Testing - All Other Occupancies

- Buildings or portions of buildings other than Group R and I occupancies must be tested using the **building thermal envelope testing** method
  - Tested in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E3158 or ASTM E1827 or an equivalent method
  - Air leakage limited to 0.40 cfm/ft^2 of building thermal envelope area at 75 Pa
  - Alternatively, portions of the building can be tested and measured air leakage area weighted
    - Entire envelope area of all stories that have any spaces directly under a roof
    - Entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade
    - Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space

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Air Barrier Testing - All Other Occupancies Continued

Exceptions:

- Buildings in CZ 2B, 3B, 3C and 5C
- Buildings larger than 5,000ft^2 in CZ 0B, 1, 2A, 4B and 4C
- Buildings between 5,000ft^2 and 50,000ft^2 in CZs 0A, 3A and 5B

C402.5.1.2 and C402.5.3

2021 Significant Changes 77

77

Air Barrier Testing - All Other Occupancies Continued

- If the building air leakage rate exceeds 0.40 cfm/ft^2 but does not exceed 0.60 cfm/ft^2
  - Diagnostic evaluation using smoke tracer or infrared imaging while building is pressurized required along with a visual inspection of the air barrier
    - Any leaks noted must be sealed where such sealing can be made without destruction of existing building components
    - A report identifying corrective actions taken to seal leaks must submitted to the code official and building owner
  - Building is deemed to comply, no retest required

C402.5.1.2 and C402.5.3

2021 Significant Changes 78

78

Buildings Exempt From Air Barrier Testing

Select Compliance Option

- Materials
- Assemblies

Verify Performance

- Review construction documents
- Inspect air barrier
- Final commission report provided
  - Deficiencies found during plan review and inspection and corrective actions

C402.5.1.2 and C402.5.1.5

2021 Significant Changes 79

79

Operable Openings Interlocking

- Large, operable openings (>40ft^2) such as roll-up doors and windows must now be interlocked with the heating and cooling system
- Time and temperature specific
  - System adjustments within 10 minutes of opening operable opening
  - Controls raise cooling setpoint to 90°F and lower heating setpoint to 55°F
  - Controls shut off the system entirely when outdoor temperatures are below 90°F or above 55°F

C402.5.11 and C403.14

2021 Significant Changes 80

80

Operable Openings Interlocking Continued

Exceptions

- Separately zoned areas associated with the preparation of food that contain appliances that contribute to the HVAC loads of a restaurant or similar type of occupancy
- Warehouses that utilize overhead doors for the function of the occupancy, where approved by the code official
- The first entrance doors where located in the exterior wall and are part of a vestibule system

IECC 2021

C402.5.11 and C403.14

2021 Significant Changes

81

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2021 Significant Changes

82

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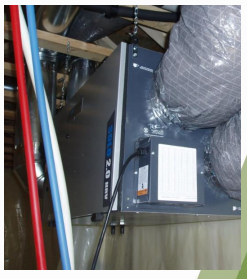
Key Mechanical System Provisions

- Heating and cooling load calculations and system design
- Equipment efficiencies and sizing
- System controls
- Economizers
- Ventilation and exhaust systems
- Fans and fan controls
- Refrigeration equipment performance
- Duct construction
- Piping insulation



IECC 2021

C403

2021 Significant Changes

83

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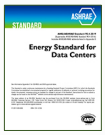
Data Centers



- Comply with Sections 6 and 8 of ASHRAE 90.4 but must follow mechanical load component tables provided in IECC Section C403.1.2

TABLE C403.1.2(1)
MAXIMUM DESIGN MECHANICAL LOAD COMPONENT (DESIGN MLC)

CLIMATE ZONE	DESIGN MLC AT 100% AND AT 50% ITE LOAD
0A	0.24
0B	0.26
1A	0.23
2A	0.24
3A	0.23
4A	0.23
5A	0.22
6A	0.22
1B	0.28
2B	0.27
3B	0.26
4B	0.23
5B	0.23

TABLE C403.1.2(2)
MAXIMUM ANNUALIZED MECHANICAL LOAD COMPONENT (ANNUALIZED MLC)

CLIMATE ZONE	HVAC MAXIMUM ANNUALIZED MLC AT 100% AND AT 50% ITE LOAD
0A	0.19
0B	0.20
1A	0.18
2A	0.19
3A	0.18
4A	0.17
5A	0.17
6A	0.17
1B	0.16
2B	0.18
3B	0.18
4B	0.18
5B	0.16

IECC 2021

C403.1.2

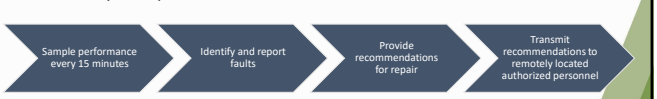
2021 Significant Changes

84

84

Fault Detection and Diagnostics

- HVAC systems serving a gross conditioned floor area of >100,000 ft^2 must include FDD system
- The system must include permanently installed sensors to measure HVAC system performance



Exception: R-1 and R-2 occupancies

C403.2.3

85

Equipment Performance Requirements

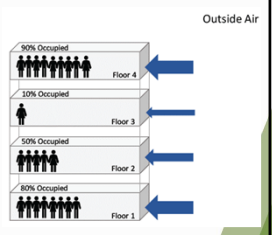
- Equipment must meet the minimum efficiency requirements of Tables C403.3.2(1) - (16)
  - HVAC equipment efficiency updated to match ASHRAE tables directly and Federal appliance manufacturing requirements
  - Additional tables added for
    - DOAS units
    - Water source heat pumps
    - Variable refrigerant flow cooling and heat pumps
    - Heat pump and heat reclaim chiller packages
    - Ceiling mounted computer room air conditioners
    - Commercial refrigerators and freezers
- Refrigeration efficiencies updated to match federal requirements

C403.3.2, C403.11

86

Demand Control Ventilation

- Required for all single-zone systems required to comply with Sections C403.5 through C403.5.3
  - Economizers
- Required for spaces larger than 500 ft^2 and with an average occupant load of at 15 people or greater per 1,000 ft^2 of floor area
- Served by systems with
  - Air-side economizer
  - Automatic modulating control of the outdoor air damper
  - Design outdoor airflow greater than 3,000 cfm



C403.7.1

87

Demand Control Ventilation Exceptions

Note several new/modified exceptions in 2021 IECC

1. Systems with energy recovery complying with Section C403.7.4.2

2. Multiple-zone systems without direct digital control of individual zones communicating with a central control panel

3. Multiple-zone systems with a design outdoor airflow less than 750 cfm

4. Spaces where more than 75% percent of the space design outdoor airflow is required for makeup air that is exhausted from the space or transfer air that is required for makeup air that is exhausted from other spaces

5. Spaces with one of the following occupancy classifications as defined in Table 403.3.1.1 of the IMC: correctional cells, education laboratories, barber, beauty and nail salons, and bowling alley seating areas

C403.7

88

Automatic Start and Stop

Provisions for stop controls introduced → Required for each HVAC system with Direct Digital Control of individual zones → Controls must allow for varying setpoint by at least 2 degrees before scheduled unoccupied periods

C403.4.2.3

2021 Significant Changes

89

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Energy Recovery Systems

Requirements for two separate categories

- Nontransient dwelling units (apartments)
  - New exhaust energy recovery requirements in dwelling units occupied for more than 30 days
  - Requires 50% cooling recovery, 60% heating recovery
  - Exceptions
    - CZ 3C and small dwelling units (<500ft²) in CZs 0B, 1, 2, 3, 4C, 5C
    - Warm climate zones exempt from heating energy recovery requirements
    - Cooler climate zones exempt from cooling energy recovery requirement
- Spaces other than nontransient dwelling units
  - Very few changes

> **ENTHALPY RECOVERY RATIO.** Change in the enthalpy of the *outdoor air* supply divided by the difference between the *outdoor air* and entering exhaust air enthalpy, expressed as a percentage.

C403.7.4

2021 Significant Changes

90

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Fan Efficiency

- FEI Website: www.amca.org/fei
- Technical papers and educational resources about Fan Energy Index

Fan Energy Index (FEI) replaces Fan Efficiency Grade (FEG) metric

FEI ≥ 1.00 for covered fans

AMCA 208

Ratings from approved third-party lab and labeled

FEI includes effects (losses) of motors and drives, if sold with fan; otherwise, FEI ratings for bare fan include default motor/drive losses

Sizing / selection window eliminated

- "15 percentage points from peak total efficiency" was difficult to enforce

C403.8.3

2021 Significant Changes

91

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Low-Capacity Ventilation Fans

- Requirements for low-capacity ventilation fans apply the efficiencies of ventilation fans typical of residential construction to mid-rise residential occupancies and small commercial buildings
  - Except when part of listed HVAC appliance
  - Except dryer exhaust, range hood main or booster fans

TABLE C403.8.5 Low-Capacity Ventilation Fan Efficacy[a]

FAN LOCATION	AIRFLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIRFLOW RATE MAXIMUM (CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
In-line fan	Any	3.8 cfm/watt	Any
Bathroom, utility room	10	2.8 cfm/watt	< 90
Bathroom, utility room	90	3.5 cfm/watt	Any

C403.8.5

2021 Significant Changes

92

92

Large-Diameter Ceiling Fans

- Large-diameter ceiling fans, as defined in C202, must be tested and labeled in accordance with AMCA 230
- Testing provisions include energy efficiency metric

$$\frac{CFM}{Watt} = \frac{\sqrt{\frac{AF}{\rho}}}{Power\ Used}$$

A=Circular area of fan (diameter)

F=Thrust (difference between hanging weight and weight while running)

P=Density of Air

C403.9

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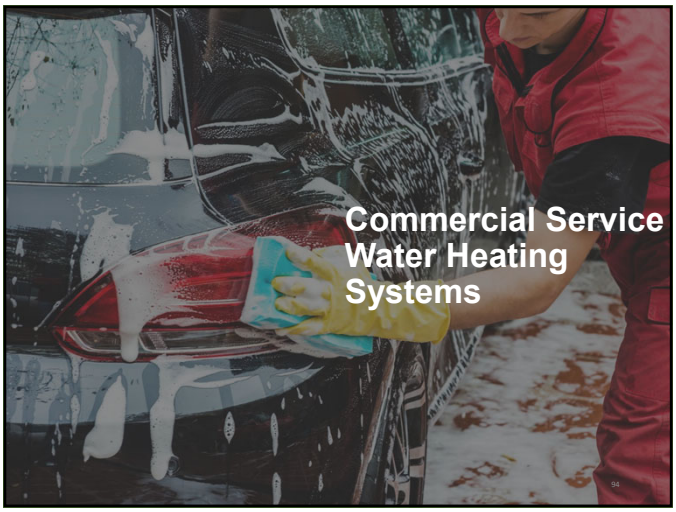

94

Service Water Heating

- Service water heating is the "supply of hot water for purposes other than comfort heating"

Key Provisions

- Equipment efficiencies
- Heat traps for hot water storage tanks
- Piping insulation
- Controls
- Heated-water circulating and temperature maintenance systems
- Drain water heat recovery units
- Pools and spas

95

High Input Service Water-Heating Systems

- Large (over 1,000,000 Btu/h) service hot water system efficiency increases from 90% to 92%
- Capacity weighted average
- Three exceptions
  - Site-recovered energy (25%)
  - Individual dwelling units
  - Individual heaters ≤ 100,000 BTU/h

Photo credit: PNNL

C404.2.1

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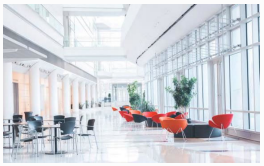
Key Electrical Power and Lighting Provisions

- Lighting controls
- Light reduction methods
- Interior and exterior lighting power
- Automatic receptacle controls
- Energy monitoring



- The lighting requirements apply to the design of:
  - New lighting systems
  - Altered components/systems as part of alteration
  - Change of use

98

General Requirements

- Lighting system controls, the maximum lighting power for interior and exterior applications, and electrical energy consumption must comply with Section C405
- **General lighting consists of all lighting included when calculating the total connected interior lighting power**
- Transformers, uninterruptable power supplies, motors and electrical power processing equipment in data center systems must comply with Section 8 of ASHRAE 90.4 in addition to this code

99

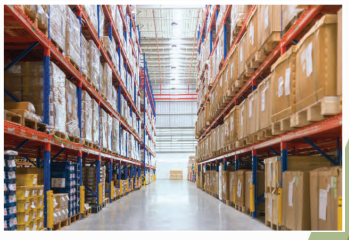
Lighting for Dwelling Units

- At least 90% of permanently installed lighting serving dwelling units
  - Must be high-efficacy (kitchen appliance lighting excluded)
  - Or comply with the daylight responsive control requirements and interior lighting power requirements

100

Occupant Sensor Controls in Warehouse Storage Areas

- Lighting in aisleway must be independent
- Time delay for occupants leaving the warehouse area and turning off or reducing the lighting is 20 minutes
- Occupancy sensor or time-switch control required

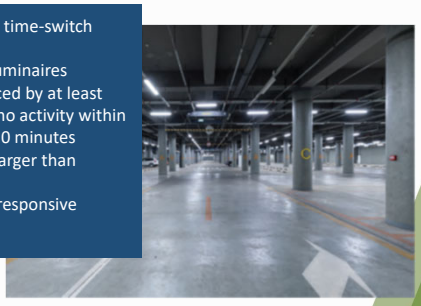


C405.2.1.2

101

Parking Garage Lighting Control

- Occupant sensor or time-switch control required
- Lighting power of luminaires automatically reduced by at least 30% when there is no activity within a lighting zone for 20 minutes
- Lighting zones not larger than 3,600ft^2
- Perimeter daylight responsive controls



C405.2.8

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Interior Lighting Power Requirements

- A building complies with this section where its total connected interior lighting power is less than the interior lighting power allowance
- The installed lighting power is the sum of the watts of all interior lighting equipment
  - 20 exceptions
- Two options to determine lighting power allowance
  - Building area method
  - Space-by-space method
    - Includes additional interior lighting power

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Interior Lighting Power Allowances: Building Area Method

- Most LPD values decreased
- A small number of building type LPD values increased

Building Area Type	LPD (w/ft^2)
Automotive facility	~~0.71~~ 0.75
Convention center	~~0.76~~ 0.64
Courthouse	~~0.90~~ 0.79
Dining: bar lounge/leisure	~~0.90~~ 0.80
Dining: cafeteria/fast food	~~0.79~~ 0.76
Dining: family	~~0.78~~ 0.71
Dormitory	~~0.61~~ 0.53
Exercise center	~~0.65~~ 0.72
Fire station	~~0.53~~ 0.56
Gymnasium	~~0.68~~ 0.76
Health care clinic	~~0.82~~ 0.81

C405.3.2(1) *(continued)*

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Interior Lighting Power Allowances: Space by Space

- Most LPD values decreased
- A few space type LPD values increased

Space Type	LPD (w/ft²)
Food preparation area	~~1.06~~ 1.09
Guestroom	~~0.77~~ 0.41
Laboratory	
In or as a classroom	~~1.20~~ 1.11
Otherwise	~~1.45~~ 1.33
Laundry / washing area	~~0.43~~ 0.53
Loading dock, interior	~~0.58~~ 0.88
Lobby	
For an elevator	~~0.68~~ 0.65
Visually impaired facility	~~2.03~~ 1.69
In a hotel	~~1.06~~ 0.51

(continued)

C405.3.2(2)

2021 Significant Changes

105

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Lighting for Plant Growth

- At least 95% of permanently installed luminaires used for plant growth and maintenance must have a photon efficiency of not less than 1.6 µmol/J
- ANSI/ASABE S640

C405.4

2021 Significant Changes

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Automatic Receptacle Control

- At least 50% of covered receptacles and 25% of branch circuit feeders to be on automatically controlled receptacles
- Multiple control options
- All controlled receptacles must be permanently marked per NFPA 70

C405.11

2021 Significant Changes

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Energy Monitoring

- Applies to new buildings 25,000 ft² or larger
- Must be equipped to measure, monitor, record and report energy consumption data
- Exception: R-2 occupancies and individual tenant spaces if the space has its own utility services and meters and has less than 5,000 ft²

TABLE C405.12.2
ENERGY USE CATEGORIES

LOAD CATEGORY	DESCRIPTION OF ENERGY USE
Total HVAC system	Heating, cooling and ventilation, including but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120-volt equipment, or by 208/120-volt equipment that is located in a building where the main service is 480/277-volt power, is permitted to be excluded from total HVAC system energy use.
Interior lighting	Lighting systems located within the building.
Exterior lighting	Lighting systems located on the building site but not within the building.
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets.
Process load	Any single load that is not included in an HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building, including but not limited to data centers, manufacturing equipment and commercial kitchens.
Building operations and other miscellaneous loads	The remaining loads not included elsewhere in this table, including but not limited to vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental fireplaces, swimming pools, in-ground spas and snow-melt systems.

C405.12

2021 Significant Changes

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Additional Efficiency Requirements

Required for prescriptive compliance

- Revised structure of C406
  - Points-based
  - 10 points (credits) required
    - 1 point equivalent to 0.25% energy savings
  - Equity of efficiency options across climate zones
- Expanded options
  - 11 options total, 3 new

IECC 2021

C406

2021 Significant Changes

110

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Additional Energy Efficiency Credit Options

1. More efficient HVAC performance
2. Reduced lighting power
3. Enhanced lighting controls
4. On-site supply of renewable energy
5. Dedicated outdoor air systems
6. High-efficiency service water heating
7. Enhanced envelope performance
8. Reduced air infiltration
9. *Energy monitoring system*
10. *Fault detection and diagnostics*
11. *Efficient kitchen equipment*

IECC 2021

C406.1

2021 Significant Changes

111

111

More Efficient HVAC Equipment Performance

- 5% heating efficiency improvement
- 5% cooling efficiency improvement
- 10% heating efficiency improvement
- 10% cooling efficiency improvement
- More than 10% cooling efficiency improvement (use equation)

IECC 2021

C406.2

2021 Significant Changes

112

112

Reduced Lighting Power

- Reduced lighting power by more than 10%
- Reduced lighting power by more than 15% (use equation)
- AND 95% high-efficacy lighting in dwelling/sleeping units

C406.3

113

Enhanced Digital Lighting Controls

1. Luminaires configured for continuous dimming
2. Luminaires addressed individually. Where individual addressability is not available for the luminaire class type, a controlled group of not more than four luminaries shall be allowed.
3. Not more than eight luminaires shall be controlled together in a daylight zone.
4. Fixtures shall be controlled through a digital control system that includes the following function:
   - 4.1 Control reconfiguration based on digital addressability
   - 4.2 Load shedding
   - 4.3 Occupancy sensors capable of being reconfigured through the digital control system
5. Construction documents include submittal of a Sequence of Operations, including a specification outlining each of the functions in Item 4
6. Functional testing of lighting controls

C406.4

114

On-site Renewable Energy

- Basic renewable credit
  - Total minimum rating of the on-site renewable energy systems:
    - At least 0.86 Btu/h per square foot or 0.25 watts/ft2 of conditioned floor area
    - At least 2% of the annual energy used for mechanical, SWH, lighting
  - Must exclude recovered or renewable water heating if used for credits
- Enhanced renewable credit
  - Systems that exceed the minimum ratings are eligible for additional energy efficiency credits (use equation)

C406.5

115

Dedicated Outdoor Air System

1. Independent ventilation system designed to provide not less than the minimum 100% outdoor air to each individual occupied space
2. Ventilation system capable of total energy recovery
3. HVAC system includes supply-air temperature controls that automatically reset the supply-air temperature
4. The controls reset the supply-air temperature not less than 25% of the difference between the design supply-air temperature and the design room-air temperature

C406.6

116

Reduced Energy Use in Service Water Heating

Applies only to select use groups

1. Group R-1: Boarding houses, hotels or motels
2. Group I-2: Hospitals, psychiatric hospitals and nursing homes
3. Group A-2: Restaurants and banquet halls or buildings containing food preparation areas
4. Group F: Laundries
5. Group R-2
6. Group A-3: Health clubs and spas
7. Group E: Schools with full-service kitchens or locker rooms with showers
8. Buildings showing a service hot water load of 10% or more of total building energy loads, shown using energy analysis

Choose one of three options

117

Reduced Energy Use in Service Water Heating

1) Recovered or renewable water heating. Building service water-heating system must have one or more of the following

- Waste heat recovery from service hot water, heat recovery chillers, building equipment or process equipment
- On-site renewable energy water-heating systems

2) Efficient fossil fuel water heater. Combined input-capacity weighted-average equipment rating of all fossil fuel water-heating equipment at least 95 percent Et or 0.95 EF.

- Buildings required to comply with the high input service water-heating system provision (C4040.2.1) receive only half the credits

3) Heat pump water heater. Where electric resistance water heaters are allowed, all service hot water system heating requirements must be met using heat pump technology with a combined input-capacity weighted-average EF of 3.0.

118

Enhanced Envelope Performance

- Total UA of the building thermal envelope as designed **is not less than 15% below the total UA** of the building thermal envelope in accordance with Section C402.1.5

119

Reduced Air Infiltration

Air infiltration verified by whole-building testing

- In accordance with ASTM E779 or ASTM E1827
- By an independent third party
- **Air-leakage rate must not exceed 0.25 cfm/ft² (2.0 L/s × m²)**
- Under a pressure differential of 0.3 inches water column (75 Pa)
- The calculated surface area being the sum of the above- and below-grade building envelope
  - Representative testing alternative for buildings over 250,000ft²

120

New Additional Efficiency Options

C406.10 Energy Monitoring

- Only applies to buildings not otherwise required to have energy monitoring (Section C405.12)

C406.11 Fault Detection and Diagnostics System

- Only applies to buildings not otherwise required to have energy monitoring (Section C403.2.3)

C406.12 Efficient Kitchen Equipment

- Only applies to Group A-2 spaces or facilities that include a commercial kitchen with at least one gas or electric fryer
  - Fryers, dishwashers, steam cookers and ovens must meet the efficiency requirements

C406.10 – C406.12

121

Additional Energy Efficiency Credit Requirements

New buildings

- Must achieve 10 credits from Tables C406.1(1) through C406.1(5)
  - 10 credits = 2.5% cost savings
- Tables based on use group of the building and climate zone
  - Office (Group B)
  - Multifamily (R) & Institutional (I)
  - Schools (E)
  - Retail (M)
  - Other
- Multiple use groups, each use group weighted by floor area to determine weighted average building credit

Tenant Spaces

- Must achieve 5 credits when selected from these options
  - More efficient HVAC
  - Reduced lighting power
  - Enhanced lighting controls
  - DOAS
  - High-efficiency service water heating
  - Energy monitoring system
- Tenant spaces deemed to comply if entire building uses these credits
  - On-site renewable energy
  - Enhanced envelope
  - Reduced air infiltration

C406.1

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Credits for Group B Occupancies

TABLE C406.1(1)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP B OCCUPANCIES

SECTION	CLIMATE ZONE															
	0A & 1A	0B & 1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% heating efficiency improvement	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1
C406.2.2: 5% cooling efficiency improvement	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406.2.3: 10% heating efficiency improvement	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2	1	1	2	2	NA	1
C406.2.4: 10% cooling efficiency improvement	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406.3: Reduced lighting power	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406.4: Enhanced digital lighting controls	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1
C406.5: On-site renewable energy	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
C406.6: Dedicated outdoor air	4	4	4	4	4	3	2	5	3	2	5	3	2	7	5	5	3
C406.7.2: Recovered or renewable water heating	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.3: Efficient fossil fuel water heater	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.4: Heat pump water heater	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.8: Enhanced envelope performance	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406.9: Reduced air infiltration	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6
C406.10: Energy monitoring	4	4	4	4	3	3	3	3	3	3	2	3	2	2	2	2	2
C406.11: Fault detection and diagnostics system	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1

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Credits for Group R and I Occupancies

TABLE C406.1(2)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP R AND I OCCUPANCIES

SECTION	CLIMATE ZONE															
	0A & 1A	0B & 1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% heating efficiency improvement	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406.2.2: 5% cooling efficiency improvement	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406.2.3: 10% heating efficiency improvement	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406.2.4: 10% cooling efficiency improvement	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406.3: Reduced lighting power	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
C406.4: Enhanced digital lighting controls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.5: On-site renewable energy	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406.6: Dedicated outdoor air system	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406.7.2: Recovered or renewable water heating	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.3: Efficient fossil fuel water heater	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.4: Heat pump water heater	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406.8: Enhanced envelope performance	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406.9: Reduced air infiltration	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3
C406.10: Energy monitoring	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406.11: Fault detection and diagnostics system	1	1	1	1	1	1	NA	1	1	NA	1	1	NA	1	1	1	1

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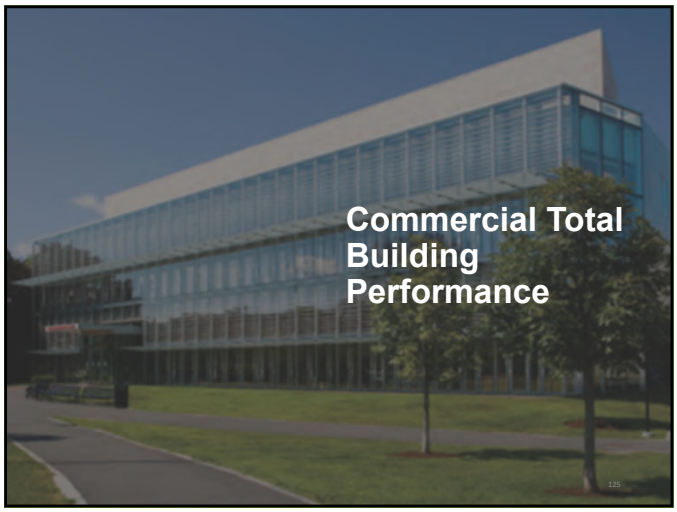

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Total Building Performance

2018 IECC

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

C407.2 Mandatory requirements. Compliance with this section requires compliance with Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404 and C405.

85%

2021 IECC

C401.2 Application. Commercial buildings shall comply with Section C401.2.1 or C401.2.2.

C401.2.1 International Energy Conservation Code. Commercial buildings shall comply with one of the following:

1. Prescriptive Compliance. The Prescriptive Compliance option requires compliance with Sections C402 through C406 and Section C408. Dwelling units and sleeping units in Group R-2 buildings without systems serving multiple units shall be deemed to be in compliance with this chapter, provided that they comply with Section R406.
2. Total Building Performance. The Total Building Performance option requires compliance with Section C407.

C407.2 Mandatory requirements. Compliance based on total building performance requires that a proposed design meet all of the following:

1. The requirements of the sections indicated within Table C407.2.
2. An annual energy cost that is less than or equal to 80 percent of the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source

80%

C407

2021 Significant Changes

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Total Building Performance

2018 IECC

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

C407.2 Mandatory requirements. Compliance with this section requires compliance with Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404 and C405.

2021 IECC

C401.2 Application. Commercial buildings shall comply with Section C401.2.1 or C401.2.2.

C401.2.1 International Energy Conservation Code. Commercial buildings shall comply with one of the following:

1. Prescriptive Compliance. The Prescriptive Compliance option requires compliance with Sections C402 through C406 and Section C408. Dwelling units and sleeping units in Group R-2 buildings without systems serving multiple units shall be deemed to be in compliance with this chapter, provided that they comply with Section R406.
2. Total Building Performance. The Total Building Performance option requires compliance with Section C407.

C407.2 Mandatory requirements. Compliance based on total building performance requires that a proposed design meet all of the following:

1. The requirements of the sections indicated within Table C407.2.
2. An annual energy cost that is less than or equal to 80 percent of the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source

C407

2021 Significant Changes

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Requirements for Total Building Performance

- Must meet requirements of Table C407.2
- Must have an annual energy cost less than or equal to 80 percent of the standard reference design
  - Standard reference design walls to be the same as proposed

TABLE C407.2
REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION[a]	TITLE
	Envelope
C402.5	Air leakage—thermal envelope
	Mechanical
C403.1.1	Calculation of heating and cooling loads
C403.1.2	Data centers
C403.2	System design
C403.3	Heating and cooling equipment efficiencies
C403.4, except C403.4.3, C403.4.4 and C403.4.5	Heating and cooling system controls
C403.5.5	Economizer fault detection and diagnostics
C403.7, except C403.7.4.1	Ventilation and exhaust systems
C403.8, except C403.8.6	Fan and fan controls
C403.9	Large-diameter ceiling fans
C403.11, except C403.11.3	Refrigeration equipment performance
C403.12	Construction of HVAC system elements
C403.13	Mechanical systems located outside of the building thermal envelope
C404	Service water heating
C405, except C405.3	Electrical power and lighting systems
C408	Maintenance information and system commissioning

a. Reference to a code section includes all the relative subsections except as indicated in the table.

C407.2

2021 Significant Changes

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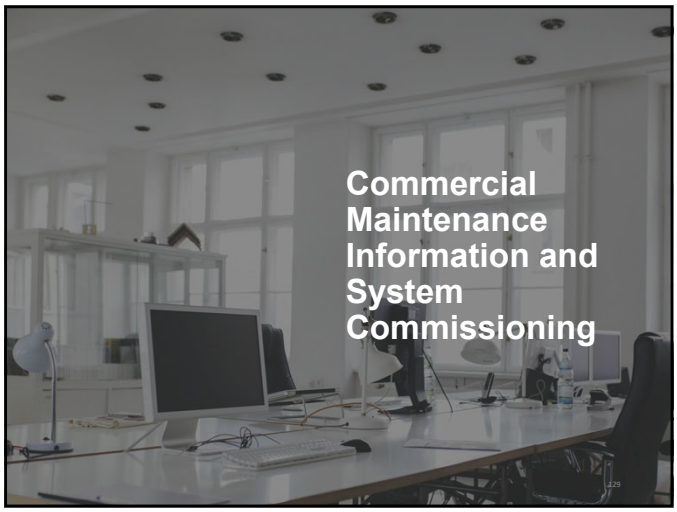

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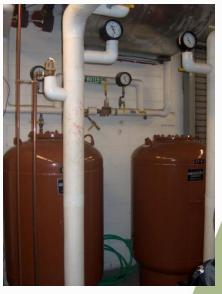
System Commissioning

- C408.1 General
- C408.2 Mechanical systems and service water-heating systems commissioning and completion requirements
- C408.3 Functional testing of lighting controls



IECC 2021

Chapter 8

2021 Significant Changes

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Existing Buildings

- Clarification that projects complying with ASHRAE 90.1 must comply fully with ASHRAE 90.1
- Pulled in previously referenced Vertical Fenestration and Skylight provisions into the body of the Additions requirements
- Set a backstop for roof insulation for roof replacements under Alterations sections

IECC 2021

Chapter 5

2021 Significant Changes

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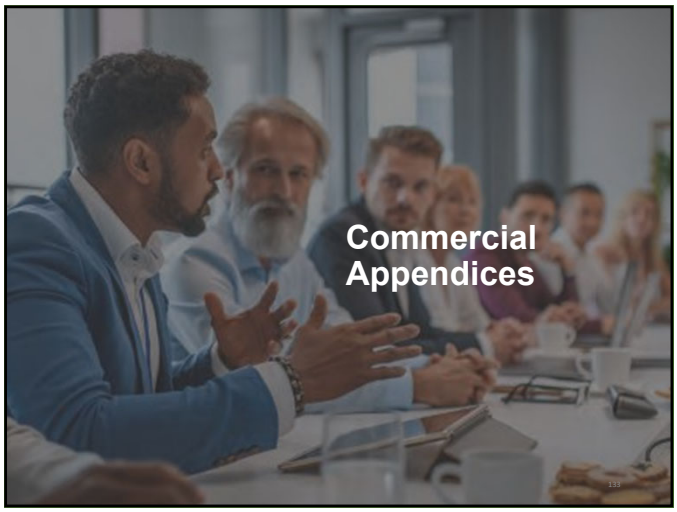

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Appendix CA: Board of Appeals

- Appendix CA provides guidance for establishing a board of appeals, including criteria for membership and instruction for developing rules and procedures
- Consistent with other I-Codes

Appendix CA

2021 Significant Changes

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Appendix CB: Electrical Energy Storage System-Ready Area

- Appendix CB is intended to encourage the installation of renewable energy systems by preparing buildings for the future installation of solar energy equipment, piping and wiring
- New provision for system-ready area for electrical energy storage
  - 2 x 4 ft area on construction docs

Appendix CB

2021 Significant Changes

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Appendix CC: Zero Energy Commercial Building Provisions

- Appendix CC provides a model for states and jurisdictions to require renewable energy systems capable of achieving net zero carbon
- Applies to new buildings
- Based on Architecture 2030

- Supplemental definitions
  - Adjusted off-site renewable energy
  - Building energy
  - Energy Utilization Intensity (EUI)
  - Off-site renewable energy system
  - On-site renewable energy system
  - Renewable energy system
  - Semiheated space
  - Zero Energy Performance Index (ZEPI PB/EE)

Appendix CC

2021 Significant Changes

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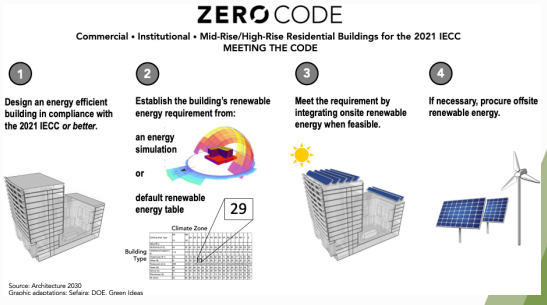
Zero Energy Commercial Building Provisions



Appendix CC

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Minimum Renewable Energy

CC103.1 Renewable energy. On-site renewable energy systems shall be installed, or off-site renewable energy shall be procured to offset the building energy as calculated in Equation CC-1.

$$RE_{onsite} + RE_{offsite} \geq E_{building} \quad \text{(Equation CC-1)}$$

where:

RE_{onsite} = Annual site energy production from on-site renewable energy systems (see Section CC103.2).

$RE_{offsite}$ = Adjusted annual site energy production from off-site renewable energy systems that may be credited against building energy use (see Section CC103.3).

$E_{building}$ = Building energy use without consideration of renewable energy systems.

- If complying with the Prescriptive Compliance option, building energy is determined:

gross conditioned floor area + gross semiheated floor area of the proposed building × EUI from Table CC103.1

- If complying with Total Building Performance or ASHRAE 90.1, building energy is determined from energy simulations

Appendix CC

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Energy Utilization Intensity

TABLE CC103.1 Energy Utilization Intensity for Building Types and Climates (kBtu/ft² – yr)

Building Area Type	Climate Zone 0A/1A	0B/1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
	kBtu/ft²-yr																
Healthcare/hospital (I-2)	119	120	119	113	116	109	106	116	109	106	118	110	105	126	116	131	142
Hotel/motel (R-1)	73	76	73	68	70	67	65	69	66	65	71	68	65	77	72	81	89
Multiple-family (R-2)	43	45	41	41	43	42	36	45	43	41	47	46	41	53	48	53	59
Office (B)	31	32	30	29	29	28	25	28	27	25	29	28	25	33	30	32	36
Restaurant (A-2)	389	426	411	408	444	420	395	483	437	457	531	484	484	589	538	644	750
Retail (M)	46	50	45	46	44	44	37	48	44	44	52	50	46	60	52	64	77
School (E)	42	46	42	40	40	39	36	39	40	40	39	43	37	44	40	45	54
Warehouse (S)	9	12	9	11	12	11	10	17	13	14	23	17	15	32	23	32	32
All others	55	58	54	53	53	51	48	54	52	51	57	54	50	63	57	65	73

Table CC103.1

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Qualifying Off-Site Procurement Methods

1. **Community renewables:** an off-site renewable energy system for which the owner has purchased or leased renewable energy capacity along with other subscribers.
2. **Renewable energy investment fund:** an entity that installs renewable energy capacity on behalf of the owner.
3. **Virtual power purchase agreement:** a power purchase agreement for off-site renewable energy where the owner agrees to purchase renewable energy output at a fixed price schedule.
4. **Direct ownership:** an off-site renewable energy system owned by the building project owner.
5. **Direct access to wholesale market:** an agreement between the owner and a renewable energy developer to purchase renewable energy.
6. **Green retail tariffs:** a program by the retail electricity provider to provide 100-percent renewable energy to the owner.
7. **Unbundled Renewable Energy Certificates (RECs):** certificates purchased by the owner representing the environmental benefits of renewable energy generation that are sold separately from the electric power.

CC103.3.1

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Advanced Technologies in Your Jurisdictions

Poll Question 5

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Additional Resources

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Digital Codes Premium Energy Collection

ICC INTERNATIONAL CODE COUNCIL®

RESNET® RESIDENTIAL ENERGY SERVICES NETWORK

amca INTERNATIONAL

ASHRAE®

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Premium Tools and Features

400+ Premium Codes and Standards Search over 400 of the latest I-codes, standards, supplements and commentaries — Only available with Premium Complete	
Offline View (Mobile App Only) Download up to 15 code titles	**Code Interpretations** Past committee interpretations on building, residential, fire mechanical, fuel gas, plumbing, energy conservation codes
Revision History Tagging View full change history and public comments	**Code Change Proposal (cdpACCESS)** View real time code change proposals under consideration across current I-Code titles
Significant Code Changes View updates and Changes to I-Codes	**Organize Notes** Organize thoughts by adding notes, files or videos into relevant code sections
Highlight and Annotatate Mark up content, highlight code book content and add annotations	**Bookmarking** Bookmark and tag sections of interest
Copy, Paste and Print Copy, paste and print sections of codes	**Errata postings** View the latest code corrections and changes
Favorites Flagging Flag any title by building a "Favorites List" of commonly accessed titles for quick reference	**Advanced Search** Use multiple filters to narrow down search results and identify codes sections more accurately

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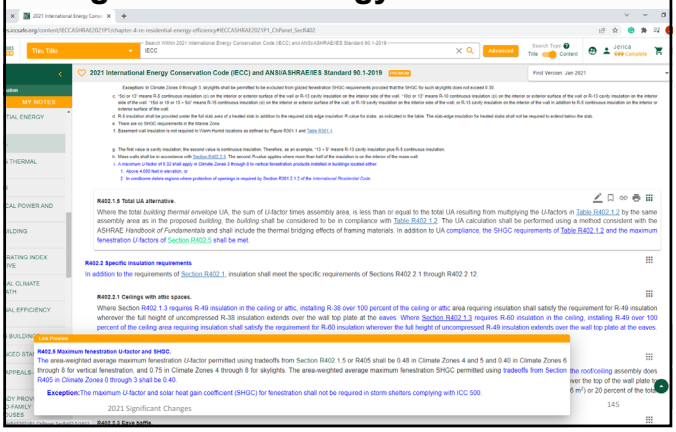
Digital Codes Energy Continued



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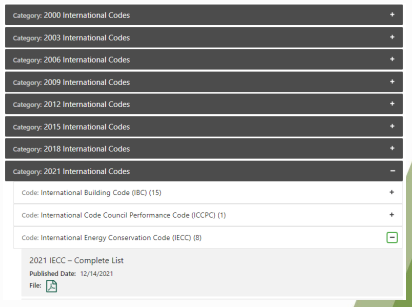
Errata Central

- I-Codes since 2000
- Supporting publications



https://www.iccsafe.org/errata-central/

2021 Significant Changes 146

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A Code on a Mission Campaign

- The Code on a Mission challenge aims to get over one-third of the U.S. population covered by the 2021 IECC by the end of 2023

Supporting Organizations

2021 Significant Changes 147

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ICC Energy and GHG Reduction Resources

- Potential topics:
  - ✓Electric Vehicle Charging
  - ✓Performance Standards for Existing Buildings
  - Electrification and Decarbonization
  - Zero Energy and Zero Carbon
  - Embodied Carbon
  - Grid Interactivity/Efficiency
  - Enhancing Energy Savings through Water Efficiency and Reuse
  - Integration of On-site Renewable Energy Generation and Energy Storage

https://www.iccsafe.org/advocacy/energy-efficiency-and-carbon-reduction/

2021 Significant Changes 148

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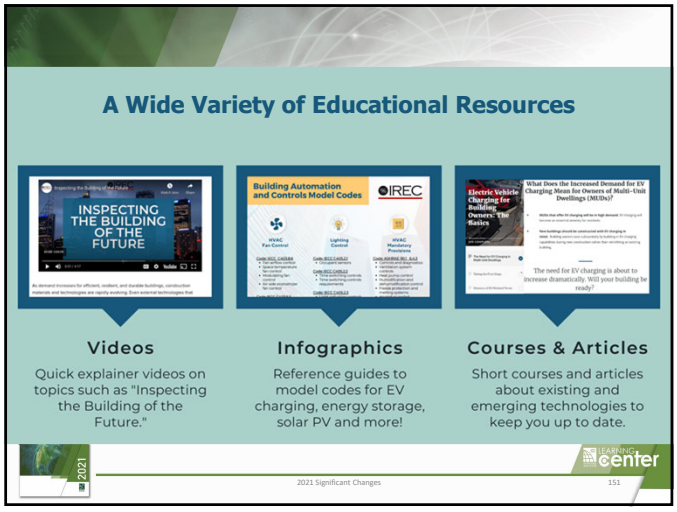

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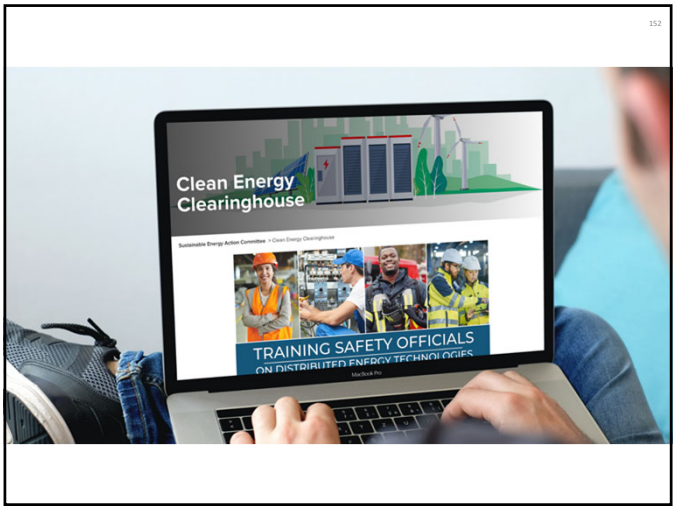

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Join the SMC!

If you're looking to get more involved in green and energy code enforcement and influence the direction of ICC, enroll in the Sustainability Membership Council today

SMC in Social Media

SMC on Twitter	SMC on LinkedIn	SMC on Facebook
Keyword: ICC_SMC	Keyword: ICC-SMC	Keyword: @SustainabilityMC

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Conclusion

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This 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. Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

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The Learning Center™
1-888-ICC-SAFE (422-7233) Ext. 33821
or
E-mail: learn@iccsafe.org
Website: learn.iccsafe.org

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File Attachments for Item:

EC-6 Fire Safety in the 2021 IBC (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

Website: https://www.iccsafe.org/edu

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: Fire Safety in the IBC

Course instructor: Samhar Hoz

Course description

People have expectations that when they enter a building, they will be safe from inherent dangers caused by natural or man-made disasters. The International Building Code (IBC) addresses that through five significant sections: code administration and enforcement, building planning, life safety, structural safety, and fire safety. The code is a set of minimum standards to protect and safeguard public health, safety and general welfare. Fire and smoke are the leading causes of death in buildings. Fire can spread rapidly within a building and, in some cases, from building to building. The IBC is designed to limit the spread of fire inside and outside of a building. The IBC protects the structure and occupants from fire by providing both passive and active fire protection. Passive fire protection safeguards the building and occupants from fire by constructing the fire protection into the structure. This is done by protecting the structural frame of the building and constructing fire-resistance-rated construction walls, floors and roofs.

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

- ☐ Code Administration
- ☐ Existing Buildings
- ☐ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

404

☐ On Demand ☐ Webinar

Course to be offered online?

- [ ] Yes
- [ ] No

Course Website

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- [ ] Residential Certifications Only
- [x] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [x] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PPT_Fire Safety within the International Building Code (IBC).pdf	2.00 MB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

Fire Safety in the IBC

People have expectations that when they enter a building, they will be safe from inherent dangers caused by natural or man-made disasters. The International Building Code (IBC) addresses that through five significant sections: code administration and enforcement, building planning, life safety, structural safety, and fire safety. The code is a set of minimum standards to protect and safeguard public health, safety and general welfare. Fire and smoke are the leading causes of death in buildings. Fire can spread rapidly within a building and, in some cases, from building to building. The IBC is designed to limit the spread of fire inside and outside of a building. The IBC protects the structure and occupants from fire by providing both passive and active fire protection. Passive fire protection safeguards the building and occupants from fire by constructing the fire protection into the structure. This is done by protecting the structural frame of the building and constructing fire-resistance-rated construction walls, floors and roofs.

Learning Objectives:

(1) Address five significant sections: code administration and enforcement, building planning, life safety, structural safety, and fire safety.
(2) How the International Building Code protects the structure and occupants from fire.
(3) Identify Passive protection and Identify active fire protection.
(4) How to limit the spread of fire inside and outside of buildings?

Timed outlines

1)	Code administration and enforcement, building planning, life safety, structural safety, and fire safety.	15
2)	Limit the spread of fire inside and outside of buildings	10
3)	Code protects the structure and occupants from fire	10
4)	Passive fire protection	20
5)	Active fire protection	20
6)	Q & A	15

Contact

s9411946@gmail.com

www.linkedin.com/in/samhar-hoz-57b625224 (LinkedIn)

Certifications

CLA Fire stopping

LEED Green Associate

Honors-Awards

Presenter at ICC (International code council), PMI (Project management associate), ACI (American concrete association)

Publications

Many technical and non-technical papers, including a paper at ASTM (American society of testing and materials)

Samhar Hoz

Staff Engineer at International Code Council

Greater Chicago Area

Experience

International Code Council

Staff Engineer

March 2020 - Present (3 years 1 month)

Codes and Standards Development

Secretary of the Building-Fire Safety Committee

Secretary of ICC Residential Seismic Assessment & Retrofit Standard Committee

One of the secretaries of code development for the Building Code Action Committee

company

Structural Engineer-Outreach manager

January 2012 - December 2019 (8 years)

Ministry of housing

Civil/Construction Engineer

January 2008 - March 2011 (3 years 3 months)

Education

Master in Engineering Management (MEM)

Master in Engineering Management (MEM) · (2018)

Bachelor in Civil/Structural engineering

Bachelor in Civil/Structural engineering · (January 2003 - December 2007)

Harvard Business School Online

Strategy Execution certificate program, Strategy Execution certificate program · (2022)

Fire safety within the International Building Code (IBC)- From design to reality-Overview

Samhar Hoz, Staff Engineer
Cell: 734-262-4651
Direct: 888-ICC-SAFE (422-7233) Ext. 4344
shoz@iccsafe.org

Speaker

- Bachelor’s degree in civil and structural engineering
- Master’s degree in Engineering management (Construction) from Eastern Michigan University.
- Eight years of combined experience in civil, construction and structural engineering.
- CLA-Firestopping
- LEED Green Assoc
- The secretary for the ICC Residential Seismic Assessment & Retrofit Standard Committee
- The secretary of the Building—Fire Safety Committee.
- One of the secretaries of code development for the Building Code Action Committee

Agenda

- How the International Building Code protects the structure and occupants from fire.
- Identify Passive protection
- Identify active fire protection
- How to limit the spread of fire inside and outside of buildings?

International Building Code

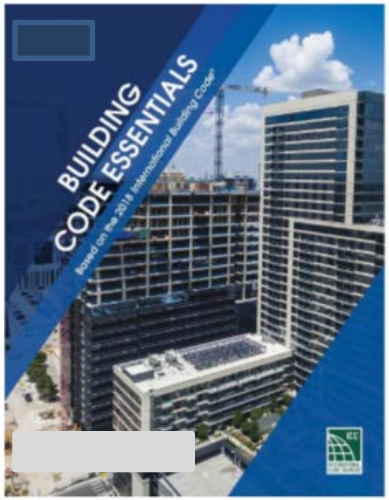
- Minimum standards to protect and safeguard

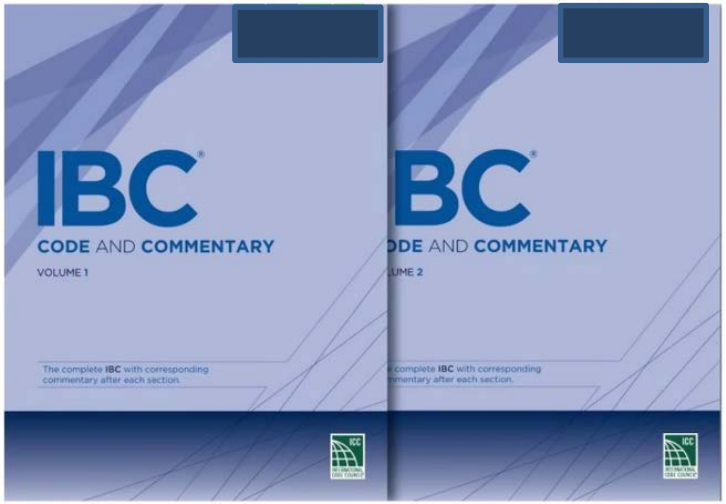
  Public health
  Safety
  General welfare.

- Applies to the construction, alteration, movement,…

- 1500 standards referenced in the I-Codes

IBC-Implementation help

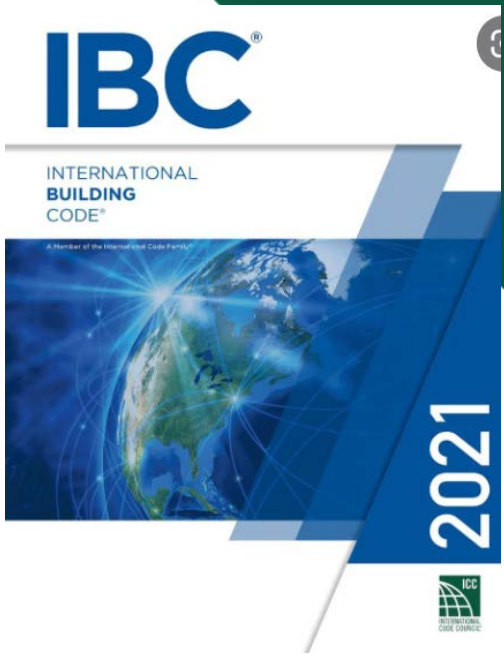




- **General**: Consumers, Regulators
- **Producer**: Builders, Contractors, Manufacturers, Material Associations, Testing Labs
- **User**: Academia, Designers, Research Labs, Owners
- Not less than 33% of each committee are Regulators

IBC-Safety

- Code Administration and Enforcement
- Building Planning
- Life Safety
- Structural Safety
- Fire Safety



Code Administration and Enforcement

- Sets of regulations
- Authority –Section 103
- Plan Review
- Permits – Section 105
- Inspections and Special Inspections
- Alternative Materials and Methods- Section 104.11- ICC Evaluation Service (ICC-ES) reviews and provides reports

Building Planning-Occupancies

- 10 different basic occupancy classifications.
- Subdivided to 26
- Based on use and function

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.

Type of Construction

- Type of construction describes its resistance to fire by addressing:

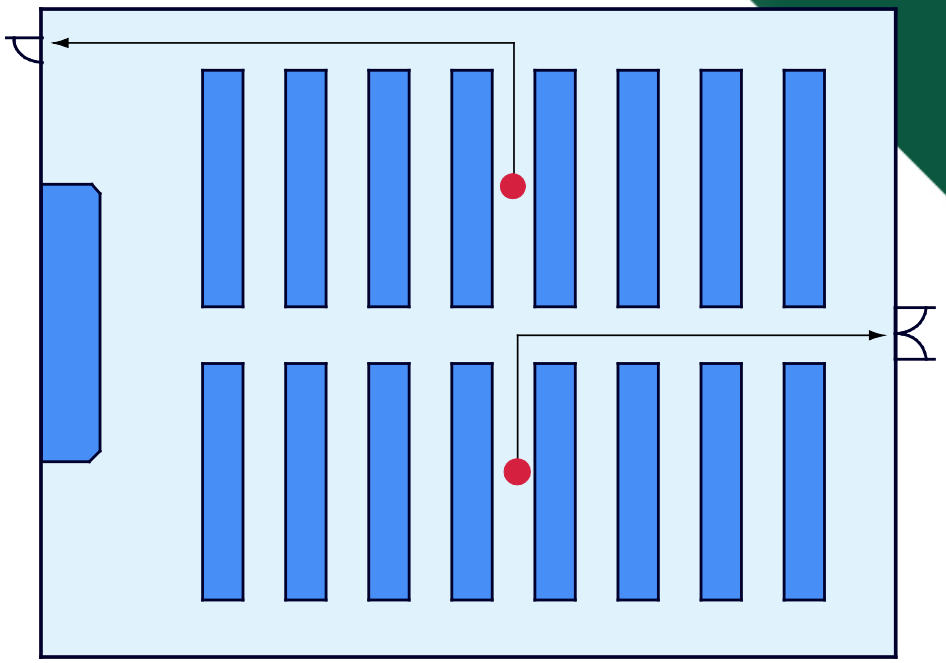
  Type of materials

  Fire protection

- Building size

Life Safety-Design of Exit System

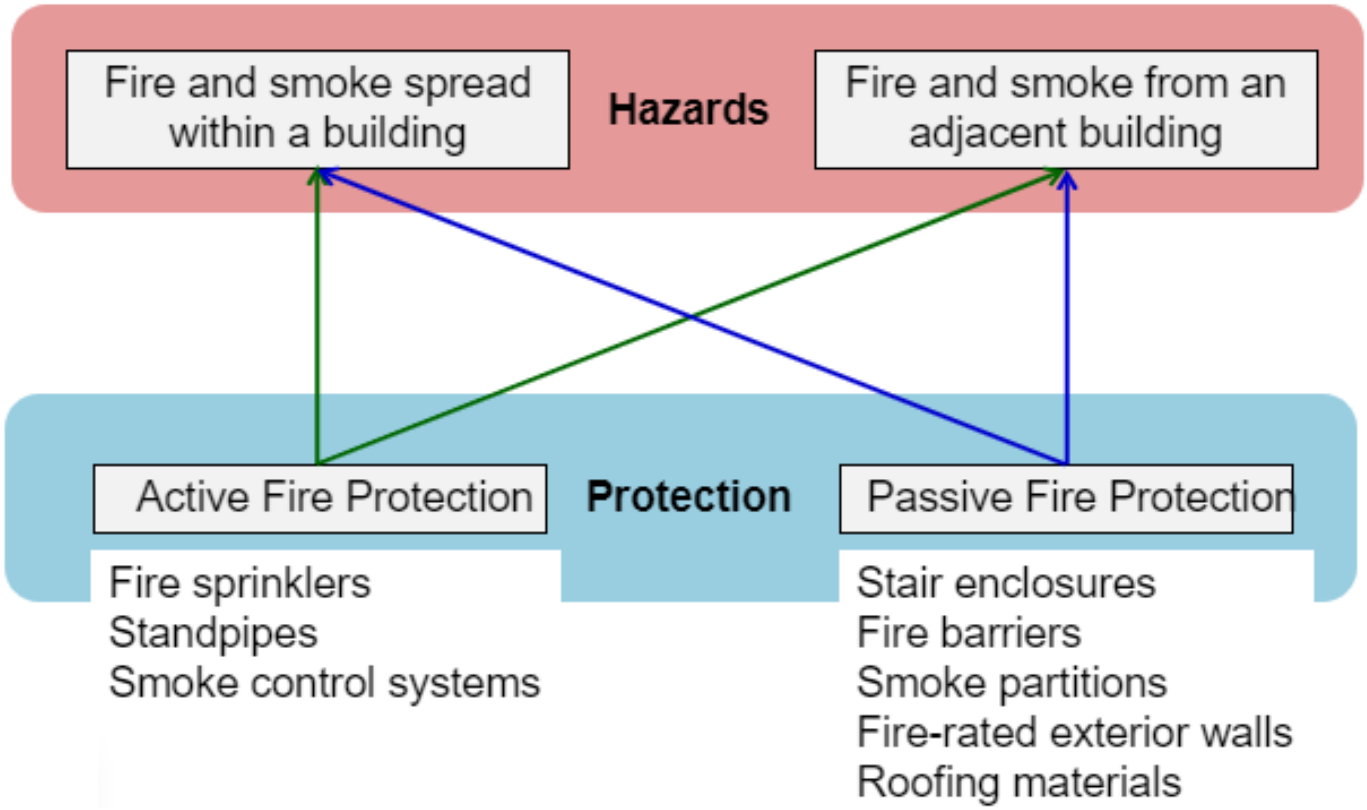
- Design occupant load
- Number of Exits
- Horizontal Travel
- Vertical Travel
- Stairways



- Accessibility-Americans with Disabilities Act Accessibility Guidelines and the Federal Fair Housing Act
- Referenced standard ICC A117.1 – Accessible and Usable Buildings and Facilities

Fire Safety

Spread of Fire and Smoke



Fire Testing Overview

https://www.youtube.com/watch?v=H6N_U5kcOYA&list=PLQdszxKprsDmVFWNSQW_Fwfd0shhJK1pe&index=15

Curtesy-TBW

What do we need to consider?

- A fire produces heat
- materials
- Fire-resistance-rated construction requirements
- Types of separations
- Height and area requirements

CHAPTER 7 FIRE AND SMOKE PROTECTION FEATURES

702 Multiple-use Fire Assemblies
703 Fire-resistance Ratings and Fire Tests
704 Fire-resistance Rating of Structural Members
705 Exterior Walls
706 Fire Walls
707 Fire Barriers
708 Fire Partitions
709 Smoke Barriers
710 Smoke Partitions
711 Floor and Roof Assemblies
712 Vertical Openings

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CHAPTER 7 FIRE AND SMOKE PROTECTION FEATURES

713 Shaft Enclosures
714 Penetrations
715 Joints and Voids
716 Opening Protectives
717 Ducts and Air Transfer Openings
718 Concealed
719 Fire-resistance Requirements for Plaster
720 Thermal- and Sound-insulating Materials
721 Prescriptive Fire Resistance
722 Calculated Fire Resistance

Determining Fire-resistance

- Fire testing of assemblies and materials
- Section 721
- Fire-resistance rating can be calculated based on specific materials

Exterior Walls

- Fire separation distance
- Table 601 – based on type of construction
- Table 602 (705.5) – based on distance to property line

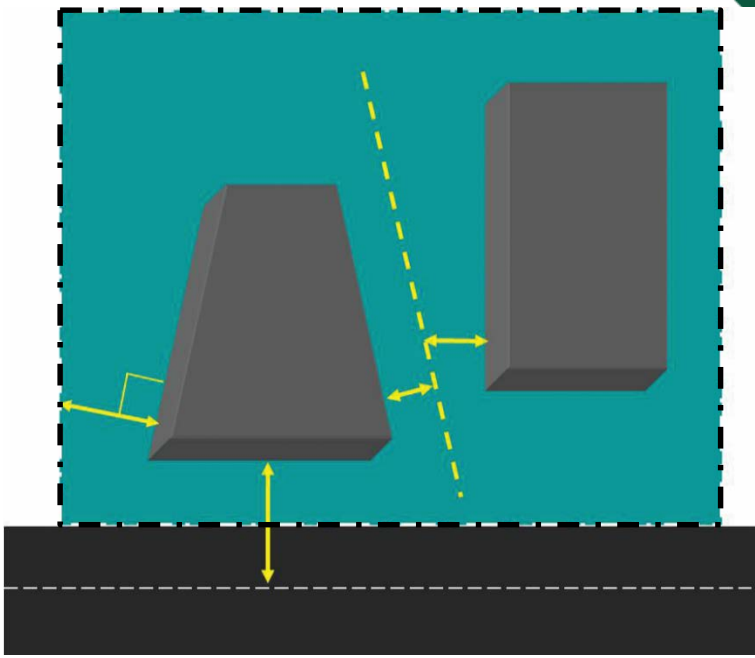


Table 601

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
	A	B	A	B	A	B	A	B	C	HT	A	B
Primary structural frame[f] (see Section 202)	3[a, b]	2[a, b, c]	1[b, c]	0[c]	1[b, c]	0	3[a]	2[a]	2[a]	HT	1[b, c]	0
Bearing walls												
Exterior[e, f]	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3[a]	2[a]	1	0	1	0	3	2	2	1/HT[g]	1	0
Nonbearing walls and partitions Exterior	See Table 705.5											
Nonbearing walls and partitions Interior[d]	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary structural members (see Section 202)	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1½[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	1½	1	1	HT	1[b,c]	0

Table 602 (705.5)

TABLE 705.5
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE[a, d, g]

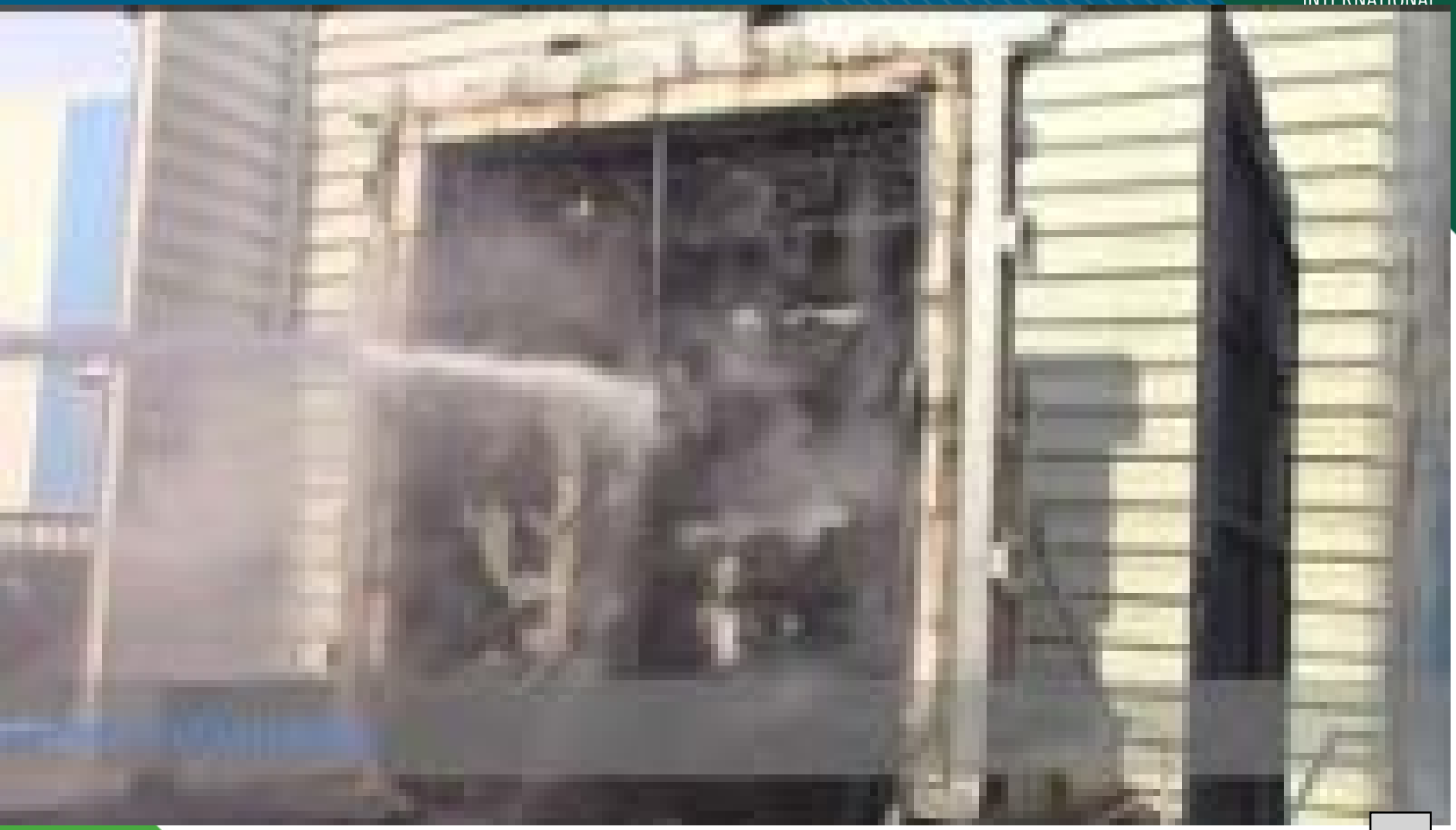
FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H[e]	OCCUPANCY GROUP F-1, M, S-1[f]	OCCUPANCY GROUP A, B, E, F-2, I, R[i], S-2, U[h]
$X < 5^b$	All	3	2	1
$5 \leq X < 10$	IA, IVA	3	2	1
	Others	2	1	1
$10 \leq X < 30$	IA, IB, IVA, IVB	2	1	1[c]
	IIB, VB	1	0	0
	Others	1	1	1[c]
$X \geq 30$	All	0	0	0

Fire-resistance Ratings – Table 721.1(2)

TABLE 721.1(2)
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a, o, p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hours	3 hours	2 hours	1 hour
1. Brick of clay or shale	1-1.1	Solid brick of clay or shale.[c]	6	4.9	3.8	2.7
	1-1.2	Hollow brick, not filled.	5.0	4.3	3.4	2.3
	1-1.3	Hollow brick unit wall, grout or filled with perlite vermiculite or expanded shale aggregate.	6.6	5.5	4.4	3.0
	1-2.1	4" nominal thick units not less than 75 percent solid backed with a hat-shaped metal furring channel $^3/_4$" thick formed from 0.021" sheet metal attached to the brick wall on 24" centers with approved fasteners, and $^1/_2$" Type X gypsum wallboard attached to the metal furring strips with 1"-long Type S screws spaced 8" on center.	—	—	5[d]	—
2. Combination of clay brick and load-bearing hollow clay tile	2-1.1	4" solid brick and 4" tile (not less than 40 percent solid).	—	8	—	—
	2-1.2	4" solid brick and 8" tile (not less than 40 percent solid).	12	—	—	—
3. Concrete masonry units	3-1.1[f, g]	Expanded slag or pumice.	4.7	4.0	3.2	2.1
	3-1.2[f, g]	Expanded clay, shale or slate.	5.1	4.4	3.6	2.6
	3-1.3[f]	Limestone, cinders or air-cooled slag.	5.9	5.0	4.0	2.7
	3-1.4[f, g]	Calcareous or siliceous gravel.	6.2	5.3	4.2	2.8
4. Solid concrete[h, i]	4-1.1	Siliceous aggregate concrete.	7.0	6.2	5.0	3.5
		Carbonate aggregate concrete.	6.6	5.7	4.6	3.2
		Sand-lightweight concrete.	5.4	4.6	3.8	2.9
		Lightweight concrete.	5.1	4.4	3.6	2.5
		One 2" unit cored 15 percent maximum and one 4" unit cored 25 percent maximum				

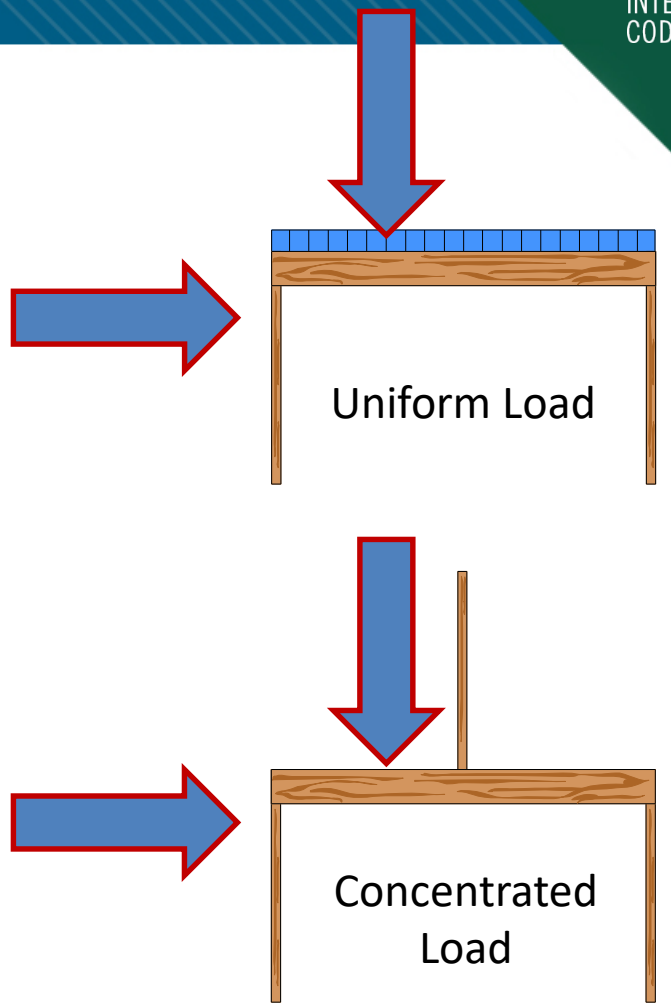
Hose stream test



https://www.youtube.com/watch?v=UJvGWUzuzB8&list=PLQdszxKprsDmVFWNSQW_Fwfd0shhJK1pe&index Curtesy- TBW

Protection of the Structure Loads

- Gravity loads
- Lateral loads
- Uniform loading
- A concentrated load

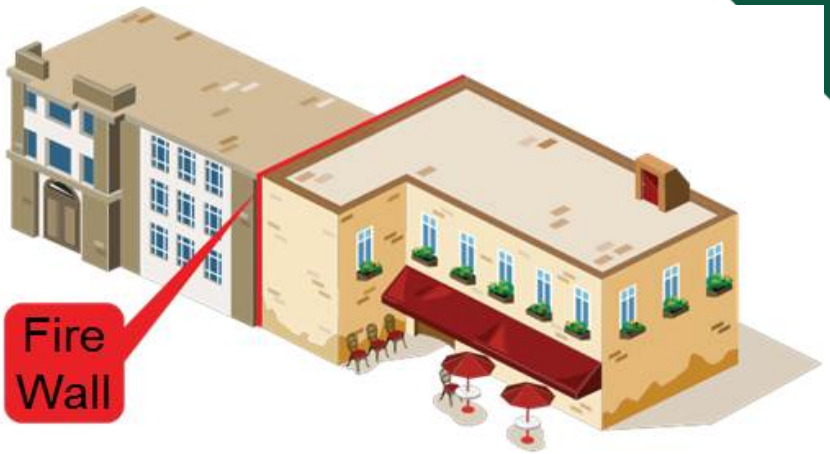


Protection of the Structure

- Primary structural frame members include:
  - Columns
  - Beams, girders
  - Floor and roof construction
  - Bracing members
- Secondary members:
  - Not connected directly to columns

Fire Walls

- A fire wall allows for the structure on each side of the wall is considered a separate building
- Must have structural stability



What do we need to consider?

- Deaths in buildings due to the rapid spread of fire
- The toxic chemicals created when finishes on walls and ceilings ignite.
- Some interior finishes burn faster than others.

Curtesy-ICC-NTA

CHAPTER 8 INTERIOR FINISHES

801 Scope
802 General
803 Wall and Ceiling Finishes
804 Interior Floor Finish
805 Combustible Materials in Types I and II Construction
806 Decorative Materials and Trim
807 Insulation
808 Acoustical Ceiling Systems

FIGURE 8-14 Steiner Tunnel for testing flame spread of interior finishes

803.1.1 Interior wall and ceiling finish materials

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Interior Finishes

TABLE 803.13
INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY[k]

GROUP	SPRINKLERED[l]			NONSPRINKLERED		
	Interior exit stairways and ramps and exit passageways[a, b]	Corridors and enclosure for exit access stairways and ramps	Rooms and enclosed spaces[c]	Interior exit stairways and ramps and exit passageways[a, b]	Corridors and enclosure for exit access stairways and ramps	Rooms and enclosed spaces[c]
A-1 & A-2	B	B	C	A	A[d]	B[e]
A-3[f], A-4, A-5	B	B	C	A	A[d]	C
B, E, M, R-1	B	C[m]	C	A	B	C
R-4	B	C	C	A	B	B
F	C	C	C	B	C	C
H	B	B	C[g]	A	A	B
I-1	B	C	C	A	B	B
I-2	B	B	B[h, i]	A	A	B
I-3	A	A[j]	C	A	A	B
I-4	B	B	B[h, i]	A	A	B
R-2	C	C	C	B	B	C
R-3	C	C	C	C	C	C
S	C	C	C	B	B	C
U	No restrictions			No restrictions		

What do we need to consider?

- Detect a fire
- Occupants
- Fire department
- Smoke

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CHAPTER 9 FIRE PROTECTION AND LIFE SAFETY SYSTEMS

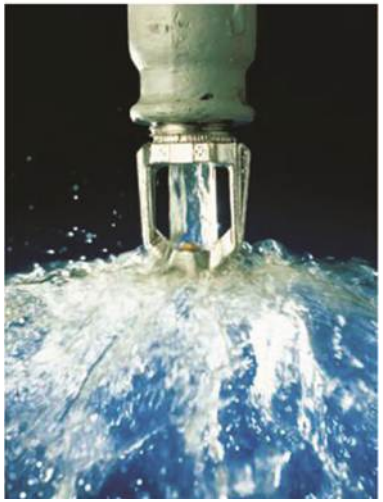
901 General
902 Fire Pump and Riser Room Size
903 Automatic Sprinkler
904 Alternative Automatic Fire-extinguishing Systems
905 Standpipe Systems
906 Portable Fire Extinguishers
907 Fire Alarm and Detection Systems
908 Emergency Alarm Systems
909 Smoke Control Systems

CHAPTER 9 FIRE PROTECTION AND LIFE SAFETY SYSTEMS

910 Smoke and Heat Removal
911 Fire Command Center
912 Fire Department Connections
913 Fire Pumps
914 Emergency Responder Safety Features
915 Carbon Monoxide Detection
916 Gas Detection Systems
917 Mass Notification Systems
918 Emergency Responder Communication Coverage

Automatic Fire Sprinklers

- Sprinklers react to heat
- Sprinklers apply water directly to the fire area
- Sprinklers normally operate independently



Automatic Fire Sprinklers-Where Required

- Required based on:

- Occupancy classification
- Use or materials handled
- Number of occupants
- Size of fire areas
- Floor level in the building

What do we need to consider?

- Requirements for exterior walls of buildings
- Wall covering
- Exterior walls that are close to lot lines
- Installation of each type of wall covering

CHAPTER 14 EXTERIOR WALLS

1401 General
1402 Performance Requirements
1403 Materials
1404 Installation of Wall Coverings
1405 Combustible Materials on the Exterior Side of Exterior Walls
1406 Metal Composite Materials (MCM)
1407 Exterior Insulation and Finish Systems (EIFS)
1408 High-pressure Decorative Exterior-grade Compact Laminates (HPL)
1409 Plastic Composite Decking

NFPA 285

https://www.youtube.com/watch?v=rsyBCE1Jn38&list=PLQdszxKprsDmVFWNSQW_Fwfd0shhJK1pe&index=13

Curtesy-TBW

TABLE 1405.1.1.1.2
MINIMUM FIRE SEPARATION FOR
COMBUSTIBLE EXTERIOR WALL COVERINGS

FIRE SEPARATION DISTANCE (feet)	TOLERABLE LEVEL INCIDENT RADIANT HEAT ENERGY (kW/m^2)
5	12.5
6	11.8
7	11.0
8	10.3
9	9.6
10	8.9
11	8.3
12	7.7
13	7.2
14	6.7
15	6.3
16	5.9
17	5.5
18	5.2
19	4.9
20	4.6
21	4.4
22	4.1
23	3.9
24	3.7
25	3.5

What do we need to consider?

- The use of plastics in building construction and components
- Foam plastics used as interior finish and trim
- Plastic veneers used on the inside or outside of a building

Chapter 26 Plastic

2602 Finish and Trim
2603 Foam Plastic Insulation
2604 Interior Finish and Trim
2605 Plastic Veneer
2606 Light-transmitting Plastics
2607 Light-transmitting Plastic Wall Panels
2608 Light-transmitting Plastic Glazing
2609 Light-transmitting Plastic Roof Panels
2610 Light-transmitting Plastic Skylight Glazing
2611 Light-transmitting Plastic Interior Signs
2612 Plastic Composites
2613 Fiber-reinforced Polymer
2614 Reflective Plastic Core Insulation

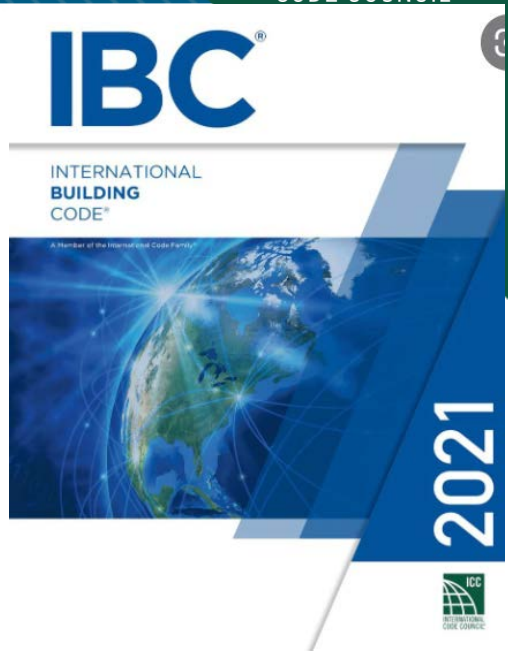
ASTM E84

https://www.youtube.com/watch?v=tO3zZn1g6cs

Curtesy-TBW

Next presentation

- Discuss each aspect in detail.
- Include in the survey a topic you want to focused on.



How can ICC Help?

- Plan review service-including Commercial, large complex projects
- Technical opinion on codes
- Webinars/certification/training- ICC calendar
- ICC-ES and NTA are accredited to the requirements of ISO

Questions…

Samhar Hoz, Staff Engineer
International Code Council
Central Regional Office
Cell: 734-262-4651
Direct: 888-ICC-SAFE (422-7233) Ext. 4344
shoz@iccsafe.org

File Attachments for Item:

EC-7 Grant Basics for Code Officials (ICC)

All certifications (1.5)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

Website: https://www.iccsafe.org/edu

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: Grant Basics for Code Officials

Course instructor: Stella Carr

Course description

In recent years the federal government has prioritized the adoption and enforcement of up-to-date building codes by providing hundreds of millions of dollars in federal grants to support activities such as consulting, publications, and training, as well as software and accreditation. Understanding the grant application process is critical towards capturing these opportunities. In this training, you will learn the basics to effectively apply for federal grants. Participants will gain the knowledge and skills necessary to navigate the grant lifecycle, from finding and applying for grants to initial post-award management and compliance. This course is tailored for relevant grants to Code Professionals and is designed and taught by ICC staff.

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

- ☐ Code Administration
- ☐ Existing Buildings
- ☐ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☐ On Demand
- ☐ Webinar

Course Website:

455

☑ No

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- ☐ Residential Certifications Only
- ☑ Administrative Course, All Certifications
- ☐ Commercial and Residential Certifications

Application materials included *

- ☑ Course Outline or Course Learning Objectives
- ☑ Presentation Materials/Slides (not required for roundtable courses)
- ☑ Assessment Materials (for online courses)
- ☑ Presenter Bio
- ☐ Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PPT_Grant Basics for Code Officials.pdf	1.26 MB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

GRANT BASICS FOR CODE OFFICIALS

Description

In recent years the federal government has prioritized the adoption and enforcement of up-to-date building codes by providing hundreds of millions of dollars in federal grants to support activities such as consulting, publications, and training, as well as software and accreditation. Understanding the grant application process is critical towards capturing these opportunities. In this training, you will learn the basics to effectively apply for federal grants. Participants will gain the knowledge and skills necessary to navigate the grant lifecycle, from finding and applying for grants to initial post-award management and compliance. This course is tailored for relevant grants to Code Professionals and is designed and taught by ICC staff.

Learning Objectives

1. Understand the Federal Grant Process: Participants will be able to explain the purpose of federal grants and their significance for individuals, organizations, and communities. They will gain a comprehensive understanding of the grant life cycle, including pre-grant preparations, the award phase, and post-grant actions.
2. Navigate the Grant Application Process: Participants will learn how to research federal grant opportunities, assess eligibility requirements, and utilize reliable grant databases and resources. They will develop the skills to complete a federal grant application, avoid common mistakes, and effectively respond to technical requirements.
3. Comply with Regulations and Requirements
4. Strengthen Grant Proposals and Budgets: Participants will learn to analyze solicitation guidelines, leverage solicitation information, and align their grant proposals with community resilience goals. They will develop the skills to create realistic and comprehensive grant budgets, justify budgetary needs, and link budgets to their proposal ideas.

Timed outline *(in increments of 25 min or less)*

Welcome	*3:15pm-3:20pm*
Introduction to Federal Grants	*3:20pm - 3:30pm*
Finding and Applying for Grants	*3:30pm - 3:40pm*
Understanding Solicitations	*3:40pm -3:50pm*
Budget-making Process	*3:50pm - 4:00pm*
Initial Post-Award Action Items	*4:00pm - 4:10pm*
Introduction to Uniform Guidance	*4:10pm - 4:20pm*
Question and Answers	*4:20pm-4:45pm*

STELLA CARR

Stella Carr is an experienced professional in energy, resilience, and sustainable development. As the Energy and Resilience Project Manager at the International Code Council, Stella plays a crucial role in facilitating access to grants for Code Council members and customers, supporting the adoption and implementation of energy and resilience building codes. With a proven track record in coordinating initiatives, developing written content, and staying abreast of emerging trends, Stella brings a unique perspective to the table. Her previous roles at ADL Ventures and Resource Exploration allowed her to demonstrate expertise in areas such as technology advancement, partnership development, and priority-based budgeting. With a passion for sustainability and community development, Stella's previous role as the Sustainability Director at the Town of Lexington, MA showcased her exceptional leadership skills and dedication to driving positive change. Having secured organizations grants from $25,000 to $2.5 Million her experience on state and federal grants provide great perspective to assist with member application journeys.

Federal Grant Basics for Code Officials

A Beginners Guide to Navigating Federal Grants

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SIGN IN/OUT

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(Automates CEU/CPE Credits in “myICC” Account)

iccsafe.org/attend

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Course Description

The effective management of federal grants is vital for individuals, organizations, and communities seeking funding for their building code projects. This course provides a basic understanding of the key components and processes involved in federal grant writing and management. Participants will gain the knowledge and skills necessary to navigate the grant lifecycle, from finding and applying for grants to post-award management and compliance. This course is tailored for relevant grants to Code Professionals and is designed and taught by ICC staff.

© International Code Council, Inc.

Agenda

1	Welcome	*3:15pm-3:20pm*
2	Introduction to Federal Grants	*3:20pm - 3:30pm*
3	Finding and Applying for Grants	*3:30pm - 3:40pm*
4	Understanding Solicitations	*3:40pm -3:50pm*
5	Budget-making Process	*3:50pm - 4:00pm*
6	Initial Post-Award Action Items	*4:00pm - 4:10pm*
7	Introduction to Uniform Guidance	*4:10pm - 4:20pm*
8	Question and Answers	*4:20pm-4:45pm*

© International Code Council, Inc.

INSTRUCTOR

Stella Carr

- Energy and Resilience Project Manager
- International Code Council, Inc.
- MPA
- Grant Writing and Grant Management Professional
- Lean Six Sigma (Green Belt)
- scarr@iccsafe.org

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GOAL & OBJECTIVES

This course guides :

1) Understand the concept of a federal grant
2) Learn how to find and apply for federal grants effectively
3) Gain knowledge about different types of solicitations, such as NOFO and FOA, and their importance in the grant process
4) Acquire the skills to decipher and navigate the grant application budget-making process
5) Identify the initial post-award action items required after receiving a federal grant
6) Learn about the Uniform Guidance and its relevance to the federal grant process

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REALITY CHECK

Why Does This Matter?

- Why apply for federal grants?
- How can this help us with building codes?
- What's the greatest challenge with grants?

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Let’s get started

Helping your community get funded!

COURSE OUTLINE

- Introduction to Federal Grants
- Finding and Applying for Federal Grants
- Understanding Solicitations
- Deciphering the Grant Application Budget Making Process
- Initial Post Award Action Items
- Introduction to Uniform Guidance

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Module 1

1. Definition and Purpose of Federal Grants
2. Importance of Federal Grants for Individuals, Organizations and Communities
3. Overview of The Federal Grant Application and Selection Process

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Module 2

1. Researching Federal Grant Opportunities
2. Identifying Reliable Grant Databases And Resources
3. Assessing Eligibility Requirements And Criteria
4. Step-by-step Guide To Completing A Federal Grant Application
5. Common Mistakes To Avoid During The Application Process

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PowerPoint® slides are tools, not educational "curriculum."

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Module 3

1. Differentiating Between Various Types Of Solicitations And Their Purpose
2. Explanation Of Key Terms: NOFO (Notice Of Funding Opportunity), FOA (Funding Opportunity Announcement), RFP (Request For Proposal), Etc.
3. Analyzing Solicitation Guidelines And Requirements
4. Leveraging Solicitation Information To Strengthen Grant Applications

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Module 4

1. Overview Of Budget Development In Grant Applications
2. Key Components Of A Grant Budget
3. Understanding Allowable And Unallowable Costs
4. Developing A Realistic And Accurate Budget Narrative
5. Tips For Justifying Budgetary Needs And Expenses

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Module 5

1. Overview Of The Post-award Process
2. Understanding The Terms And Conditions Of The Grant Award
3. Establishing Project Management And Reporting Procedures
4. Compliance Requirements And Obligations
5. Financial Management And Reporting Responsibilities

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Module 6

1. Explanation Of The Uniform Guidance (2 CFR Part 200)
2. History And Purpose Of The Uniform Guidance
3. Key Principles And Requirements Of The Uniform Guidance
4. Impact Of The Uniform Guidance On Federal Grant Recipients
5. Best Practices For Adhering To The Uniform Guidance

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Discussion

© International Code Council, Inc.

KEY POINTS

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EVALUATON & SIGN OUT

Thanks for Allowing Us to Serve You!

Please Complete Your Evaluation & Sign Out

1

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2

iccsafe.org/attend

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International Code Council, Inc.
Training Department

888-ICC-SAFE, Ext 33821
Learn@ICCSAFE.org

Building Professional Careers!

Template by Matthew Winn, SVP of Training, ICC (V.23.06-1)

File Attachments for Item:

EC-8 How to Be a Better Leader by Practicing Active Listening (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *	Organization	Email *	Phone Number *
Laura Morris	International Code Council	lmorris@iccsafe.org	(708) 799-2300

Address *	City *	State *	Zip Code *
4051 W Flossmoor Road	country Club Hills	IL	60478

Website	Conference Sponsor (if applicable)	Conference Email
https://www.iccsafe.org/edu		lmorris@iccsafe.org

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429)

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title

How to be a Better Leader by Practicing Active Listening

Course instructor

Samhar Hoz

Course description

The responsibilities of each one of us could vary. Still, we all have shared aspects of teamwork, meetings, planning and organizing the work, managing the day-to-day activities, identifying potential, and delivering projects. Active listening is essential in our collaboration, meetings, and solving disputes or conflicts.
We listen to obtain information, understand, and share experiences and points of view. Active listening determines ways/suggested solutions to meet all stakeholders' shared goals and provides a good teamwork environment. It also provides good data for critical thinking. Critical thinking includes analysis and evaluation of an issue to make a judgment. Also Identify potentials is critical; one of the essential tools is to allow brainstorming between all team members at all company levels to get general feedback and suggestions that could help modify or enhance some of the processes to improve the outcomes.
All of the above provide the ability to be a great leader by making reasonable decisions, solve a problem, develop alternate solutions, and look for root causes of issues or conflicts.

Instructional hours per session	Number of Sessions	Course Date	Course Location
1.5	1		St. Louis, MO

Special Content

- ☐ Code Administration
- ☐ Existing Buildings
- ☐ Electrical Instruction

Conference Course	Conference Name	Conference location

- [ ] Plumbing Instruction

Course to be offered online?

- [ ] Yes
- [x] No

- [ ] On Demand
- [ ] Webinar

Course Website

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- [ ] Residential Certifications Only
- [x] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [x] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PPT_How to be a Leader by mastering active listening.pdf	1.10 MB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

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New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

How to be a Better Leader by Practicing Active Listening

The responsibilities of each one of us could vary. Still, we all have shared aspects of teamwork, meetings, planning and organizing the work, managing the day-to-day activities, identifying potential, and delivering projects. Active listening is essential in our collaboration, meetings, and solving disputes or conflicts.

We listen to obtain information, understand, and share experiences and points of view. Active listening determines ways/suggested solutions to meet all stakeholders' shared goals and provides a good teamwork environment. It also provides good data for critical thinking. Critical thinking includes analysis and evaluation of an issue to make a judgment. Also Identify potentials is critical; one of the essential tools is to allow brainstorming between all team members at all company levels to get general feedback and suggestions that could help modify or enhance some of the processes to improve the outcomes.

All of the above provide the ability to be a great leader by making reasonable decisions, solve a problem, develop alternate solutions, and look for root causes of issues or conflicts.

Learning Objectives:

1. Discuss the barriers that affect effective listening and how to overcome them.
2. Discuss how we are all leaders in our ways and how to be successful leaders.
3. Managing expectations, your expectations and other people expectations.
4. Identify ways to overcome challenges by having strategies, resources, skills, and support.

Timed outlines

1)	Barriers that affect effective listening and how to overcome them	20
2)	How we are all leaders in our ways	10
3)	How to be successful leaders	15
4)	Managing expectations, your expectations and other people expectations	15
5)	Ways to overcome challenges by having strategies, resources, skills, and support	15
6)	Q & A	15

Contact

s9411946@gmail.com

www.linkedin.com/in/samhar-hoz-57b625224 (LinkedIn)

Certifications

CLA Fire stopping

LEED Green Associate

Honors-Awards

Presenter at ICC (International code council), PMI (Project management associate), ACI (American concrete association)

Publications

Many technical and non-technical papers, including a paper at ASTM (American society of testing and materials)

Samhar Hoz

Staff Engineer at International Code Council

Greater Chicago Area

Experience

International Code Council

Staff Engineer

March 2020 - Present (3 years 1 month)

Codes and Standards Development

Secretary of the Building-Fire Safety Committee

Secretary of ICC Residential Seismic Assessment & Retrofit Standard Committee

One of the secretaries of code development for the Building Code Action Committee

company

Structural Engineer-Outreach manager

January 2012 - December 2019 (8 years)

Ministry of housing

Civil/Construction Engineer

January 2008 - March 2011 (3 years 3 months)

Education

Master in Engineering Management (MEM)

Master in Engineering Management (MEM) · (2018)

Bachelor in Civil/Structural engineering

Bachelor in Civil/Structural engineering · (January 2003 - December 2007)

Harvard Business School Online

Strategy Execution certificate program, Strategy Execution certificate program · (2022)

How to be a Leader by mastering active listening

Samhar Hoz Engineer

ICC (International Code counsel)

Speaker

- Bachelor's degree in civil and structural engineering
- Master's degree in Engineering management (Construction) from Eastern Michigan University.
- Eight years of combined experience in civil, construction and structural engineering.
- CLA-Firestopping
- LEED Green Assoc
- The secretary for the ICC Residential Seismic Assessment & Retrofit Standard Committee
- The secretary of the Building—Fire Safety Committee
- One of the secretaries of code development for the Building Code Action Committee

Agenda

- Discuss the barriers that affect effective listening and how to overcome them.
- Discuss how we are all leaders in our ways and how to be successful leaders.
- Identify ways to overcome challenges
- Describe strategies, resources, skills, and support.

Why do we need active listening?

Manage the day-to-day activities

Plan and organize the work

Active listening?

Identify potentials

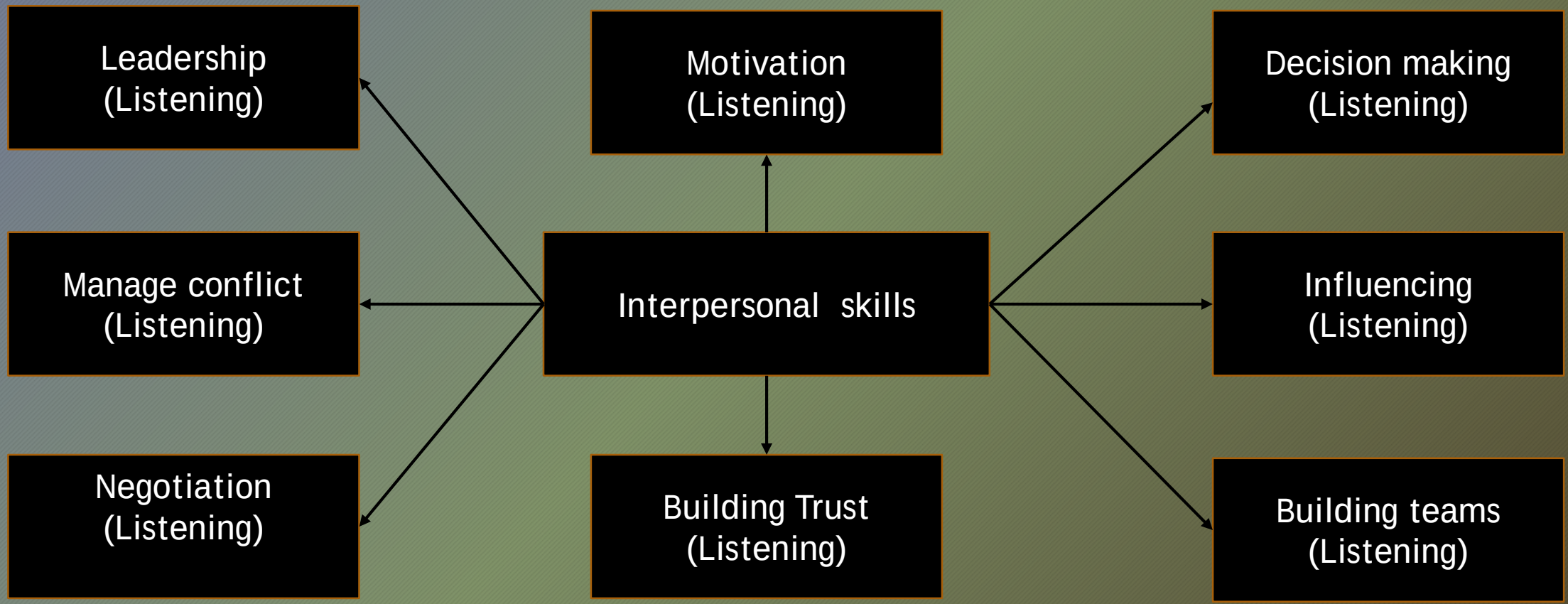
Deliver outcome

https://www.youtube.com/watch?v=ip40qRkiZpk

Active listening benefits

- Determine ways/suggested solutions to meet the common goal
- Working well in a team
- Critical thinking: the objective analysis and evaluation of an issue in order to form a judgment.
- Ability to make informed decisions by evaluating several different sources of information objectively
- Problem-solving
- Develop Alternate Solutions
- Look for Root Causes

Why? Interpersonal skills



https://www.youtube.com/watch?v=ip40qRkIZpk

What is Active Listening?

- Accept different point of view
- Attention to both the big picture and small details.
- Building a successful career, it doesn't happen in isolation, it is a teamwork.
- active listening is an art
- One of the main skills: speaking skills, writing skills, and listening skills.
- What are you trying to get out of the discussion

How to improve listening skills?

- Avoid distractions
- Avoid Thinking of your answer before hearing the entire question.
- Acknowledgement, Encourage them to continue speaking! (Is active listening for you or for them?)

Best active listening strategies?

- Listen to everyone
- Clarify sources
- Investigate (Prior to the meeting)
- Clarify conflict

For attendees

One of the biggest challenges of communication for you?

Competencies

Knowledge

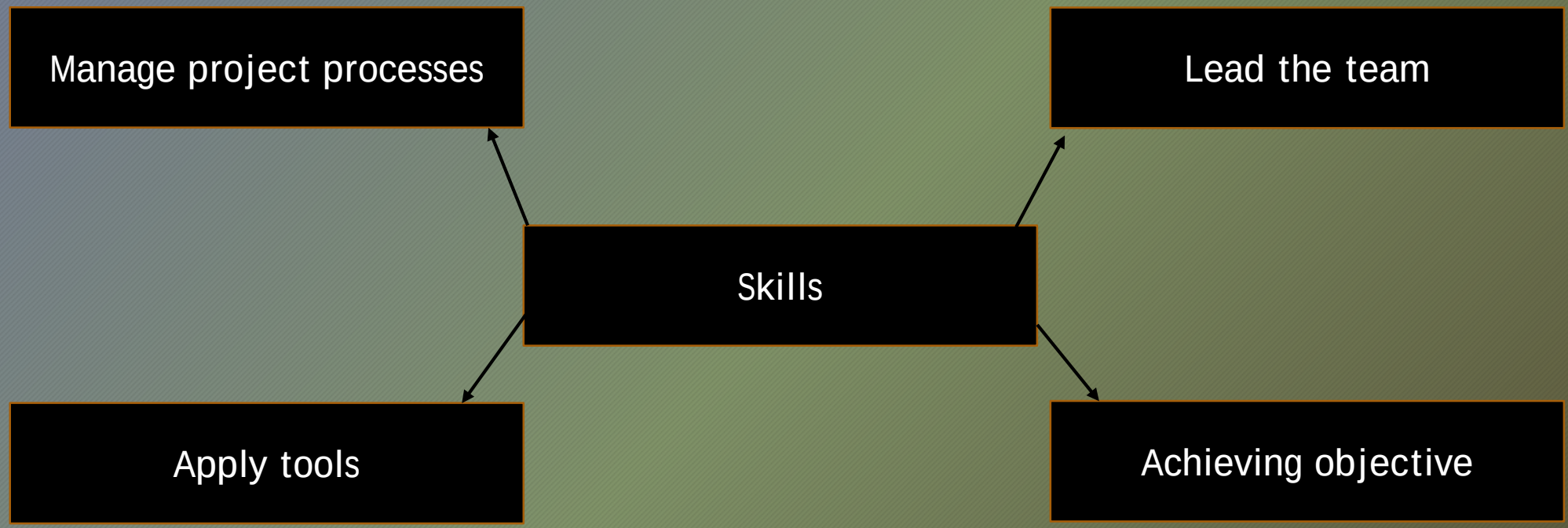
https://www.youtube.com/watch?v=ip40qRkiZpk

Performance

Personal

Anything is hard in the beginning until you learn the aspect of it!

Roles of manager and/or leader



Why Managers/Leaders Fail?

Fail

COMPANIES MAKE THE WRONG CHOICE IN SELECTING MANAGERS

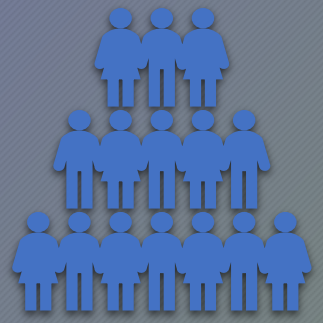
82 PERCENT OF THE TIME.

THE STUDY ALSO FOUND THAT MANAGERS ACCOUNT FOR

70 PERCENT OF EMPLOYEES' ISSUES WITH ENGAGEMENT.

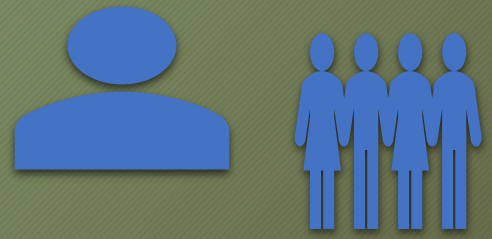
LOW EMPLOYEE ENGAGEMENT LEADS TO LOW PRODUCTIVITY

https://businessdegrees.uab.edu/blog/why-managers-fail-a-look-at-common-misconceptions-in-management/



Managers/Leaders who fail believe that establishing an open-door policy with employees will suffice.

They expect employees to come to them when problems arise, but that typically isn't the case.



Approaching a manager can be a challenging

Common missteps that explain why managers/leaders fail

Management challenges

- Achieving a Stretch Goal
- Bringing Out the Best in Your Employees
- Underperforming Employees
- Outstanding Employees
- Set Expectations
- Define Milestones
- Responding to a Crisis
- Continuous Improvement (Lessons learns)

For attendees

Why do you think Managers/Leaders Fail?

Types of management?

- Authoritative management
- Persuasive management style
- Consultative management
- Participative management
- Collaborative management
- Coaching management style.

A Win-Win Negotiation Successful Strategies

Both parties gain equal advantage.

Separate the people from the problem

Interests, not positions.

Mutual gain

Objective criteria.

Use BATNA (Best Alternative To a Negotiated Agreement).

Jack Welch -What is the role of a leader?

https://youtu.be/ojkOs8Gatsg

Questions

Samhar Hoz, Staff Engineer
International Code Council
Central Regional Office
Direct: 888-ICC-SAFE (422-7233) Ext. 4344
shoz@iccsafe.org

File Attachments for Item:

EC-9 Professional Ethics (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

Website: https://www.iccsafe.org/edu

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: Professional Ethics

Course instructor: Matthew Winn

Course description:

This session explores the challenges and opportunities associated with ethical behavior in modern business behavior and provides practical suggestions for participants to pursue higher ethical standards.

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

- ☐ Code Administration
- ☐ Existing Buildings
- ☐ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☑ No

☐ On Demand ☐ Webinar

Course Website:

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- [ ] Residential Certifications Only
- [x] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [x] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PPT_Professional Ethics.pdf	715.09 kB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

Professional Ethics

Description: This session explores the challenges and opportunities associated with ethical behavior in modern business behavior and provides practical suggestions for participants to pursue higher ethical standards.

Objectives:

1. Articulate the relevance of ethics in modern society
2. Define ethics and trace the historical development
3. Understand the layers and variations of ethics
4. Explore major ethical principles
5. Apply the ethical implications to our relationships

Timed Outline: 90 minutes / 1.5 hrs.

Professional Ethics

5	Introduction
10	Defining Ethics
10	Ethical Levels
10	Ethical Relationships
20	Ethical Principles, Part 1
20	Ethical Principles, Part 2
10	Implications
5	Review & Conclusion

90 min total.

Matthew Winn
Senior Vice President of Training

Winn joined the International Code Council in early 2022 when his company (devoted to training construction contractors) was acquired and he took over responsibility for the combined training endeavors of ICC. He holds a bachelor's degree in Accounting, a Master's of Business Administration degree in Executive Leadership, and active CPA licenses in Texas & Georgia. He is a licensed plumbing inspector, an OSHA Authorized Instructor, and NCCER Master Trainer. Before leading his own business, Matthew previously served as the Chief Financial Officer of three companies, the Divisional Vice-President of Operations for a publicly traded company, and President of a Financial Services company. Matthew is the author or editor of over 20 training curriculums developed for professionals in the construction trades and has personally taught in over a dozen countries around the world.

Professional Ethics

Ethics is knowing the difference between what you have a right to do and what is right to do.

Potter Stewart
Former US Supreme Court Justice

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1

Module Objectives

1. Articulate the relevance of ethics in modern society
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4. Explore major ethical principles
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Reality Check

- How would you define ethics?
- Who in your life do you consider ethical? Why?
- Is there any reason to do more than the law requires of us? Why or why not?
- Are professional ethics different than personal ethics? If so, how?
- Do businesses have ethics? If so, what are examples?
- Is ethical behavior an advantage or disadvantage in business? Why?

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Why Does This Matter?

- As tempting as idea may sound in midst of our modern turmoil
- None of us can live fulfilling lives long-term in complete isolation
- Why "solitary confinement" historically understood punishment or torture
- Not minimizing difference between extroverts and introverts
  - Suggests interaction with other people is human need
  - Although not as immediate as water, food, shelter
- Relationships are a built-in human desire

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Why Does This Matter?

Ultimately, every topic of significance comes back to relationships:

- Families are collections of individual people.
- Businesses are interactions between people (employees and customers).
- Communities are collections of individuals as well as households of people.
- Governments are led and operated by people.

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Why Does This Matter?

- History reveals
  - Every group of people (family, tribe, community, country)
  - Eventually follows a generally accepted rules to avoid chaos and open conflict
- Often memorialized into written laws
  - Usually include most important points
  - Don't address every expectation of behavior
- Additional unwritten rules
  - Part of culture of any society
  - Points addressing how people relate to one another
  - Can be understood as "ethics" of that culture

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Why Does This Matter?

- Since only laws are written down
  - Presumably understood if not agreed upon by everyone in society
  - Means individuals have more freedom to accept or reject optional ethical expectations
- Gives rise to some being considered more ethical than others
- Even if everyone considered "law abiding"

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Why Does This Matter?

People who choose to act more ethically generally do so for several reasons:

- Personal moral or spiritual convictions
- Expectations of other influencers
- Doing so is more advantageous

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Defining Ethics

Let's first address several definitions related to this topic.

Personal Ethics: The rules or standards that govern decisions. Some equate "ethics" with conscience or a clear sense of "right" and "wrong." Others contend ethics are an internal code governing an individual's conduct, ingrained into each person by family, faith, tradition, community, laws, and personal mores.

Business Ethics: The set of moral rules, practices and policies that govern how businesses operate, how business decisions are made, and how people are treated, both internally (employees) and externally (customers, suppliers).

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Defining Ethics

Let's first address several definitions related to this topic.

Professional Ethics: The personal and corporate standards of behavior expected of professionals. Because professionals exercise special knowledge and skill, how the use of this knowledge should be governed when providing a service to the public can be considered a moral issue and is termed "professional ethics." One of the earliest examples of professional ethics is the Hippocratic oath to which medical doctors still adhere to this day.

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History of Ethics

It is also helpful to understand how we arrived at our modern idea of ethics:

- Ancient epic poems portrayed values to be observed and admired in leaders.
- Greek philosopher, Socrates, gave birth to philosophy as a distinct topic of study.
- Greek philosopher, Plato, articulated the idea of seeking the "greatest good."
- Theologians in the Middle Ages developed the idea of "natural law" around human worth.
- 19th century utilitarianism says right actions bring greatest happiness to greatest number.
- 20th century brought distinctions for animal, business, environmental and bioethics.

Common theme in progression is answer to one question in every situation:

What is the greatest good?

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Differing Perspectives

<u>Cultural Differences</u>

- Anyone who has been privileged to travel he world
  - Immediately recognize idea of "ethical behavior" is contextual
  - It varies based on location and culture
- Example:
  - Residents of US generally believe a signed contract is final agreement
  - Every action should be in accordance with agreement for parties to be considered "ethical"
  - However, in other cultures, an agreement (even written) is simply starting point
  - Negotiations continue throughout life of a project, even through final payment

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Differing Perspectives

Cultural Differences

- Different cultures value different things
- Results in significantly varying ethical expectations
- Lack of appreciation for this point is source of
  - Much frustration
  - Numerous international legal proceedings
  - Even wars

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Ethical Levels

- As previous definitions of ethics suggest, we practice ethics on several levels
- Hierarchy moves from us as individuals to our small part in world
  - Typically concerned with ethical behavior in our immediate interactions
  - Long before concerned about our impact on globe
  - More likely to be concerned with what we see and what affects us daily
  - Less on issues we only hear about and may never experience firsthand
- Perhaps too theoretical, prefer to define hierarch in terms of relationships

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Ethical Relationships

- Even those who embrace high ethical standards
- Quickly realize the goal is more difficult than it seems
- Due to the actions of others
- Gives rise to situational applications
  - Example: “Live at peace with everyone, as far as it depends on you”
  - Romans 12:18

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Ethical Relationships

- Practically, our acceptance of responsibility toward others often depends on
  - How closely they are related to us
  - How regularly we interact with them
- In that regard, application of ethical principles may also be seen as hierarchy
  - Based on relationships
  - From closest to farthest removed

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Ethical Relationships

- As we proceed through suggested ethical principles
- We can grow personally by applying them up this chart
- First with family and coworkers
- Moving up & out through our community, country and even world

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Ethics & Reputation

- As one last point before exploring potential ethical principles
- Let's be very practical—what's in it for me?
  - If don't have family, peer, or spiritual conviction toward ethical behavior
  - Why should we care?
- Answer in our context, "because it is good business."

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Ethics & Reputation

- To make point, would you prefer to have an ethical or unethical person as your:
  - Spouse?
  - Employer?
  - Employee?
  - Doctor?
  - Banker?
- Odds are we would prefer to deal with ethical people
- Everyone else feels same way towards us
- When we are ethical in our dealings, we have greater opportunities!
- Reputation matters & good reputation may be most valuable belonging in life

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Ethical Principles

- 15 principles that follow are not all inclusive
- Provide significant examples of ethical perspectives
- Ethics is not a clear science but more of a complex art
- Room for constructive disagreement on details
- Principles arranged in intentional order, raising bar higher as we proceed
  - From most basic idea of not hurting others
  - To almost universally desired "Golden Rule"

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Do No Harm

- Already mentioned Hippocratic oath
- Oath of ethics historically taken by physicians: First do no harm
- Dates to fifth century BC & attributed to Greek doctor, Hippocrates
- In general context, provides baseline of ethical behavior most can agree upon
- Ethical person doesn't intentionally harm other people
- Will actively seek to avoid harming others whenever possible
- Because life is messy
  - Many would suggest exceptions for self-defense or justified war
  - Doesn't weaken most basic ethical principle

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Obey Laws To Which You Are Subject

- Already stated ethics are separate from laws & rise above them in expectations
- However, we hesitate to call a habitual lawbreaker an ethical person
- So, adherence to laws has a place in our ethical principles
- While unjust laws have been challenged & changed throughout history
  - Those who live with perpetual apathy toward (or in defiance of) laws
  - Known as criminals and outlaws
  - Rarely described as ethical & trusted only by those who share in rebellious endeavors
  - Proverbial Robin Hood (stole from rich, give to poor) may be an exception
  - Motives described in that story are rarely found in historical fact

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Maintain Loyalty to Commitments

- Honesty is at heart of this ethical principle, but loyalty is even bigger concept
- Tend to trust people who live up to commitments, distrust those who do not
- Whether involves money, time, exclusivity, confidentiality, other major concern
- When we are loyal, people more likely to trust us & view as ethical
- True of spouse, children, employer, employees, friends, every relationship
- Like other principles, describing in personal terms
- Also true of businesses & any other organizations
- We prefer to deal with companies we trust to do what they say they will do

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Accept Responsibility for Own Actions

- First three principles unlikely to draw much dissent
- Fourth marks transition into cultural challenges in 21st century America
- Culture teaches to take credit when we can & avoid blame when possible
- To be fair, usually start down this path as children trying to avoid punishment
- Clear sign of maturity when willingly take responsibility for ourselves & actions
- In professional context, so rare today that customers are often stunned
  - When a product or service provider accepts responsibility
  - Proactively moves to correct any wrong
- We like to say, best way to build customer loyalty is to serve them well & next best way is to recover well when (not if) something goes wrong

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Respect Other's Rights, Needs, Desires

- U.S. built with clear preference for right of individuals to pursue freedom
- Even most libertarian perspectives would argue
  - We are free to do as we wish as long as it doesn't harm or infringe on rights of others
  - There's issue, almost everything we do has some effect on others
- If we infringe on someone else's rights, that's legal issue (see second principle)
- We have opportunities to allow someone who has a greater need for some product or service to go ahead of us (allowing someone about to miss their connecting flight to go ahead of us comes to mind)
- Even further step is allowing someone else's preference to have priority over yours (perhaps a spouse with regard to a restaurant or vacation selection)
- Simply being aware of needs or desires of others & deferring when we can dramatically raises perception of our ethical behavior

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Speak Truthfully In Every Aspect of Life

- If we believe someone is ethical, we believe we can trust what they tell us
  - We sense how important when considering how sworn in to give legal testimony.
  - "Do you promise to tell the truth, the whole truth, and nothing but the truth?"
  - We have evolved to this long oath because of human tendency for even "honest" person to omit key facts or embellish truth to put themselves in a better light
- On other hand
  - We also encounter individuals who wield truth like a weapon
  - Using facts they uncover to attack their adversaries
- We are viewed as ethical when answer questions truthfully, don't conceal key facts to our advantage, avoid using information we discover against others
- Modern political process come to mind as stark contrast? You aren't alone!

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Earn Trust Through Reliability

- Mentioned trust several times; viewing as ethical & trustworthy closely linked
- Already covered loyalty & truthfulness, reliability is even broader concept
  - When view someone as ethical, know how they are going to respond in situations
  - Even when they haven't made a commitment to us in that regard
  - Some may call this dependability as well
- When we live and operate with consistency
  - Living up to principles we articulate & expect from others
  - People will build even deeper trust because they know what to expect
  - This isn't shunning spontaneity or creativity
  - Describing reactions to dangerous, tempting, or uncertain situations
  - We feel we know how ethical people in our lives will respond, especially in difficult times
  - Hopefully others can say same thing about us

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Act Fairly Towards Those You Lead or Influence

- Old saying
  - "A successful man is one who earns $1,000 more than his brother-in-law."
  - Tend to judge ourselves relative to others (wealth, looks, success, morality, etc.)
- We can feel we treated unfairly in absolute terms
- Offense multiplied when treated poorly compared to others in same situation
- When we are in positions of leadership or influence
  - Any sign of favoritism will be fatal to our standing as an ethical person
  - Shouldn't preclude promoting or compensating differently based on performance
  - Should preclude favoritism based on friendships (or subtle bribes!)
- Especially precarious in family businesses, deference given to family members
  - Devastating results to motivation & moral of non-family members
  - May have worked harder & contributed more than family members

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Prudently Use Resources Available To You

- 9th principle, significant step up in challenge to ideas of broader culture
- In U.S., compared to world, relatively free to do as we will with what we have
- However, "Just because we can do something doesn't mean we should"
  - Rarely consider someone ethical if routinely see them wasting what earned or been given
  - Money, time, health, relationships, opportunities
- Without wading into highly divisive topics around environment
  - Most would agree our natural resources are not unlimited & prudent to use responsibly
  - "Waste not, want not" turns out to be true in more cases than we realize
- If enjoy what we have without flippantly wasting, additional element of ethical behavior appreciated by others

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Avoid Inconsequential Controversies

- Easy to become embroiled in controversy these days
- Share opinion in public (govt meeting or social media) to prove this is true
- "Pick battles that are big enough to matter and small enough to win."
  - Wise, ethical people are not afraid to promote or defend what they believe is right
  - They don't waste influence on petty differences that are of no real consequence
- When we see someone
  - Avoid multiple opportunities to engage in arguments that can't be won
  - So can deliver full impact on debates that matter
  - Tend to admire ethics of that person, even if disagree with them on point debated
- Being ethical doesn't mean being a pushover, it means pushing back only when it is appropriate & necessary

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Create Positive Change Whenever Possible

- Most of us want our lives to matter
- When we are gone
  - We want someone (or some group) to be sad we have departed
  - But thankful we lived because of our influence on them
- Few will have opportunity to influence large number of people in critical event
- Most build legacy one action, relationship, decision, or interaction at a time
  - When those opportunities are overwhelmingly positive
  - Meaning we naturally & regularly bring positive change into lives of others
  - We are respected as being ethical as well as trusted & cherished
- Ethical people seek to leave world better off than when they entered it

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Help Others When You Have The Opportunity

- Even if didn't grow up in Christian tradition, most heard Good Samaritan story
  - Innocent person had been attacked & injured
  - Two people passed by trying to ignore the situation
  - Third, an outcast, stopped to provide medical attention
  - Took victim to a safer place for recovery, even at personal expense
  - This may be most commonly known example of ethical behavior on planet
- Notice compassion has nothing to do with requirement or even responsibility
- All about choosing to make world a better place, one person at a time
- When notice those opportunities & take action according to our ability
  - Will be considered ethical behavior
  - Our standing in eyes of others will grow accordingly

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Share Information Others Deserve To Know

- Transparency is buzzword in modern U.S. culture
- Means not hiding information others should have access to know & understand
  - Publicly traded companies must publish financial results to facilitate informed investment
  - Public officials must disclose finances to protect against conflicts of interest
- In everyday situations
  - Some collect & conceal information to increase own power & control
  - Others share knowledge as long as doesn't break a confidence or confidentiality
- When we share information that will help others
  - Especially when do so without expecting specific financial gain for ourselves
  - People will view us a being highly ethical & will be more likely to share what they know
  - In other words, everyone wins!

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Use Personal Influence For Common Good

- When a politician wins a campaign decisively
  - Other candidates aligned with lead candidate often succeed as well
  - We refer to this expanded benefit to others as "coat tails" of primary candidate
  - Simply means person used influence to benefit others in addition to themselves
- If use same idea in personal or business situations
  - Ethical people don't mind sharing their success with others
  - Helping others succeed along with themselves
- Far more than an ethical principle; it is a worldview
  - Some see world as zero-sum game, we only advance at detriment of someone else
  - But this ethical principle dares to suggest we can advance while helping others advance
  - It brings us very near highest bar of ethical behavior

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Treat Others As You Wish To Be Treated

- Treating others as we want to be treated historically called "Golden Rule"
- Ethic of reciprocity
- Stated positively or negatively in most philosophies & religions through history:
  - That which you hate to be done to you, do not do to another. Ancient Egyptian Maxim
  - Avoid doing what you would blame others for doing. Thales, Ancient Greece
  - Whatever is disagreeable to yourself do not do unto others. Zorastrianism
  - Hurt not others in ways that you yourself would find hurtful. Buddhism
  - Love your neighbor as yourself. Judaism
  - Treat others as you treat yourself. Hinduism
  - That which you want for yourself, seek for mankind. Islam
  - Do to others what you want them to do to you. Jesus

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Treat Others As You Wish To Be Treated

- Saved this last ethical principle as pinnacle of ethical behavior
- Despite simplicity, most difficult to live out in every aspect of our lives & society
- If we are honest, most of us are inherently selfish
  - Simply following our natural tendency in favor of self-preservation
  - If left unchecked, can grow into self-absorption later in life

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Treat Others As You Wish To Be Treated

- In theory, this should be easy
- Simply give others what we expect in return
- We all recognize the challenge
  - Not everyone will return kindness
  - Our sense of justice or fairness is understandably offended
  - We naturally react defensively or even aggressively toward others

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Treat Others As You Wish To Be Treated

- If we maintain maturity & ethical commitment to be unwavering
  - In spite of what others do
  - Results can be astonishing
- Who wouldn't appreciate being treated with respect & dignity we feel deserve?
- We consider that person highly ethical
- Will be true of us when we treat others same way

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Implications

- We may find these principles challenging
- Tempting to dismiss them as too theoretical or impractical for modern life
- To avoid that dismissive temptation
  - Let's consider for a moment what our situations might look like
  - If we truly endeavor to live at highest ethical principles outlined

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Family

- Imagine a household where family members
  - Give each other priority in their schedules
  - Listen to what others are experiencing & have to say
  - Have unshakeable commitment to promises they have made to each other
  - Mutually prioritize needs and aspirations of other family members over their own
- Without intending to minimize very real challenges families face today
  - This one statement covers vast majority of issues that destroy marriages & families
  - We can all do better, especially in relationships closest to us

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Workplace

- Even with highest commitment to family, spend more waking hours at work
  - Have a tremendous opportunity to influence these relationships in positive way
  - Moving past constant competition toward mutual advancement
- Office or workplace politics
  - Sap energy & performance from any organization
  - Struggle against each other instead of working together
- Ethical principles described, when broadly accepted across an organization
  - Lead to healthier environments
  - People more likely to enjoy their work & be successful at it
- Makes organization more successful as an added bonus for everyone

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Community

- Communities & neighborhoods often aren't what they used to be
  - Change became more pronounced during & after COVID 19 pandemic
  - Even if only see neighbors as we enter garages or driveways, still impact one another
- For those of us living in formal subdivisions, covenants
  - Require us to maintain properties
  - Avoid activities that interfere with our neighbors' quiet enjoyment of their homes
- Unfortunately, it often takes a disaster to bring us together
  - Helping one another avoid physical injury, limit damage, or recover from devastation
  - We have opportunities to think of those around us even without a catastrophic event

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Society

- We live in a time of great division
  - To be fair, plenty to be divided about
  - Entire society questions & then tries to reestablish what really matters
  - What, if anything, is universally true & what values do we still share?
- Ethical principles shouldn't discourage passionate debate of issues we face
- Should inform "how" we engage in debate
  - Increasing use of violence to resolve conflict or bring attention to our complaints
  - Just a sign of falling ethical standards
  - Ethical people will use ideas, words & appropriate actions to bring about positive change
  - Approaching those who disagree with respect as fellow human beings
- We don't have to agree, but we can still seek to live in peace with one another, so far as it depends on us.

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Humanity

- For decades, we have said, "the world is getting smaller."
  - Technological advances allow us to travel almost anywhere in world within 24 hours
  - We can also communicate with most everyone on planet instantly
  - We are aware of major events in real-time, as they are happening
- This means we are more aware of each other than ever before
  - Understanding our similarities & differences, how we impact each other through decisions
  - Regardless of our personal positions, we recognize that topics such as global warming, renewable energy, financial globalization, free trade and tariffs, biological and nuclear weapons, as well as spread of pandemics all point to our collective impact on rest of world
- Ethical perspectives needed for global challenges more than any previous time

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Conclusion

- Ethical behavior doesn't mean
  - We must allow ourselves to be taken advantage of
  - We have to give away our goods & services in marketplace
- Making a good living, protecting our family, defending our rights are all ethical
- Ethical principles are about
  - How we live our days
  - How we interact with other people in our lives & sharing our world

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Conclusion

- It's true, some unethical people appear to achieve their goals faster
- However, ethical people tend to have different set of priorities
  - Not only include financial success
  - Also include healthy relationships, less stress, more pride in who they are as human beings
  - Pursuit of financial success is perfectly appropriate, but life is about more than just money
- For our lives to matter, over the long-term, we must leave the world a little better as a result of us being here.

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Conclusion

Are we seeking the greatest good?

If we are pursuing an ethical lifestyle, we are more likely to enjoy the journey and attract the highest quality of friends and colleagues to travel along with us.

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Big Ideas

1. Personal Ethics are the rules or standards that govern our decisions.
2. The common theme in ethics through history is answering: What is the greatest good?
3. Different cultures value different things, which result in significantly varying ethical expectations.
4. Practically speaking, our acceptance of responsibility toward other people often depends on how closely they are related to us or how regularly we interact with them.
5. Reputation matters and a good reputation may be one of the most valuable belongings we have throughout our lives.
6. The Golden Rule is considered the pinnacle of ethical behavior.
7. Ethical people tend to have priorities that not only include financial success, but also include healthy relationships, less stress, and more pride in who they are as human beings.

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Application Questions

1. "Solitary confinement" is historically understood to be a punishment because none of us can live fulfilling lives in complete isolation from other fellow humans.
   a. True
   b. False

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Application Questions

2. Ultimately, every topic of significance in the world comes back to _____.
   a. Money & power
   b. Personal comfort
   c. Relationships between people
   d. Personal improvement

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Application Questions

3. Written laws _____ address every expectation of behavior.
   a. Usually
   b. Rarely
   c. Always
   d. Don't

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Application Questions

4. People who choose to act more ethically generally do so for which reason(s)?
   a. Personal moral or spiritual convictions
   b. Expectations of other influencers
   c. Doing so is more advantageous
   d. All of the above

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Application Questions

5. How the use of special knowledge should be governed when providing a service to the public can be considered a moral issue and is termed "_____ ."
   a. Personal Ethics
   b. Business Ethics
   c. Professional Ethics
   d. Collective Ethics

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Application Questions

6. One of the earliest examples of professional ethics is the _____ oath to which medical doctors still adhere to this day.
   a. Hypocritic
   b. Hippocratic
   c. Hellenistic
   d. Hedonistic

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Application Questions

7. The common theme in the historical progression of ethics is an answer to one question in every situation we face:
   a. What is the greatest good?
   b. How can I help humanity?
   c. What is best for me?
   d. How can I help my neighbor?

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Application Questions

8. "Ethical behavior" is not contextual, meaning it is consistent based on location and culture.
   a. True
   b. False

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Application Questions

9. In other cultures, an agreement (even written) is simply the starting point for negotiations that continue throughout the life of a project, even through final payment.
   a. True
   b. False

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Application Questions

10. Different cultures value different things, which result in significantly varying ethical expectations. Lack of appreciation for this point is the source of:
    a. Frustration
    b. International legal proceedings
    c. Wars
    d. All of the above

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Application Questions

11. We are more likely to be concerned with what we see and what affects us daily than on issues we only hear about and may never experience firsthand.
    a. True
    b. False

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Application Questions

12. "Live at peace with everyone, as far as it depends on you" is a _____ application.
    a. Controversial
    b. Conversational
    c. Situational
    d. Tactical

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Application Questions

13. The application of ethical principles may also be seen as a hierarchy based on _____.
    a. Spiritual convictions
    b. Family expectations
    c. Local laws
    d. Relationships

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Application Questions

14. A good _____ may be one of the most valuable belongings we have throughout our lives.
    a. Career
    b. Reputation
    c. Stock option
    d. Employment agreement

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Application Questions

15. Ethics is not a clear science but more of a complex art, so there is room for constructive disagreement on details.
    a. True
    b. False

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Application Questions

16. The Hippocratic oath says:
    a. Treat others as you want to be treated
    b. Do the greatest good possible
    c. First do no harm
    d. Don't lie to other people

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Application Questions

17. Adherence to laws has no place in our ethical principles.
    a. True
    b. False

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Application Questions

18. Our culture teaches us to:
    a. Take credit whenever we can
    b. Avoid blame whenever possible
    c. Both of the above
    d. None of the above

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Application Questions

19. Simply being aware of the needs and desires of others and deferring when we can dramatically raises the perception of our ethical behavior.
    a. True
    b. False

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Application Questions

20. Viewing someone as ethical and trusting them are closely linked.
    a. True
    b. False

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Application Questions

21. We tend to judge ourselves relative to:
    a. Others we know
    b. Our hero figures
    c. Our parents' expectations
    d. The law

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Application Questions

22. Just because we can do something doesn't mean we should.
    a. True
    b. False

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Application Questions

23. According to our text, the most commonly known example of ethical behavior on the planet is:
    a. The Buddha
    b. The Prophet
    c. Robin Hood
    d. The Good Samaritan

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Application Questions

24. The principle of treating others as we want to be treated is historically called the "_____."
    a. Golden Rule
    b. Golden Parachute
    c. Golden Egg
    d. Golden Watch

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Application Questions

25. Making a good living, protecting our family, and defending our rights are all ethical undertakings.

a. True

b. False

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Additional Resources

What Are Ethical Values in Business?

https://leaders.com/articles/company-culture/ethical-values/

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File Attachments for Item:

EC-10 The Plumbing Industry (ICC)

All certifications (3 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: Country Club Hills

State *: IL

Zip Code *: 60478

Website: iccsafe.org

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: The Plumbing Industry

Course instructor: Matthew Winn

Course description:

Explore the challenges, roadblocks, and opportunities plumbing professionals face in today's rapidly evolving business environment. Hear from the experts in the field about what they're facing and talk with others in the industry about best practices in safety, codes, new technologies, and more

Instructional hours per session: 3

Number of Sessions: 1

Course Date: 2023-10-09

Course Location: St. Louis, MO

Special Content

- ☐ Code Administration
- ☐ Existing Buildings
- ☐ Electrical Instruction
- ☑ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☑ No

☐ On Demand ☐ Webinar

Course Website:

535

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- [ ] Residential Certifications Only
- [x] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [x] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
The Plumbing Industry Today -outline & ppt.pdf	1.12 MB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

The Plumbing Industry Today

Moderator:

- Matthew Winn, SVP of Training, International Code Council

Participants:

- Matt Sigler, Executive Director of PMG, International Code Council
- Terry Smith, Owner, American Plumbing & Past Chair of Louisiana State Plumbing Board
- James A. Richardson Jr., Plumbing Inspection Supervisor, City of Columbus, OH
- Ned Dickey, U.S. Product Compliance Manager, Hansgrohe

Description/Goal:

- Explore the challenges, roadblocks, and opportunities plumbing professionals face in today's rapidly evolving business environment. Hear from the experts in the field about what they're facing and talk with others in the industry about best practices in safety, codes, new technologies, and more.

Learning Objectives:

- Articulate the key challenges found in today's plumbing industry.
- Explore the roadblocks to success for plumbing related organizations.
- Identify new opportunities within the plumbing industry.
- Agree on ways ICC can facilitate success within the plumbing industry.

Timed Outline:

- Panel Discussion
    - Key challenges found in today's plumbing industry, 20 minutes
    - Roadblocks to success for plumbing related organizations, 20 minutes
    - New opportunities within the plumbing industry, 20 minutes
    - Ways to facilitate success within the plumbing industry, 20 minutes
    - Question & Answer session, 10 minutes
- Small Group Rotating Breakout Sessions
    - Business related topics, 20 minutes
    - Codes related topics, 20 minutes
    - Regulatory topics, 20 minutes
    - Supplies & manufacturing topics, 20 minutes
    - Final Session Action Items, 10 minutes

Matthew Winn
Senior Vice President of Training

Winn joined the International Code Council in early 2022 when his company (devoted to training construction contractors) was acquired and he took over responsibility for the combined training endeavors of ICC. He holds a Bachelor's degree in Accounting, a Master's of Business Administration degree in Executive Leadership, and active CPA licenses in Texas & Georgia. He is a licensed plumbing inspector, an OSHA Authorized Instructor, and NCCER Master Trainer. Before leading his own business, Matthew previously served as the Chief Financial Officer of three companies, the Divisional Vice-President of Operations for a publicly traded company, and President of a Financial Services company. Matthew is the author or editor of over 20 training curriculums developed for professionals in the construction trades and has personally taught in over a dozen countries around the world.

The Plumbing Industry Today

Challenges | Opportunities | Actions

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Use this QR Code or URL to Sign In & Sign Out

(Automates CEU/CPE Credits in "myICC" Account)

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INSTRUCTOR

Matthew Winn

- Senior Vice President of Training
- International Code Council, Inc.
- MBA, CiRM, CGMA, CPA
- NCCER Master Trainer
- OSHA Authorized Instructor
- Licensed Plumbing Inspector (TX)
- Former CEO, Winn's Career Education
- mwinn@iccsafe.org

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GOAL & OBJECTIVES

This session explores the challenges, roadblocks, and opportunities plumbing professionals face in today's rapidly evolving business environment.

1) Articulate key challenges in today's industry
2) Explore roadblocks to success
3) Identify new opportunities
4) Agree on ways ICC can facilitate success

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Panelists

Matt Sigler	Terry Smith	James Richardson	Ned Dickey
ICC PMG Group	American Plumbing	City of Columbus, OH	Hansgrohe

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COURSE OUTLINE

- Panel Discussion
  - Key challenges
  - Roadblocks to success
  - New opportunities
  - Ways to facilitate success
- Small Group Discussions
  - Business
  - Codes
  - Regulatory
  - Supplies & Products

8

Panel Discussion

1. Key challenges found in today's plumbing industry
2. Roadblocks to success for plumbing related organizations
3. New opportunities within the plumbing industry
4. Ways to facilitate success within the plumbing industry
5. Question & answer session

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Small Group Discussions

1. Matt Sigler: Codes
2. Terry Smith: Business (and Regulatory)
3. James Richardson, Jr: Regulatory
4. Ned Dickey: Supplies & Manufacturing
5. Matthew Winn: Training & Development

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Thanks for Allowing Us to Serve You!

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International Code Council, Inc.
Training Department

888-ICC-SAFE, Ext 33821
Learn@ICCSAFE.org

Building Professional Careers!

Template by Matthew Winn, SVP of Training, ICC (V.23.06-1)

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File Attachments for Item:

EC-11 The Tiny House (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

Website: https://www.iccsafe.org/edu

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: The Tiny House

Course instructor: John Gibson

Course description:

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

- ☐ Code Administration
- ☐ Existing Buildings
- ☐ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☐ No

☐ On Demand ☐ Webinar

Course Website:

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

546

Course applicable for the following certifications *

- [x] Residential Certifications Only
- [ ] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [x] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PPT_The Tiny Houses 2023 ICC ABM- St. Louis (1).pdf	3.53 MB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information
1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

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   b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
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4. Course date(s) and location: not necessary at this time, enter if known.

Special Content
1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

The Tiny House, Building It Right
Based on the 2021 International Residential Code
(90 minute- seminar)

Description:

This seminar provides an overview of how the 2021 International Residential Code (IRC) relates to the construction of tiny houses. It will present some of the key concepts of conventional residential construction practices with an emphasis on the relaxed requirements that are specific to tiny houses, found in the IRC Appendix AQ Tiny Houses.

Objectives:

At the end of this presentation, attendees will be better able to:

1) Understand the scope and application of the IRC to tiny house construction
2) Identify those provisions that establish general building provisions and egress from tiny houses
3) Recognize the special relaxed provisions regarding lofts that are contained in the Appendix AQ of the IRC
4) Identify some of the building service requirements in the IRC for electrical, plumbing, mechanical, and energy that could pertain to tiny house construction

Timed Outline: 90 minutes / 1.5 hours

Introduction:	15 minutes
Sitework and Foundations:	10 minutes
Framing, Siding and Roofing:	10 minutes
Living Environment and Home Safety:	10 minutes
Lofts, Appendix AQ:	15 minutes
Mechanical, Plumbing, Electrical:	15 minutes
Energy and Alternatives:	10 minutes
Closing:	5 minutes
	90 minutes

John M. Gibson, Jr., M.C.P., C.B.O., C.P.C.A., C.F.M. –

John is a Technical Manager and Instructor for the International Code Council (ICC). A certified Master Code Professional and Certified Fire Marshal; he has forty (40) other certifications, including thirty- three (33) from the ICC. Having earned a B.S. in Engineering from the University of Delaware, he has also studied Architecture at Georgia Tech and completed courses in Emergency Management and Fire Prevention at the National Emergency Training Center. Formerly the Director of the Department of Permits and Inspections for Frederick County Maryland, he is an ICC Honorary Member, has served on the ICC- Evaluations Services (ICC- ES) Board of Directors, the ICC Code Correlating Committee, the Board of Directors for BOCA International, Inc., Maryland's Governor's Smart Code Strategy Group, Chaired the ICC Board for International Professional Standards and is an Honorary Member and Past President of the Maryland Building Officials Association. He currently teaches ICC administrative, building, residential, existing building, property maintenance, zoning, green building, wildland/urban interface, energy courses, and is a contract instructor at the Dept. of Homeland Security, United States Fire Administration, National Fire Academy, and Emmitsburg, MD. He received the ICC Educator of the Year award in 2010.

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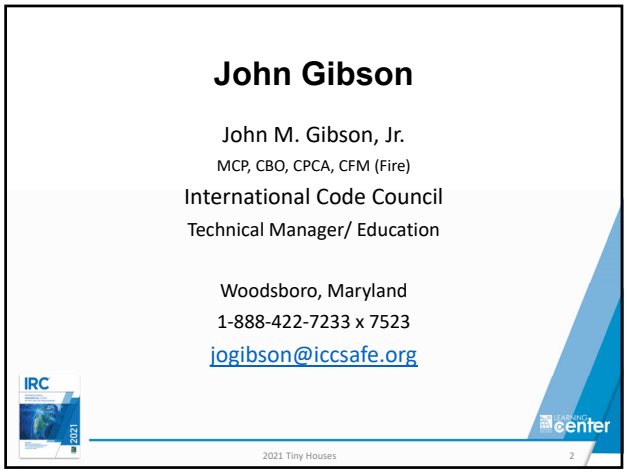

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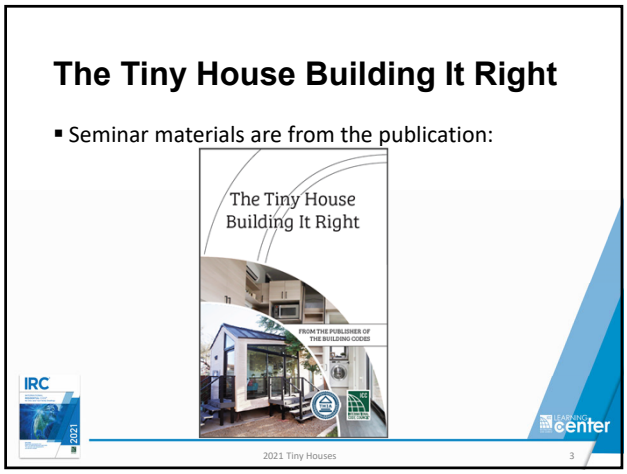

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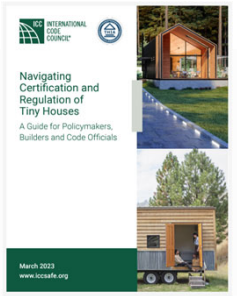
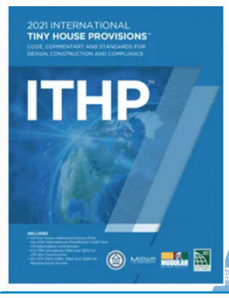
ICC Resources

https://www.iccsafe.org/tinyhomes/





2021 Tiny Houses 4

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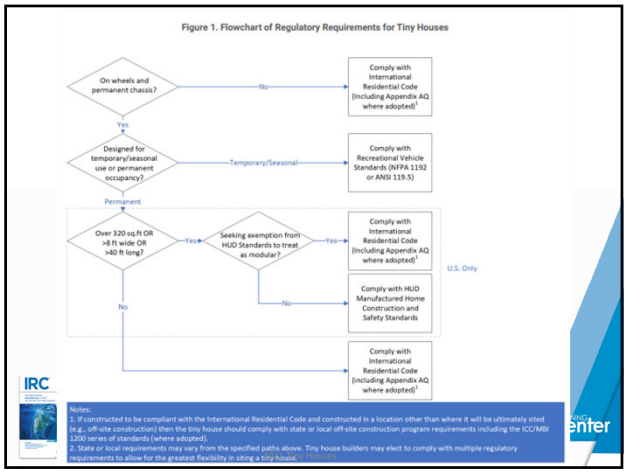

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Tiny Houses and the IRC

Moves in recent code editions:

- Removed: minimum floor area of 120 sf for one habitable room
- Added: Ship's ladders & Alternating tread devices
  - Egress from lofts ≤ 200 sf
- Added: Appendix AQ

2021 Tiny Houses 7

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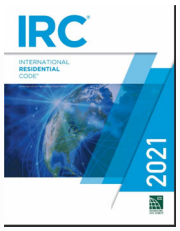
Appendix AQ Tiny Houses

- Appendix chapters not in effect unless adopted
- Supplemental or specialized information
- Alternative methods
- Sometimes moved into body of code in future



2021 Tiny Houses 8

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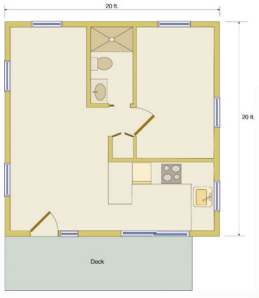
Appendix AQ Tiny Houses

- Tiny house ≤ 400 sf excluding lofts
- Relaxed provisions:
  - Sleeping / storage lofts
  - Compact stairs
  - Ladders
  - Guards
  - Ceiling heights
  - Emergency escape
  - Energy provisions



2021 Tiny Houses 9

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Types of Tiny Houses

- IRC regulates dwellings
  - Permanent living facilities and utilities
  - On a foundation
    - Built on site or
    - Constructed elsewhere and placed on a foundation at the site
- IRC silent regarding tiny houses on wheels
  - Zoning: recreational vehicle
  - Stay limited on residential lot

IRC 2021 LEARNING center

2021 Tiny Houses 10

10

Zoning

- Ordinances are variable (not based on a model code)
- Historically a hurdle to tiny houses
- Regulate land use
- Intent to protect the public health, comfort, safety and welfare
- Minimum / max. size of dwelling units
- Density
- Height
- Styles and exterior finishes

IRC 2021 LEARNING center

2021 Tiny Houses 11

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Zoning

- Many jurisdictions now accepting tiny houses
  - Economic benefits for citizens
  - Environmental benefits
  - Low-income housing
  - Housing for people experiencing homelessness

IRC 2021 LEARNING center

2021 Tiny Houses 12

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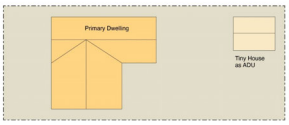
Accessory Dwelling Units (ADUs)

- Fully functional dwelling unit
  - Kitchen, bathroom & sleeping space
- Smaller & accessory to primary dwelling
- Attached or detached
- May be tiny house if permitted by ordinance
- Other names for ADUs:
  - Guest houses or guest cottages
  - Granny flats
  - In-law suites



2021 Tiny Houses 13

13

ADU & Tiny House Design Consideration

- Zero-entry design (Optional)
  - Aging in place
  - Exterior landing level with floor
  - Removes steps
  - Helps prevent injuries
  - Ease of access throughout
  - Increase size of interior doors

2021 Tiny Houses 14

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The Building Department

- Health, safety and welfare
- Minimum acceptable standards
- IRC as model code adopted by reference
- Processes:
  - Plans
  - Permits
  - Inspections
  - Certificates of occupancy

2021 Tiny Houses 15

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Alternative Materials and Methods of Construction

- Code is specific in its intention to not exclude the use of any material or method of construction
- Obligation to approve alternatives meeting intent of IRC
- Examples:
  - Post or pier foundation
  - Shipping containers
  - Appendix AQ when not adopted

16

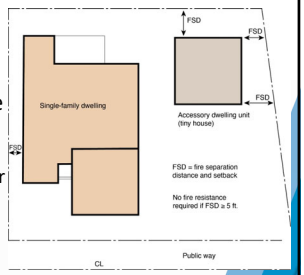
Sitework

Chapter 2

17

Fire Separation Distance

- Measured perpendicular to the exterior wall
- Measured between the building and:
  - Lot lines
  - Centerline of a street or alley
- No fire resistance required when maintaining 5 ft. FSD



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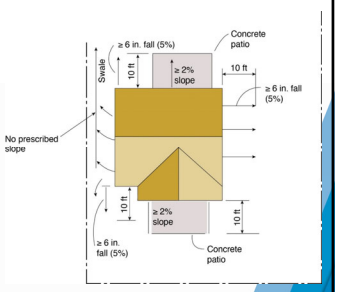
Storm Drainage

- 6 in. fall in 10 ft. from foundation (5%)
- Exceptions when approved
- Impervious surfaces 2%
- To approved location



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Foundations

Chapter 3

20

Foundation materials

- Prescriptive
  - Continuous concrete footings
    - Concrete or CMU walls
    - Crawl space
    - Slab-on-ground
- Alternatives
  - Pier or post foundation
    - Cost-effective

21

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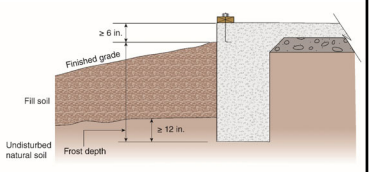
Footings

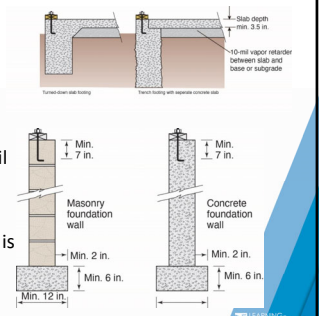
- Footings must bear on undisturbed ground
- Footings protected from frost
- Exterior footings 12 in below undisturbed ground level
- Detrimental materials removed prior to placing concrete



22

Sizing Concrete Footings

- IRC prescribes width of continuous footings
  - Method of construction
  - Type of foundation
  - Ground snow load
  - Load-bearing value of soil
- For tiny houses:
  - Min. 12-in wide by 6-in deep continuous footing is typically adequate



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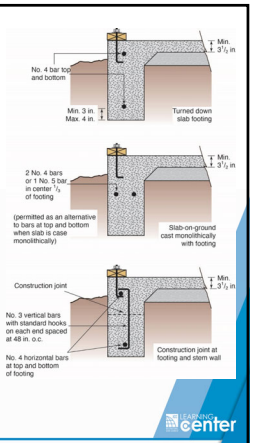
Reinforcing

- No reinforcing in SDC A, B, C
- Reinforcing prescribed in SDC D_0, D_1 or D_2
  - Spread footing and stem walls
  - Slab-on-ground



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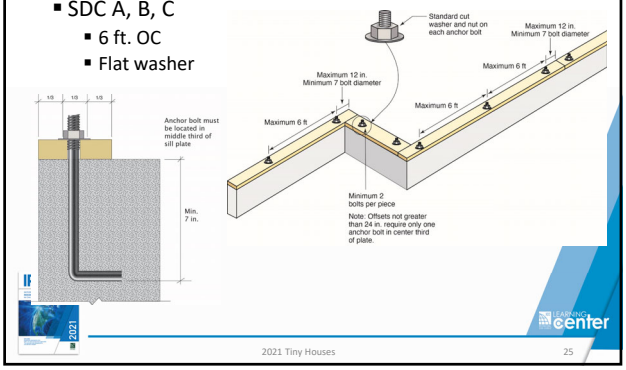
Foundation Anchorage

- SDC A, B, C
  - 6 ft. OC
  - Flat washer



2021 Tiny Houses 25

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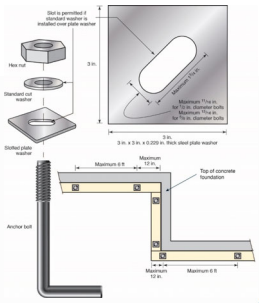
Foundation Anchorage

- SDC D_0, D_1 and D_2
  - 6 ft. OC
  - 3-in x 3-in plate washers approximately ¼ in thick



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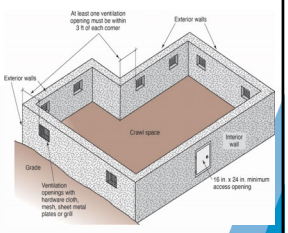
Crawl Spaces

- Ventilation of crawl space required
  - Circulate air
  - Dissipate condensation
- Method of ventilation
  - Foundation openings
  - Mechanical exhaust ventilation
  - Connection to the conditioned air supply of the dwelling
- Access to underfloor spaces
  - 18 in x 24 in through floor
  - 16 in x 24 in through perimeter wall



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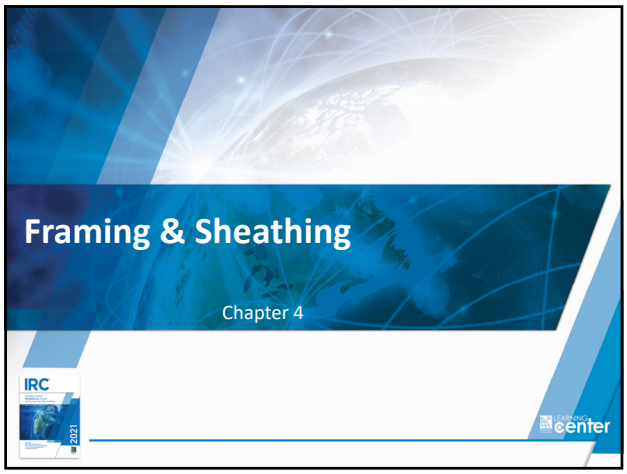

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Engineered Wood Products

- LVL or SCL typically used for ridge beams in tiny houses
- Types of products
  - Plate-connected open web trusses
  - I-joists
  - Glued-laminated lumber
  - Laminated veneer lumber (LVL)
  - Other structural composite lumber (SCL)

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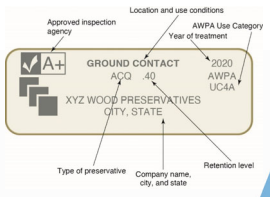
Wood Treatment

- Wood in locations subject to decay requires:
  - Wood treated with preservatives; or
  - Naturally durable wood
    - Redwood
    - Cedar



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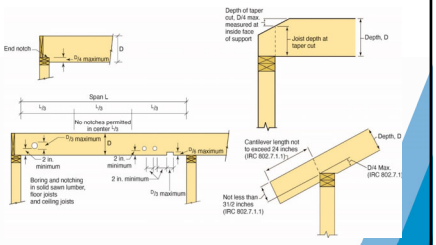
Cutting, Boring and Notching

- Floor & roof framing:



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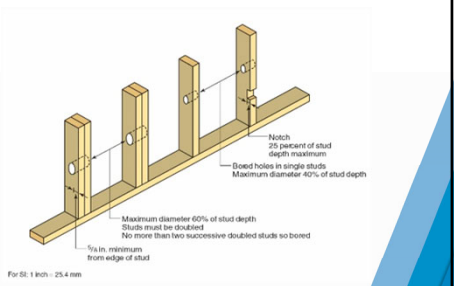
Cutting, Boring and Notching

- Exterior walls and interior bearing walls



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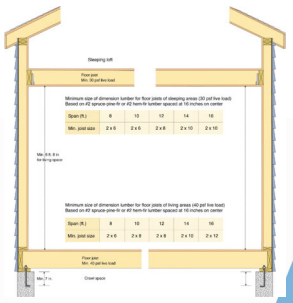
Floor framing

- Support beams
- Floor joists
  - Live load 40 psf
  - Sleeping live load 30 psf
- Floor sheathing
- Necessary connections



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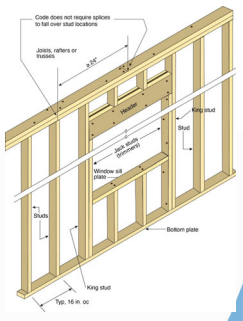
Wall framing

- Single-story tiny homes
  - 2 x 4 or 2 x 6 studs 16 in. or 24 in. OC
- Wood structural panel sheathing
  - Blocking between studs at horizontal joints
  - Fastener spacing is 6 in. OC at panel edges and 12 in. OC intermediate



2021 Tiny Houses 34

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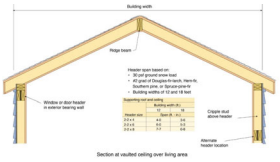
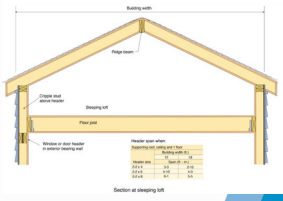
Headers

- The prescriptive tables for headers provide the span and bearing support (jack stud) requirements for dimension lumber headers
- Headers in tiny homes typically require only one king stud and one jack stud at each end
- See figure for spans





2021 Tiny Houses 35

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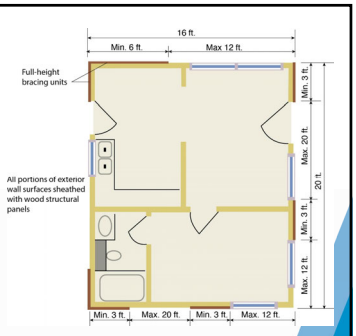
Wall Bracing

- Simplified bracing method
  - Wood structural panels on all exterior wall surfaces
  - Typically two panels (bracing units) required on each side of building
  - Min. 3 ft. length of bracing unit
  - SDC A, B or C
  - Ultimate design wind speeds ≤ 130 mph



2021 Tiny Houses 36

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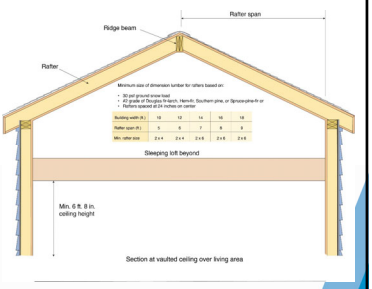
Roof framing

- Prescriptive rafter tables:
  - Snow load of the geographic area (roof live load of 20 psf if snow loads less than 30 psf)
  - Ceiling material attached or not attached to the bottom of the rafter
- Rafters line up opposite each other at the ridge and are typically framed to a ridge board.
- Ridge beam required if no ceiling joists



IRC 2021

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Roofing & Siding

Chapter 5

IRC 2021

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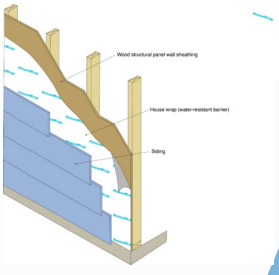
Water-resistant barrier

- 3 components of a weather-resistant exterior wall assembly:
  - Water-resistive barrier required over sheathing of all exterior walls
    - Approved house wrap
  - Flashing
  - Siding or veneer



IRC 2021

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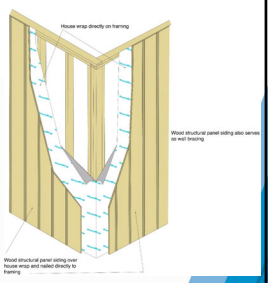
Water-resistant barrier

- Water-resistive barrier directly over studs
  - Approved house wrap
- Wood structural panel siding
  - Serves as wall bracing



2021 Tiny Houses 40

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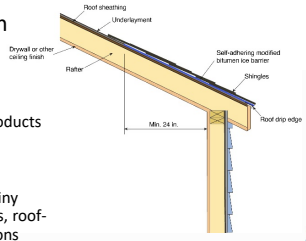
Roof covering

- Weather protection system:
  - Underlayment
    - Felt or new manufactured products
  - Ice barriers
  - Flashing
    - Simple roofs for tiny houses (no valleys, roof-to-wall intersections
  - Roofing material



2021 Tiny Houses 41

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Healthy Living Environment

Chapter 6

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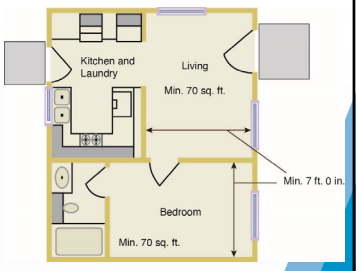
Room areas

- Prior to 2015 IRC : one habitable room ≥ 120 sf
  - a barrier to tiny house construction
  - requirement removed
- Habitable rooms
  - ≥ 70 sf
  - ≥ 7 ft dimension



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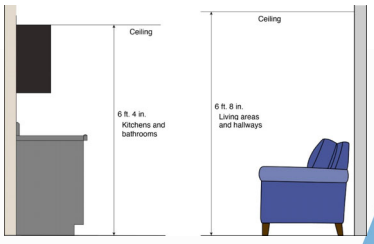
Ceiling Height

- Generally 7 ft.
  - 6 ft. 8 in. bath, laundry, basement
- Appendix AQ Tiny Houses
  - 6 ft. 8 in. living areas
  - 6 ft. 4 in. kitchen and bath
  - Lofts covered in Ch. 8



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Home Safety

Chapter 7

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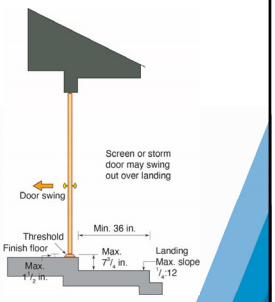
Exterior exit door

- Swinging side-hinged exterior egress door
- Net opening of 32 in. by 78 in.
- Max threshold height 1 ½ in.
- Landing 36 in. direction of travel
- Landing max. 7 ¾ in. below top of threshold
  - Door swings in



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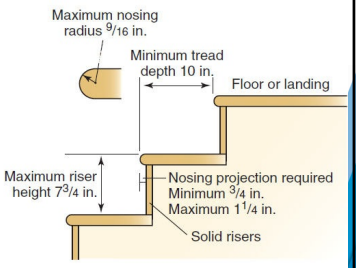
Stairs

- Other than loft stairs (covered later)
- Typically exterior stair
  - Riser ≤ 7¾ in.
  - Tread ≥ 10 in.
  - Variance ≤ ⅜ in.
  - Nosing projection ¾ - 1¼ in.



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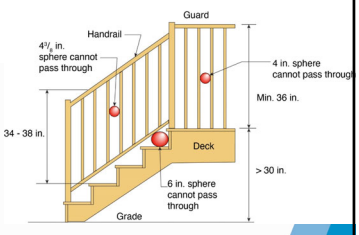
Guards

- Openings shall not allow a 4-in. sphere to pass through
  - 4 ⅜ in. along stairs
- Top rail to resist concentrated load of 200 lbs.
- Infill components to resist 50-lb. horizontal load applied to an area of 1 ft²



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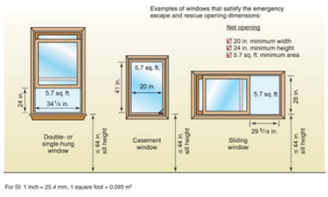
Emergency Escape and Rescue Openings



- Sleeping rooms
- Basements (not typical for tiny house)
- Minimum width = 20”
- Minimum height = 24”
- Minimum area = 5.7 ft^2
  - 5.0 ft^2 for grade floor openings

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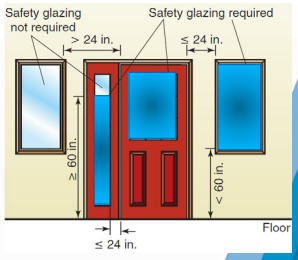
Safety Glazing

- In doors
- Adjacent to doors
  - Within 24 in.
  - < 60 in. above floor



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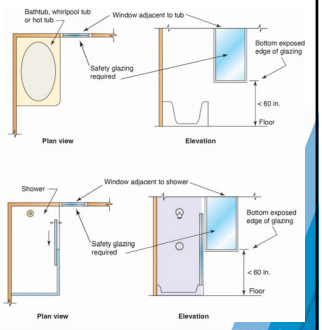
Safety Glazing

- Tub/shower enclosure
- Adjacent to tub/shower



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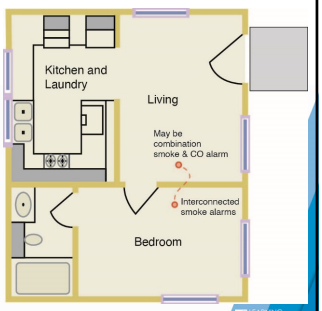
Smoke Alarms

- In each sleeping room
- Outside each sleeping area
- On each story
- Building wiring system to provide primary power
- Battery backup
- Interconnection



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Carbon Monoxide Alarms

- Required if
  - Fuel-fired appliance or
  - Attached garage communicating with dwelling unit
    - Garage unusual for tiny home
- Locations
  - Outside of each separate sleeping area
- House wiring with battery backup
- Interconnection if two or more alarms

2021 Tiny Houses 53

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Automatic Fire Sprinkler Systems

- IRC required in:
  - New dwellings
- Design criteria:
  - IRC Section P2904
  - NFPA 13D
- Often amended out of code locally

2021 Tiny Houses 54

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Lofts- Appendix AQ

Chapter 8

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Lofts and the IRC

- IRC has previously recognized lofts ≤ 200 sf with ship's ladder or alternating tread device
- IRC Appendix AQ, Tiny Houses, when adopted
  - Tiny house ≤ 400 sf excluding lofts
  - Loft area and reduced ceiling heights
  - Compact stairs and ladders for access and egress to lofts
  - Lower loft guard heights
  - Relaxed emergency escape and rescue from lofts

2021 Tiny Houses 56

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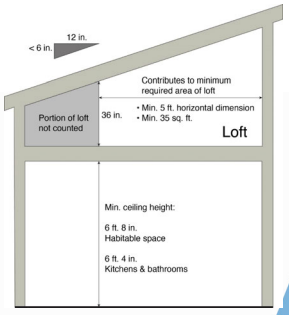
Loft Dimensions

- Loft area ≤ 35 sf
- Min. horizontal dimension 5 ft.
- Ceiling height ≥ 3 ft. to count for the above dimensions



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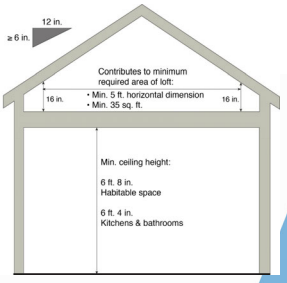
Loft Dimensions

- Exception if roof/ceiling slope is ≥ 6:12
  - Ceiling height ≥ 16 in. to establish area and horizontal dimension above



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Loft stairs

- Compact (steeper) stairs are allowed
  - Tread depth = 20 inches – (4/3 x riser height)
  - Riser height = 15 inches - (3/4 x tread depth)

Note: Either formula gives same result.

Riser height (in.)	Tread depth (in.)
7 (min.)	10 ¾
7 ½	10
8	9 ¼
8 ½	8 ¾
9	8
9 ½	7 ¼
10	6 ¾
10 ½	6
11	5 ¼
11 ½	4 ¾
12 (max)	4

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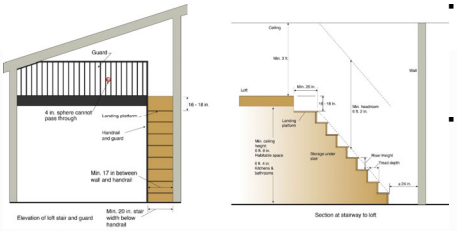
Loft stairs

- Width
  - ≥ 17 in. at or above handrail
  - ≥ 20 in. below handrail
- Headroom ≥ 6 ft. 2 in.
- Landing platform at top of stair if loft ceiling < 6 ft. 2 in.
  - ≥ 20 in. width and depth
  - 16 in. – 18 in. riser height
- Bottom landing ≥ 24 in. in direction of travel



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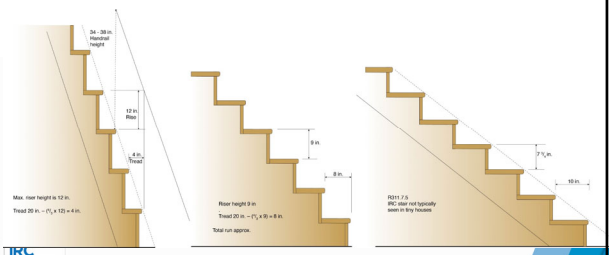
Loft stairs



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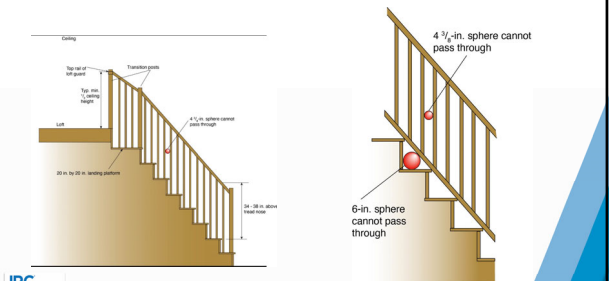
Loft stair guard and handrail



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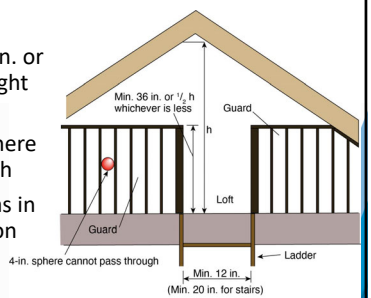
Loft Guards

- Guard height ≥ 36 in. or ½ of loft ceiling height (whichever is less)
- Spacing so 4-in. sphere cannot pass through
- Stair guards same as in body of code Section R312



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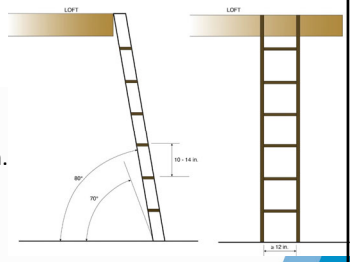
Loft Ladder

- Rung width ≥ 12 in.
- Rung spacing 10 – 14 in.
- Incline 70 – 80 degrees
- Support 300-lb load



2021 Tiny Houses 64

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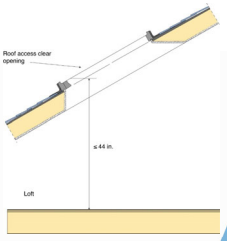
Emergency Escape and Rescue Openings

- Appendix AQ allows egress roof access window
- Same net opening dimensions as EERO in body of code
  - Max 44 in. above floor



2021 Tiny Houses 65

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Mechanical

Chapter 9

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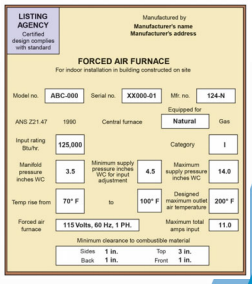
Heating for tiny houses

- Single heat source is possible
- Direct-vent appliances
- Electric heat
- In-floor heat



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Whole-house Mechanical Ventilation

- Prescriptive airflow rate based on:
  - Floor area of dwelling unit
  - Number of bedrooms
  - Continuous or intermittent
- System design
  - One or more supply or exhaust fans, or a combination
  - Outdoor air ducts connected to the return permitted to supply ventilation

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Bathrooms with Mechanical Ventilation

- Referred to as local exhaust by the code
- Minimum ventilation rate for a bathroom
  - 50 cfm for intermittent operation or
  - 20 cfm for continuous operation
- Bathroom fans may be considered as a component of whole-house mechanical ventilation

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Combustion Air

- Gas-fired appliance:
  - From an indoor space with volume ≥ 50 cu. ft. per 1000 Btu/h input rating of all appliances, or
  - Obtained from outdoors
- Direct vent draws all combustion air from outdoors
  - Air intake located adjacent to the gas vent termination
  - In accordance with the manufacturer's instructions

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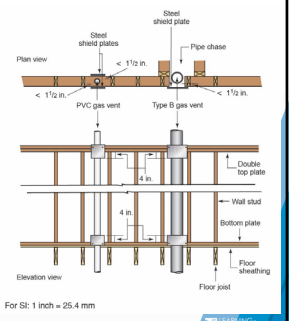
Vents

- Gas appliance vents listed and labeled for use with the type of appliance
  - (except plastic for Cat IV appliances)
- Clearance to combustibles per listing
- Protection from damage
  - < 1½ inches from the edge of the framing
  - fastener shield plate of 16-gauge steel



For SI: 1 inch = 25.4 mm

2021 Tiny Houses 71

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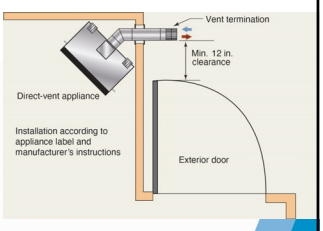
Direct-vent Appliance Vents

- Draw all combustion air directly from outside
- Produce lower-temperature flue gases
- Vented through the exterior wall and terminate near the combustion air intake location
- Clearance to openable window or door
  - ≥ 6 in. for an appliance ≤ 10,000 Btu/Hr
  - ≥ 9 inches for a rating up to ≤ 50,000 Btu/Hr.
  - ≥ 12 in. clearance above finished grade
  - Manufacturer's instructions



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Plumbing

Chapter 10

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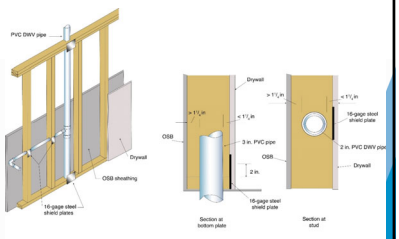
Pipe Protection from Damage

- Concealed piping installed through studs, joists or rafters
- < 1¼ in. from nearest edge
  - Shield plates ≥ 0.0575" thick steel (No. 16 Gage)
    - Covers area where the pipe passes through
    - Extends ≥ 2" above sole plates and below top plates
- Exception for cast-iron and galvanized steel pipe



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Testing of Piping Systems

- Building sewer
  - Water test ≥ 10-foot head of water
- DWV system requires
  - Water test ≥ 10-foot head of water
  - Air test maintaining 5 psi pressure
  - Vacuum test maintaining 5 psi of negative pressure
- Water supply system
  - Water pressure ≥ working pressure of system
  - Copper and PEX air at ≥ 50 psi
- All tests must be maintained for 15 minutes without leakage.

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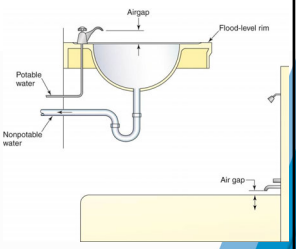
Water Supply Protection

- Listed backflow prevention devices
  - Hose connections
  - Boilers
  - Heat exchangers
  - Lawn irrigation systems
- Air gap
  - Sinks, lavatories and bathtubs



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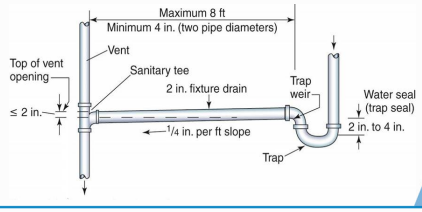
Fixture Vents

- The distance from the trap to the vent is limited
  - Self-siphoning fixtures such as water closets are not limited
- Vent connection is not permitted to be below the trap weir



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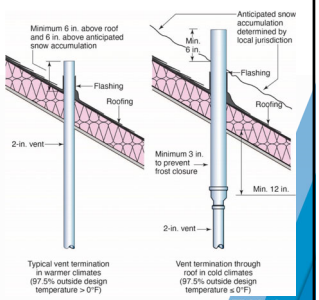
Vent Termination

- Open vents
  - ≥ 6 in. above roof
  - ≥ 6 in. above anticipated snow accumulation
- Frost closure
  - 97.5% outside design temperature ≤ 0°F
  - Increase to 3 in. at point ≥ 12 in. inside building envelope



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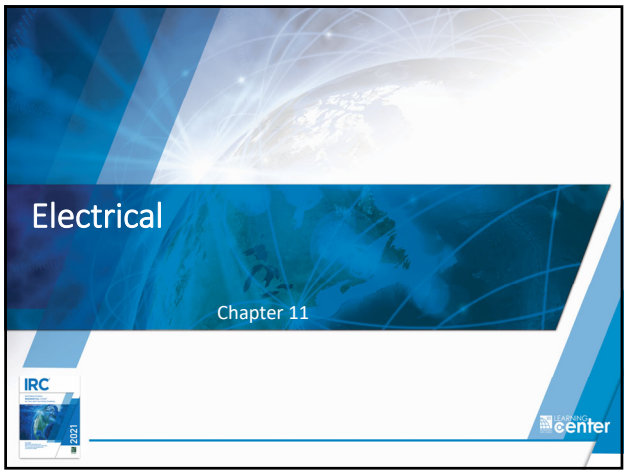

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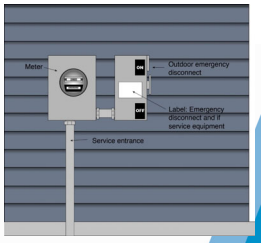
Electrical Disconnect and Surge Protection

- Emergency disconnect is required outside the building
- Sign identifying purpose and if
  - Service disconnect
    - Yes or no
  - Meter disconnect
- Surge protection device
  - Located integral to or adjacent to service equipment



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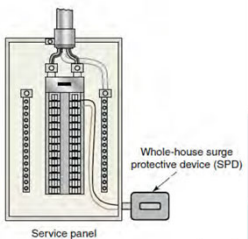
Electrical Service Size and Rating

- Minimum service size is 100 amps
- 100-amp service typically:
  - No. 4 AWG copper or
  - No. 2 AWG aluminum



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Required Branch Circuits

Table 11-1 Required Branch Circuits

Area or appliance served	Circuit(s)	Circuit may also serve	Alternate
Kitchen countertop receptacles	Min. two 20-amp small appliance circuits	Other receptacle outlets in kitchen, and dining areas	Appliances may be served by an individual 15-amp circuit
Bathroom receptacle outlet(s)	Min. one 20-amp circuit	–	Circuit dedicated to a single bathroom may supply lights, fan and other equipment in that bathroom
Laundry area receptacles	Separate 20-amp circuit	–	–
Central heating equipment	Individual branch circuit sized for equipment	–	–

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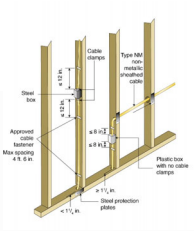
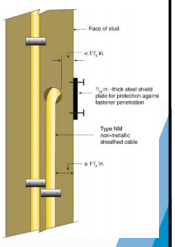
Type NM Cable

- Protection for concealed cable
  - < 1 ¼ in. from face of stud
  - Requires steel shield plate





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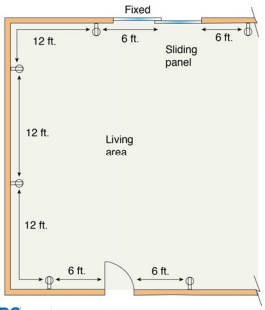
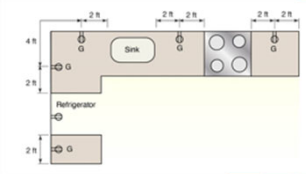
Receptacle Outlet Locations



- Habitable rooms
  - General receptacles
  - Within 6 ft. at any point along wall
- Kitchen Counters
  - Within 2 ft. at any point along counter



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Ground-fault Circuit Interrupter (GFCI) Protection

- GFCI protection required at receptacles
  - Bathroom
  - Laundry
    - Including electric dryer
  - Kitchen counter
  - Exterior
  - Crawl space (receptacles and lighting)
  - Other potentially wet or damp areas

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Arc-fault Circuit Interrupter (AFCI) Protection

- Detect unwanted arcing in branch circuit wiring
- Open circuit before excessive heat buildup can cause fire
- Installed in service panel or subpanel
- Required for
  - Living areas, Hallways, Closets
  - Lighting and Smoke alarm outlets
- Not required in areas requiring GFCI protection

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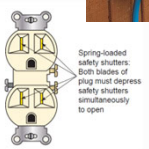
Receptacles

- Wet locations
  - Weatherproof enclosure when cord plugged in
  - Prohibited in or over tubs or showers and within 3 ft.
- Tamper-resistant receptacles
  - In locations accessible to children



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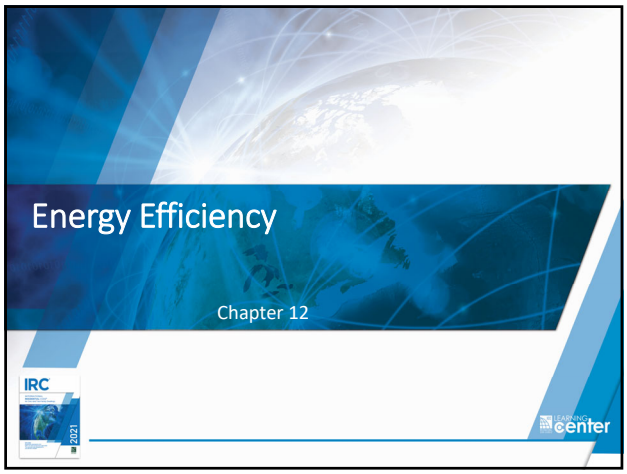

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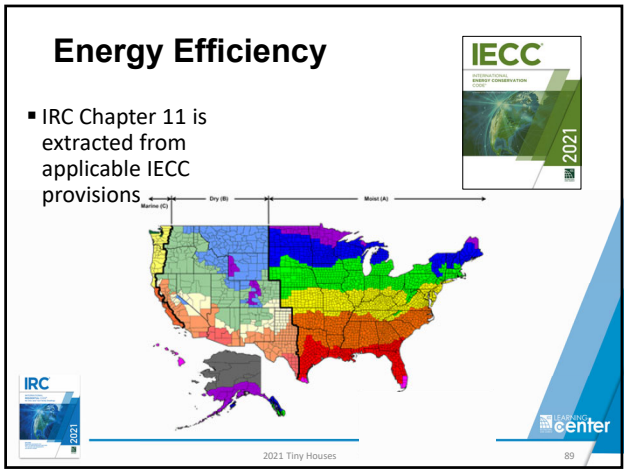

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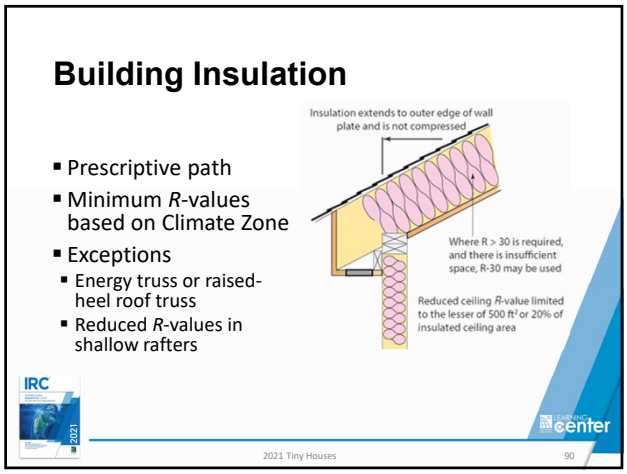

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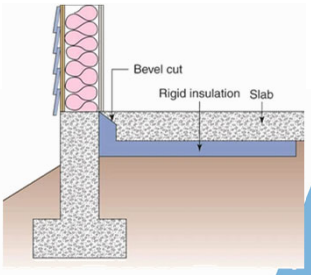
Slab-on-grade Floors

- Floor <12 in. below grade
- Combination of vertical and horizontal insulation
- Heavy termite areas exempt



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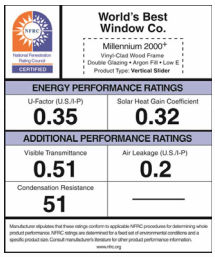
Windows and Doors

- Fenestration
  - Skylights
  - Windows
  - Doors
- U-factor
- Solar Heat Gain Coefficient (SHGC)



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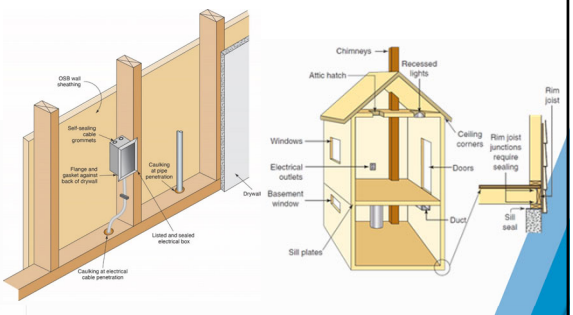
Sealing against Air Leakage



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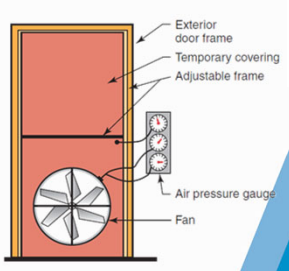
Testing

- Appendix Section AQ106.1, Exception for Tiny Houses
- Blower door test required
- Allowable air-leakage rate
  - 0.30 cubic feet per minute (cfm) per square foot of the enclosure area
- Mechanical ventilation required



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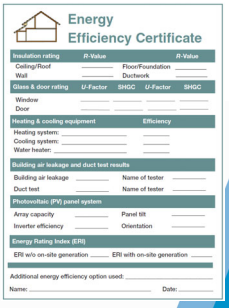
Energy Certificate

- Completed by
  - Builder or
  - Other approved party
- Listing
  - Code edition
  - Compliance path
  - Insulation & fenestration values
  - Equipment type & efficiency
  - Air testing results
- Permanent certificate posted in approved indoor location



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Alternative Compliance for Tiny Houses

- Appendix AQ Alternate path for compliance
  - Nearly energy independent, complies if meets all of the following:
    - Insulation and fenestration meet the maximum *U*-factor.
    - Building thermal envelope meets the air barrier, air sealing and insulation installation requirements of Table N1102.4.1.1.
    - Solar, wind or other renewable energy source supplies ≥ 90 percent of energy use.
    - Solar, wind or other renewable energy source supplies ≥ 90 percent of the energy for service water heating.
    - Permanently installed lighting fixtures contain only high-efficacy lighting sources.
    - Whole-house mechanical ventilation is provided.
  - Blower door test and other energy provisions not required

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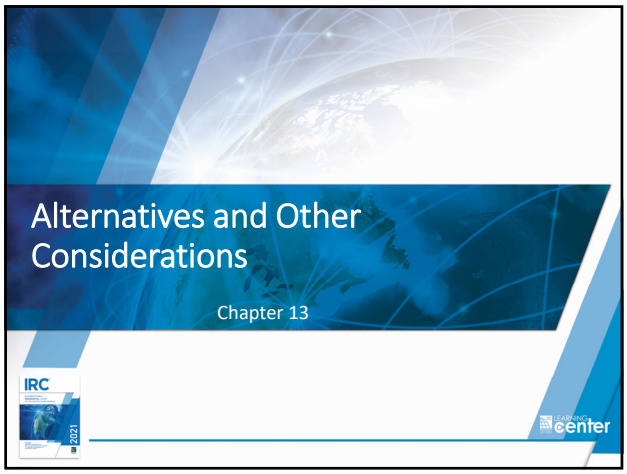

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Modifications & Alternatives

- Modification:
  - Special individual reason makes strict letter of code impractical
  - Modification meets **intent and purpose** of code
  - Such modification does not lessen:
    - Health
    - Accessibility
    - Life safety and fire safety
    - Structural requirements
- Alternates:
  - Method, material or work is equivalent of that prescribed in code for:
    - Quality
    - Strength
    - Effectiveness
    - Fire resistance
    - Durability
    - Safety

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Research Reports

- Supporting data, where necessary to assist in approval of assemblies or materials not specifically addressed in code, to consist of valid research reports from approved sources.
- ICC Evaluation Service (ICC ES) is one of a number of agencies that provide research reports for alternative materials and methods.
  - Acceptance of such reports is subject to that of the building official.

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Application and Administration of the I-Codes 99

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Transportation, Max Tongue Weights and Towing Capacity

Tongue load is generally 10-15% of total tiny house weight.

Society of Automotive Engineers (SAE International) standards at **https://www.sae.org/:**
SAE J684 Trailer Couplings, Hitches, and Safety Chains—Automotive Type
SAE J785 Trailer Axle Alignment
SAE J2638 Fifth Wheel and Gooseneck Attachment Performance Up to 13608/kg (30000/lb) Trailer Weight
SAE J2664 Trailer Sway Response Test Procedure
SAE J2807 Performance Requirements for Determining Tow-Vehicle Gross Combination Weight Rating and Trailer Weight Rating
National Highway Traffic Safety Administration (MHTSA) Information at **www.nhtsa.gov :**
Information and Certification FAQ **Importation and Certification FAQs | NHTSA**
National Association of Trailer Manufacturers **www.natm.com:**
Compliance Verification program **Compliance Verification Program—National Association of Trailer Manufacturers (natm.com)**

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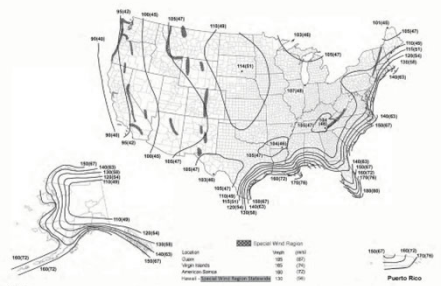
Wind loads per location



Notes:
1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).
6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed

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Alternative Foundation Systems

FIGURE 13-3

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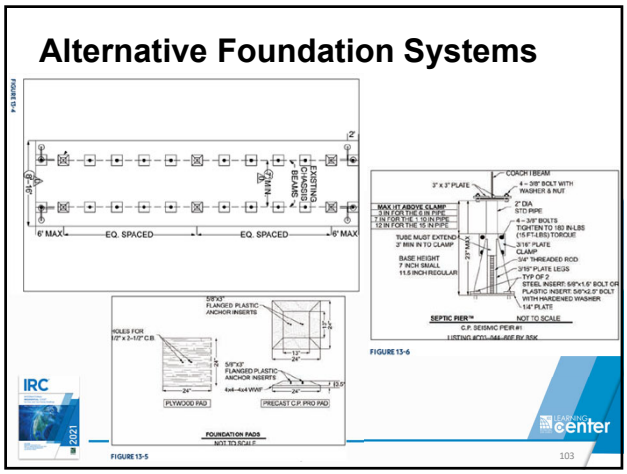

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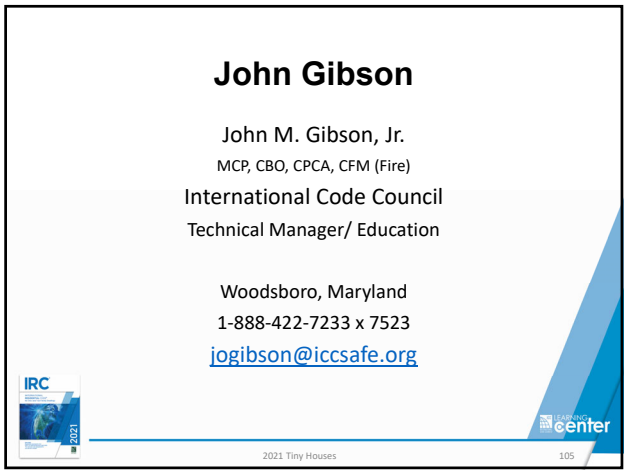

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Final Reflection

- **What?** What happened and what was observed in the training?
- **So what?** What did you learn? What difference did this training make?
- **Now what?** How will you do things differently back on the job as a result of this training?

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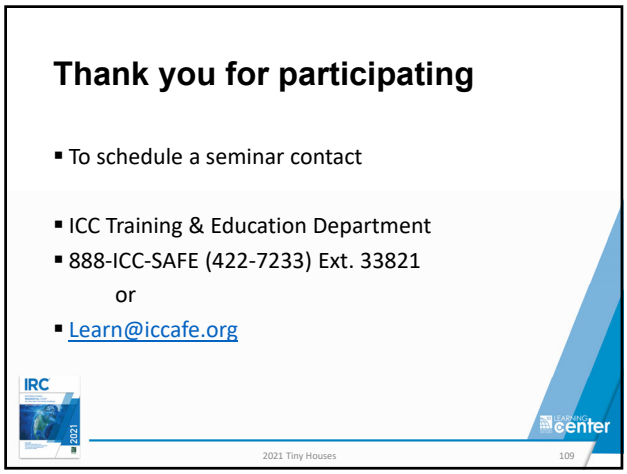

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File Attachments for Item:

EC-12 2017 vs. 2023 NEC Review (Southwest Ohio Electrical Organization)

All certifications (four 7.5-hour sessions)

Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Lorenzo M Adam

Organization: Southwest Ohio Electrical Organization

Address: 27 Penbrooke Court, Monroe, Ohio 45050

E-mail: lorenzomadam@gmail.com Telephone: 513-435-2622

Website:

Conference Sponsor (if applicable) Conference Email:

Check here if Course Renewal: Prior course number (*i.e. BBS2018-429*)

Renewals will only be granted for identical content and certifications, within the current code cycle.
Attach a copy of prior course approval letter for confirmation. No further information is required.

New Course Information:

Course title: 2017 vs 2023 NEC Review Chapter 1 & 2

Course instructor: Various ESIs (See Instructors List)

Course description:

An in-depth target analysis between the 2017 NEC and 2023 NEC including potential errors from skipping the 2020 NEC code adoption

Instructional hours per session: 7.5 Number of Sessions: 1

Course Date(s) and Location: September 9, 2023 / Mason, Ohio

Special Content:

Code Administration:
Existing Buildings:
Electrical Instruction: Yes
Plumbing Instruction:

Conference Course:
Conference Name:
Conference location:

Course to be offered online? **On Demand** **Webinar**

Course Website:

Detail online course participation confirmation method *(i.e. test, quizlets, participant activity confirmation)*:

Course applicable for the following certifications

Residential Certifications Only: Commercial Certifications: Yes

Administrative Course, All Certifications:

Application materials included:

Yes	Course Outline or Course Learning Objectives
Partial	Presentation Materials/Slides (not required for roundtable courses)
--	Assessment Materials (for online courses)
Yes	Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

2017 vs 2023 NEC Review

Agenda for September 9th, 2023

Instructors: Dewayne Jenkins, Gaylord Poe, Caty Robinson, Lorenzo Adam, Pete Baldauf.

7:00 – 7:30 am	Registration
7:30 – 9:30 am	NEC Review Chapters 1 & 2
9:30 – 9:40 am	Break
9:40 – 12:00 m	NEC Review Chapters 1 & 2
12:00 – 1:00 pm	Lunch Break
1:00 – 2:35 pm	NEC Review Chapters 1 & 2
2:35 – 2:45 pm	Break
2:45 – 4:00 pm	NEC Review Chapters 1 & 2

2017 vs 2023 NEC Review

Course outline for September 9th, 2023

This first Saturday will cover **Changes in Chapters 1 and 2** of the 2017 and 2023 NEC Review. The instruction will include the proper use and limitations for material and equipment used for electrical installations and the requirements for compliance with the NEC.

The instructor will also emphasize the importance of the changes and it affects future code proposals.

- Chapter 1. General
  - Articles 100 and 110
- Chapter 2. Wiring and Protection.
  - Articles 210 – 220 – 225 - 230

The presentation will be in Power Point format. Contractors and ESIs will benefit as well as Plans Examiners and Professional Designers by getting first-hand information on these changes. Both the Ohio Building Code, and the Residential Code of Ohio, in chapters 27 and 33 respectively refer to **2017 NFPA 70** as the standard to comply with electrical installations.
Even though the State of Ohio has not adopted the 2023 NFPA 70 version, the purpose of this class is to update the attendees on the code changes and not on the enforcement.

Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Lorenzo M Adam

Organization: Southwest Ohio Electrical Organization

Address: 27 Penbrooke Court, Monroe, Ohio 45050

E-mail: lorenzomadam@gmail.com Telephone: 513-435-2622

Website:

Conference Sponsor (if applicable) Conference Email:

Check here if Course Renewal: Prior course number (*i.e. BBS2018-429*)

Renewals will only be granted for identical content and certifications, within the current code cycle.
Attach a copy of prior course approval letter for confirmation. No further information is required.

New Course Information:

Course title: 2017 vs 2023 NEC Review Chapter 3 & 4

Course instructor: Various ESIs (See Instructors List)

Course description:

An in-depth target analysis between the 2017 NEC and 2023 NEC including potential errors from skipping the 2020 NEC code adoption

Instructional hours per session: 7.5 Number of Sessions: 1

Course Date(s) and Location: October 14, 2023 / Mason, Ohio

Special Content:

Code Administration:
Existing Buildings:
Electrical Instruction: Yes
Plumbing Instruction:

Conference Course:
Conference Name:
Conference location:

Course to be offered online? **On Demand** **Webinar**

Course Website:

Detail online course participation confirmation method *(i.e. test, quizlets, participant activity confirmation)*:

Course applicable for the following certifications

Residential Certifications Only: Commercial Certifications: Yes

Administrative Course, All Certifications:

Application materials included:

Yes	Course Outline or Course Learning Objectives
Partial	Presentation Materials/Slides (not required for roundtable courses)
--	Assessment Materials (for online courses)
Yes	Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

2017 vs 2023 NEC Review

Agenda for October 14th, 2023

Instructors: Dewayne Jenkins, Gaylord Poe, Caty Robinson, Lorenzo Adam, Pete Baldauf.

7:00 – 7:30 am	Registration
7:30 – 9:30 am	NEC Review Chapters 3 through 4
9:30 – 9:40 am	Break
9:40 – 12:00 m	NEC Review Chapters 3 through 4
12:00 – 1:00 pm	Lunch Break
1:00 – 2:35 pm	NEC Review Chapters 3 through 4
2:35 – 2:45 pm	Break
2:45 – 4:00 pm	NEC Review Chapters 3 through 4

2017 vs 2023 NEC Review

Course outline for October 14th, 2023

This second Saturday will cover **Changes in Chapter 3 through 4** of the 2017 and 2023 NEC Review. The instruction will include the proper use and limitations for material and equipment used for electrical installations and the requirements for compliance with the NEC.

The instructor will also emphasize the importance of the changes.

- Chapter 2. Wiring and Protection.
  - Articles 240 – 250
- Chapter 3. Wiring Methods and Materials.
  - Article 300
- Chapter 4. Equipment.
  - Articles 400 – 404 – 406 – 410 – 422 – 440 – 445 - 450

The presentation will be in Power Point format. Contractors and ESIs will benefit as well as Plans Examiners and Professional Designers by getting first-hand information on these changes. Both the Ohio Building Code, and the Residential Code of Ohio, in chapters 27 and 33 respectively refer to **2017 NFPA 70** as the standard to comply with electrical installations.
Even though the State of Ohio has not adopted the 2023 NFPA 70 version, the purpose of this class is to update the attendees on the code changes and not on the enforcement.

Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Lorenzo M Adam

Organization: Southwest Ohio Electrical Organization

Address: 27 Penbrooke Court, Monroe, Ohio 45050

E-mail: lorenzomadam@gmail.com Telephone: 513-435-2622

Website:

Conference Sponsor (if applicable) Conference Email:

Check here if Course Renewal: Prior course number (*i.e. BBS2018-429*)

Renewals will only be granted for identical content and certifications, within the current code cycle.
Attach a copy of prior course approval letter for confirmation. No further information is required.

New Course Information:

Course title: 2017 vs 2023 NEC Review Chapter 5 & 6

Course instructor: Various ESIs (See Instructors List)

Course description:

An in-depth target analysis between the 2017 NEC and 2023 NEC including potential errors from skipping the 2020 NEC code adoption

Instructional hours per session: 7.5 Number of Sessions: 1

Course Date(s) and Location: November 18, 2023 / Mason, Ohio

Special Content:

Code Administration:
Existing Buildings:
Electrical Instruction: Yes
Plumbing Instruction:

Conference Course:
Conference Name:
Conference location:

Course to be offered online? **On Demand** **Webinar**

Course Website:

Detail online course participation confirmation method *(i.e. test, quizlets, participant activity confirmation)*:

Course applicable for the following certifications

Residential Certifications Only: Commercial Certifications: Yes

Administrative Course, All Certifications:

Application materials included:

Yes	Course Outline or Course Learning Objectives
Partial	Presentation Materials/Slides (not required for roundtable courses)
--	Assessment Materials (for online courses)
Yes	Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

2017 vs 2023 NEC Review

Agenda for November 18th, 2023

Instructors: Dewayne Jenkins, Gaylord Poe, Caty Robinson, Lorenzo Adam, Pete Baldauf.

7:00 – 7:30 am	Registration
7:30 – 9:30 am	NEC Review Chapters 5 & 6
9:30 – 9:40 am	Break
9:40 – 12:00 m	NEC Review Chapters 5 & 6
12:00 – 1:00 pm	Lunch Break
1:00 – 2:35 pm	NEC Review Chapters 5 & 6
2:35 – 2:45 pm	Break
2:45 – 4:00 pm	NEC Review Chapters 5 & 6

2017 vs 2023 NEC Review

Course outline for November 18th, 2023

This third Saturday will cover **Changes in Chapter 5 and 6** of the 2017 and 2023 NEC Review. The instruction will include the proper use and limitations for material and equipment used for electrical installations and the requirements for compliance with the NEC.

The instructor will also emphasize the importance of the changes.

- Chapter 5. Special Occupancies.
  - Articles 500 – 511 – 514 – 517 – 525 - 590
- Chapter 6. Special Equipment.
  - Article 600 - 625

The presentation will be in Power Point format. Contractors and ESIs will benefit as well as Plans Examiners and Professional Designers by getting firsthand information on these changes. Both the Ohio Building Code, and the Residential Code of Ohio, in chapters 27 and 33 respectively refer to **2017 NFPA 70** as the standard to comply with electrical installations.
Even though the State of Ohio has not adopted the 2023 NFPA 70 version, the purpose of this class is to update the attendees on the code changes and not on the enforcement.

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Application for Continuing Education Course Approval

Provider Information:

Name: Lorenzo M Adam

Organization: Southwest Ohio Electrical Organization

Address: 27 Penbrooke Court, Monroe, Ohio 45050

E-mail: lorenzomadam@gmail.com Telephone: 513-435-2622

Website:

Conference Sponsor (if applicable) Conference Email:

Check here if Course Renewal: Prior course number (*i.e. BBS2018-429*)

Renewals will only be granted for identical content and certifications, within the current code cycle.
Attach a copy of prior course approval letter for confirmation. No further information is required.

New Course Information:

Course title: 2017 vs 2023 NEC Review Chapter 7 & 8

Course instructor: Various ESIs (See Instructors List)

Course description:

An in-depth target analysis between the 2017 NEC and 2023 NEC including potential errors from skipping the 2020 NEC code adoption

Instructional hours per session: 7.5 Number of Sessions: 1

Course Date(s) and Location: December 9, 2023 / Mason, Ohio

Special Content:

Code Administration:
Existing Buildings:
Electrical Instruction: Yes
Plumbing Instruction:

Conference Course:
Conference Name:
Conference location:

Course to be offered online? **On Demand** **Webinar**

Course Website:

Detail online course participation confirmation method *(i.e. test, quizlets, participant activity confirmation)*:

Course applicable for the following certifications

Residential Certifications Only: Commercial Certifications: Yes

Administrative Course, All Certifications:

Application materials included:

Yes	Course Outline or Course Learning Objectives
Partial	Presentation Materials/Slides (not required for roundtable courses)
- -	Assessment Materials (for online courses)
Yes	Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

2017 vs 2023 NEC Review

Agenda for December 9th, 2023

Instructors: Dewayne Jenkins, Gaylord Poe, Caty Robinson, Lorenzo Adam, Pete Baldauf.

7:00 – 7:30 am	Registration
7:30 – 9:30 am	NEC Review Chapters 7 through 8
9:30 – 9:40 am	Break
9:40 – 12:00 m	NEC Review Chapters 7 through 8
12:00 – 1:00 pm	Lunch Break
1:00 – 2:35 pm	NEC Review Chapters 7 through 8
2:35 – 2:45 pm	Break
2:45 – 4:00 pm	NEC Review Chapters 7 through 8

2017 vs 2023 NEC Review

Course outline for December 9th, 2023

This second session will cover **Changes in Chapter 7 through 8** of the 2017 and 2023 NEC Review. The instruction will include the proper use and limitations for material and equipment used for electrical installations and the requirements for compliance with the NEC.

The instructor will also emphasize the importance of the changes.

- Chapter 6. Special Equipment.
  - Articles 680 – 682 - 690 - 695
- Chapter 7. Special Conditions.
  - Articles 700 – 701 – 702 – 725 – 760
- Chapter 8. Communications Systems.
  - Article 800

The presentation will be in Power Point format. Contractors and ESIs will benefit as well as Plans Examiners and Professional Designers by getting first-hand information on these changes. Both the Ohio Building Code, and the Residential Code of Ohio, in chapters 27 and 33 respectively refer to **2017 NFPA 70** as the standard to comply with electrical installations.
Even though the State of Ohio has not adopted the 2023 NFPA 70 version, the purpose of this class is to update the attendees on the code changes and not on the enforcement.

INSTRUCTOR QUALIFICATIONS

Lorenzo M. Adam

Lorenzo started his electrical training in 1983. In 1988, he started his own electrical company. In 1996, he obtained the State Electrical Inspector certification. In 1997, he joined the City of Troy as a Building/Electrical Inspector. Currently, he works for the City of Mason. Lorenzo has an Electrical Plans Examiner, Residential Building Official, Building Inspector, Building Official interim certification from the State of Ohio. Lorenzo is currently the secretary/treasurer for the SW Division of IAEI, Ohio Chapter, secretary/treasurer for the Ohio Chapter IAEI and Treasurer and Past President of the Southwestern Ohio Building Officials Association (SWOBOA).

Address: 27 Penbrooke Ct., Monroe, Ohio 45050

Gaylord K. Poe

Gaylord Poe started his longstanding career in the electrical industry in 1969. He earned his Electrical Safety Inspector Certificate (#592) in 1978. He continued to work as an electrician until 1983 when he joined the IBI team as a commercial/industrial field inspector. He was promoted to Commercial Coordinator in 1986, to Assistant Chief Electrical Inspector in 1994, and to Chief Electrical Inspector and President in 2000. He earned his Ohio Electrical Plan Examiner and IAEI Electrical Inspector-Plan Review certificates in 2005. He is the only Ohio ESI certified by the IAEI as a Master Electrical Inspector (2009).
Gaylord is a member of the UL Electrical Council, the NFPA, the Cincinnati Business Development and Permit Center Advisory Committee, the Board of Trustees for the GCEA, the Electrical Trades Advisory Committee for Scarlet Oaks JVS, and is actively involved in course development and training classes for the continuing education programs of the IAEI, IEC, GCEA, and NECA. Gaylord has been involved with the IAEI since the early 1980's. He currently has become the Past-President of the IAEI SW Division, in which he served for 17 years combine.

Address: Suite 125-W, 250 West Court Street, Cincinnati, OH 45202

Caty Robinson

Caty Robinson began her electrical career working as an apprentice in the Dayton, Ohio area. As a member of IBEW Local 82 Caty served a full apprenticeship and worked in the field as a journeyman wireman for Kastle Electric. Caty's Ohio certification #2647 is for ESI (2004) and EPE (2013). Caty joined Inspection Bureau, Inc. (IBI) in 2008 as a commercial Electrical Safety Inspector. Caty currently serves as IBI's Commercial Coordinator and inspects in IBI's commercial territories and Kentucky. Caty is also a member of the IAEI Ohio Chapter SW Division

Address: Suite 125-W, 250 West Court Street, Cincinnati, OH 45202

Peter M. Baldauf

Peter has been in the electrical industry for over 15 years. He began his electrical career working through a trade school in Dayton, Ohio. After graduation, he enrolled in the Associated Builders and Contractors State certified electrical apprenticeship program. Peter attended the program for the full four years and upon completion of the program, he relocated to Tacoma, Washington. In Tacoma, he sat for a State administered test and received State of Washington certification as a journeyman electrician, which is required by the Division of Labor and Industry in that State to perform work as an electrician. Upon his return to the State of Ohio, Peter sat for and was issued a license by the State of Ohio to perform duties associated with the installation and servicing of fire alarm systems. He also applied and sat for the test to become a State Certified Electrical Safety Inspector. He was awarded this Certification in September of 1998. Peter began his career in public service with Montgomery County Building Regulations as an Electrical Inspector in August of 1999. He is currently employed with the City of Vandalia as an Electrical Inspector. Peter also instructs classes for the Master Electrical Contractors Association, Adequate Wiring Committee, and International Association of Electrical Inspectors. He also has certification through the City of Dayton Board of Education as an Adult Education Instructor.

Address: 3600 Shroyer Road, Kettering, OH 45429

Daniel Dewayne Jenkins

Dewayne started his career in the electrical field in 1982 in Dayton, Ohio and several years of experience in the electrical industry both as a contractor and inspector. He served 4 years in an electrical apprenticeship program and has over 8 years in the field as a journeyman electrician and he has 4 years, to his credit, as an electrical estimator and project manager.

Dewayne has been a licensed electrical contractor and a certified electrical safety inspector since 1996. He also holds Ohio certifications as building inspector (1998), electrical plans examiner (2006) and residential building official (2007) and chief building official (2008). He is currently employed by the City of Kettering in the position as an electrical plans examiner, electrical safety inspector and building inspector.

Dewayne is an adjunct lecturer II for Sinclair Community College in the electrical trades for several years. A technical presenter for the Ohio Board of Building Standards (OBBS), International Association of Electrical Inspectors (IAEI), Master Electrical Contractors Association (MECA), Adequate Wiring Committee (AWC) & Greater Cincinnati Electrical Association (GCEA). He has served as President for the Ohio Chapter IAEI (2010). Dewayne has also served as President of the Miami Valley Building Officials Council (2002 & 2003). He currently is the President of the Southwest Division, IAEI and serves on the Electrical Safety Inspector Advisory Committee for the Ohio Board of Building Standards.

Address: 3600 Shroyer Road, Kettering, OH 45429

2023 30-Hour Course
Sponsored by Southwest Division Ohio IAEI

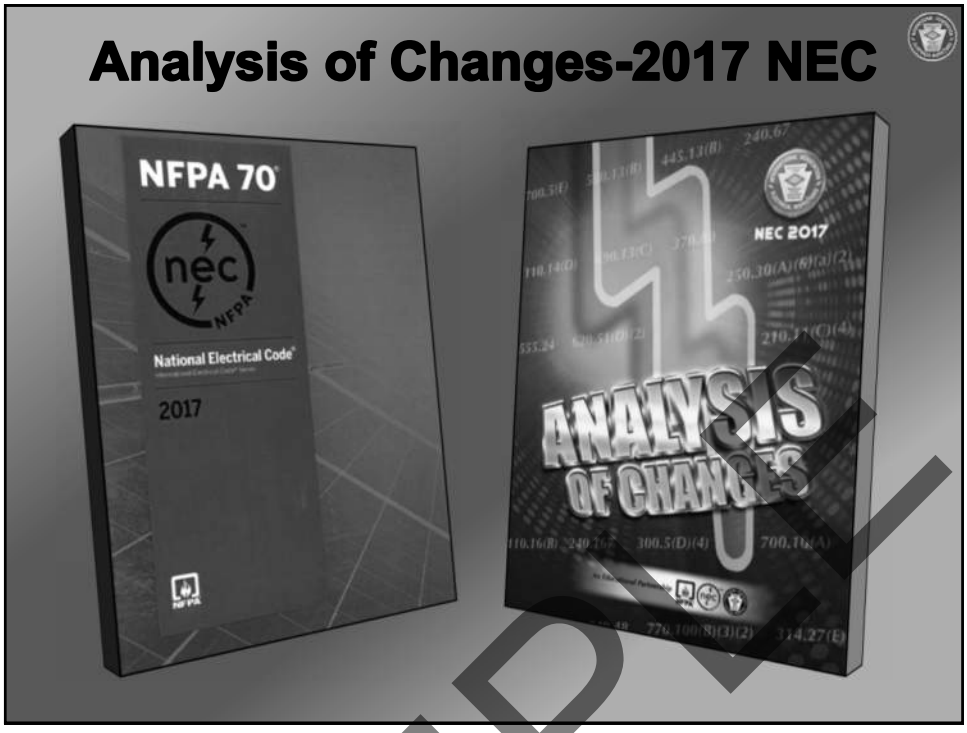
Facility

The facility is conveniently located in Mason, about 1mile from I-71 and 3 miles from I-75. Classes are held at the **City of Mason, Community Room, 6000 Mason-Montgomery Rd., Mason, Ohio**. The room occupancy is good for 100 students comfortably with tables and chairs. There are provisions for audio-visual equipment (screen, microphone, and speakers). Restrooms are located nearby the room for females and males. Refreshments are served during the morning. Duration of the instruction is 7.5 hours. 7:30am – 4:00pm.

Course Materials

Every attendee is responsible for bringing an edition of the 2017 and 2023 NEC. The instructors will also have on hand the necessary references to answer questions about other codes or standards. Most of the presentations are on a slide-format (Power Point).

Analysis of Changes-2017 NEC



4

Code-Wide Changes: (5) New Articles

Article 425 Fixed Resistance and Electrode Industrial Process Heating Equipment. This article covers fixed industrial process heating employing electric resistance or electrode heating technology (boilers, electrode boilers, duct heaters, strip heaters, immersion heaters, process air heaters, or other approved fixed electric equipment used for industrial process heating).

Article 691 Large-Scale Photovoltaic (PV) Electric Power Production Facility. This article covers the installation of large-scale PV electric power production facilities operated for the sole purpose of providing electric supply to a system operated by a regulated utility for the transfer of electrical energy with a generating capacity of no less than 5,000 kW (generating stations, substations, associated generator, storage battery, transformer, and switchgear areas).

Article 706 Energy Storage Systems . This article applies to all permanently installed energy storage systems (ESS) operating at over 50 volts ac or 60 volts dc that may be stand-alone or interactive with other electric power production sources.

Article 710 Stand-Alone Systems. This article covers electric power production sources operating in stand-alone mode.

Article 712 Direct Current Microgrids (DC Microgrids). This article applies to direct current microgrids, which is a power distribution system consisting of more than one interconnected dc power sources, supplying dc-dc converters(s), dc loads(s), and/or ac loads(s) powered by dc-ac inverters(s).

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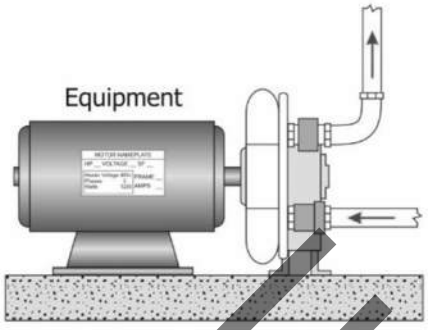
SAMPLE

Article 100 Definitions: Building and Structure

Building



Structure

Building - A structure that stands alone or that is ~~cut off~~ separated from adjoining structures by fire walls ~~with all openings therein protected by approved fire doors~~.

Structure - That which is built or constructed, other than equipment.

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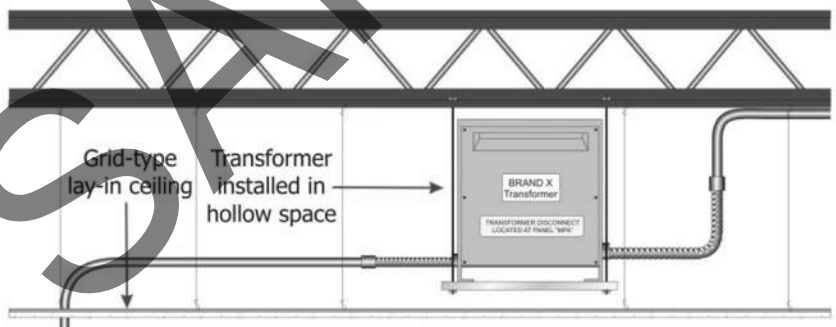
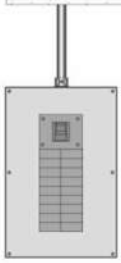
110.26(A)(4) Limited Access Working Space





Equipment installed above a lay-in ceiling to have accessible opening not smaller than 22 in. × 22 in. *(crawl space, not smaller than 22 in. × 30 in.)*

Width of working space to be width of the equipment enclosure or a minimum of 30 in., whichever is greater

Table 110.26(A)(1) depth requirements to apply in front of enclosure

Height of the working space to be the height necessary to install the equipment in the limited space

Horizontal ceiling structural member/access panel permitted in space

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210.8(B)(9) GFCI for Non-Dwelling Unit *(Commercial, Industrial)* Crawl Spaces

All single-phase receptacles (150 volts to ground or less, 50 amperes or less) and three-phase receptacles (150 volts to ground or less, 100 amperes or less) installed in non-dwelling unit crawl spaces requires GFCI protection

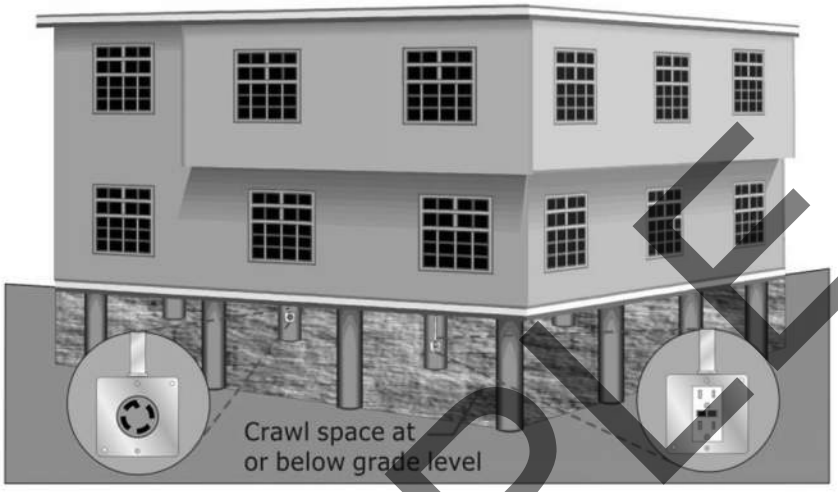

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Table 240.6(A) Standard Ampacity Ratings for Fuses and Inverse Time Circuit Breakers

The standard ampere ratings for fuses and inverse time circuit breakers shall be considered as shown in Table 240.6(A)

15	20	25	30	35
40	45	50	60	70
80	90	100	110	125
150	175	200	225	250
300	350	400	450	500
600	700	800	1000	1200
1600	2000	2500	3000	4000
5000	6000			

Additional standard ampere ratings for fuses shall be 1, 3, 6, 10, and 601

The use of fuses and inverse time circuit breakers with nonstandard ampere ratings shall be permitted

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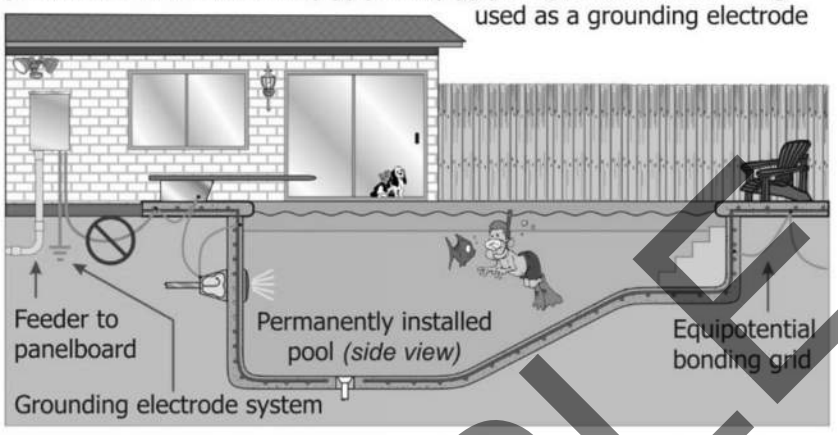
SAMPLE

250.52(B)(3) Not Permitted for Use as Grounding Electrodes

The structures and structural reinforcing steel of an in-ground swimming pool as described in 680.26(B)(1) and (B)(2) are prohibited from being used as a grounding electrode



The provisions of 680.26 for equipotential bonding are to reduce voltage gradients *(difference of voltage potential between two conducting objects)*, not to establish a grounding electrode system for a building or structure

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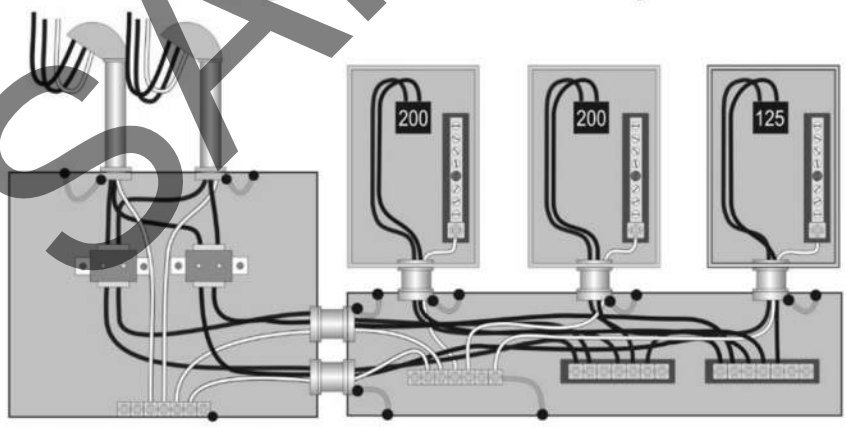
250.102 Grounded Conductor, Bonding Conductors and Jumpers



Grounded conductors, bonding conductors, and bonding jumpers of copper, aluminum, copper-clad aluminum, or other corrosion-resistant material are to be sized in accordance with 250.102 and Table 250.102(C)(1)

Supply-side bonding jumpers installed in parallel in two or more raceways or cables to comply with 250.102(C)(2)

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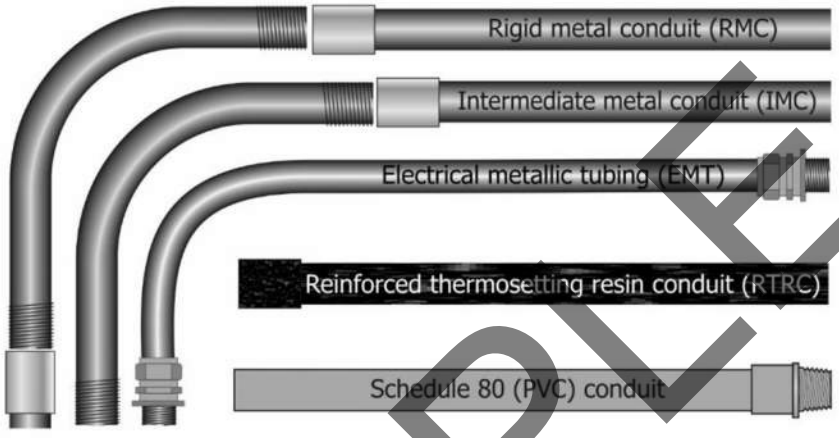
300.5(D)(4) Protection from Physical Damage

Where direct-buried conductors and cables are installed in enclosures or raceways and are subject to physical damage, electrical metallic tubing (EMT), rigid metal conduit (RMC), intermediate metal conduit (IMC), reinforced thermosetting resin conduit (RTRC) (Type RTRC-XW), Schedule 80 rigid polyvinyl chloride (PVC) conduit, or equivalent is allowed to be used to provide protection from physical damage



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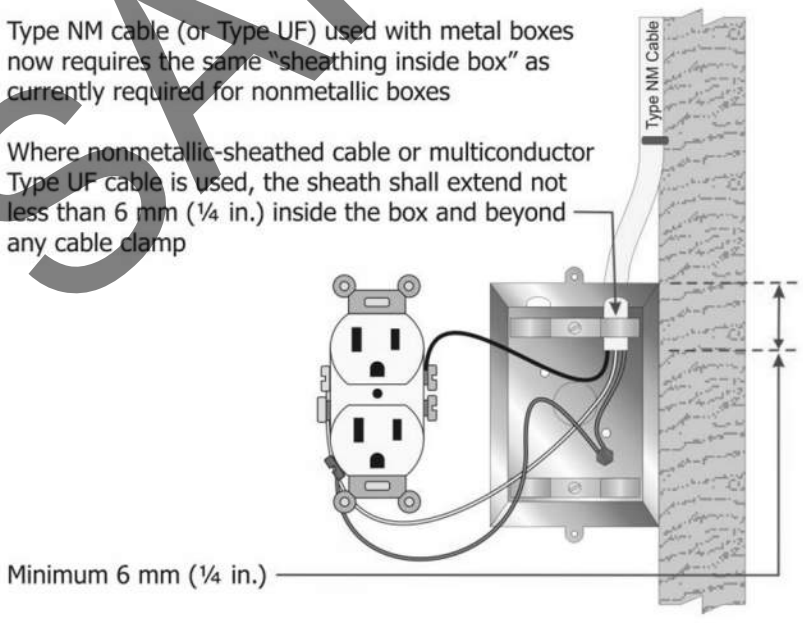
314.17(B) Type NM Cable Entering Metal Boxes

Type NM cable (or Type UF) used with metal boxes now requires the same "sheathing inside box" as currently required for nonmetallic boxes

Where nonmetallic-sheathed cable or multiconductor Type UF cable is used, the sheath shall extend not less than 6 mm (¼ in.) inside the box and beyond any cable clamp



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SAMPLE

366.20 Parallel Conductors in Auxiliary Gutters

Service equipment with auxiliary gutters

Single conductor cables comprising each phase, neutral, or grounded conductor of an ac circuit are permitted to be connected in parallel

Conductors to 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

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404.2(C) Grounded Conductor at Switch Locations

A grounded conductor is generally required to be installed and connected to the switching device at locations where switches control lighting loads that are supplied by a grounded general-purpose branch circuit

Grounded conductor is generally **NOT** required at the following locations:

Where multiple switch locations control the same lighting load such that the entire floor area of the room or space is visible from the single or combined switch locations, the grounded circuit conductor shall only be required at one location

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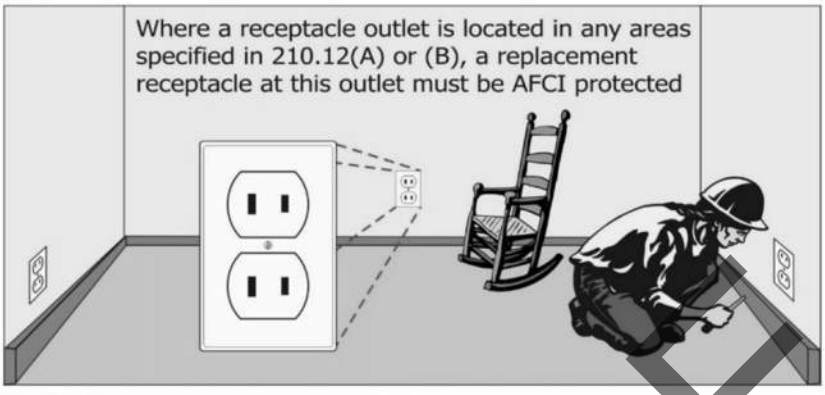
SAMPLE

406.4(D)(4) Replacement Receptacles (AFCI)



Ex. No. 1: AFCI protection not required where all of the following apply:

(1) Replacement complies with 406.4(D)(2)(b) *(two-wire system-GFCI)*

(2) Impracticable to provide an EGC as provided by 250.130(C)

(3) Listed combination type AFCI circuit breaker not commercially available

(4) GFCI/AFCI dual function receptacles not commercially available

Ex. No. 2: Exception at 210.12(B) shall not apply to replacement of receptacles

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406.12 Tamper-Resistant Receptacles

All 15- and 20-ampere, 125- and 250-volt nonlocking-type receptacles in areas specified in 406.12(1) through (7) must be listed tamper-resistant receptacles: (1) Dwelling units in all areas specified in 210.52 and 550.13; (2) Guest rooms and guest suites of hotels and motels; (3) Child care facilities

Tamper-resistant receptacle requirements have been expanded to include: all areas specified in 550.13 at mobile and manufactured homes

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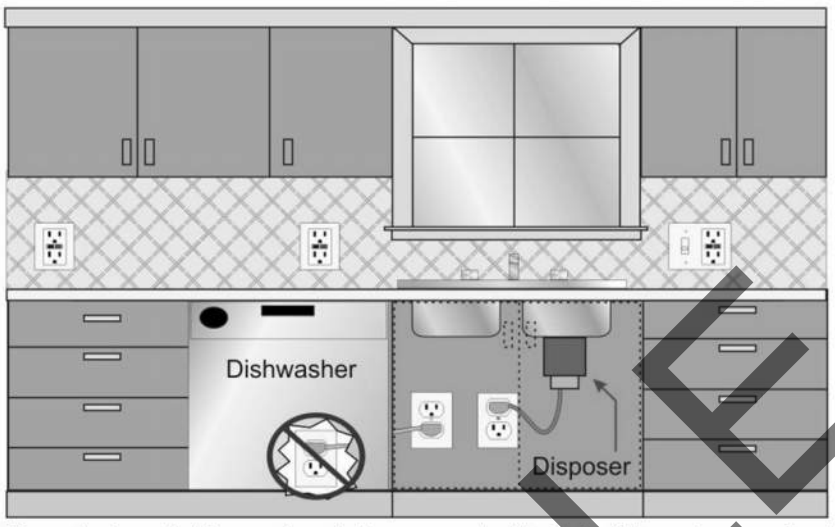
SAMPLE

422.16(B)(2) Built-In Dishwashers



Receptacle outlet for cord-and-plug connected built-in dishwasher required to be located in the space adjacent to the space containing the dishwasher only with the length of a cord for a built-in dishwasher lengthened from 1.2 m (4 ft) to 2.0 m (6½ ft)

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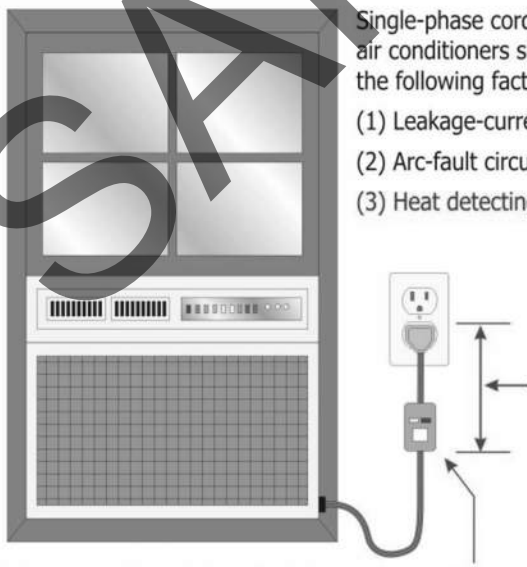
440.65 Protection Devices for Room AC Units

Single-phase cord- and plug-connected room air conditioners shall be provided with one of the following factory-installed devices:

(1) Leakage-current detector-interrupter (LCDI)

(2) Arc-fault circuit interrupter (AFCI)

(3) Heat detecting circuit interrupter (HDCI)



The protection device shall be an integral part of the attachment plug or be located in the power supply cord within 300 mm (12 in.) of the attachment plug

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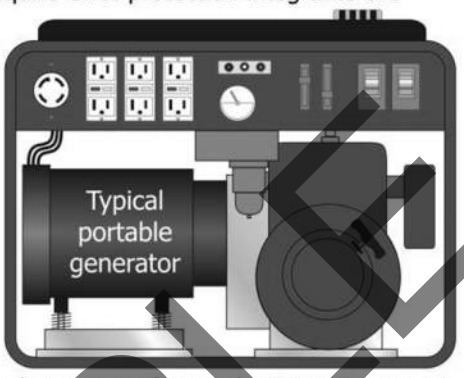
SAMPLE

445.20 GFCI Protection for Receptacles on 15-kW or Smaller Portable Generators

Receptacle outlets that are a part of a 15-kW or smaller portable generator shall have listed GFCI for personnel integral to the generator or receptacle

445.20(A): Unbonded (floating neutral) generators with both 125-volt and 125/250-volt receptacle outlets require GFCI protection integral to the generator or receptacle on all 125-volt and 15- and 20-ampere receptacle outlets

See exception where the 125-volt receptacle outlets(s) is interlocked such that it is not available for use when any 125/250-volt receptacle(s) is in use)



If the generator was manufactured or remanufactured prior to January 1, 2015, listed cord sets or devices incorporating listed GFCI protection for personnel identified for portable use shall be permitted

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SAMPLE

500.5(A) ~~Classifications of Locations~~ General

The title of 500.5(A) was changed to "General" as it applies to all of 500.5

Refrigerant machinery rooms containing ammonia refrigeration may be classified as "unclassified" locations based on the use of gas detection and adequate ventilation *(concentration not exceeding 150 ppm)*

Class I, II, and III Locations and Groups

Substance	Gas	Dust	Fibers/Flyings
Class	Class I [500.5(B)]	Class II [500.5(C)]	Class III [500.5(D)]
Division 1 (Normally Hazardous)	Flammable or combustible concentrations exist under normal operating conditions	Group E, Groups F & G Normally in air in ignitible concentrations	Where they are manufactured
Division 2 (Normally Hazardous)	Confined within closed systems and closed containers	Groups F & G Not normally in air in ignitible quantities	Where they are stored
Groups	A, B, C, and D *NEC* 500.6(A)	E, F, and G *NEC* 500.6(B)	No Groups
NEC Article	501	502	503

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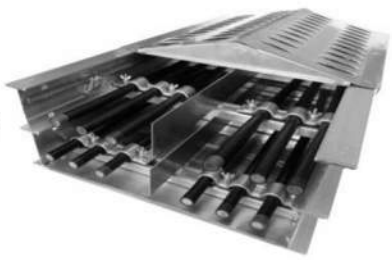
501.10(B)(1) Class I, Division 2

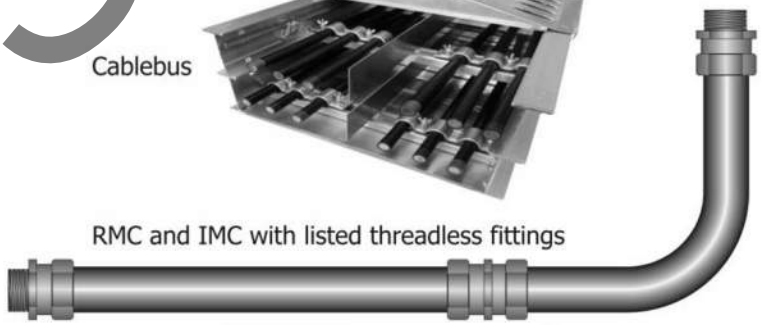
Rigid metal conduit (RMC) and intermediate metal conduit (IMC) with listed threadless fittings have been added to the allowable wiring methods in a Class I, Division 2 location

Cablebus also added to permitted wiring methods in a Class I, Division 2 location

Cablebus



RMC and IMC with listed threadless fittings



Class I, Division 2 location

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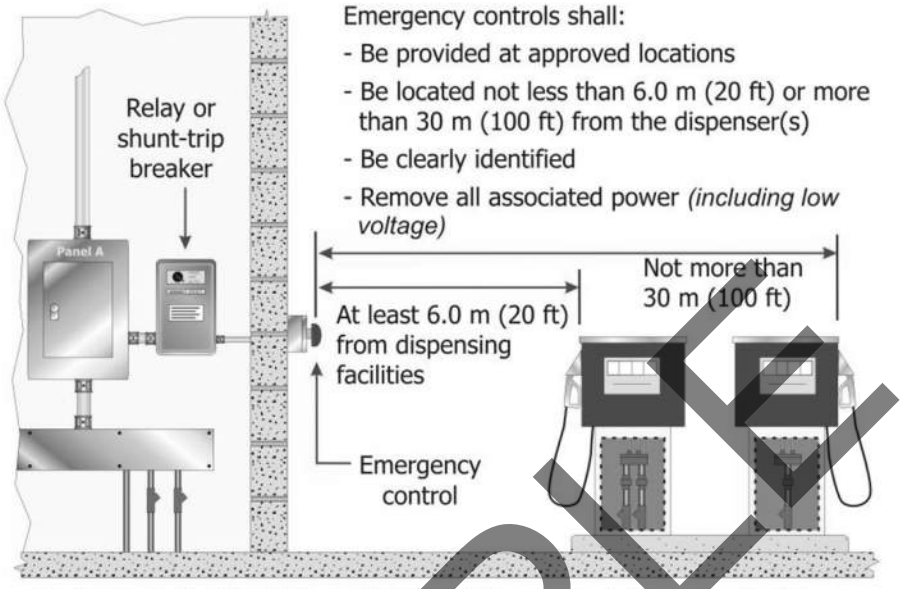
SAMPLE

514.11 Emergency Controls for Fuel Dispensers



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Applies to both Attended and Unattended motor fuel dispensing facilities

33

517.2 Definitions (Health Care Facilities)

Health Care Facilities. Buildings, portions of buildings, or mobile enclosures in which human medical, dental, psychiatric, nursing, obstetrical, or surgical care are provided. [99: 3.3.67]

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Informational Note: Examples of health care facilities include, but are not limited to, hospitals, nursing homes, limited care facilities, clinics, medical and dental offices, and ambulatory care centers, whether permanent or movable.

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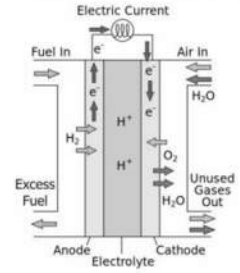
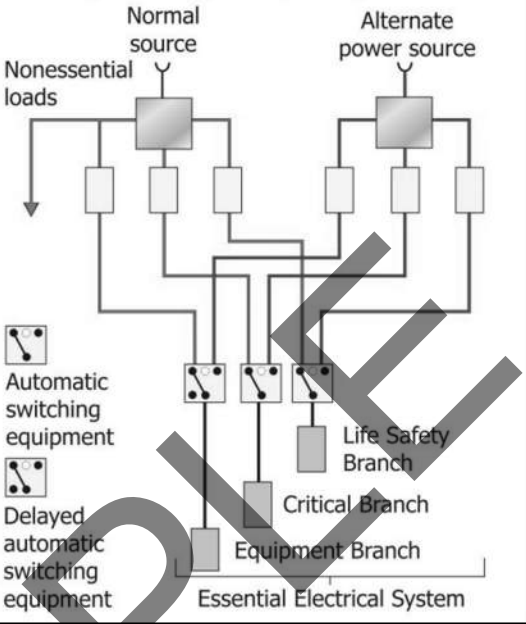
SAMPLE

517.30(B) Sources of Power
Essential Electrical System (Hospital)

Requirements for two independent sources of power and an alternate source of power for the essential electrical system for hospitals and other health care facilities were revised and relocated to 517.30 *(was 517.35)*

Fuel cell systems will now be permitted to serve as the alternate source for all or part of an essential electrical system





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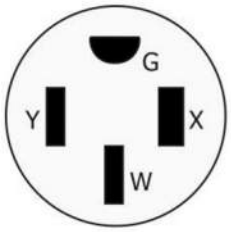
551.71 Type Receptacles Provided at RV Parks

Every RV site (with electrical power provided) must be equipped with a certain number and type of receptacles *[see 551.71(A) through (F)]*

20-A, 125-V, 2-pole, 3-wire, grounding type

30-A, 125-V, 2-pole, 3-wire, grounding type



50-A, 125/250-V, 3-pole, 4-wire, grounding type

551.71 has been broken into six separate first level subdivisions with titles

The number of RV sites required to be equipped with 50-ampere, 125/250-volt receptacles has increased from 20 percent to 40 percent for all new RV sites

GFCI devices used in RV site electrical equipment not required to be weather or tamper resistant in accordance with 406.9 and 406.12

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555.19(B) GFCI Protection for Personnel

GFCI protection required for all 125-volt, single-phase, 15- and 20-ampere receptacles installed outdoors, in boathouses, and in buildings or structures used for storage, maintenance, or repair regardless of the intended use

The term, "where portable electrical hand tools, electrical diagnostic equipment, or portable lighting equipment are to be used" was deleted

The removal of this portable electrical hand tool, etc. conditional language will aid the AHJ in enforcement of the GFCI requirements at these locations

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605.9(C) Receptacles at Office Furnishings

An individual office furnishing or groups of interconnected individual office furnishings shall not contain more than (13) 15-ampere, 125-volt receptacles

For purposes of this requirement, a receptacle is considered:
(1) Up to two (simplex) receptacles provided within a single enclosure and that are within 0.3 m (1 ft) of each other or...
(2) One duplex receptacle

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SAMPLE

680.2 Definitions - Electrically Powered Pool Lift

Electrically Powered Pool Lift. An electrically powered lift that provides accessibility to and from a pool or spa for people with disabilities.

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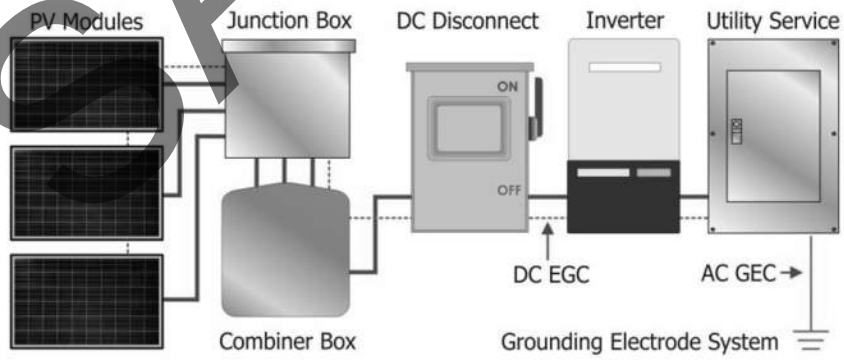
690.2 Definition: Functional Grounded PV System

Functional Grounded PV System. A PV system that has an electrical reference to ground that is not solidly grounded.



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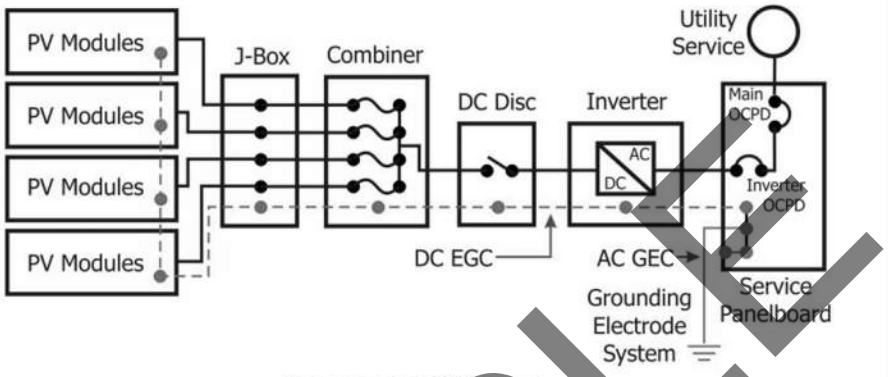
Informational Note: A functional grounded PV system is often connected to ground through a fuse, circuit breaker, resistance device, non-isolated grounded ac circuit, or electronic means that is part of a listed ground-fault protection system. Conductors in these systems that are normally at ground potential may have voltage to ground during fault conditions.

201

SAMPLE

690.35 Ungrounded PV System (Deleted)

Provisions for Ungrounded Photovoltaic (PV) Power System have been deleted as the issues and topics previously covered at 690.35 are addressed in other locations within Article 690



Ungrounded PV System
(now referred to as a Functional Grounded PV System)

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SAMPLE

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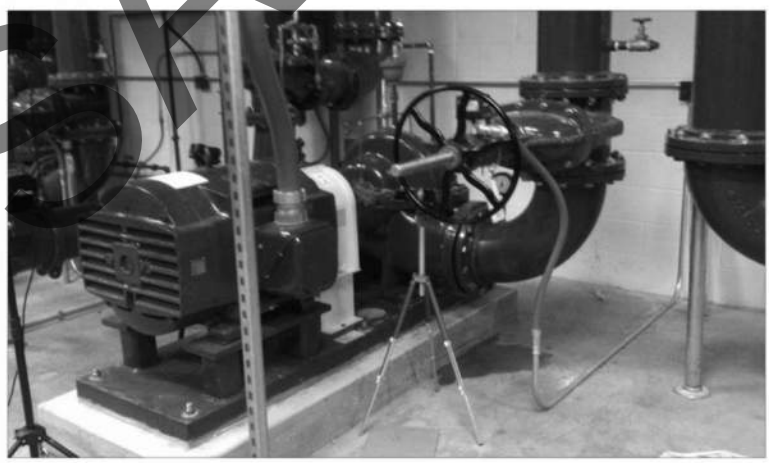
695.6(G) Fire Pumps (GFP Prohibited)

Ground-fault protection of equipment shall not be installed in any fire pump power circuit



Revision changed 695.6(G) from "ground-fault protection of equipment shall not be permitted for fire pumps" to "ground-fault protection of equipment shall not be installed in any fire pump power circuit"

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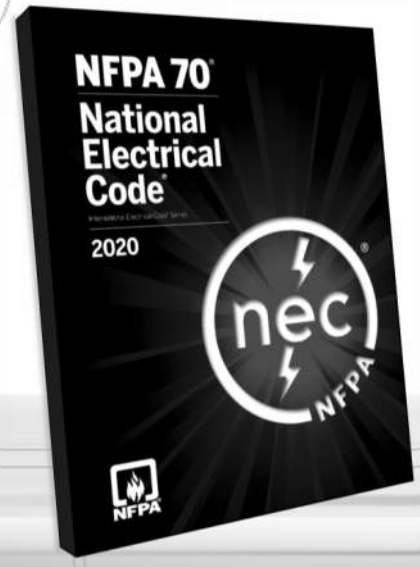
Analysis of Changes – 2020 *NEC*



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SAMPLE

4

New Articles for the 2020 *NEC*

Article 242 Overvoltage Protection (CMP-10) This article provides the general requirements, installation requirements, and connection requirements for overvoltage protection and overvoltage protective devices. Part II covers surge-protective devices (SPDs) permanently installed on premises wiring systems of not more than 1000 volts, nominal, while Part III covers surge arresters permanently installed on premises wiring systems over 1000 volts, nominal.

Article 337 Type P Cable (CMP-6) This article covers the use, installation, and construction specifications for up through 2000 volt Type P cable (armored and unarmored). Type P cable is a factory assembly of one or more insulated flexible tinned copper conductors, with associated equipment grounding conductor(s), with or without a braided metallic armor and with an overall nonmetallic jacket.

Article 311 Medium Voltage Conductors and Cable (CMP-6) This article covers the use, installation, construction specifications, and ampacities for Type MV medium voltage conductors and cable. Type MV conductor and cable requirements that were previously found in Articles 310 (Conductors or General Use) and 328 (Medium Voltage Cable) were consolidated into one article.

Article 800 General Requirements for Communications Systems (CMP-16) This article covers general requirements for communications systems. These general requirements apply to communications circuits, community antenna television and radio distribution systems, network-powered broadband communications systems, and premises-powered broadband communications systems, unless modified by Articles 805, 820, 830, and or 840. **[Previous Article 800 (Communication Circuits) is now Article 805]*

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Article 100 Part III Hazardous (Classified) Locations (CMP-14)

The hazardous (classified) location definitions will be moved to new Part III of Article 100 for added clarity and usability

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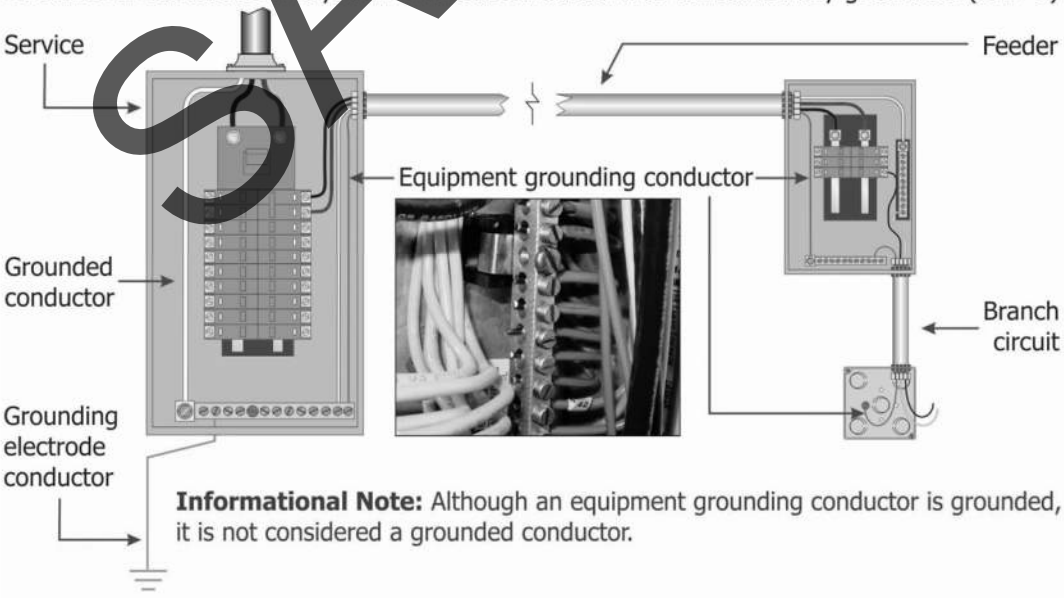
Article 100 Definitions: Grounded Conductor (I-Note)

Grounded Conductor. A system or circuit conductor that is intentionally grounded. (CMP-5)



Informational Note: Although an equipment grounding conductor is grounded, it is not considered a grounded conductor.

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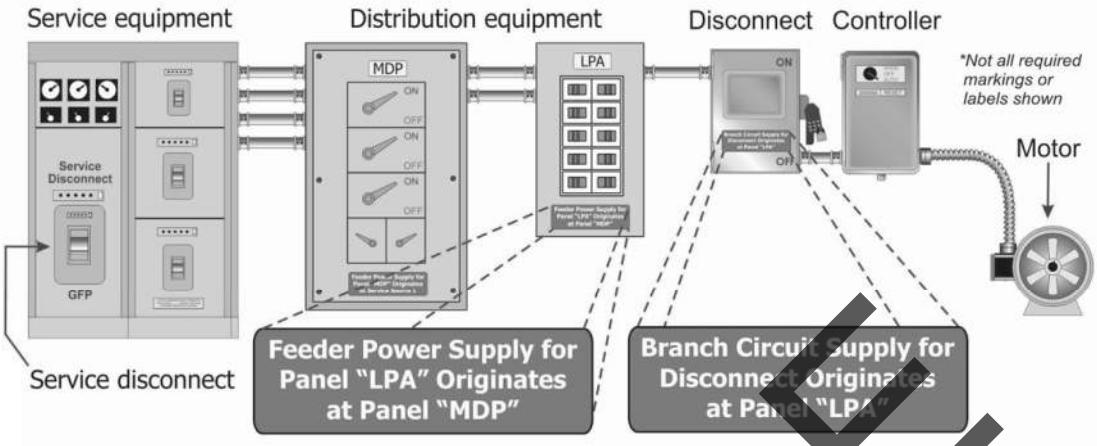
SAMPLE

110.22(A) Identification of Disconnecting Means



Each disconnecting means shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident

In other than one- or two-family dwellings, the marking shall include the identification of the circuit source that supplies the disconnecting means

The marking shall be of sufficient durability to withstand the environment involved

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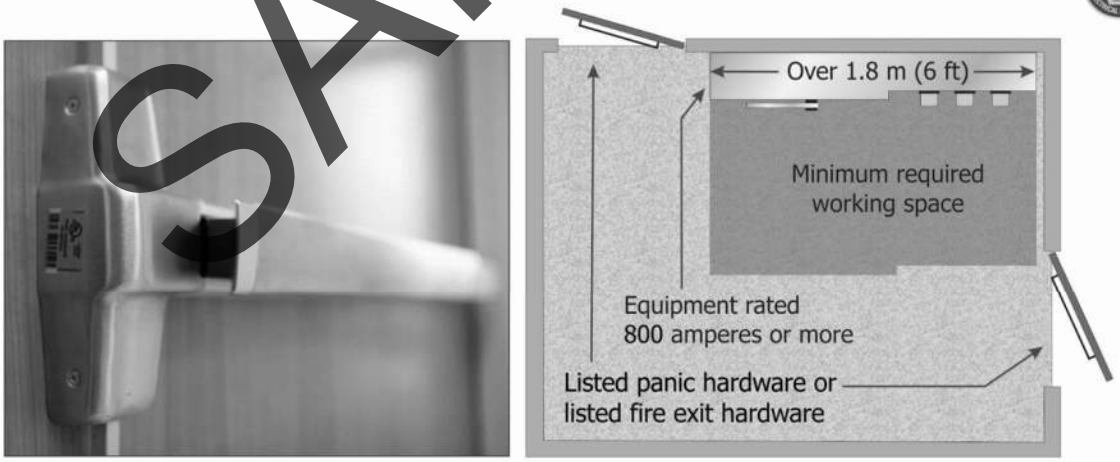
110.26(C)(3) Personnel Doors



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

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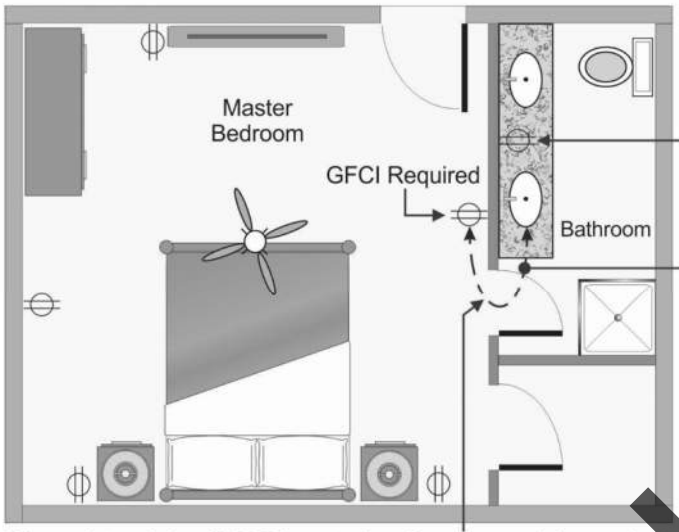
SAMPLE

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]*

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Table 220.12 General Lighting Loads by Non-Dwelling Occupancy *(Part 1)*

Type of Occupancy	Unit Load Volt-amperes/m^2	Unit Load Volt-amperes/ft^2
Automotive facility	16	1.5
Convention Center	15	1.4
Courthouse *(was Courtrooms)*	15 ~~22~~	1.4 ~~2.0~~
Dormitory	16	1.5
Exercise center	15	1.4
Fire station	14	1.3
Gymnasium[a] *(was Armories and auditoriums)*	18 ~~11~~	1.7 ~~1.0~~
Health care clinic *(was Hospitals)*	17 ~~22~~	1.6 ~~2.0~~
Hospital	17	1.6
Hotels and motels, including apartment houses without provisions for cooking by tenants[b]	18 ~~22~~	1.7 ~~2.0~~
Library	16	1.5
Manufacturing facility[c] *(was Industrial commercial (loft) bldg)*	24 ~~22~~	2.2 ~~2.0~~
Motion picture theater	17	1.6
Museum	17	1.6
Office[d] *(was Office buildings)*	14 ~~39~~	1.3 ~~3.5~~

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SAMPLE

Table 220.12 General Lighting Loads by Non-Dwelling Occupancy *(Part 2)*

Type of Occupancy	Unit Load Volt-amperes/m^2	Unit Load Volt-amperes/ft^2
Parking garage[e] *[was Garages-commercial (storage)]*	3 ~~6~~	0.3 ~~0.5~~
Penitentiary	13	1.2
Performing arts theater	16	1.5
Police station	14	1.3
Post office	17	1.6
Religious facility *(was Churches)*	24 ~~11~~	2.2 ~~1.0~~
Restaurant[f] *(was Restaurants and Clubs)*	16 ~~22~~	1.5 ~~2.0~~
Retail[g, h] *(was Barber shops and beauty parlors and Stores)*	20 ~~33~~	1.9 ~~3.0~~
School/university *(was Schools)*	33	3.0
Sports arena	33	3.0
Town hall	15	1.4
Transportation	13	1.2
Warehouse	13 ~~3~~	1.2 ~~0.25~~
Workshop	18	1.7

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SAMPLE

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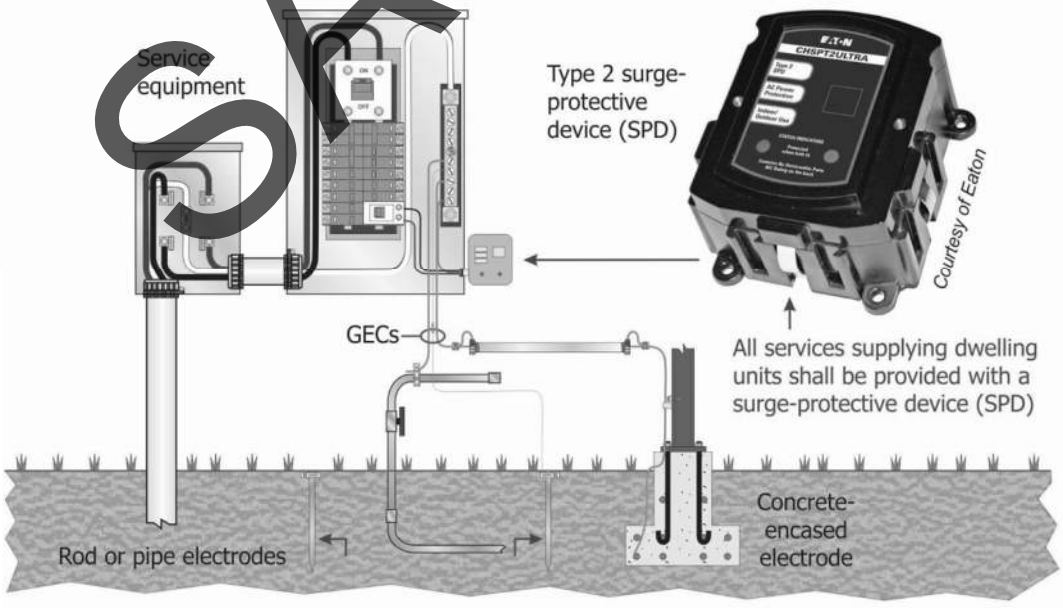
230.67 Surge Protection for Dwelling Units



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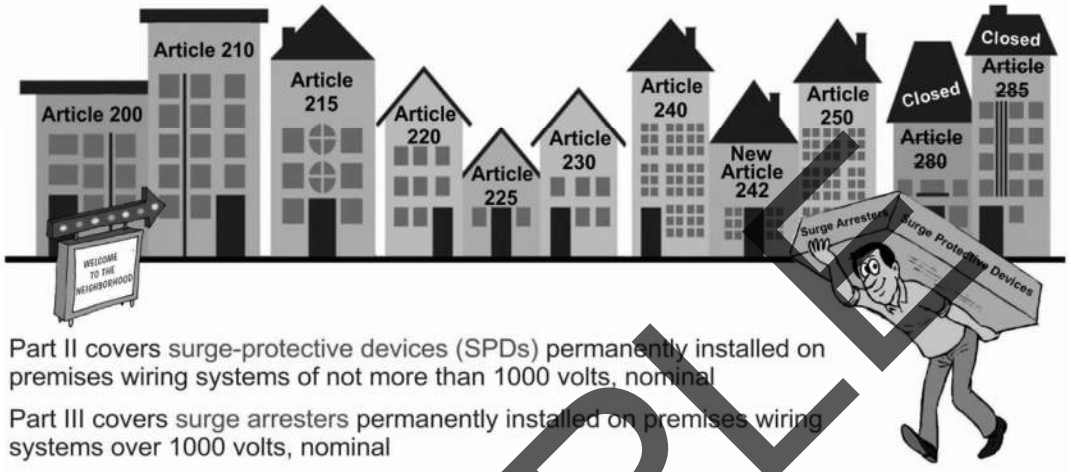
Article 242 Overvoltage Protection

New Article 242 added to provide the general, installation, and connection requirements for overvoltage protection and overvoltage protective devices

Relocates previous Articles 280 and 285 into a new Article 242



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

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

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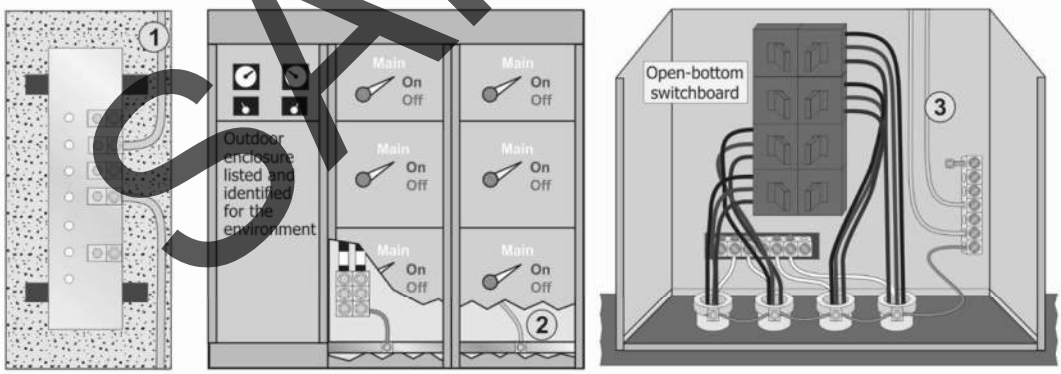
250.64(A) Aluminum or Copper-Clad Aluminum GECs



Grounding electrode conductors (GEC) of bare, covered, or insulated aluminum or copper-clad aluminum shall comply with the following:

1. Bare or covered GECs ***not permitted*** to be installed where subject to corrosive conditions or be installed in direct contact with concrete *(without an extruded polymeric covering)*
2. Terminations made within outdoor enclosures that are listed and identified for the environment are ***permitted*** within 450 mm (18 in.) of bottom of the enclosure
3. Aluminum or copper-clad aluminum GECs installed external to buildings or equipment enclosures ***not permitted*** to be terminated within 450 mm (18 in.) of the earth

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SAMPLE

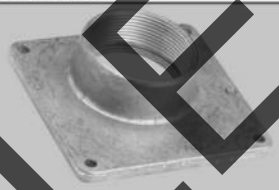
300.4(G) Protection Against Physical Damage - ~~Insulated~~ Fittings

Where raceways contain 4 AWG or larger insulated circuit conductors, and conductors enter a cabinet, a box, an enclosure, or a raceway, conductors shall be protected by any of the following:

(1) 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 by using an identified insulating material that is securely fastened in place



(4) Threaded hubs or bosses (integral part of cabinet, box, enclosure, or raceway) with smoothly rounded or flared entry

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334.2 Nonmetallic-Sheathed Cable - Type NMS Deleted

All references to Type NMS cable has been deleted from Article 334 as this cable construction is no longer manufactured

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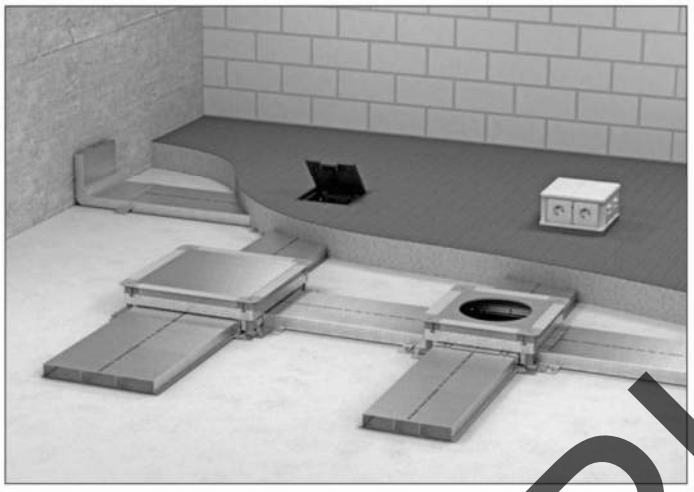
374.6 Listing Requirements for Cellular Metal Floor Raceways

A new 374.6 was added to Article 374 requiring all cellular metal floor raceways to be listed



Cellular Metal Floor Raceway

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404.9 General-Use Snap Switches, Dimmers, and Control Switches

Faceplates provided for snap switches, dimmers, and control switches mounted in boxes and other enclosures required to be installed so as to completely cover the opening and, where the switch is flush mounted, seat against the finished surface

Metal faceplates are required to be bonded to an equipment grounding conductor (EGC)

Listed kits or listed assemblies are not required to be connected to an EGC if (4) conditions are met, including if the device is provided with a nonmetallic faceplate and the device is designed such that no metallic faceplate replaces the one provided

Snap Switches

Dimmers

Control Switches

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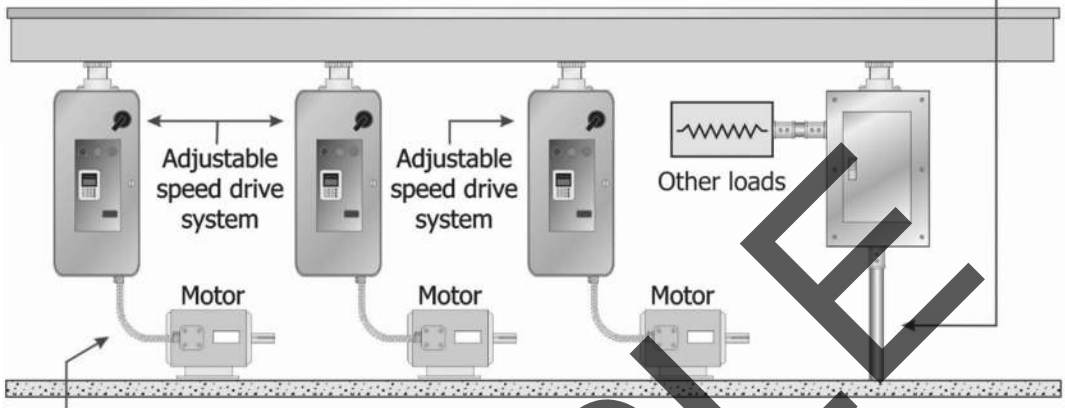
SAMPLE

430.122(D) Several Motors or Motor(s) and Other Load(s)- Adjustable-Speed Drive Systems With Power Conversion Equipment

Conductors supplying several motors or motor(s) and other load(s), including power conversion equipment, required to have calculated ampacity in accordance with 430.24, using the rated input current of the power conversion equipment



Output conductors between power conversion equipment and the motor must have an ampacity equal to or larger than 125 percent of the motor full-load current (w/ exception) [430.122(B)]

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445.18(D) Emergency Shutdown Device at Dwelling Units

An outdoor emergency generator shutdown device is required for generators installed at one- and two-family dwelling units *(other than cord-and-plug-connected generators)*

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SAMPLE

500.7(K) Combustible Gas Detection System

These requirements surrounding a combustible gas detection system as a protection technique were appropriately revised and expanded to provide more sufficient detail to install and operate a gas detection system

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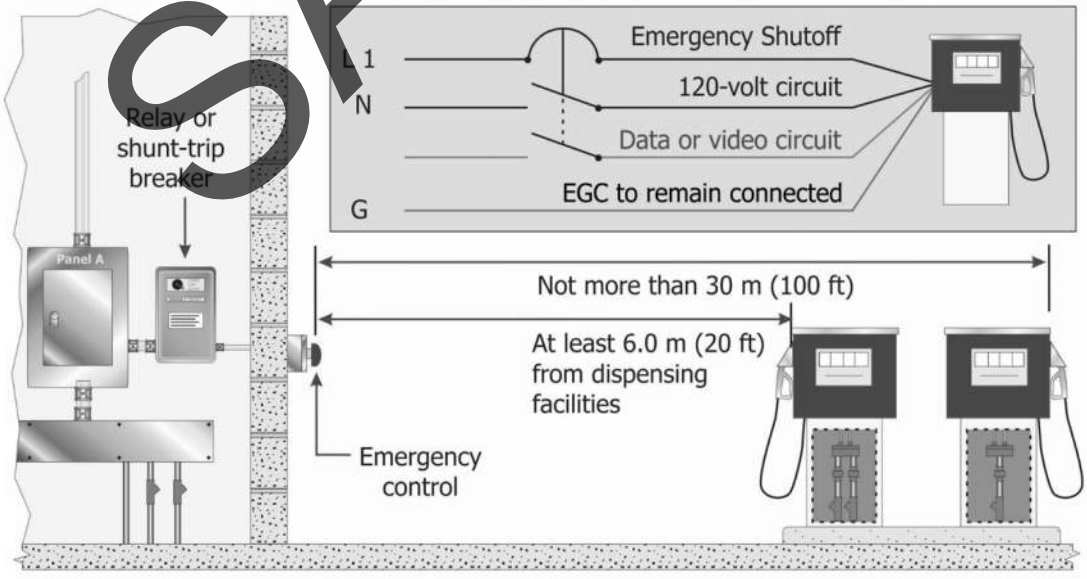
8

514.11(A) Emergency Controls for Fuel Dispensers

Emergency shutoff device shall disconnect simultaneously from the source of supply, all conductors of the circuits, including the grounded conductor *(EGCs to remain connected)*



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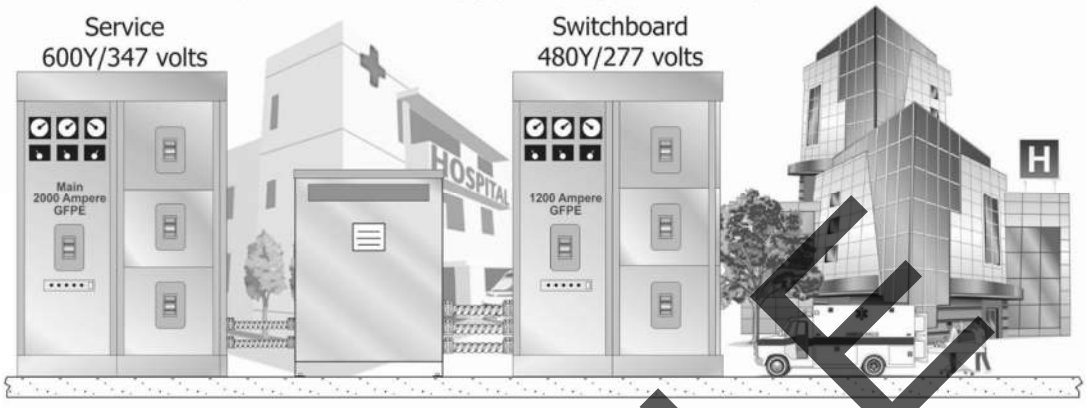
SAMPLE

517.17(D) Performance Testing of GFP Systems at Health Care Facilities

When ground-fault protection of equipment is first installed, each level required to be performance tested to ensure compliance with 517.17(C) *(selectively coordinated)*



Testing to be conducted by a qualified person(s) using a test process in accordance with the instruction provided with the equipment

Written record of this testing to be kept and made available to the authority having jurisdiction

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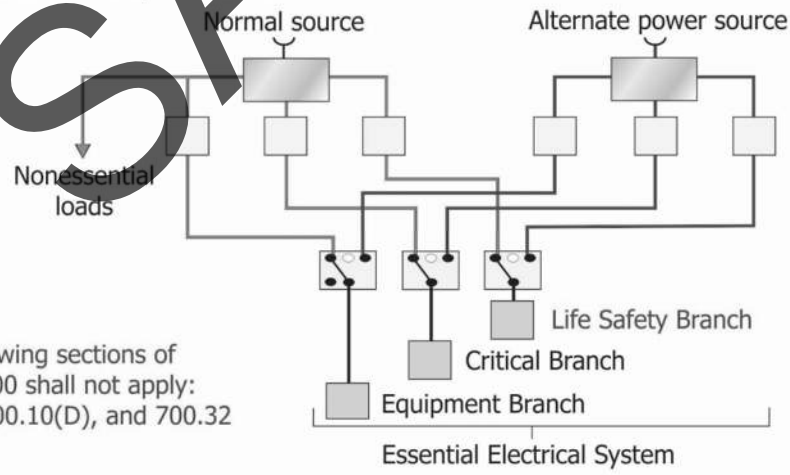
517.26 Application of Other Articles (Health Care Facilities)

Life safety branch of the essential electrical system shall meet the requirements of Article 700, except as amended by Article 517



The following sections of Article 700 shall not apply: 700.4, 700.10(D), and 700.32

Branch circuits that supply emergency lighting shall be installed to provide service from a source complying with 700.12 when normal supply for lighting is interrupted or where single circuits supply luminaires containing secondary batteries (amended from 700.17)

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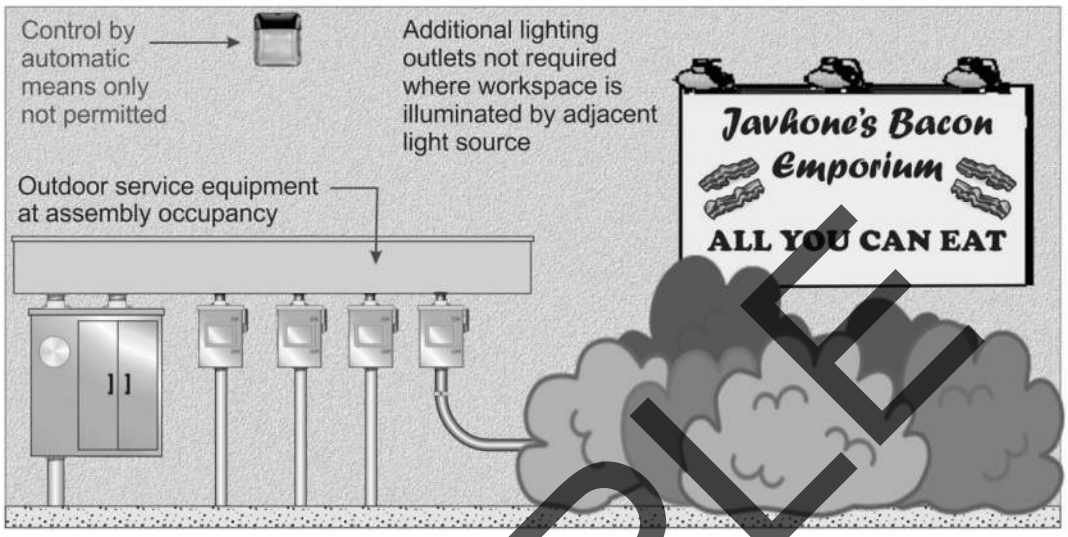
SAMPLE

518.6 Outdoor Illumination - Assembly Occupancies

Illumination required for working spaces about fixed service equipment, switchboards, switchgear, panelboards, or motor control centers installed outdoors that serve assembly occupancies



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525.20(G) Protection of Flexible Cords or Cables

Flexible cords or cables accessible to the public shall be arranged to minimize tripping hazards

Flexible cords or cables permitted to be covered with nonconductive matting secured to the walkway surface *or* protected with another approved cable protection method

The matting or other protection method cannot constitute a greater tripping hazard than the uncovered cables

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SAMPLE

550.32(E) Supply Receptacles for Mobile or Manufactured Homes

Receptacles located outside mobile or manufactured homes required to be provided with GFCI protection as specified by 210.8(A)

Receptacles providing power to mobile or manufactured homes in accordance with 550.10, are not required to be provided with GFCI protection

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555.35(B) Leakage Current Measurement Device at Marinas, Etc.

Where more than three receptacles supply shore power to boats, a leakage current measurement device shall be available and be used to determine leakage current from each boat that will utilize shore power

Photo courtesy of Marina Electrical Equipment (MEE)

Leakage current measurement will provide the capability to determine when an individual boat has defective wiring or other problems contributing to hazardous voltage and current

The use of a test device will allow the facility operator to identify a boat that is creating problems

The use of a test device will also help the facility operator prevent a particular boat from contributing to hazardous voltage and current in the marina area

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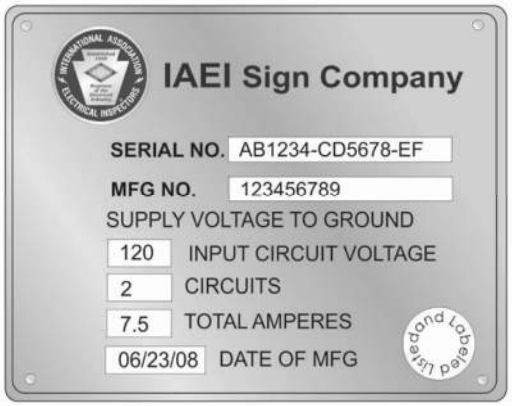
SAMPLE

600.4(D) Visibility of Markings - Electric Signs and Outline Lighting

Signs and outline lighting systems required to be marked with such things as manufacturer's name, trademark, input voltage and current rating, maximum allowable lamp wattage per lampholder, and other means of identification [600.4(A) and (C)]



Markings and listing labels are required to be visible after installation and must be permanently applied in a location visible prior to servicing

Marking permitted to be installed in a location not viewed by the public

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600.35 Retrofit Kits

New 600.35 gives specific installation instructions for retrofit kits for signs and outline lighting systems

General-use or sign-specific retrofit kits for sign or outline lighting systems to include installation instructions and requirements for field conversion of a host sign

Retrofit kits shall be listed and labeled

All parts that are not replaced by a retrofit kit shall be inspected for damage

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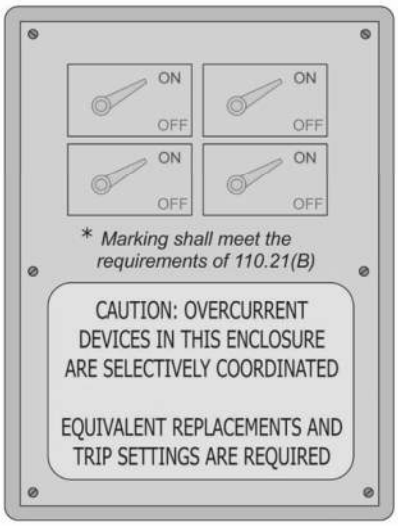
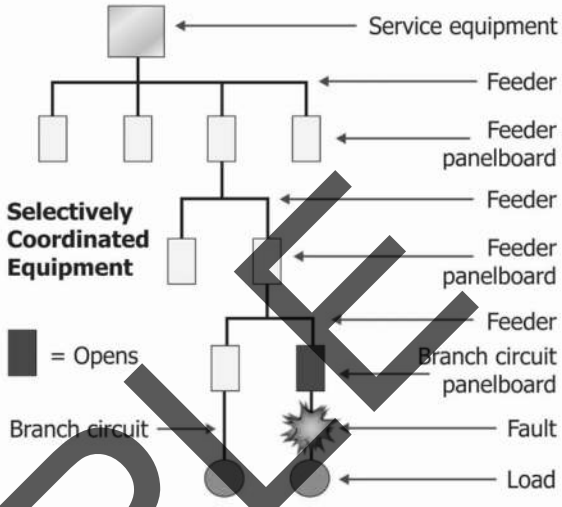
SAMPLE

620.65 Signage for Selective Coordination

(Elevators, Dumbwaiters, Escalators, Moving Walks, Platform Lifts, and Stairway Chairlifts)

Equipment enclosures containing selectively coordinated overcurrent devices required to be legibly marked in the field to indicate that the overcurrent devices are selectively coordinated





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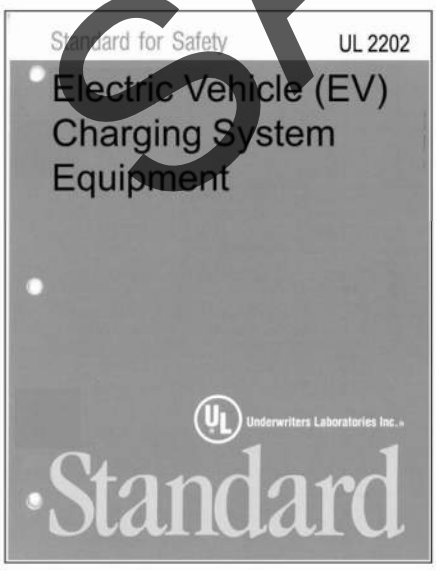
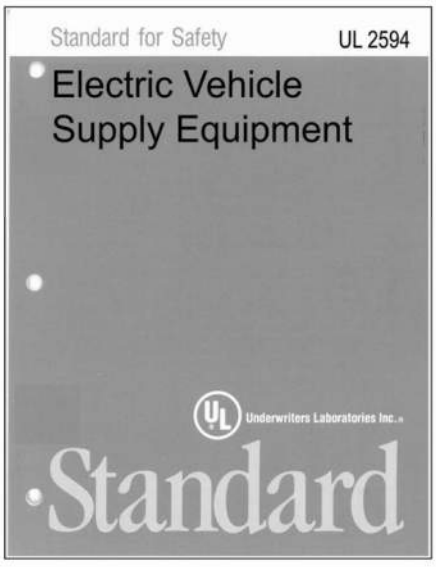
Article 625 - Part II EV Equipment Construction

All product construction requirements in Part II of Article 625 addressing product features that are an integral part of the listing requirements for EV product were removed from Article 625





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SAMPLE

680.2 and 680.14 Corrosive Environments

Corrosive Environment. Areas where pool sanitation chemicals are stored, handled, or dispensed, and confined areas under decks adjacent to such areas, as well as areas with circulation pumps, automatic chlorinators, filters, open areas under decks adjacent to or abutting the pool structure, and similar locations.

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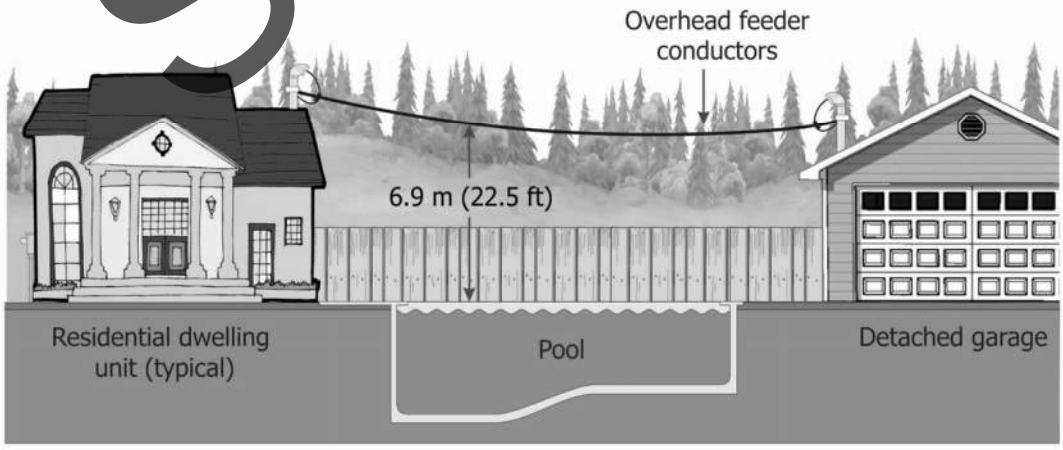
680.9(A) Overhead Power Conductor Clearances

The minimum clearances for overhead power conductors *(not just service conductors)* from pools, fountains, etc. shall comply with the provisions in Table 680.9(A) for conductors operating at 0 to 750 volts to ground [6.9 m (22.5 ft)] *(typical)*



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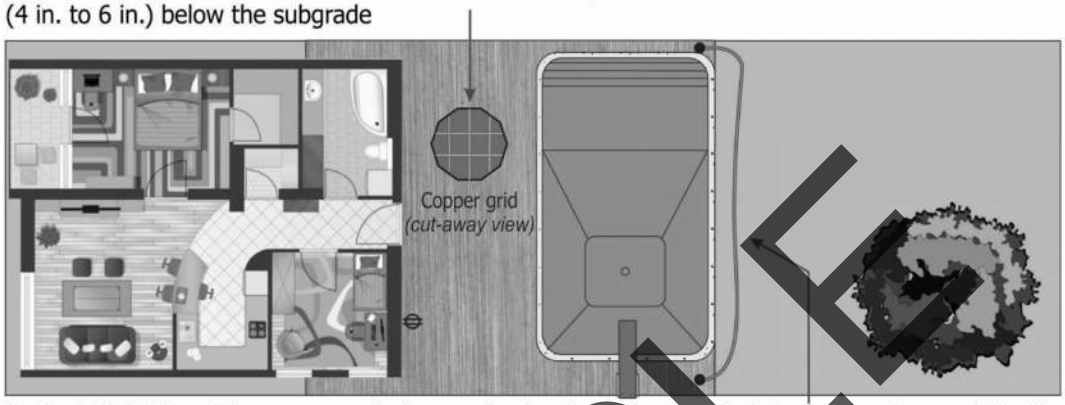
SAMPLE

680.26(B)(2)(c) Copper Grid for Perimeter Surfaces

Where structural reinforcing steel is not available or encapsulated, an 8 AWG copper grid system is permitted to be utilized arranged in a 300-mm (12-in.) by 300-mm (12-in.) network of conductors in a uniformly spaced perpendicular grid pattern with a tolerance of 100 mm (4 in.)

Required to be secured within or under the deck or unpaved surfaces between 100 mm to 150 mm (4 in. to 6 in.) below the subgrade



A single 8 AWG solid copper conductor or structural reinforcing steel *(rebar or wire mesh)* in the concrete is also permitted as the bonding grid for the perimeter surface

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690.4(B) PV Equipment Listing and Evaluation

Equipment intended for use in PV systems required to be listed or be evaluated for the application and have a field label applied

- Equipment required to be listed or evaluated:
- Inverters
- Motor generators
- PV modules
- ac modules and ac module systems
- dc combiners
- dc-to-dc converters
- Rapid shutdown equipment
- dc circuit controllers
- Charge controllers

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SAMPLE

690.31 Wiring Methods for Solar Photovoltaic (PV) Systems

690.31 was revised and re-organized for clarity and to bring PV wiring methods for PV source and output circuits to one location

(A) Wiring Systems

(B) Identification and Grouping
- (1) Identification
- (2) Grouping

(C) Cables
- (1) Single-Conductor Cables
- (2) Cable Tray
- (3) Multiconductor Jacketed Cables
- (4) Flexible Cords and Cables Connected to Tracking PV Arrays
- (5) Flexible, Fine Stranded Cables
- (6) Small-Conductor Cables

(D) Direct-Cirrent on or in Buildings
- (1) Flexible Wiring Methods
- (2) Marking and labeling Required

(E) Bipolar Photovoltaic Systems

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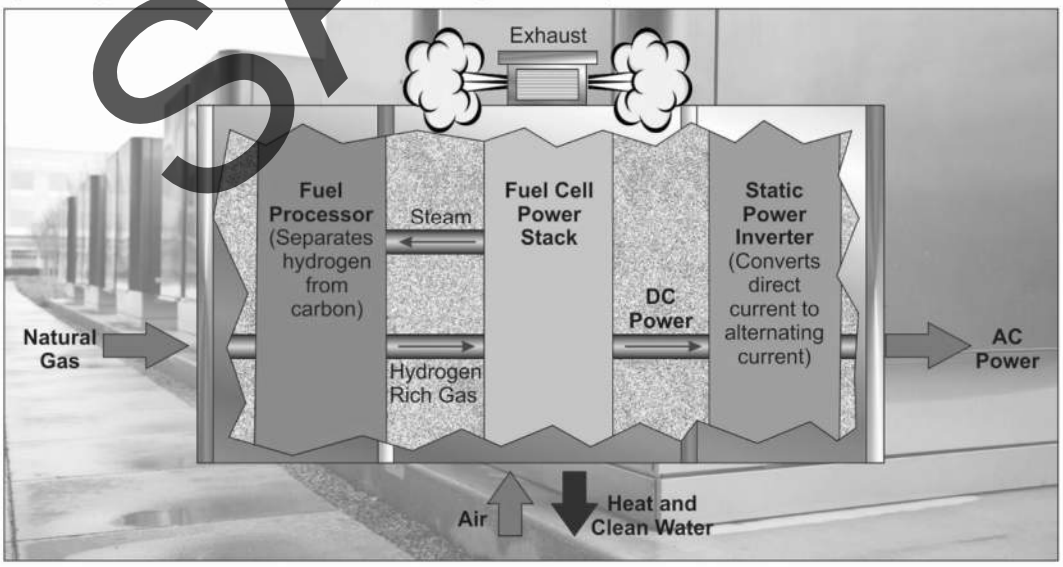
692.4(B) Identification of Power Sources (Fuel Cell Systems)

Three separate List Items where created to clearly identify the requirements for different fuel cell system types to add clarity to the placarding of these systems



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SAMPLE

695.3(C)(3) Selective Coordination (Fire Pumps)

Fire pumps in multibuilding campus-style complexes require all overcurrent protective device(s) to be selectively coordinated with all supply-side overcurrent protective device(s)

Selective coordination required to be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems

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SAMPLE

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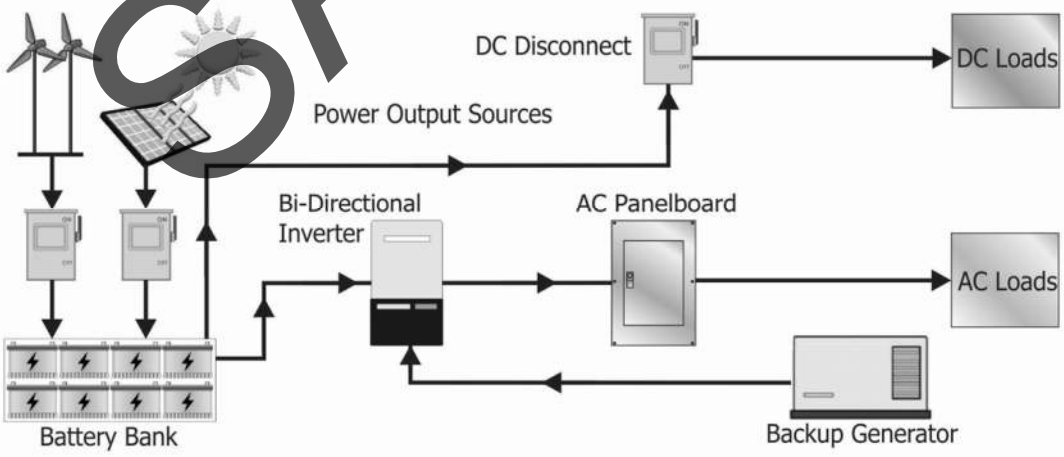
710.15 General Requirements for Stand-Alone Systems

New provisions added to 710.15 to recognize that stand-alone systems can deliver power to three-phase applications as well as single-phase systems



710.15(D): Three-phase Supply. Stand-alone and microgrid systems are permitted to supply three-phase, 3-wire or 4-wire systems

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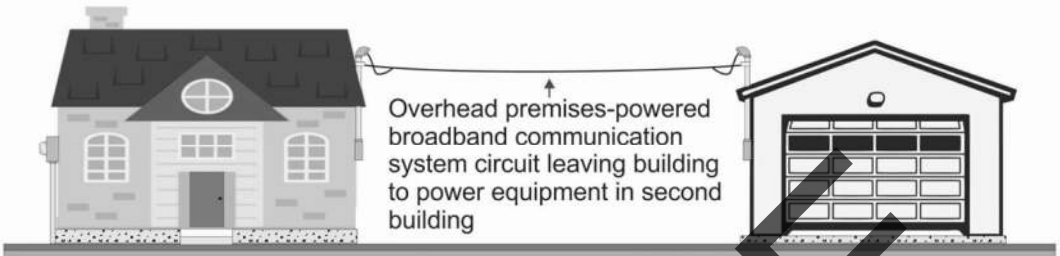
840.94 and 840.102 Premises Circuits Leaving the Building

840.94: Requires circuits leaving a building to power equipment remote to that building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, to comply with 805.90 *(Protective Devices)* and 805.93 *(Grounding, Bonding, or Interruption of Non-Current-Carrying Metallic Sheath Members of Communications Cables)*



If coaxial cables are present, required to comply with 820.100 *(Cable Bonding and Grounding) (which references 800.100)* and 800.106

840.102: Requires communications wires and cables circuits leaving the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere to comply with 800.100 *(Cable and Primary Protector Bonding and Grounding)* and 800.106 *(Primary Protector Grounding and Bonding at Mobile Homes)*

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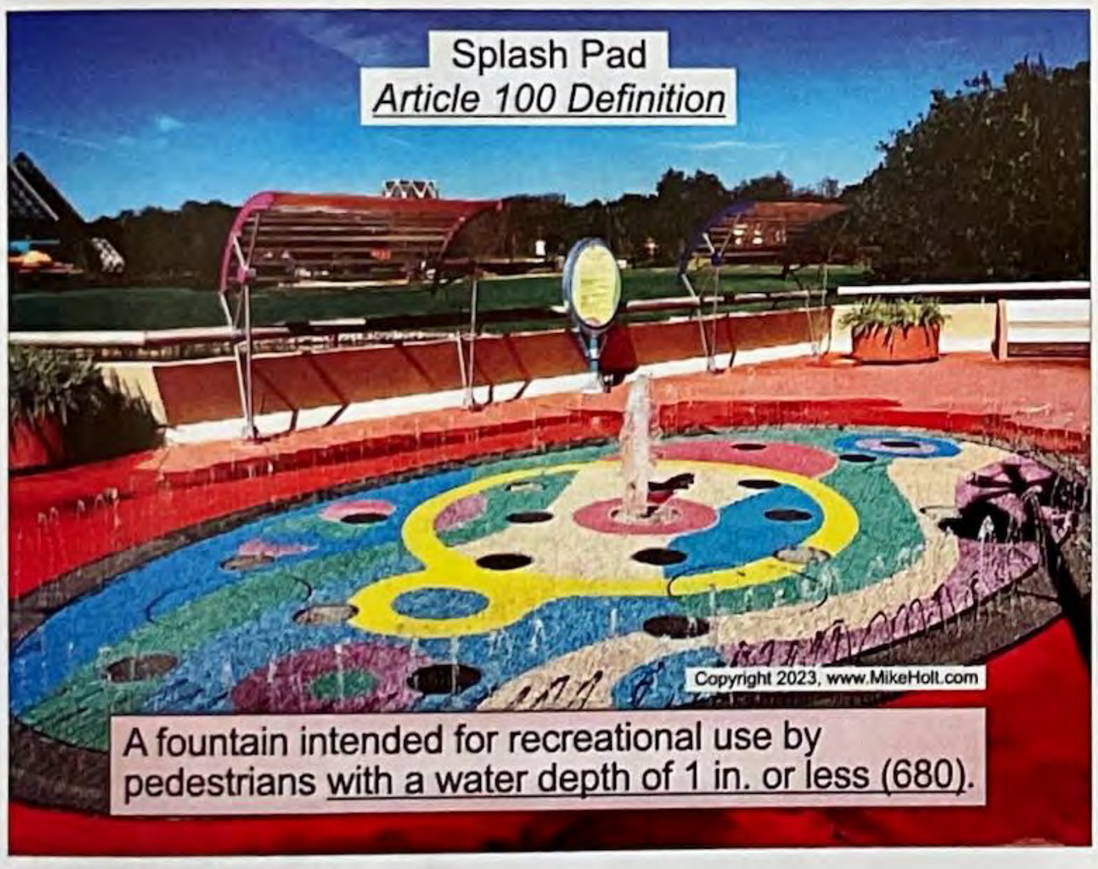
SAMPLE

Authors Comment:

- A short circuit occurs when there is an unintentional electrical connection between two phase conductors, or a phase conductor and neutral conductor.

Splash Pad. A fountain intended for recreational use by pedestrians with a water depth of 1 in. or less. This definition does not include showers intended for hygienic rinsing prior to use of a pool, spa, or other water feature (Article 680). ▸Figure 100–24



▸Figure 100–24

Analysis

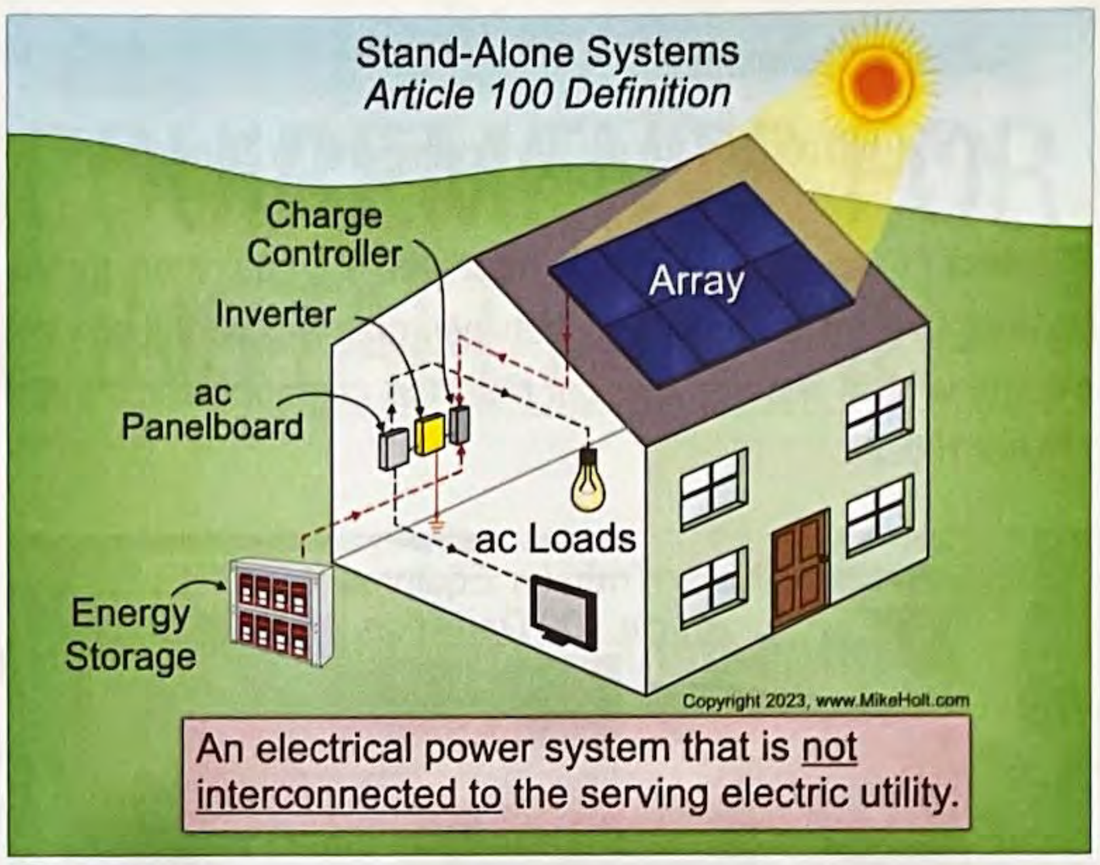
CLARIFIED

Stand-Alone System. This definition now clarifies that stand-alone systems are NOT connected to any other system.

Stand-Alone System. An electrical power system that is not interconnected to the electric utility power system. ▸Figure 100–25

Author's Comment:

- Although stand-alone systems can operate independently of the serving electric utility, they may include a connection to the serving electric utility for use when not operating in stand-alone mode ("island mode").



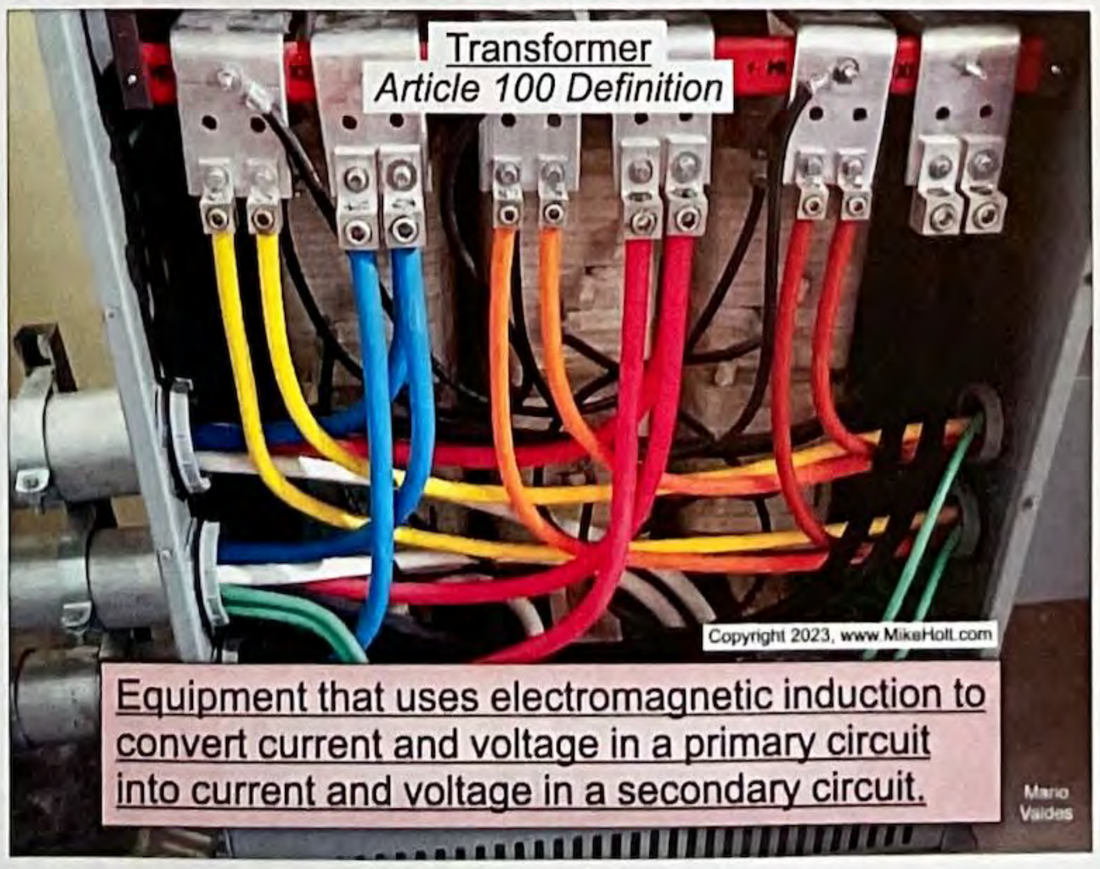
▸Figure 100–25

Analysis

NEW

Transformer. I'm not sure we were confused on this one, but it's a great definition and it found a home in Article 100.

Transformer. Equipment, either single-phase or polyphase, that uses electromagnetic induction to convert current and voltage in a primary circuit into current and voltage in a secondary circuit. ▸Figure 100–26



▸Figure 100–26

▸Figure 230–7

230.62 Service Equipment—Enclosed or Guarded

Language was added to clarify where line-side terminal barriers are required.

Analysis

CLARIFIED

The rule in 230.62(C) was changed to clarify that protective barriers are required for any uninsulated exposed parts on the line side of the service disconnect when in the open position. This was always the intent of the rule, but the language was not completely clear.

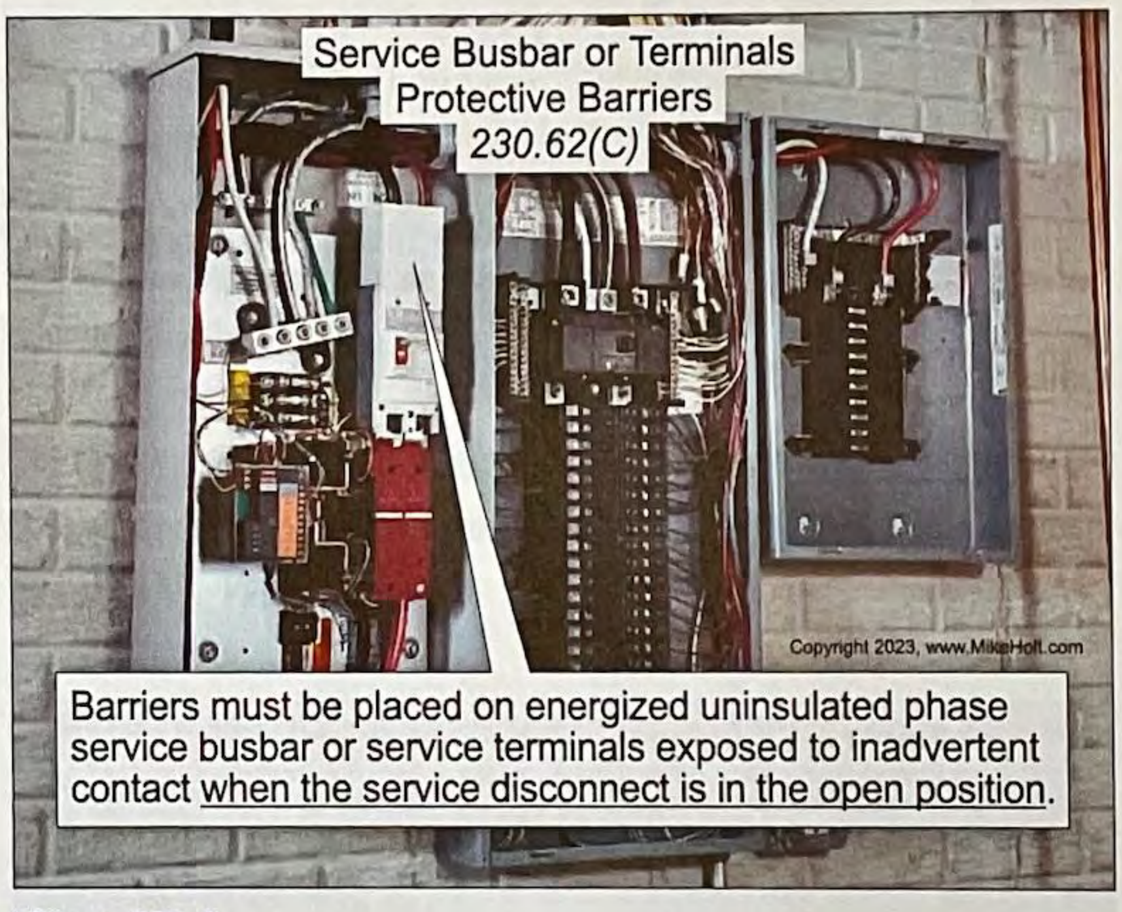
230.62 Service Equipment—Enclosed or Guarded

Energized parts of service equipment must be enclosed as specified in 230.62(A) or guarded as specified in 230.62(B).

(A) Enclosed. Energized parts must be enclosed so they will not be exposed to accidental contact or must be guarded in accordance with 230.62(B).

(B) Guarded. Energized parts that are not enclosed must be installed on a switchboard, panelboard, or control board and guarded in accordance with 110.18 and 110.27. Where energized parts are guarded as provided in 110.27(A)(1) and (A)(2), a means for locking or sealing doors providing access to energized parts must be provided.

(C) Barriers. Barriers must be placed on energized uninsulated phase service busbar or service terminals exposed to inadvertent contact when the service disconnect is in the open position. ▸Figure 230–8



▸Figure 230–8

Author's Comment:

- The line-side of the service disconnect will have energized parts even with the disconnect in the open position. Barriers provide some measure of safety against inadvertent contact with line-side energized parts.

230.67 Surge Protection

This section was expanded to cover occupancies other than dwellings and to establish a minimum nominal discharge current for surge-protective devices.

643

230.71 Maximum Number of Disconnects

This section caused a lot of stir in the 2020 *Code* cycle by requiring a physical barrier between each of the sections of a meter pack or switchgear without a main disconnecting means. Several revisions here aim to solve some of the field issues created by the rules last cycle while preserving the intended added safety.

Analysis

CLARIFIED The revision to 230.71(B)(3) clarifies that the vertical barriers between the sections of switchboards must maintain the inadvertent contact protective barriers between adjacent sections.

EXPANDED Section 230.71(B)(4) was expanded to require each have a separate compartment for multiple service disconnects in transfer switches.

NEW Section 230.71(B)(5) is new and permits meter centers with a main service disconnecting means upstream of the metering center in a separate compartment to be used to meet the intent of this rule.

NEW Section 230.71(B)(6) is also new and adds MCCs to the types of service disconnecting equipment covered under this rule. The previous Informational Note said that MCCs are one of the types of equipment covered by this rule, but this revision now places it in enforceable text. Up to two service disconnects in an MCC are permitted, provided each is in its own unit and there are barriers to prevent inadvertent contact between the units.

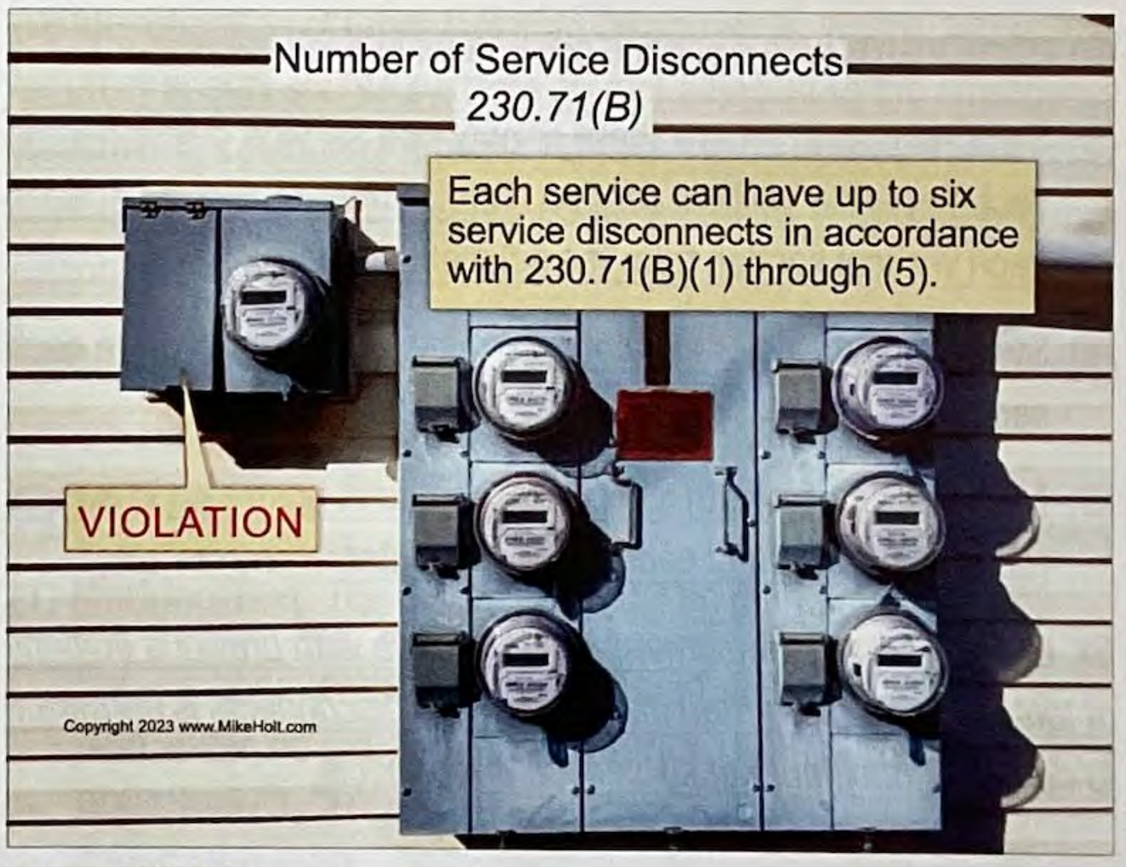
NEW A new Exception was added to 230.71(B) permitting the use of spare service disconnect spaces in equipment installed prior to the adoption of the 2020 *NEC*.

230.71 Number of Service Disconnects

Each service must have only one service disconnect except as permitted in 230.71(B). ▸Figure 230–11

▸Figure 230–11

(B) Two to Six Service Disconnecting Means. Each service can have up to six service disconnects in accordance with 230.71(B)(1) through (5). ▸Figure 230–12



▸Figure 230–12

Caution

CAUTION: This rule limits six disconnects for each service or set of service-entrance conductors. For example, if the building has more than one service as permitted by 230.2, then there can be more than six service disconnects at the building. ▸Figure 230–13

ARTICLE
300

GENERAL REQUIREMENTS FOR WIRING METHODS AND MATERIALS

Introduction to Article 300—General Requirements for Wiring Methods and Materials

Article 300 contains the general requirements for all wiring methods included in the *NEC*. However, it does not apply to twisted-pair cable and coaxial cable (which are covered in Chapters 7 and 8), unless Article 300 is specifically referenced.

This article is primarily concerned with how to install, route, splice, protect, and secure cables, conductors, and raceways. How well you understand and apply the requirements of Article 300 will usually be evident in the finished work. Many of its requirements will affect the appearance, longevity, and even the safety of the installation. Installing conductors takes critical thinking, for example installing the phase conductors in one raceway and the neutral conductors in another raceway will cause inductive heating effects. Pay close attention to the building construction to be aware of what to do when cables are installed through framing members or penetrate fire walls. After studying and learning the rules in this article, you will immediately realize that the burial depth requirements of 300.5 were possibly overlooked or ignored.

A good understanding of this article will start you on the path to correctly and safely installing the wiring methods included in Chapter 3. Be sure to carefully consider the accompanying illustrations and refer to the definitions in Article 100 as needed.

300.3 Conductors

The rule requiring all conductors of the circuit to be in the same raceway added language to include conduit bodies. In addition, the voltage ranges were expanded to include both 1000V ac and the newly added 1500V dc.

Analysis

CLARIFIED

The rules in 300.3(B) require all conductors of the circuit, including any grounded or grounding conductors, to be in the same raceway. "Conduit bodies" were added to that list to address possible confusion in applying this rule.

EXPANDED

Subdivision (C) was expanded by allowing conductors carrying up to 1500V dc to occupy the same enclosure or raceway as conductors up to 1000V ac, if all conductor insulation is rated for the maximum circuit voltage present.

300.3 Conductors

(B) Conductors Grouped Together. All conductors of a circuit, including the neutral and equipment grounding conductors, must be installed together in the same raceway, conduit body, cable, trench, cord, or cable tray except as permitted by (1) through (4). ▶Figure 300–1

300.6 Protection Against Corrosion

Raceways, cable trays, cable armor, boxes, cable sheathing, cabinets, enclosures, elbows, couplings, fittings, supports, and support hardware must be suitable for the environment.

(A) Ferrous Metal Equipment. Ferrous metal raceways, enclosures, cables, cable trays, cabinets, enclosures, fittings, and support hardware must be protected against corrosion by a coating of approved corrosion-resistant material. ▸Figure 300–16

▸Figure 300–16

Author's Comment:

- According to UL "DYIX" Guide, supplementary corrosion protection is required when a ferrous metal raceway transitions from concrete encasement to the soil. ▸Figure 300–17

▸Figure 300–17

Where corrosion protection is required and IMC or RMC is threaded in the field, the threads must be coated with an approved electrically conductive, corrosion-resistant compound.

300.12 Mechanical Continuity—Raceways and Cables

Conduit bodies were added to this rule for consistency with other sections.

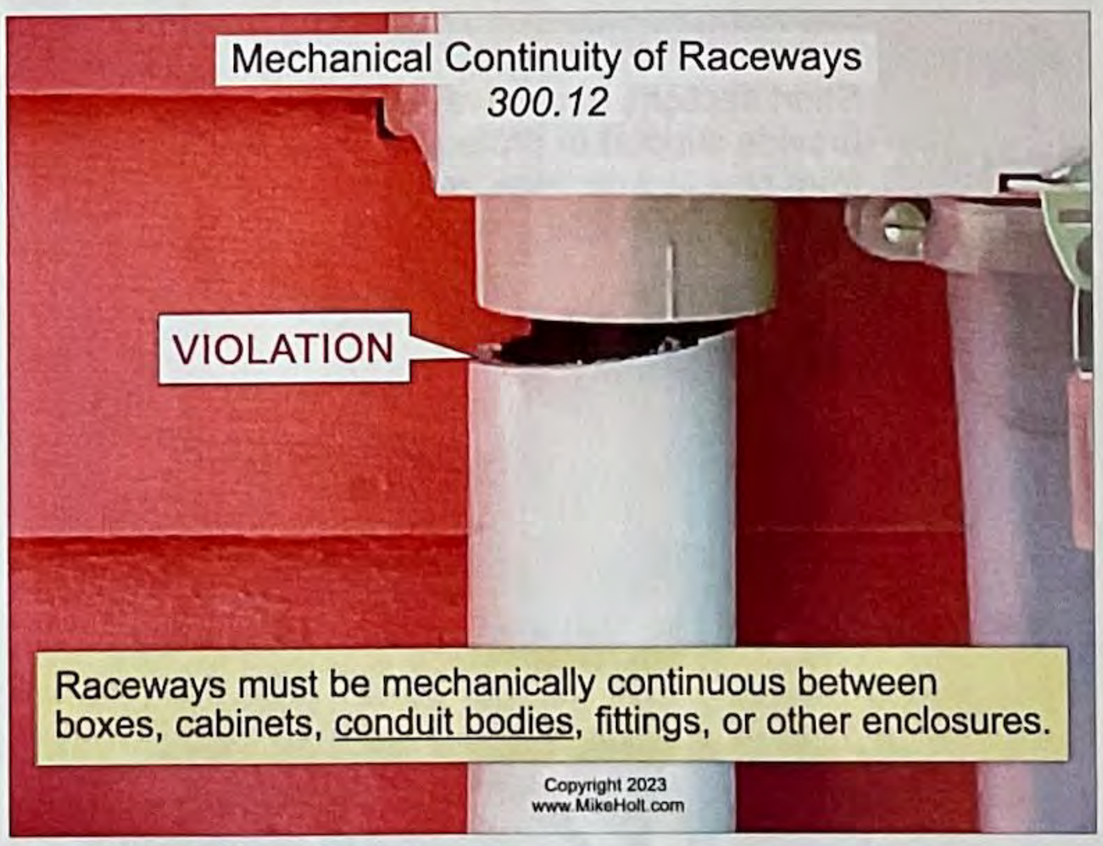
Analysis

EXPANDED

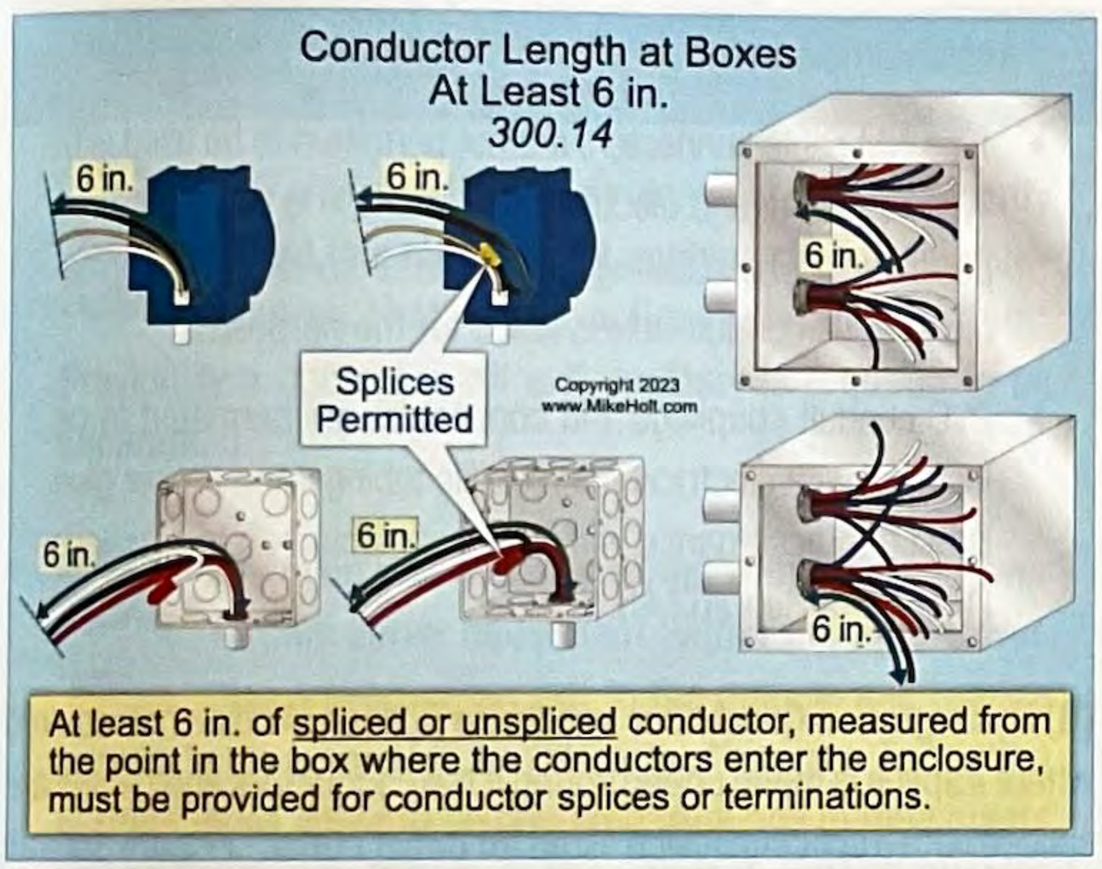
Raceways and cables must be mechanically continuous between enclosures, boxes, cabinets, and newly added "conduit bodies." This addition was made to be consistent with the title of Section 300.15, which includes "conduit bodies."

300.12 Mechanical Continuity

Raceways and cable sheaths must be mechanically continuous between boxes, cabinets, conduit bodies, fittings, or other enclosures. ▸Figure 300–18 and ▸Figure 300–19

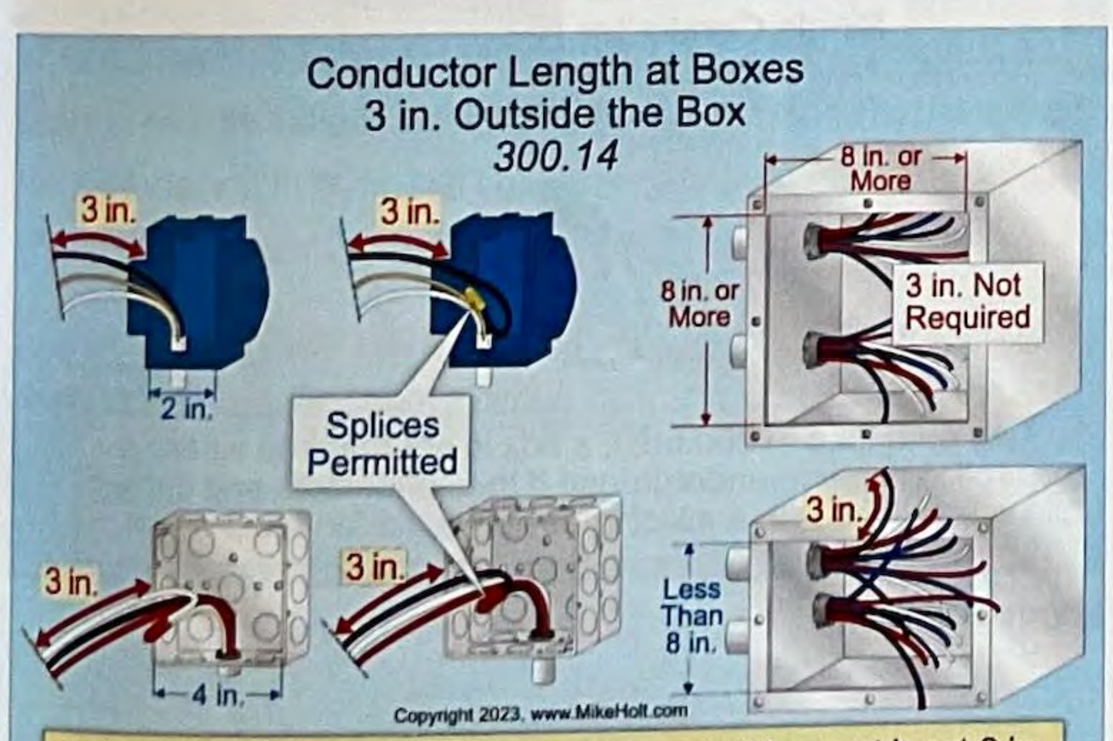


▸Figure 300–18



▸Figure 300–22

Boxes with openings less than 8 in. at any dimension must have at least 6 in. of conductor, measured from the point where the conductors enter the box, and at least 3 in. of conductor outside the box. ▸Figure 300–23



▸Figure 300–23

300.15 Boxes or Fittings

The language was revised to clarify that boxes are not required at wiring method transition points.

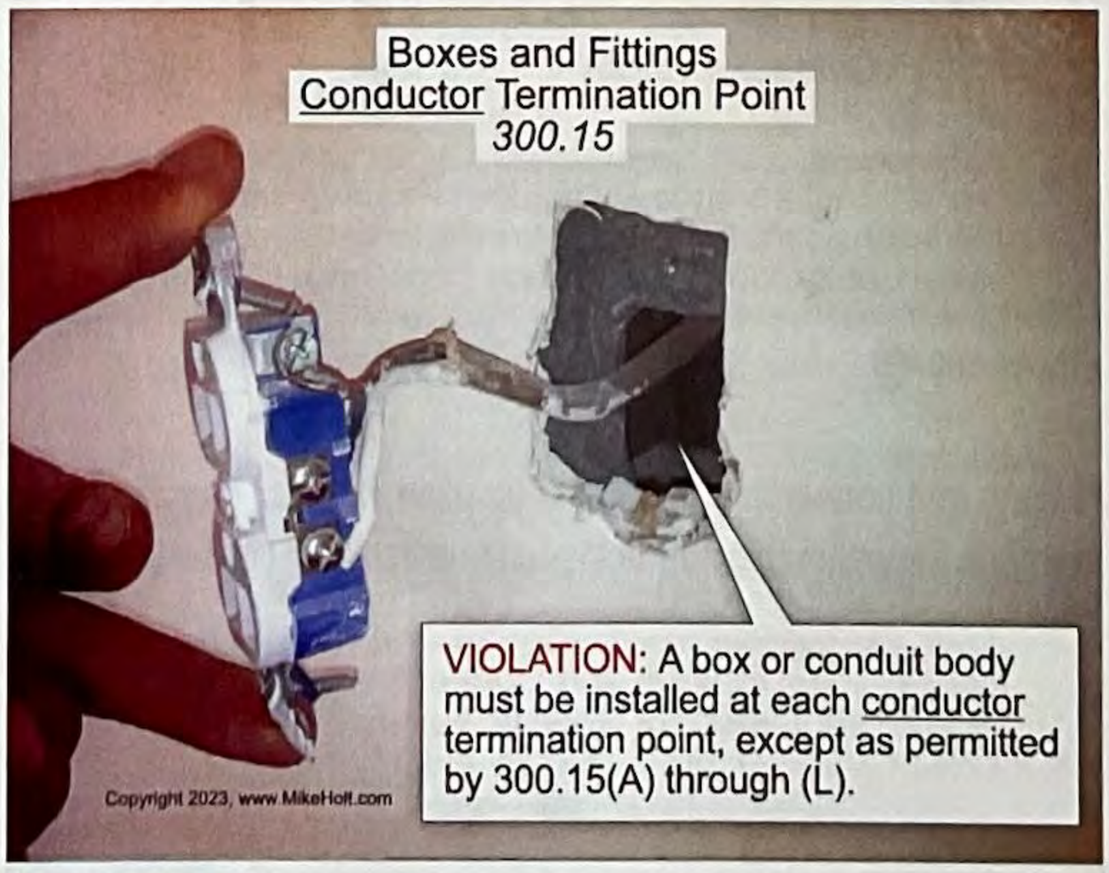
Analysis

CLARIFIED

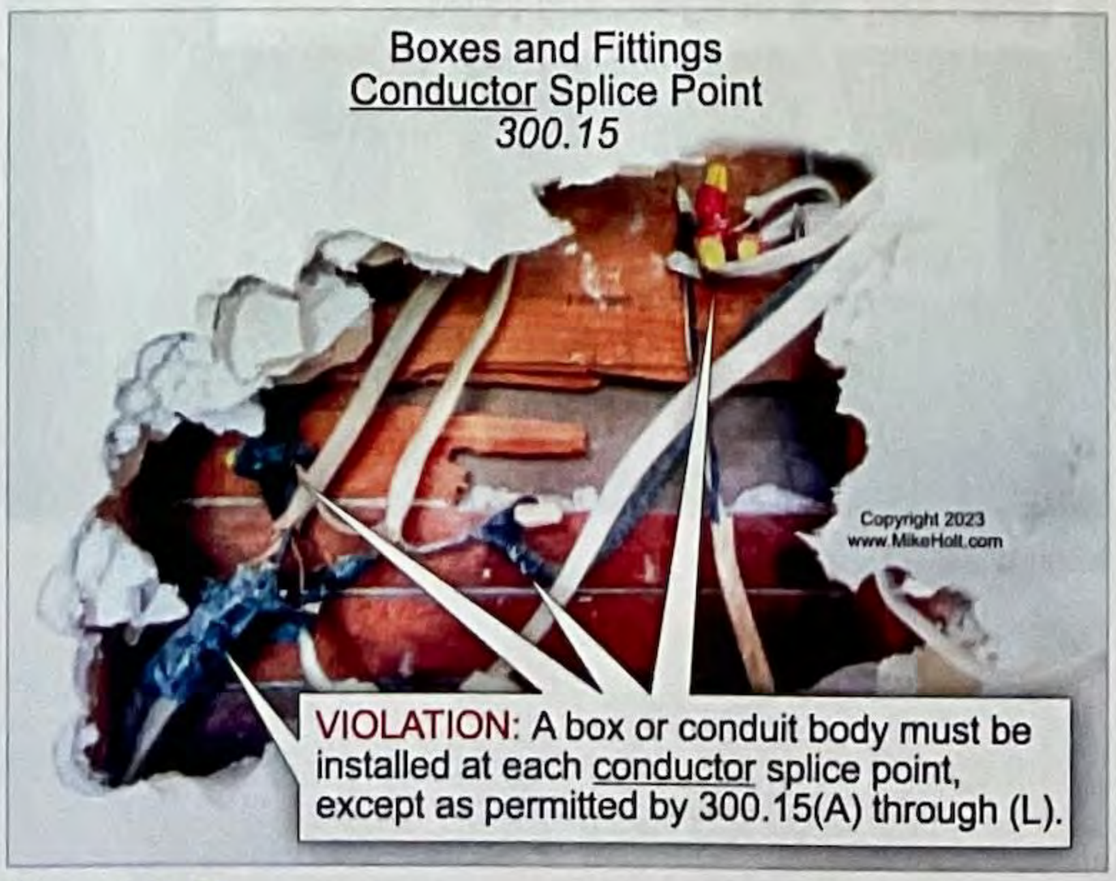
The word "conductor" was added throughout the charging text clarifying that a box is not required for a transition between two different wiring methods if there is no splice. Even though this was already covered in 300.15(F), it was not part of the charging statement.

300.15 Boxes or Fittings

A box or conduit body must be installed at each conductor splice point and conductor termination point, except as permitted by 300.15(A) through (L): ▸Figure 300–24 and ▸Figure 300–25



▸Figure 300–24



▸Figure 300–25

CLARIFIED

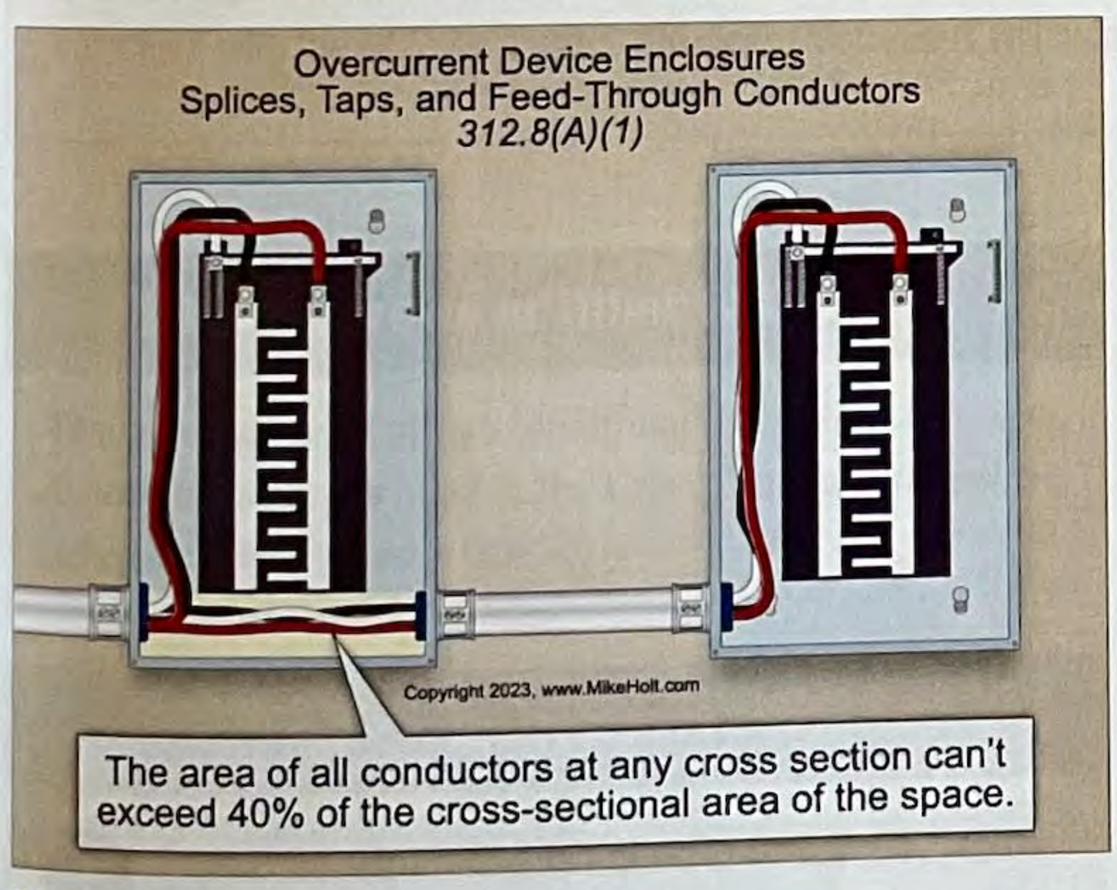
Editorial revisions were made to (B) clarifying that power management equipment of either the field-installed or listed kit type (these are two different product types and standards) may be installed in a switch or overcurrent device enclosure.

312.8 Overcurrent Device Enclosures

Cabinets for panelboards are permitted to contain wiring as provided in 312.8 (A) and (B).

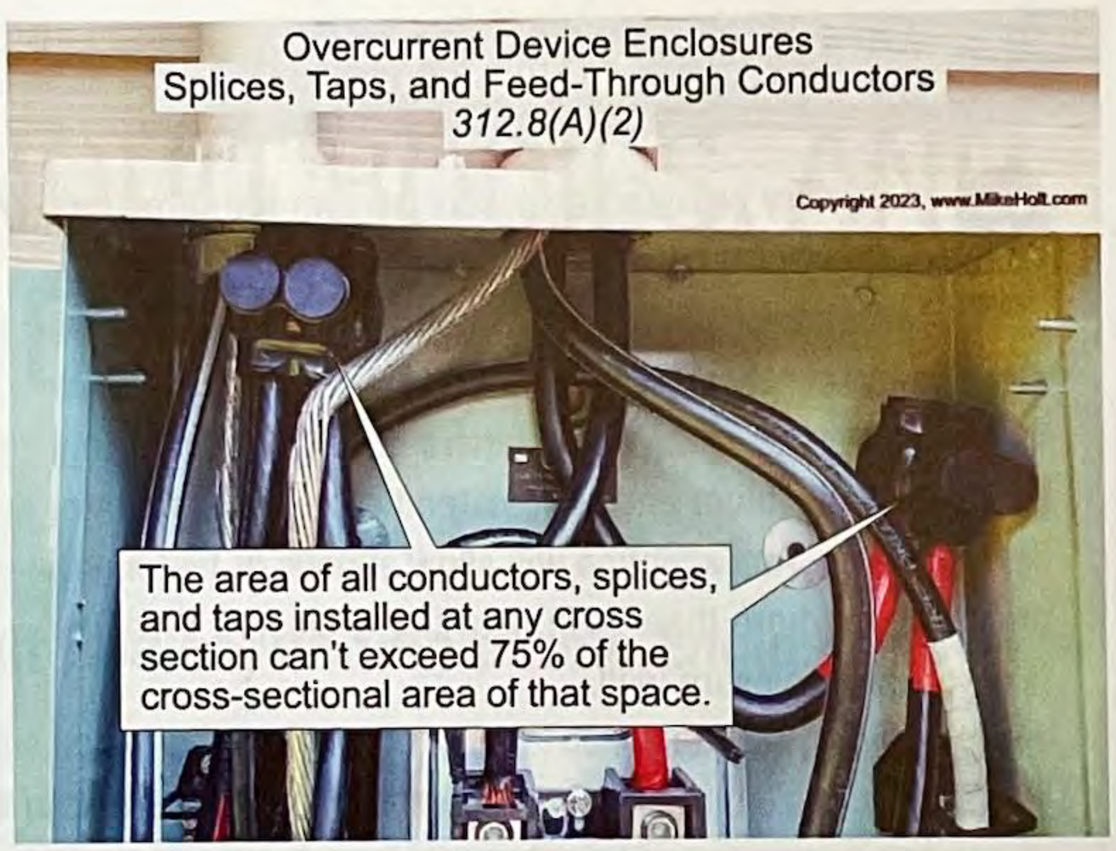
(A) Splices, Taps, and Feed-Through Conductors. The wiring space within cabinets for panelboards can be used for conductors feeding through, spliced, or tapped where all the following conditions are met:

(1) The area of all conductors at any cross section does not exceed 40 percent of the cross-sectional area of that space. ▸Figure 312–5



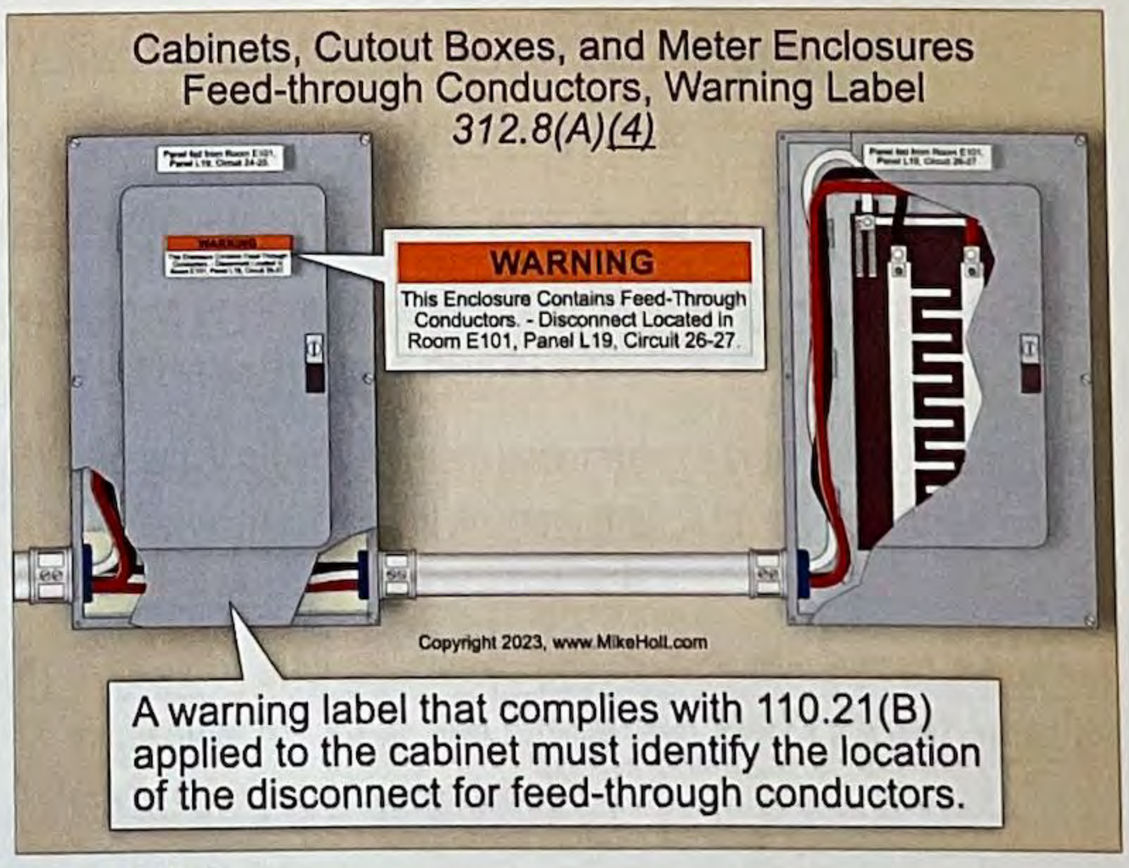
▸Figure 312–5

(2) The area of all conductors, splices, and taps installed at any cross section does not exceed 75 percent of the cross-sectional area of that space. ▸Figure 312–6



▸Figure 312–6

(4) Where conductors feed through the cabinet, a permanently affixed warning label sufficiently durable to withstand the environment involved, and complying with 110.21(B), must be applied on the cabinet to identify the location of the disconnect for the feed-through conductors. ▸Figure 312–7



▸Figure 312–7

Author's Comment:

- The 40 and 75 percent requirements apply to all conductors, all splices, and all taps within the cross-sectional area, not just conductors, splice(s), or tap(s) being added.

(3) The bending space for conductors 4 AWG and larger complies with 314.28(A)(2).

312.10 Screws or Other Fasteners

This new section addresses the hazards created by screws or fasteners that enter the wiring spaces of enclosures.

ARTICLE
404
SWITCHES

Introduction to Article 404—Switches

The requirements of Article 404 address switches of all types including snap (toggle) switches, dimmer switches, fan switches, disconnect switches, circuit breakers, and automatic switches such as time clocks and timers.

404.1 Scope

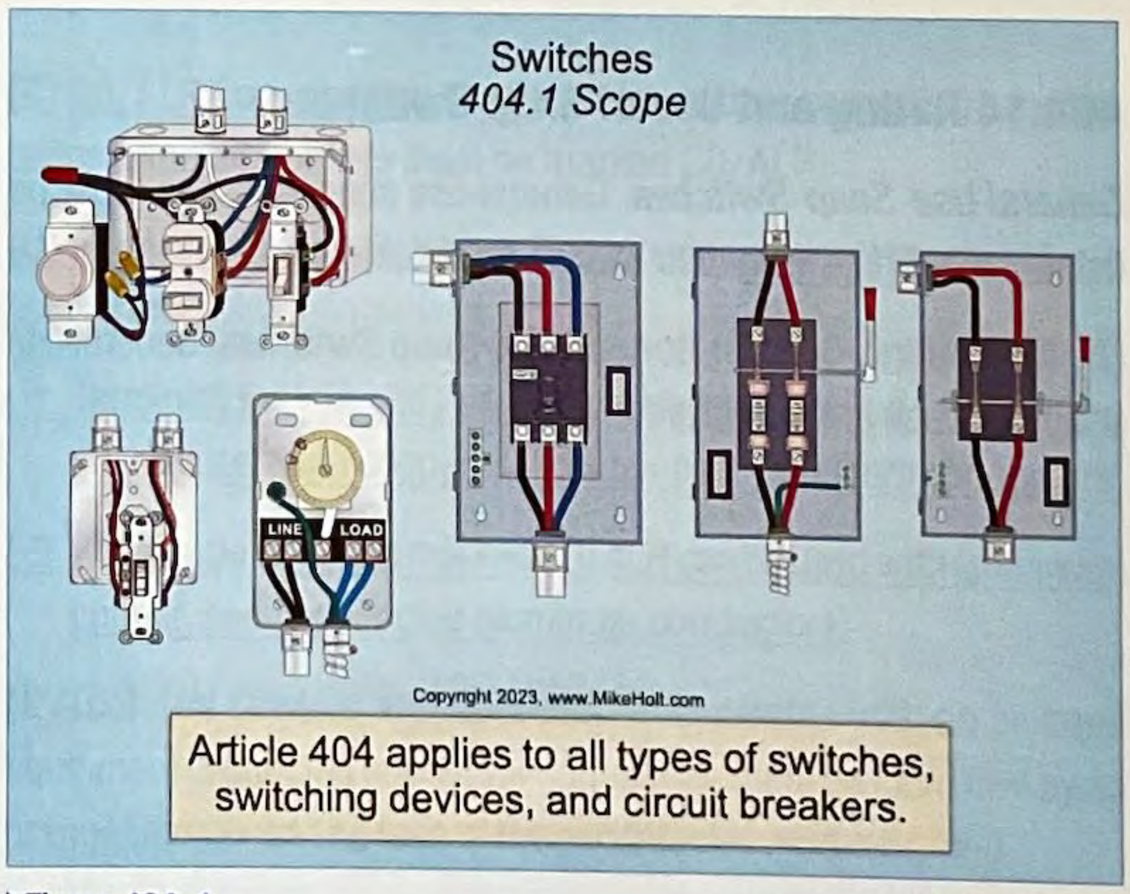
New language tells us that Article 404 does not apply to battery-powered wireless control equipment.

Analysis

CLARIFIED

A new sentence was added clarifying that Article 404 does not apply to wireless control equipment that is not connected to circuit conductors like a wireless remote control. Now if we can just figure out what a listed wall-mounted control device is we are going to be doing well.

A new Informational Note tells us to see 210.70 for a related requirement where battery-powered control devices are used to control a required lighting outlet.



▸Figure 404–1

404.1 Scope

The requirements of Article 404 apply to all types of switches, switching devices, and circuit breakers. ▸Figure 404–1

This article does not cover wireless control equipment to which circuit conductors are not connected.

Note: See 210.70 for additional information related to branch circuits that include switches or listed wall-mounted control devices.

404.14 Rating and Use of Switches

A new subdivision (D) was added addressing push-in terminals, and 15A and 20A snap switches not marked CO/ALR can now be used with copper-clad aluminum.

ARTICLE
404
SWITCHES

Introduction to Article 404—Switches

The requirements of Article 404 address switches of all types including snap (toggle) switches, dimmer switches, fan switches, disconnect switches, circuit breakers, and automatic switches such as time clocks and timers.

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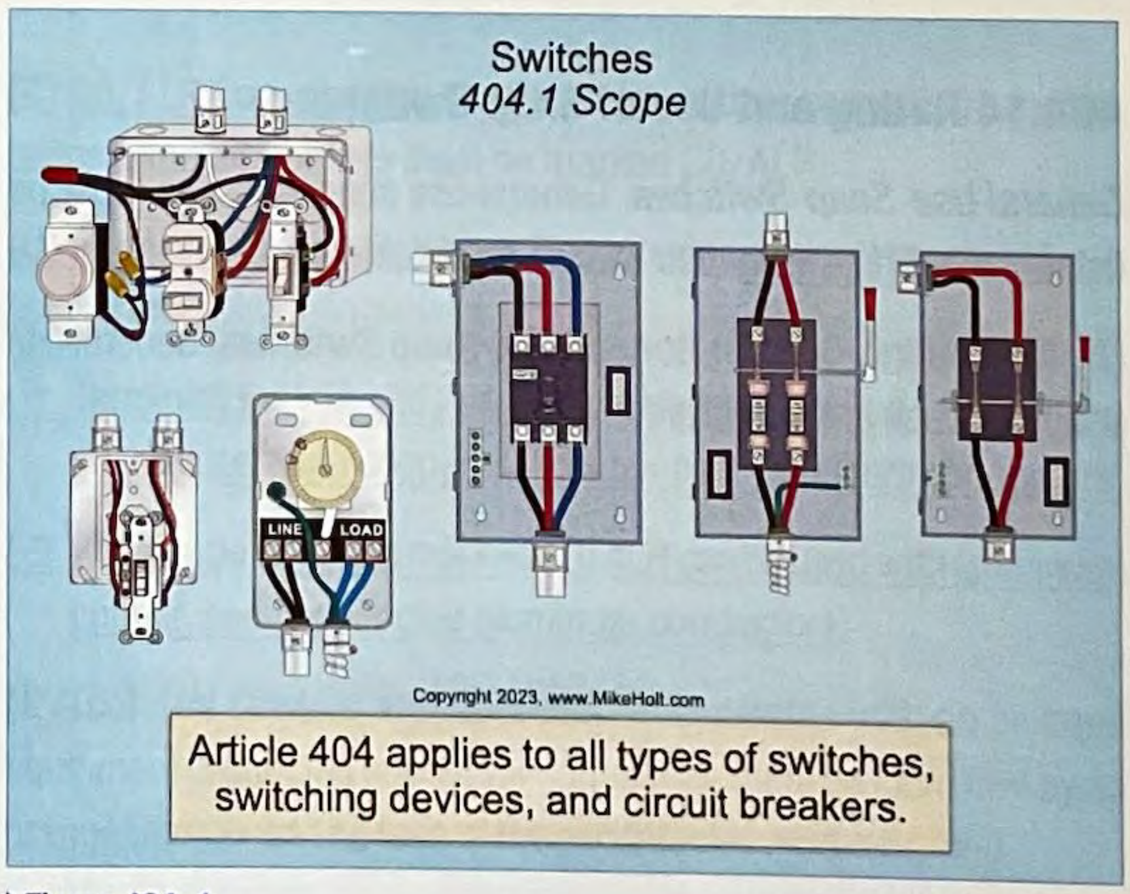

▸Figure 404–1

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404.14 Rating and Use of Switches

A new subdivision (D) was added addressing push-in terminals, and 15A and 20A snap switches not marked CO/ALR can now be used with copper-clad aluminum.

ARTICLE
406

RECEPTACLES, ATTACHMENT PLUGS, AND FLANGED INLETS

Introduction to Article 406—Receptacles, Attachment Plugs, and Flanged Inlets

This article covers the rating, type, and installation of receptacles, attachment plugs, and flanged inlets. There are many types of receptacles such as self-grounding, isolated ground, tamper resistant, weather resistant, GFCIs and AFCIs, energy controlled, work surface and countertop assemblies, USBs, surge protectors, and so on. Examine the rules carefully and remember an outlet is not a receptacle.

406.3 Receptacle Rating and Type

The title of (C) was changed to clarify that this section covers receptacles marked CO/ALR and a new subdivision (D) is another change related to the use of copper-clad aluminum conductors.

Analysis

CLARIFIED

The title of (C) was changed to clarify that this section covers receptacles marked CO/ALR. This rule only applies to receptacles rated 20A or less.

NEW

Subdivision (D) was added to address the use of copper-clad aluminum conductors. Where a 15A or 20A receptacle is not marked CO/ALR, it can only be used with copper or copper-clad aluminum conductors. The CO/ALR making permits the receptacle to be used with aluminum, copper, or copper-clad aluminum conductors. Where the receptacle has push-in terminals, it can only be installed on 14 AWG solid copper conductors.

406.3 Receptacle Rating and Type

(A) Receptacles. Receptacles must be listed and marked with the manufacturer's name or identification and voltage and ampere ratings.

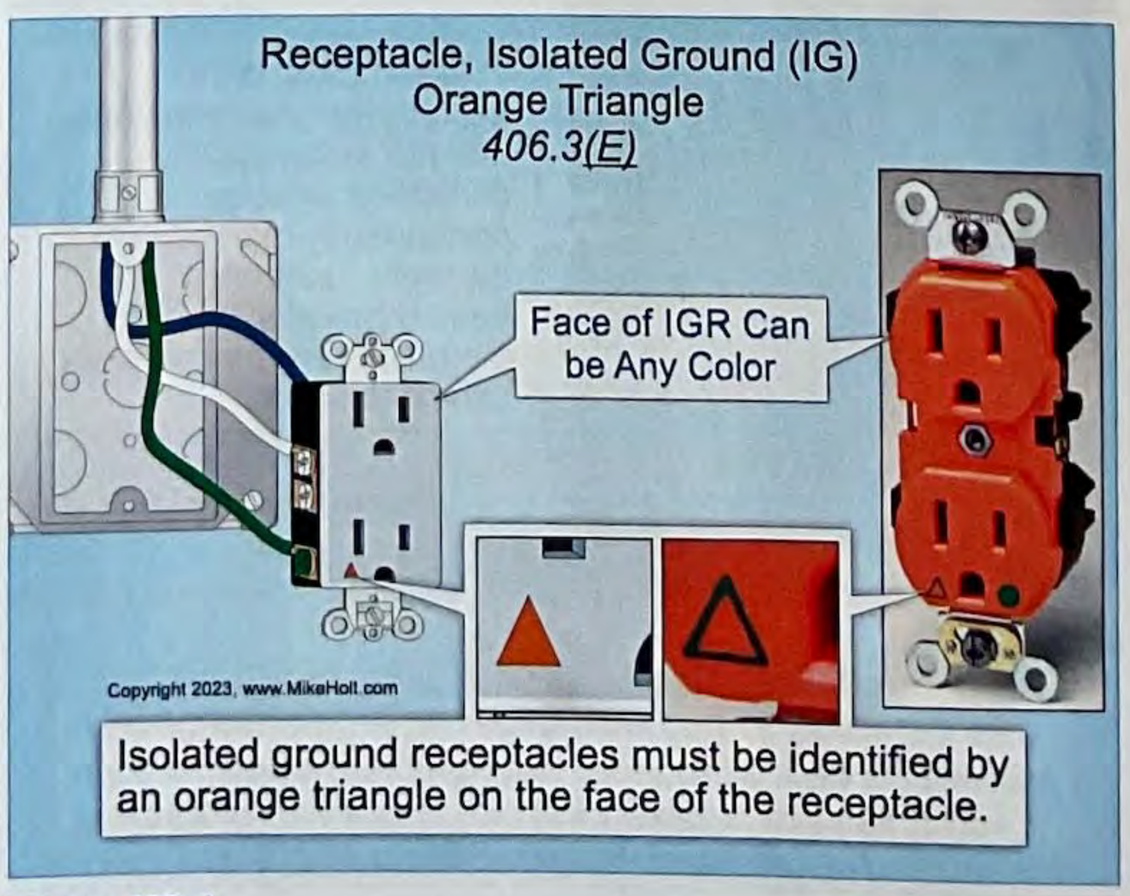
(C) CO/ALR Receptacles. Aluminum conductors connected to receptacles rated 20A or less must be marked CO/ALR.

(D) Receptacle Terminations. Receptacle terminations must be in accordance with the following:

(1) Terminals for 15A and 20A receptacles not marked CO/ALR can only be used with copper and copper-clad aluminum conductors.

(2) Receptacle terminals marked CO/ALR can be used with aluminum, copper, and copper-clad aluminum conductors.

(E) Isolated Ground Receptacles. Receptacles with an isolated equipment grounding conductor connection must be identified by an orange triangle on the face of the receptacle. ▸Figure 406–1



▸Figure 406–1

ARTICLE
406

RECEPTACLES, ATTACHMENT PLUGS, AND FLANGED INLETS

Introduction to Article 406—Receptacles, Attachment Plugs, and Flanged Inlets

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Analysis

CLARIFIED

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NEW

Subdivision (D) was added to address the use of copper-clad aluminum conductors. Where a 15A or 20A receptacle is not marked CO/ALR, it can only be used with copper or copper-clad aluminum conductors. The CO/ALR making permits the receptacle to be used with aluminum, copper, or copper-clad aluminum conductors. Where the receptacle has push-in terminals, it can only be installed on 14 AWG solid copper conductors.

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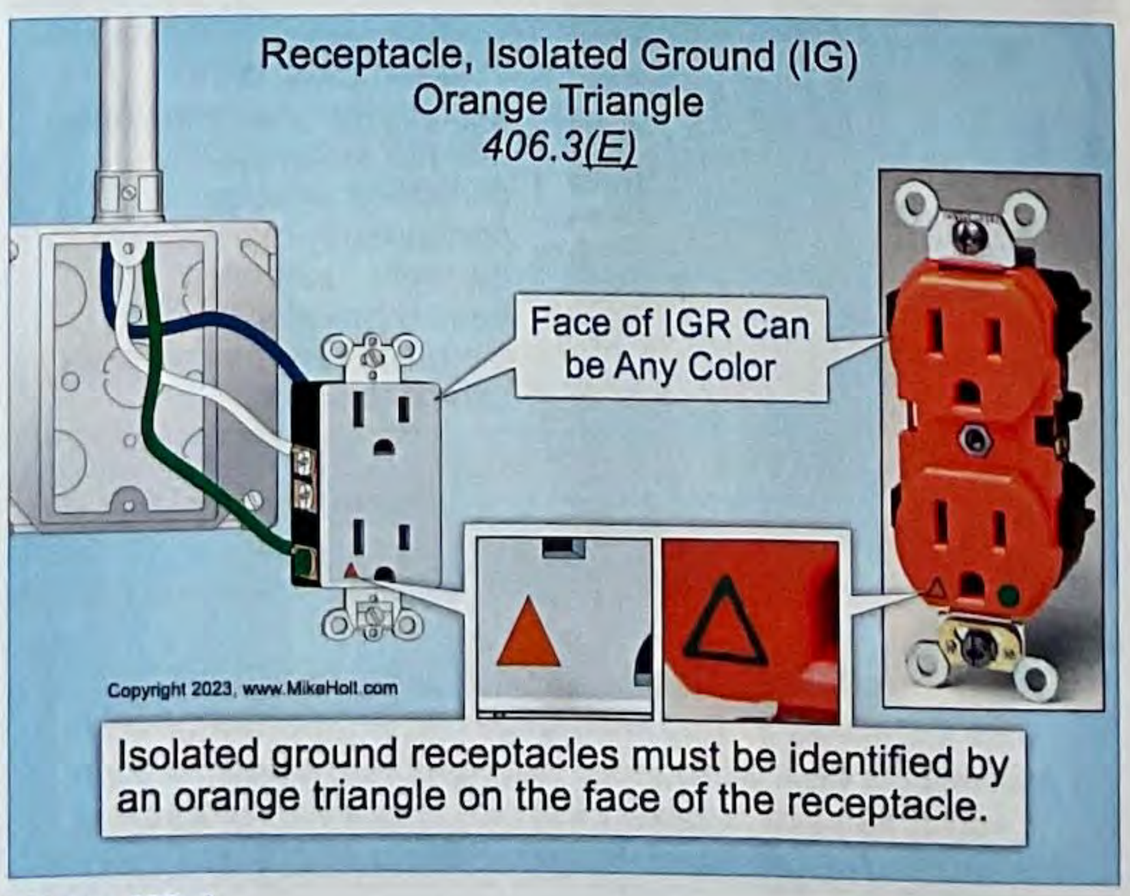


▸Figure 406–1

ARTICLE
450

TRANSFORMERS AND TRANSFORMER VAULTS (INCLUDING SECONDARY TIES)

Introduction to Article 450—Transformers and Transformer Vaults (Including Secondary Ties)

This article covers transformers supplying power and lighting loads. For the purposes of Article 450 only, a transformer is an individual power transformer, single- or poly-phase, identified by a single nameplate—unless otherwise indicated.

A major concern with transformers is preventing overheating. The *Code* does not completely address this issue. Article 90 explains that the *NEC* is not a design manual, and it assumes that anyone using the *Code* has a certain level of expertise. Proper transformer selection is an important part of preventing them from overheating. The *NEC* assumes you have already selected a transformer suitable for the load characteristics. For the *Code* to tell you how to do that would push it into the realm of a design manual. Article 450 then takes you to the next logical step—providing overcurrent protection and the proper connections. But this article does not stop there because 450.9 provides ventilation requirements, and 450.13 contains accessibility requirements.

Part I contains the general requirements such as guarding, marking, and accessibility, Part II contains those for different types of transformers, and Part III covers transformer vaults.

450.1 Scope

The previous exceptions in the text were converted to rules and the references to complete articles were removed to comply with the requirements of the *NEC* Style Manual.

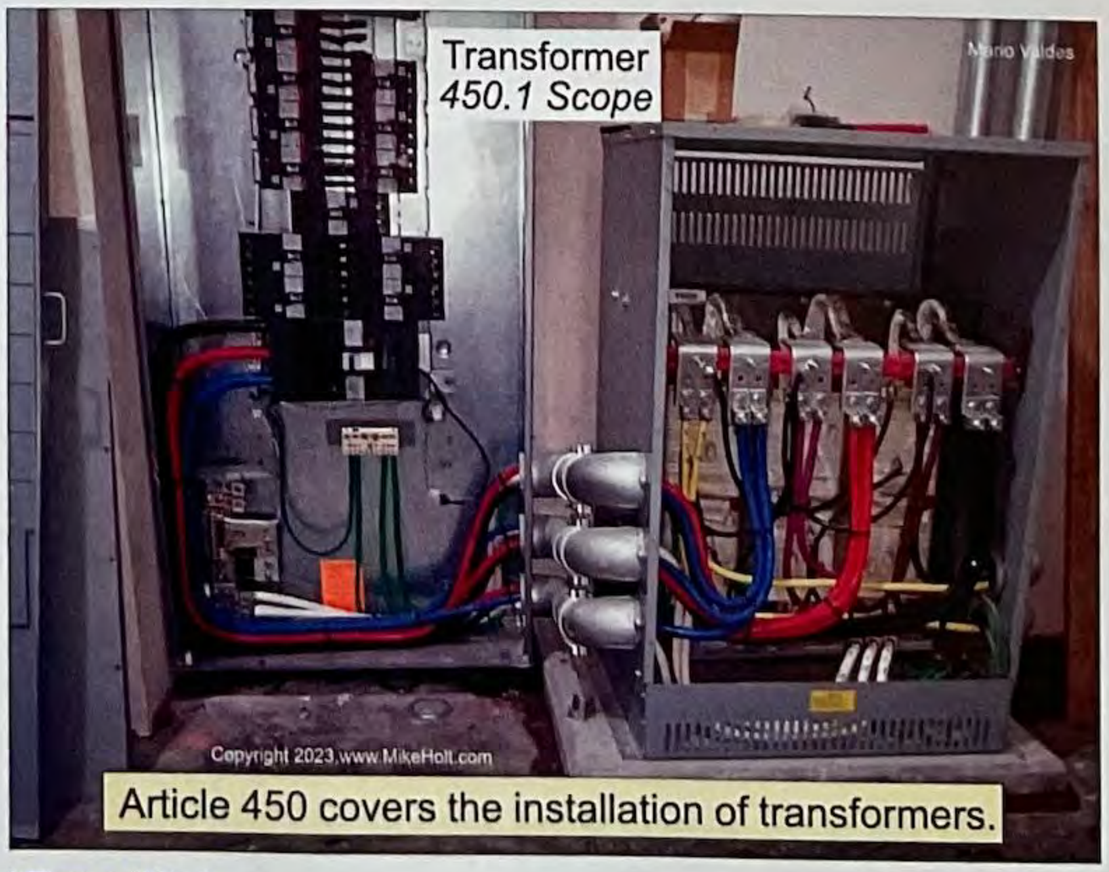
Analysis

REORGANIZED

Although it looks like a lot happened here it was really a rework of the existing rules. This section previously had an odd start in that it stated all the things it did not cover as Exceptions. The Exceptions have now been relocated into the scope text as list items (1) through (8). There were no technical changes with this reorganization.

450.1 Scope

Article 450 covers the installation requirements of all transformers other than the following: ▸Figure 450–1



Article 450 covers the installation of transformers.

▸Figure 450–1

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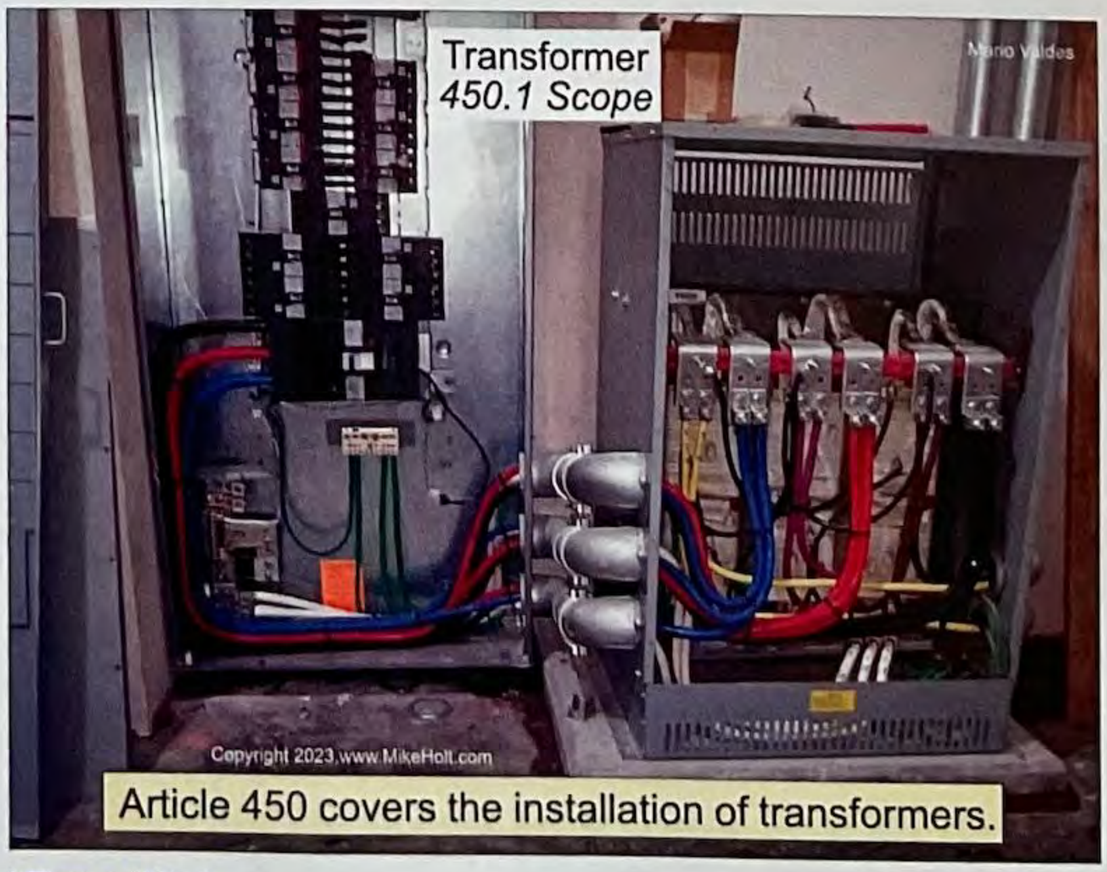


▸**Figure 450–1**

ARTICLE

502 CLASS II LOCATIONS

Introduction to Article 502—Class II Locations

If an area has combustible dust present, it is considered a Class II location. Examples of such locations include flour mills, grain silos, coal bins, wood pulp storage areas, and munitions plants.

Article 502 follows a logical arrangement similar to that of Article 501 and provides guidance in selecting equipment and wiring methods for Class II locations, including distinctions between Class II, Division 1 and Class II, Division 2 requirements.

502.10 Wiring Methods

As we have seen in other areas of Chapter 5, revisions were made to allow the use of coated RMC and IMC. The bonding requirements for LFMC were clarified as well.

Analysis

EXPANDED

Revisions to (A)(1)(1) clarify that the use of RMC and IMC with supplemental corrosion protection coatings are permitted in these locations, and (A)(2)(2) clarifies that LFMC must be bonded in accordance with 502.30(B).

NEW

New parent text was added to (B) to clarify that the wiring methods for Class II, Division 2 locations must be in accordance with 502.10(B)(1) through (4).

CLARIFIED

The rules in (B)(1)(2) now clarify that RMC and IMC with supplemental corrosion protection coatings (PCV coated conduit) are permitted, and (B)(1)(3) clarifies that the use of listed compression-type connectors and couplings are required for EMT in Class II, Division 2 locations.

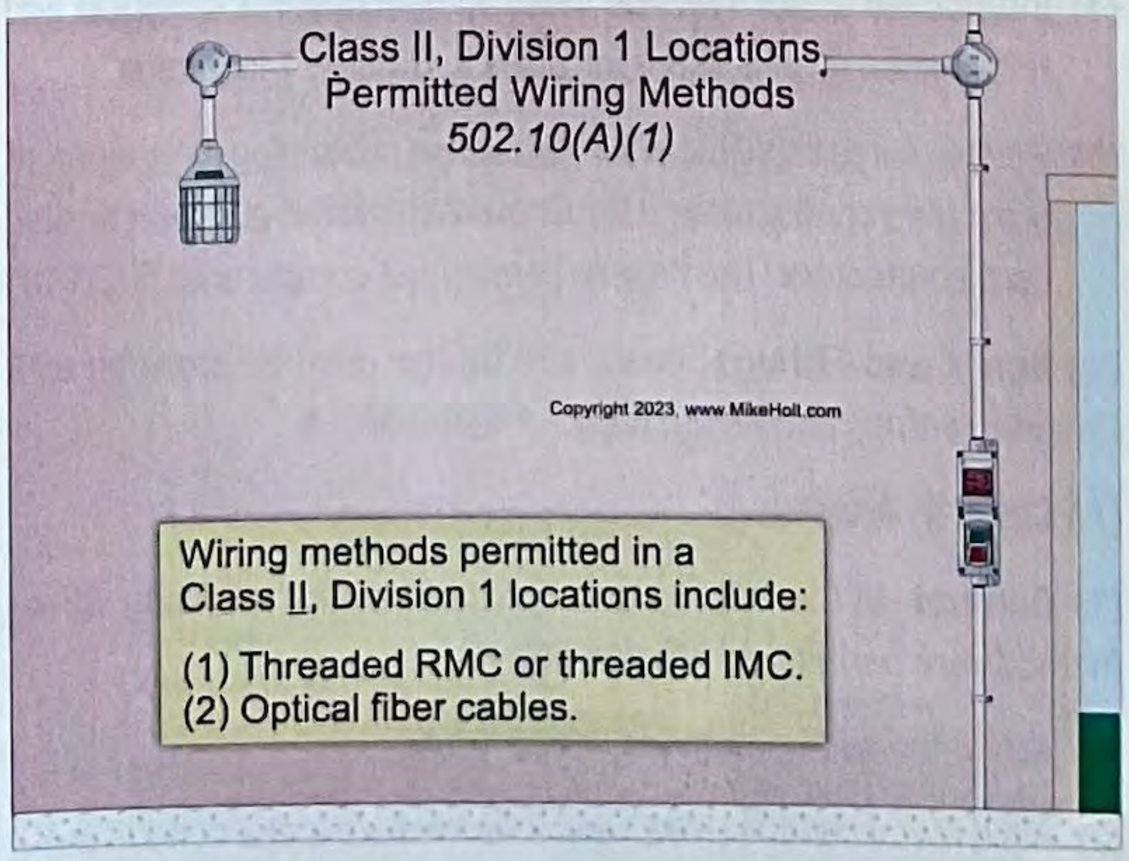
EXPANDED

The rule in (B)(1)(7) now clearly permits the use of other raceways like Schedule 80 PVC and RTRC in restricted industrial establishments.

502.10 Wiring Methods

(A) Class II, Division 1.

(1) General. The following wiring methods can be installed in a Class II, Division 1 location: ▸Figure 502–1



▸Figure 502–1

ARTICLE
502 CLASS II LOCATIONS

Introduction to Article 502—Class II Locations

If an area has combustible dust present, it is considered a Class II location. Examples of such locations include flour mills, grain silos, coal bins, wood pulp storage areas, and munitions plants.

Article 502 follows a logical arrangement similar to that of Article 501 and provides guidance in selecting equipment and wiring methods for Class II locations, including distinctions between Class II, Division 1 and Class II, Division 2 requirements.

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As we have seen in other areas of Chapter 5, revisions were made to allow the use of coated RMC and IMC. The bonding requirements for LFMC were clarified as well.

Analysis

EXPANDED

Revisions to (A)(1)(1) clarify that the use of RMC and IMC with supplemental corrosion protection coatings are permitted in these locations, and (A)(2)(2) clarifies that LFMC must be bonded in accordance with 502.30(B).

NEW

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EXPANDED

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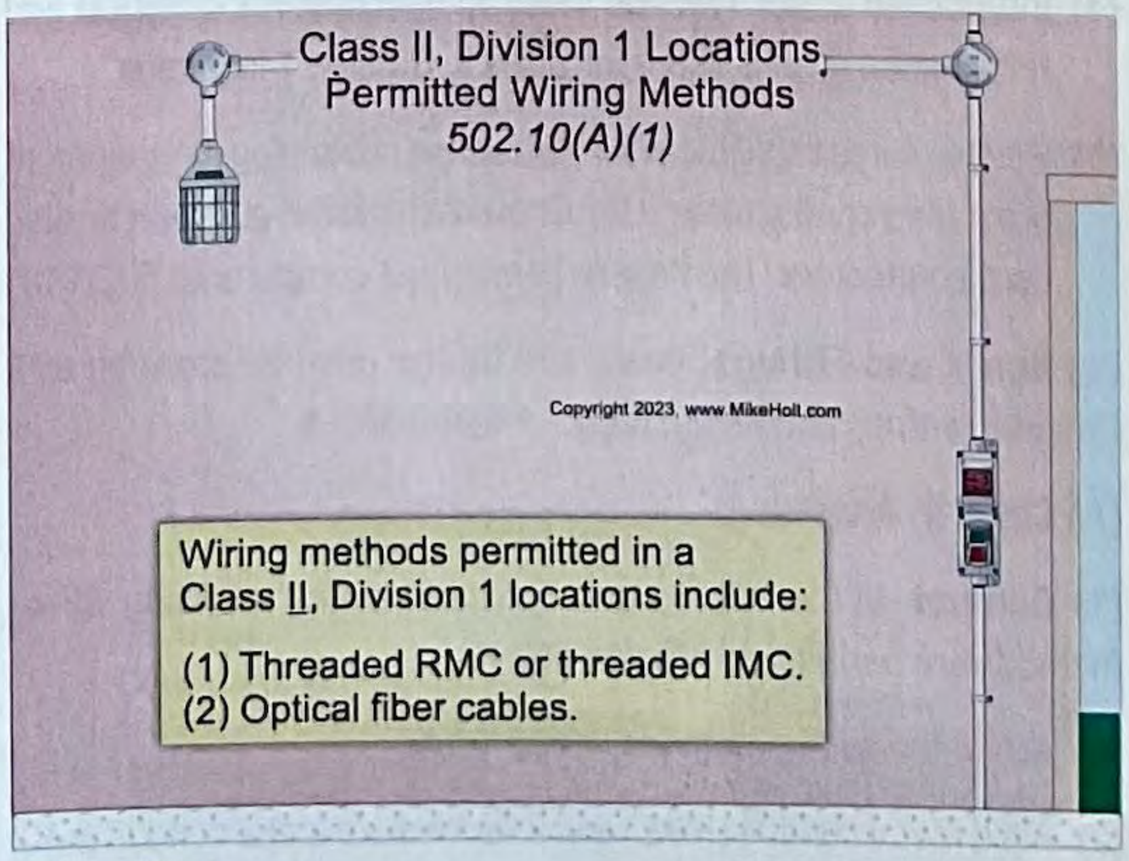


▸Figure 502–1

Analysis

REDUCED

Clothes Closet Storage Space. The definition that was in Article 410 included many measurements which were requirements. The *NEC* Style Manual does not permit definitions to contain requirements. Those requirements are now found in 410.16(A).

Clothes Closet Storage Space. The area within a clothes closet in which combustible materials can be kept (Article 410).

▶Figure 100–4

Analysis

NEW

Commissioning. This is a new definition in the *NEC* but not a new on in the industry. It was added to support various rules in Chapter 7.

Commissioning. The process, procedures, and testing used to set up and verify the initial performance, operational controls, safety systems, and sequence of operation of electrical devices and equipment prior to them being placed into active service.

Author's Comment:

- This term is used in Emergency Power Systems 700.3, Legally Required Standby Power Systems 701.3, Energy Storage Systems 706.7(A), and Critical Operations Power Systems 708.8.

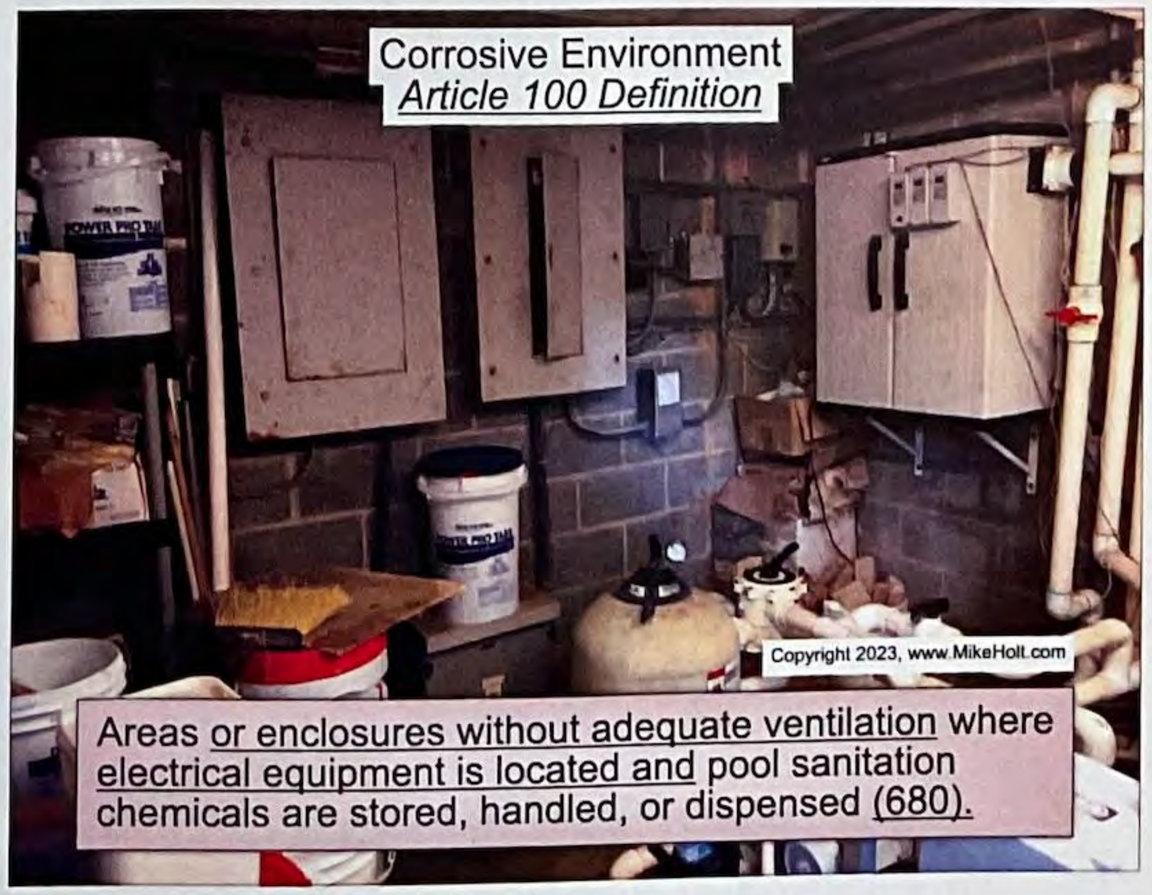
Cord Set. A length of flexible cord having an attachment plug at one end and a cord connector at the other end. ▶Figure 100–4

Analysis

NEW

Corrosive Environment. This is an example of a term that appears in one form or another in many *Code* articles, but this definition is specific to Article 680. This definition makes it possible to correctly enforce the requirements for corrosive environments in Article 680 instead of using a vague dictionary definition.

Corrosive Environment. Areas or enclosures without adequate ventilation where electrical equipment is located and pool sanitation chemicals are stored, handled, or dispensed (Article 680). ▶Figure 100–5



▶Figure 100–5

▸Figure 100–19

Analysis

NEW

Power-Supply Cord. This term has been misused over the years. Adding it to Article 100 makes it easier to understand the requirements that apply to these cords.

Power-Supply Cord. An assembly consisting of an attachment plug and a length of flexible cord connected to utilization equipment.

Author's Comment:

- Article 400 contains information on the use of Power-Supply Cords.

Analysis

NEW

Primary Source. While there wasn't a great deal of confusion in the energy sector on this term, there was some misunderstanding that this definition will clear up. This is especially true for those new to Chapter 6 and Chapter 7 installations.

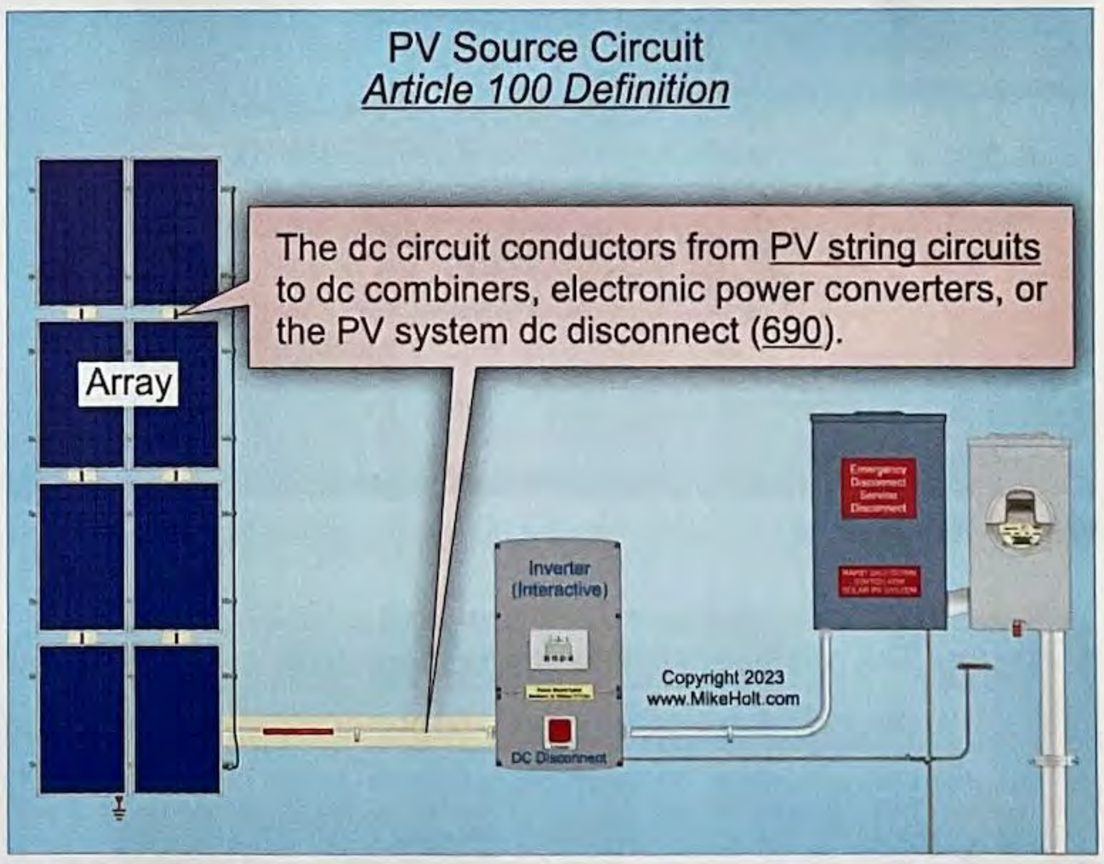
Primary Source. An electric utility or another source of power that acts as the main forming and stabilizing source in an electric power system.

Analysis

RELOCATED

PV DC Circuit, Source. (PV Source Circuit). This term is one of many that are now in Article 100 to clarify the application of the rules contained in Article 690.

PV DC Circuit, Source. (PV Source Circuit). The PV source dc circuit consists of the dc circuit conductors between modules in a PV string and from PV string circuits to dc combiners, electronic power converters, or the PV system dc disconnect (Article 690). ▸Figure 100–20



▸Figure 100–20

PV DC Circuit, String. (PV String Circuit). The PV source circuit conductors of one or more series-connected PV modules. (Article 690)

Sealed [as applied to hazardous (classified) locations]. Constructed such that equipment is sealed effectively against entry of an external atmosphere and is not opened during normal operation or for any maintenance activities.

Author's Comment:

- Articles 501, 502, 503 contains information on the use of the term Sealed as it relates to hazardous (classified) locations.

Analysis

EDITED

The global changes made in this section are not technical in nature but were a massive improvement from a usability standpoint. One change that stands out is changing the phrase "arc-fault circuit interrupter" to "AFCI" throughout the section.

REORGANIZED

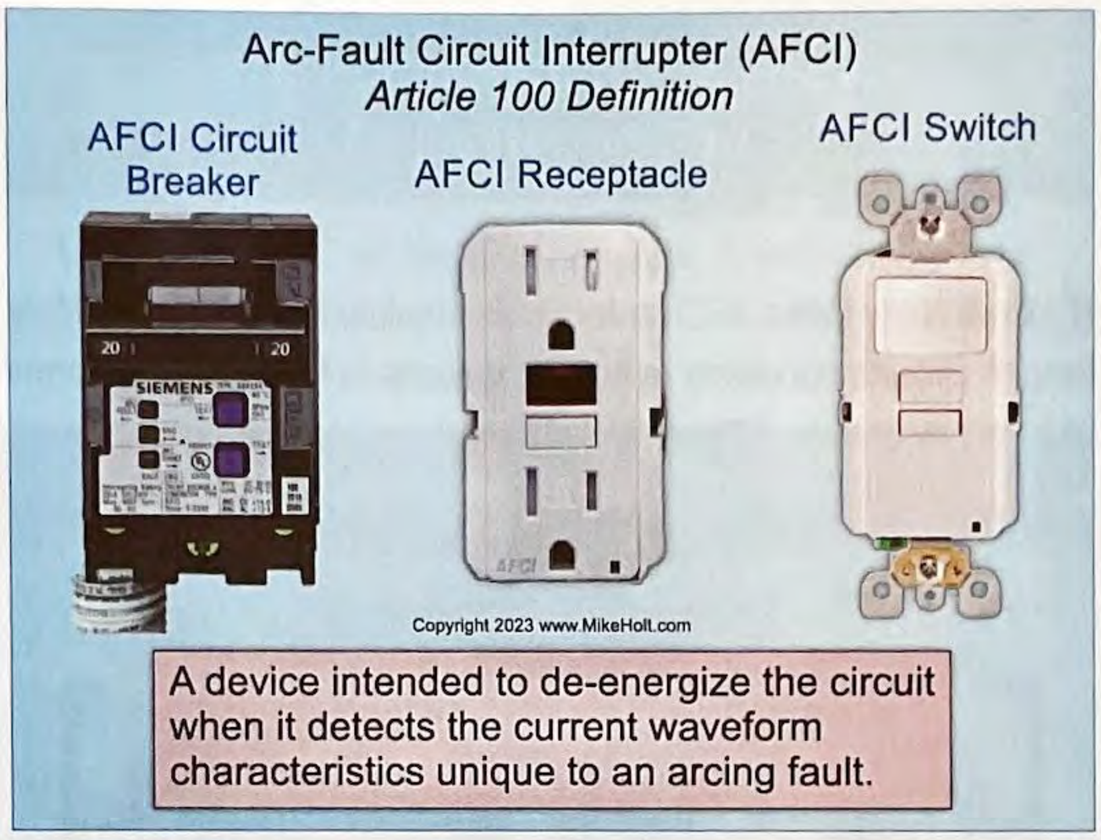
The rules for dwelling unit AFCIs were moved to subdivision (B), dormitory units were moved to (C), and the coverage requirements were converted into simple numbered lists. Rules about AFCI protection for branch-circuit extensions or modifications were moved to (E), and all the associated references within 210.12 were updated to match.

EXPANDED

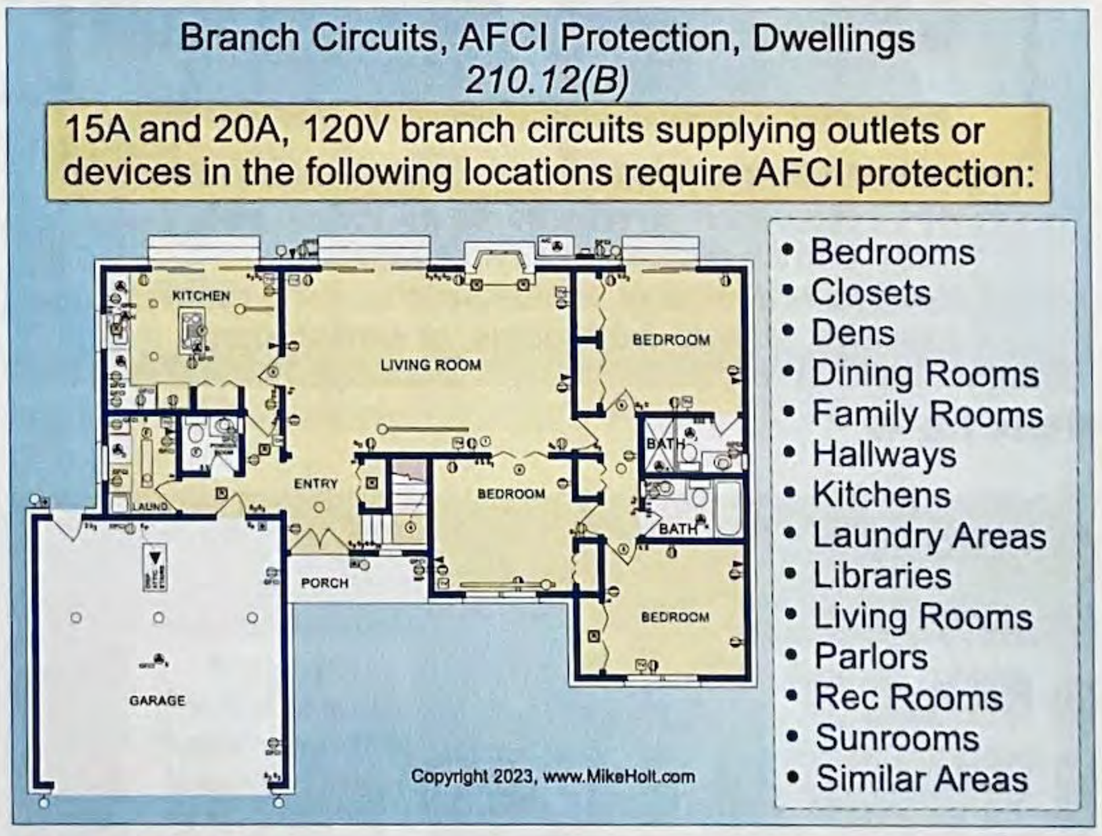
The requirement to provide 15A and 20A branch circuits with AFCI protection was expanded to include the new allowance for 10A branch circuits in (B) through (D).

NEW

Subdivision (C) became (D) and was retitled as Other Occupancies. The requirements were reorganized into a list format which includes a list item 3 to clear up any confusion about AFCI protection requirements for branch circuits in the sleeping rooms of fire houses, rescue squads, police departments, and similar locations.



▶Figure 210–47



▶Figure 210–48

210.12 Arc-Fault Circuit-Interrupter Protection

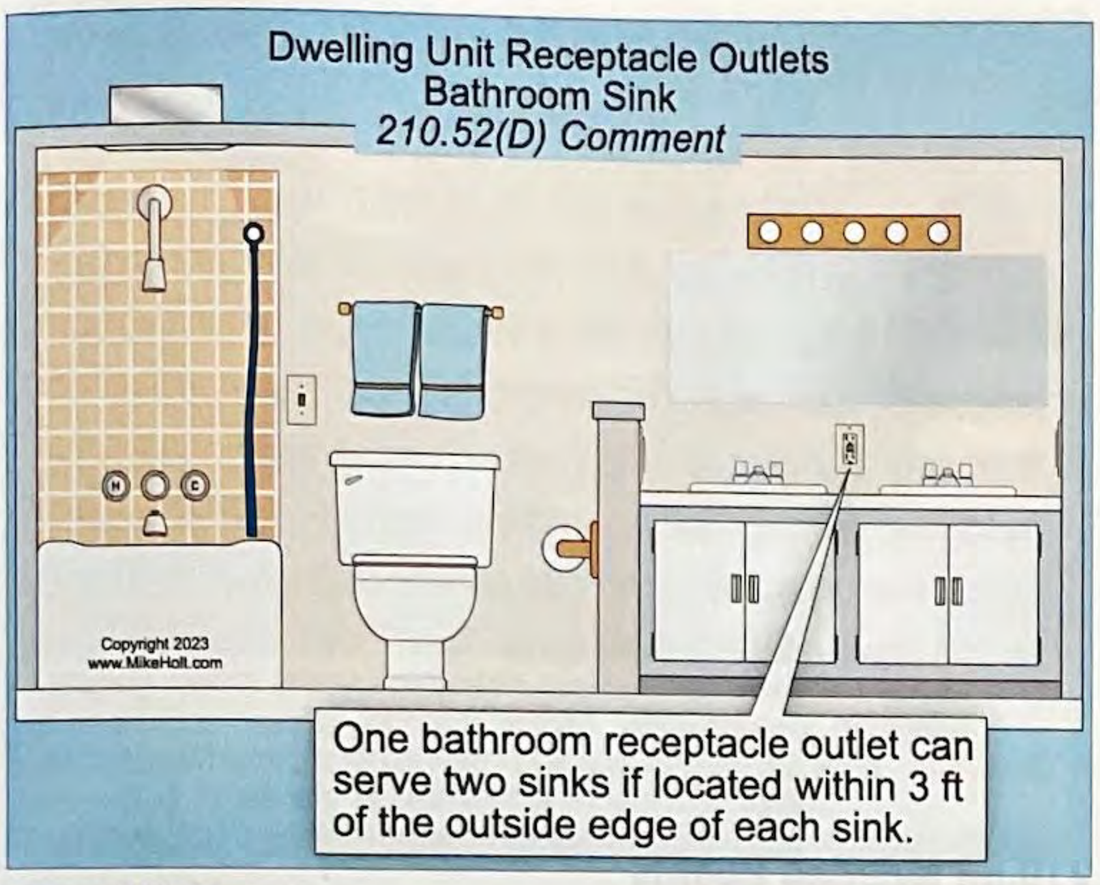
Arc-fault circuit-interrupter protection (AFCI), in a readily accessible location, is required in accordance with 210.12(B) through (C).

Author's Comment:

- According to Article 100, an "Arc-Fault Circuit Interrupter (AFCI)" is a device intended to de-energize the circuit when it detects the current waveform characteristics unique to an arcing fault. ▶Figure 210–47

(B) Dwelling Units. AFCI protection is required for 15A or 20A, 120V branch circuits supplying outlets or devices in the following dwelling unit locations: ▶Figure 210–48

(1) Kitchens
(2) Family rooms
(3) Dining rooms
(4) Living rooms
(5) Parlors
(6) Libraries
(7) Dens
(8) Bedrooms
(9) Sunrooms
(10) Recreation rooms
(11) Closets
(12) Hallways
(13) Laundry areas
(14) Similar areas



▶Figure 210–71

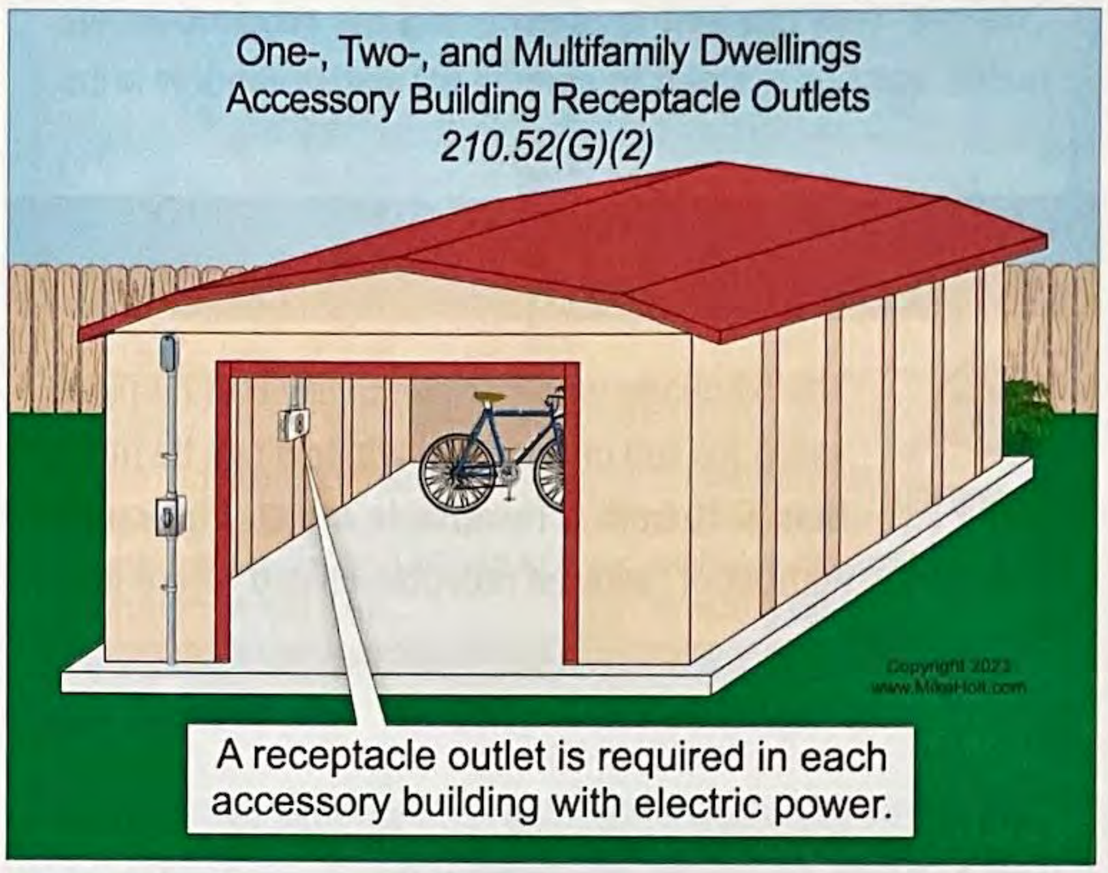
(G) Garage, Basement, and Accessory Building Receptacle Outlet(s). For one- and two-family dwellings, and multifamily dwellings, at least one receptacle outlet must be installed in accordance with (1) through (3). Receptacles supplying only a permanently installed premises security system are not considered as meeting these requirements.

(1) Garages. A receptacle outlet is required in each vehicle bay of a garage with electric power and must be installed no higher than 5 ft 6 in. above the floor. ▶Figure 210–72

▶Figure 210–72

Ex: A receptacle outlet is not required in a garage space not attached to an individual dwelling unit of a multifamily dwelling.

(2) Accessory Building Receptacle Outlets. A receptacle outlet is required in each accessory building with electric power. ▶Figure 210–73



▶Figure 210–73

(3) Basements. Each unfinished portion of a basement must have a receptacle outlet. ▶Figure 210–74

▶Figure 210–74

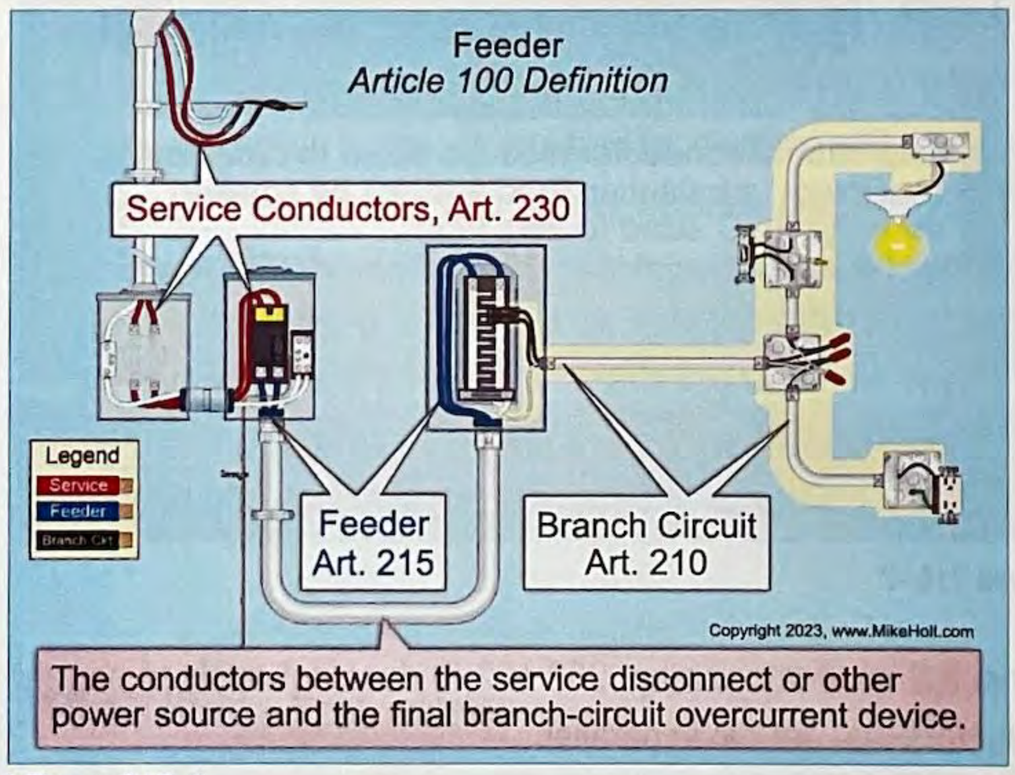
ARTICLE 215 FEEDERS

Introduction to Article 215—Feeders

Article 215 covers the rules for the installation, protection, and ampacity of feeders. It is important to understand the distinct differences between these circuits to correctly apply the *Code* requirements.

Feeders are the conductors between the service disconnect, the separately derived system, or other supply source, and the final branch-circuit overcurrent protective device. Conductors past the final overcurrent protective device protecting the circuit and the outlet are branch-circuit conductors and fall within the scope of Article 210 [Article 100 Definitions]. ▸Figure 215–1

It is easy to be confused between feeder, branch-circuit, and service conductors so it is important to evaluate each installation carefully using the Article 100 definitions to be sure the correct *NEC* rules are followed.



▸Figure 215–1

215.2 Conductor Sizing

This section was reorganized for readability without technical changes. Changes to (B) clarify that the feeder grounded conductor cannot be smaller than the EGC.

Analysis

REORGANIZED

The information that was in (1)(a) and (1)(b) became list items (1) and (2) without change. Section 215.2(A)(2), grounded conductors, became 215.52(B). Section 215.52(A)(3) is now (C) and the former (B) was deleted as that is now covered in Part III of Article 235.

CLARIFIED

The requirements for the feeder grounded conductor in 215.2(A)(2) now clearly state that it cannot be smaller than the equipment grounding conductor size required by 250.122. The rule previously referenced 250.122 but did not specify "the equipment grounding conductor size."

REORGANIZED

This section has been reorganized with 215.2(A)(2) and (A)(3) becoming 215.2(B) and 215.2(C). There were no technical changes with the reorganization but the rules for feeders over 1000V were moved to Article 235.

ARTICLE
220

BRANCH-CIRCUIT, FEEDER, AND SERVICE LOAD CALCULATIONS

Introduction to Article 220—Branch-Circuit, Feeder, and Service Load Calculations

This article focuses on the requirements for calculating demand loads (including demand factors) to size branch circuits [210.19(A)], feeders [215.2(A)(1)], and service conductors [230.42(A)].

Part I describes the layout of Article 220 and provides a table showing where other types of load calculations can be found in the *NEC*. Part II provides requirements for branch-circuit calculations and for specific types of branch circuits. Part III covers the requirements for feeder and service calculations using what is commonly called the "Standard Method of Calculation." Part IV provides optional calculations that can be used in place of the standard calculations [Parts II and III]. "Farm Load Calculations" are discussed in Part V of this article.

In some cases, the *Code* provides an optional method [Part IV] for feeder and service calculations in addition to the standard method [Part III], however they do not yield identical results. In fact, the optional method of calculation will often result in a smaller feeder or service. The neutral conductor must be calculated using the standard method [220.61]. As you work through Article 220, be sure to study the illustrations to help you fully understand this article's requirements. Also, be sure to review the examples in Annex D of the *NEC* to gain more practice with these calculations. The *Code* recognizes that not all demand for power will occur at the same time and it is because of this load diversity that certain demand factors are able to be applied.

220.1 Scope

The scope was edited to reflect the addition of Parts VI and VII.

Analysis

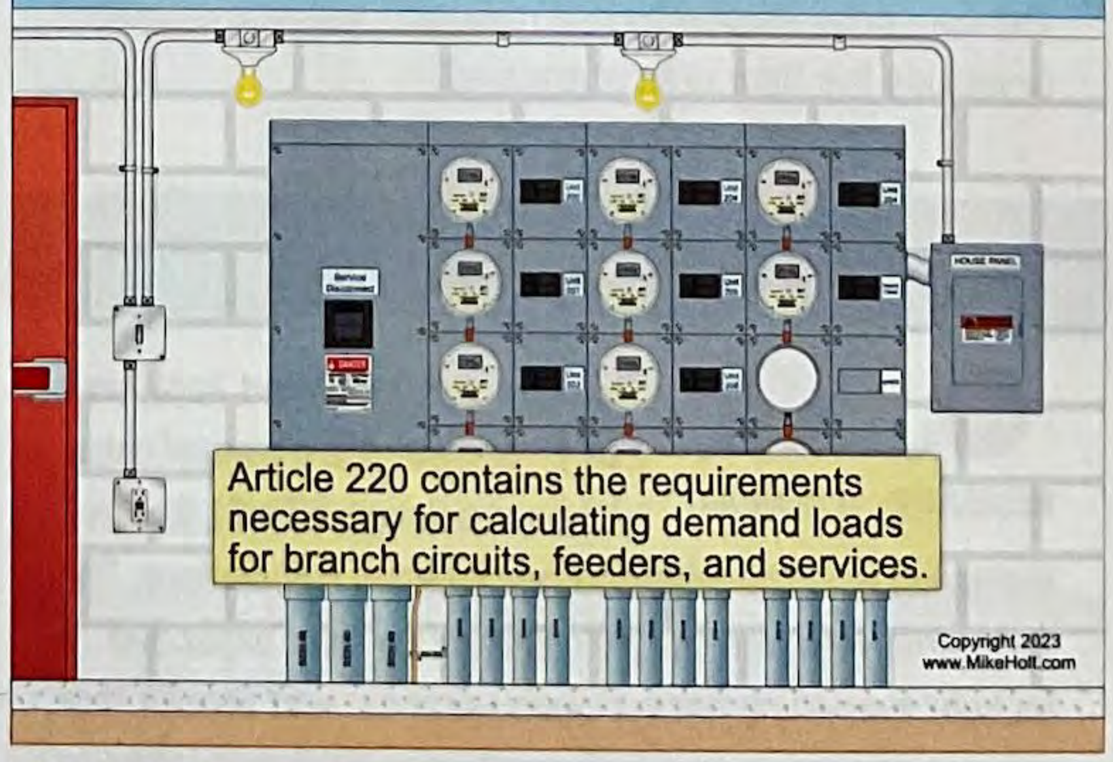
EXPANDED

Part VI for health care facilities and Part VII for marinas were added to the article, and the scope was revised to include those new Parts.

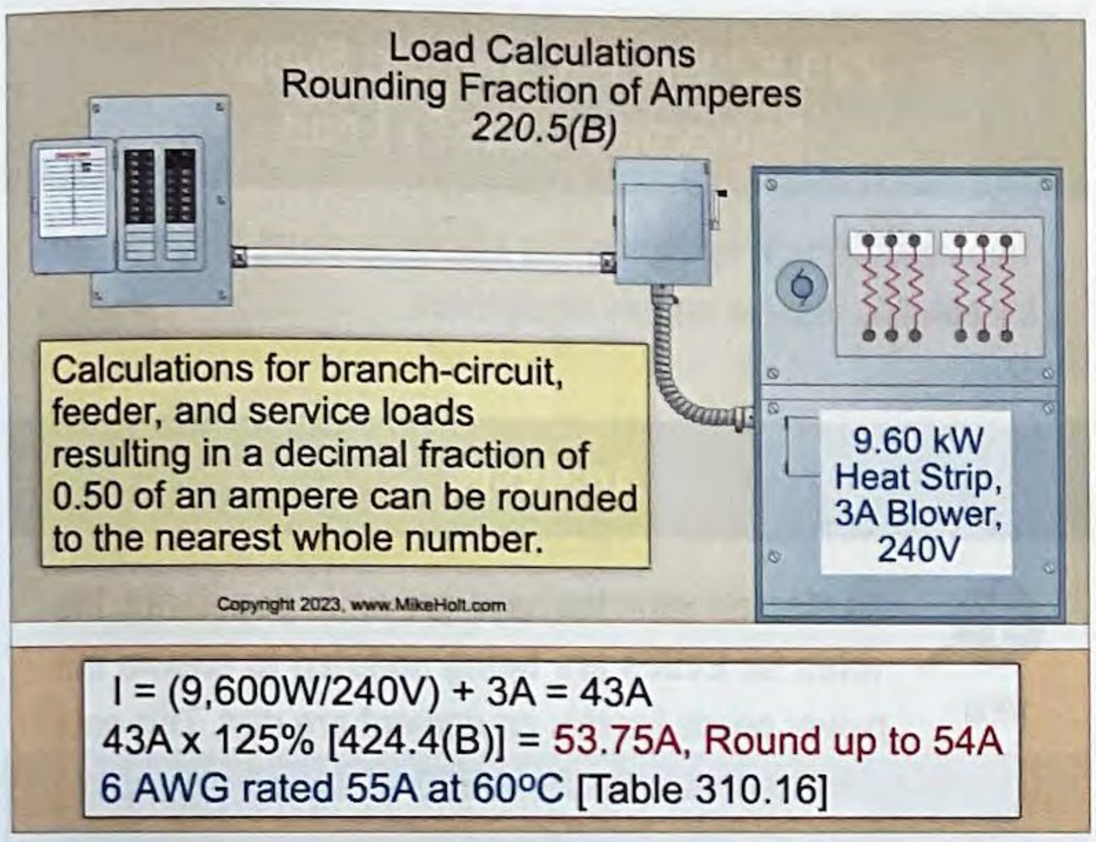
220.1 Scope

This article contains the requirements necessary for calculating demand loads for branch circuits, feeders, and services. ▶Figure 220–1

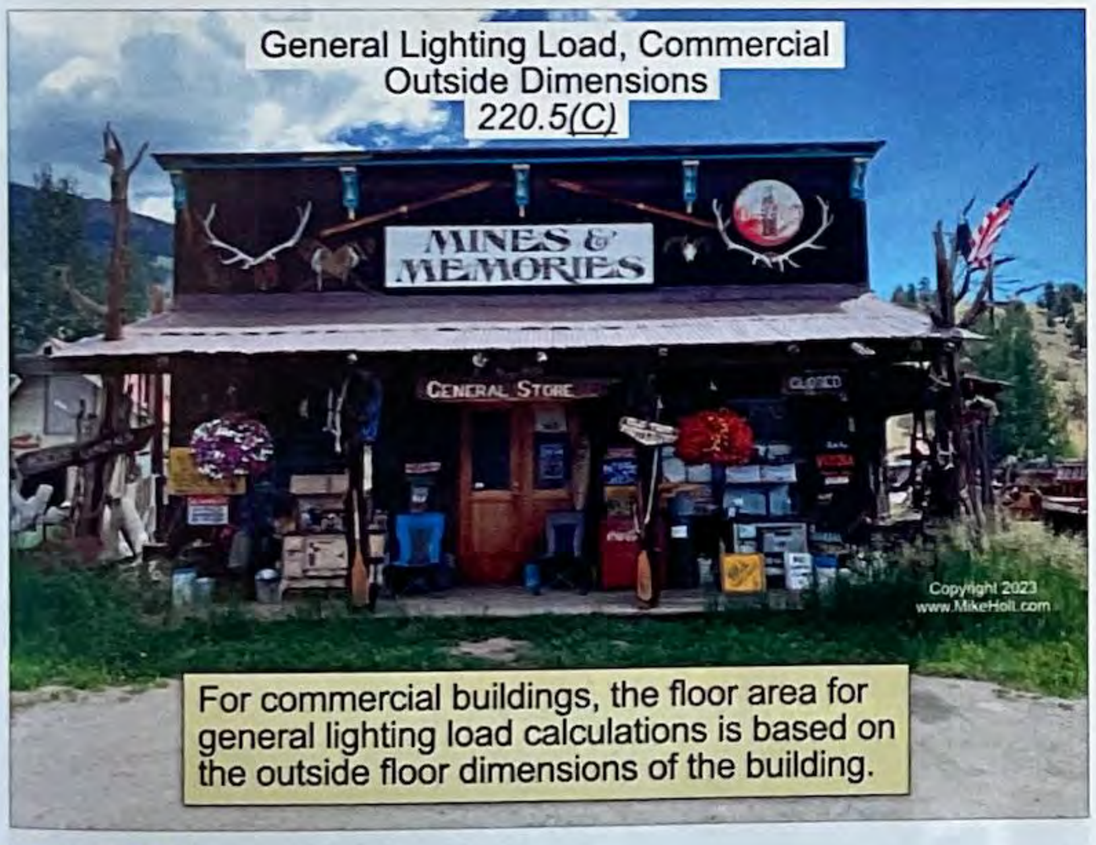
Branch-Circuit, Feeder, and Service Load Calculations
220.1 Scope



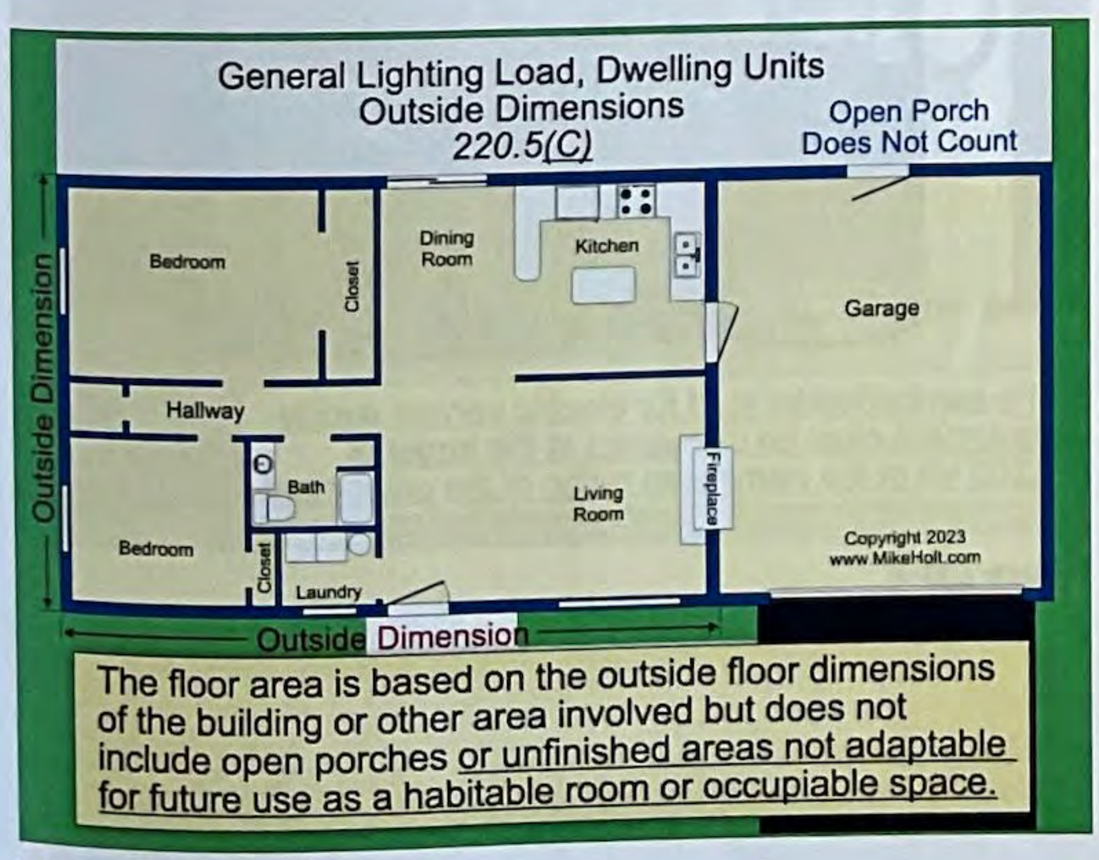
▶Figure 220–1



▸Figure 220–4



▸Figure 220–5



▸Figure 220–6

220.53 Appliance Load—Dwelling Unit(s)

Editorial changes were made in this section to clarify to what the rule applies.

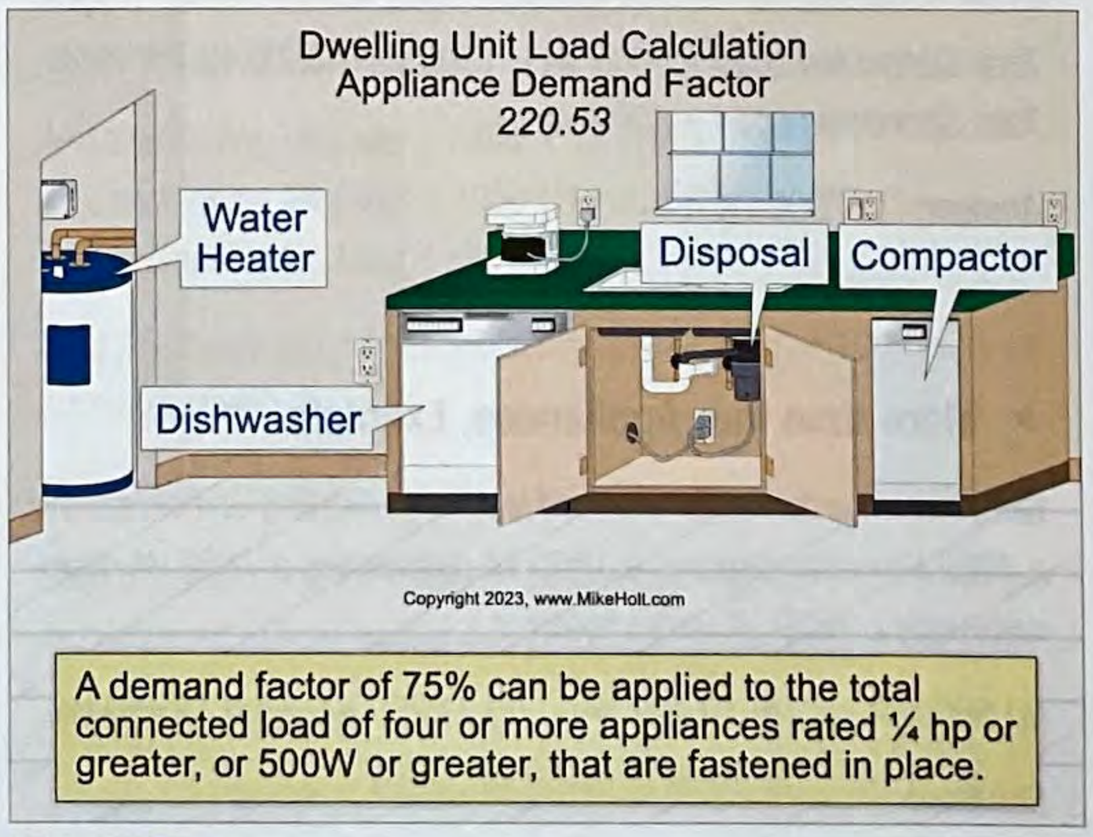
Analysis

EXPANDED EDITED

There were a few editorial changes made in this section to improve its usability with no real technical change. Electric vehicle supply equipment (EVSE) was added as list item 5 to identify that these loads are significant, and no reduction is permitted.

220.53 Appliance Demand Load, Dwelling

A demand factor of 75 percent can be applied to the total connected load of four or more appliances rated ¼ hp or greater, or 500W or greater, that are fastened in place. ▸Figure 220–7



▸Figure 220–7

This demand factor does not apply to:

(1) Household electric cooking equipment that is fastened in place

(2) Clothes dryers

(3) Space-heating equipment

(4) Air-conditioning equipment

(5) Electric vehicle supply equipment (EVSE)

▶ Example

Question: *What is the load for ten 9600W EVSEs?*

(a) 56,000 VA (b) 76,000VA (c) 86,000 VA (d) 96,000 VA

Solution:

EVSE Load = 9600 VA x 10
EVSE Load = 96,000 VA

Answer: *(d) 96,000 VA*

220.60 Noncoincident Loads

Revisions in this section clarify that an air-conditioning load can be considered a noncoincident load.

Analysis

CLARIFIED

Revisions to this section are intended to clarify that when determining the largest noncoincident load where the air-conditioning unit itself is the largest motor, you must use the air-conditioning load as the largest motor for the service calculation as well as the largest noncoincident load (which is usually the heat). This language is still a brain bender but if you take your time reading the rule, it makes sense.

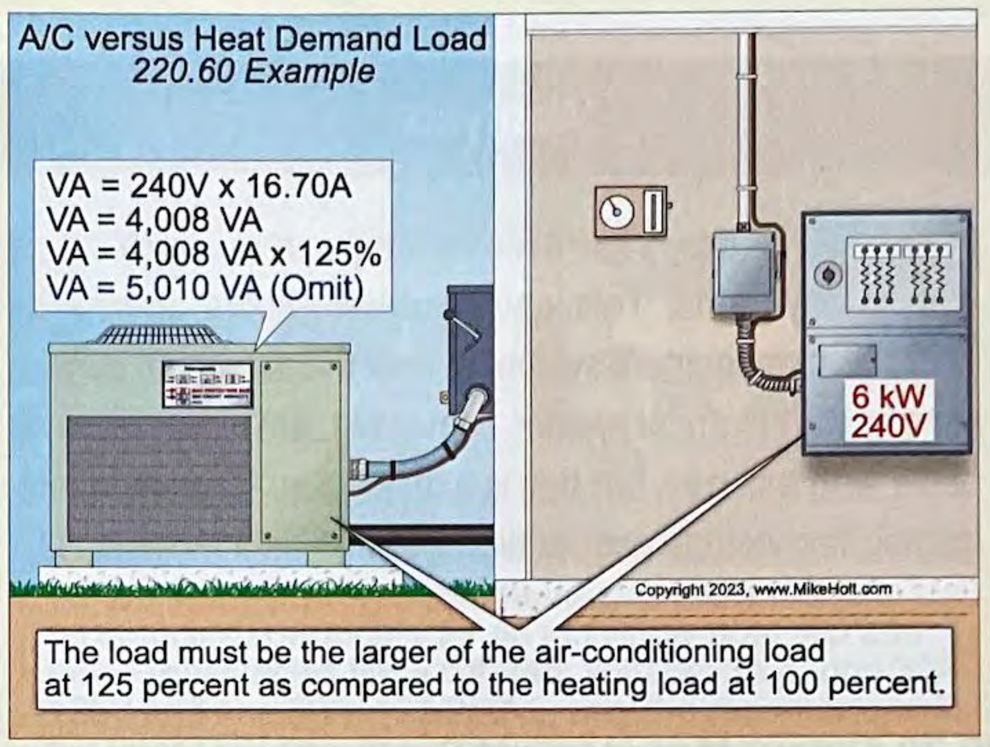
220.60 Noncoincident Loads

If two or more loads are unlikely to be used at the same time, only the largest load is used for load calculations. The load must be the larger of the air-conditioning load at 125 percent [220.50(B)] as compared to the heating load at 100 percent [220.51].

▶ Example

Question: *What is the demand load for one 16.70A, 240V air-conditioning unit and one 6 kW, 240V electric space heater?* ▶**Figure 220–10**

(a) 5 kW (b) 6 kW (c) 11 kW (d) none of these



▶**Figure 220–10**

Solution:

Step 1: *Determine the air-conditioning load at 125 percent in accordance with 220.50(B).*

Air-Conditioning VA Load = 240V × 16.70A × 125%
Air-Conditioning VA Load = 4008 VA × 125%
Air-Conditioning VA Load = 5010 VA

Step 2: *Determine the electric space heating load at 100 percent in accordance with 220.51.*

Heat Load = 6000W

Step 3: *Determine the larger of air-conditioning load at 125 percent as compared to heat load at 100 percent in accordance with 220.60.*

Heat Load = 6000W

Answer: *(b) 6 kW*

▸Figure 100–19

Analysis

NEW

Power-Supply Cord. This term has been misused over the years. Adding it to Article 100 makes it easier to understand the requirements that apply to these cords.

Power-Supply Cord. An assembly consisting of an attachment plug and a length of flexible cord connected to utilization equipment.

Author's Comment:

- Article 400 contains information on the use of Power-Supply Cords.

Analysis

NEW

Primary Source. While there wasn't a great deal of confusion in the energy sector on this term, there was some misunderstanding that this definition will clear up. This is especially true for those new to Chapter 6 and Chapter 7 installations.

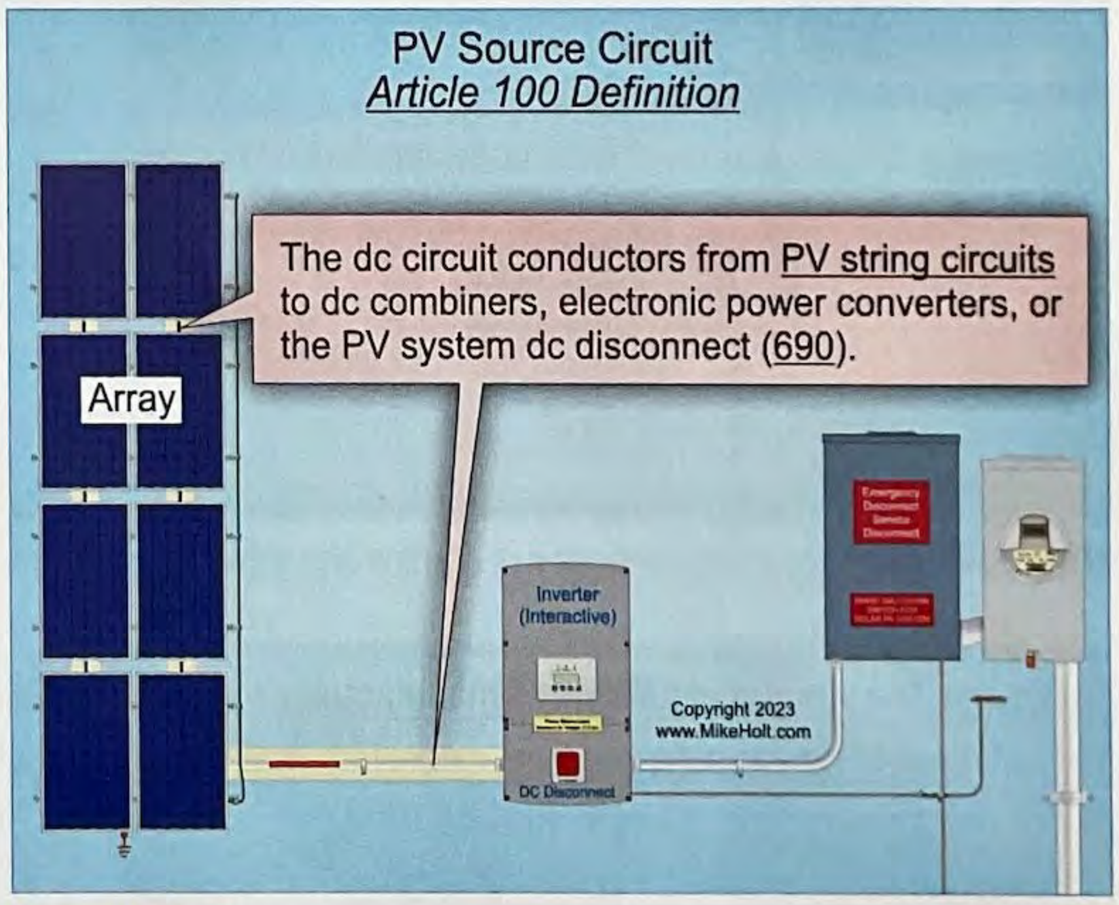
Primary Source. An electric utility or another source of power that acts as the main forming and stabilizing source in an electric power system.

Analysis

RELOCATED

PV DC Circuit, Source. (PV Source Circuit). This term is one of many that are now in Article 100 to clarify the application of the rules contained in Article 690.

PV DC Circuit, Source. (PV Source Circuit). The PV source dc circuit consists of the dc circuit conductors between modules in a PV string and from PV string circuits to dc combiners, electronic power converters, or the PV system dc disconnect (Article 690). ▸Figure 100–20



▸Figure 100–20

PV DC Circuit, String. (PV String Circuit). The PV source circuit conductors of one or more series-connected PV modules. (Article 690)

Sealed [as applied to hazardous (classified) locations]. Constructed such that equipment is sealed effectively against entry of an external atmosphere and is not opened during normal operation or for any maintenance activities.

Author's Comment:

- Articles 501, 502, 503 contains information on the use of the term Sealed as it relates to hazardous (classified) locations.

File Attachments for Item:

EC-13 2023 NEC (ICC)

All certifications (1.5 hours)

Application for Continuing Education Course Approval

Application for Continuing Education Course Approval

Provider Information

Name *: Laura Morris

Organization: International Code Council

Email *: lmorris@iccsafe.org

Phone Number *: (708) 799-2300

Address *: 4051 W Flossmoor Road

City *: country Club Hills

State *: IL

Zip Code *: 60478

Website: https://www.iccsafe.org/edu

Conference Sponsor (if applicable):

Conference Email:

☐ Check here if Course Renewal

Prior course number(s)' (i.e. BBS2018-429):

Renewals will only be granted for identical content and hours, within the current code cycle. Attach a copy of prior course approval letter for confirmation. No further information is required

New Course Information

Course title: 2023 NEC

Course instructor: Tim Mikloiche

Course description:

The IAEI staff and IAEI representatives on the NFPA NEC Code Making Panels have worked together to develop a quality seminar program that will provide information about code changes covering the safe installation and use of electrical products pertaining to the 2023 National Electrical Code.

Instructional hours per session: 1.5

Number of Sessions: 1

Course Date: 2023-10-10

Course Location: St. Louis, MO

Special Content

- ☐ Code Administration
- ☐ Existing Buildings
- ☑ Electrical Instruction
- ☐ Plumbing Instruction

Conference Course:

Conference Name:

Conference location:

Course to be offered online?

- ☐ Yes
- ☑ No

☐ On Demand ☐ Webinar

Course Website:

667

Detail online course participation confirmation method (i.e. test, quizlets, participant activity confirmation):

Course applicable for the following certifications *

- [ ] Residential Certifications Only
- [x] Administrative Course, All Certifications
- [ ] Commercial and Residential Certifications

Application materials included *

- [x] Course Outline or Course Learning Objectives
- [x] Presentation Materials/Slides (not required for roundtable courses)
- [x] Assessment Materials (for online courses)
- [x] Presenter Bio
- [ ] Prior Course Approval Letter

Upload less than 100mb (Please attach PDF files only) *

File Name	Size
Outline & PPT_Analysis of Changes - 2023 NEC Part 1-NC (ICC 2023 St Louis).pdf	6.88 MB

Applicant Full Name *

Laura Morris

Date of Submission

07/31/2023

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least one commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review.

Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content.
Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

Title of Course: IAEI's Analysis of Changes – 2023 *NEC*
(2023 ICC Conference- St. Louis, Missouri)

Course Syllabus: This is an extensive and popular program analyzing the major changes to the NEC for this code cycle. Members of the eighteen *NEC* code-making panels contributed to the development of this authoritative text. This seminar covers significant changes and includes interpretations by the group that enforces the *Code.* The four-color book is loaded with illustrations that clearly identify and explain the changes.

Topic Outline for IAEI Analysis of Changes-2023 *NEC (90 min)*	
Introduction	5 min
NEC Chapter 1 – General Requirements	20 min
NEC Chapter 2 – Wiring and Protection	25 min
NEC Chapter 3 – Wiring Methods and Materials	15 min
NEC Chapter 4 – Equipment for General Use	20 min
Q & A	5 min
Total CE Hours	**90 min**

Course Description: The IAEI staff and IAEI representatives on the NFPA *NEC* Code Making Panels have worked together to develop a quality seminar program that will provide information about code changes covering the safe installation and use of electrical products pertaining to the 2023 National Electrical Code.

Course Objectives: This course is designed to cover the major changes in the National Electrical Code for the 2023 *NEC* code cycle. For this code cycle there are new articles as well as numerous changes and some re-organization that will be discussed.

Upon completion of this seminar, participants will be better able to:

- Understand new requirements for GFCI protection
- Understand new definition and their applications
- Understand servicing, reconditioning and maintenance requirements
- Understand receptacle requirements concerning wiring practices and new TR locations
- Understand the new load calculation format

Method of Presentation: Microsoft PowerPoint® Presentations

Tim Mikloiche Bio (2022)

Tim is a Building Official/Supervisor of Inspections for a municipality in the State of Connecticut. He started out as an apprentice, then went on to become a State of Connecticut licensed Journeyman, Master Electrician/Electrical Contractor, and Electrical Inspector. Along the way he obtained a degree in Electro-Mechanical Engineering Technology.

Tim is on the State of Connecticut Codes and Standards Committee. He is a member of IAEI, and NFPA. He has represented IAEI on NFPA CMP-3 for the 2020 and 2023 NEC code cycle. He is the 2nd Vice Chair on NFPA's Electrical Inspector Member Section Executive Board.

IAEI's Analysis of Changes- 2023 *NEC*

Your essential guide to the most important changes in the 2023 National Electrical Code

IAEI The Electrical Safety Leader

ICC INTERNATIONAL CODE COUNCIL

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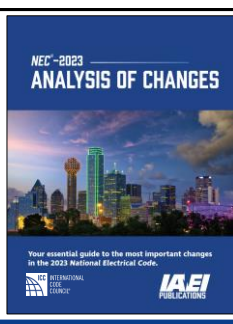

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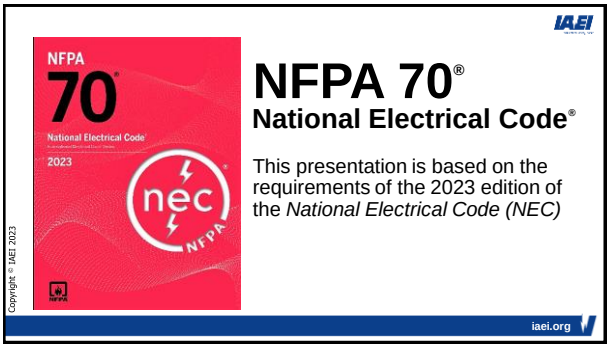
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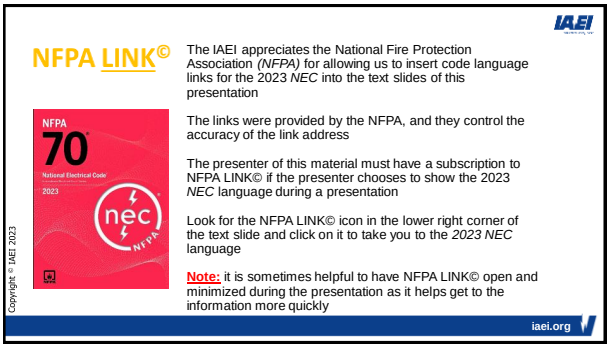
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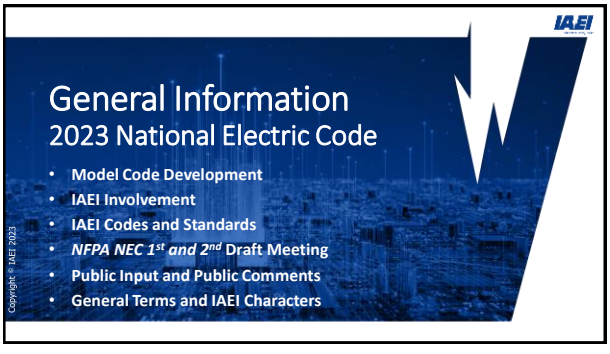
General Information
2023 National Electric Code
Model Code Development
IAEI Involvement
IAEI Codes and Standards
NFPA NEC 1st and 2nd Draft Meeting
Public Input and Public Comments
General Terms and IAEI Characters
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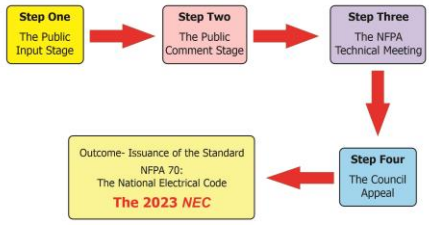
Model Code Development Process

The process of updating the National Electrical Code from one cycle to the next



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The Development of the 2023 *NEC*

Interesting information about this revised document

- IAEI provided 36 members as CMP representatives to the *NEC* revision process
- IAEI Codes and Standards Committee vetted and submitted IAEI endorsed Public Inputs and Public Comments to NFPA for consideration
- NFPA *NEC* First and Second Draft meetings were conducted virtually instead of in person
- Code Making Panel Task Group meetings were also conducted virtually
- There following were submitted to NFPA for this edition of the *Code*:
  - 4006 Public Inputs
  - 1805 First Revisions
  - 1956 Public Comments
  - 900 Second Revisions
  - 441 Correlating Notes
  - 55 Certified Amending Motions
- Several IAEI members served on NFPA Correlating Committee Task Groups to work on issues needing to be resolved

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Terms Used During the Presentation

AHJ- Authority Having Jurisdiction
CMP- Code Making Panel
CPSC- Consumer Products Safety Commission
IAEI- International Association of Electrical Inspectors
ICSC- IAEI Codes and Standards Committee
NEC- National Electrical Code
NECA- National Electrical Contractors Association
NEMA- National Equipment Manufacturers Association
NFPA- National Fire Protection Association
UL- Underwriters Laboratories

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THANK YOU for your continued partnership with the IAEI in the promotion of electrical safety
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SIEMENS
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LEVITON
PACE
Pass & Seymour
legrand
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IEEE
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Independent Electrical Contractors
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NEMA
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SEAC

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IAEI
Code-Wide Changes
• NEC Style Manual Changes
• Definition Location
• Reconditioned Equipment
• Medium Voltage Requirements
• Copper Clad Aluminum
• New Articles for 2023 NEC
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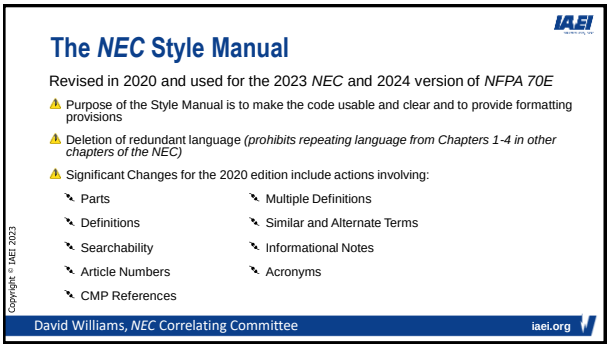
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The NEC Style Manual
Revised in 2020 and used for the 2023 NEC and 2024 version of NFPA 70E
Purpose of the Style Manual is to make the code usable and clear and to provide formatting provisions
Deletion of redundant language (prohibits repeating language from Chapters 1-4 in other chapters of the NEC)
Significant Changes for the 2020 edition include actions involving:
Parts
Definitions
Searchability
Article Numbers
CMP References
Multiple Definitions
Similar and Alternate Terms
Informational Notes
Acronyms
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David Williams, NEC Correlating Committee
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Definitions

Definitions were relocated to Article 100 and arranged in alphabetical order with no parts

- Article 100 now contains approximately 800 definitions
- Additional definition structure requirements were also added to this *Code* cycle
- This allows the *NEC* to follow the same layout as other *NFPA* documents that have all definitions in one chapter
- Similar terms and acronyms may be used along with provisions for electronic searching
- Relocation revealed multiple terms defined differently in the code, which were also addressed with the *NEC Style Manual* revision
- All definitions apply throughout the *Code* (*An article number appearing after the defined term indicates the definition only applies to that article)*

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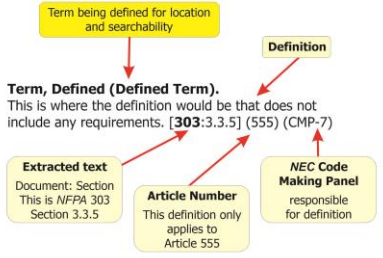
Article 100- Definitions



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Reconditioned Equipment

The xxx.2 sections in many chapters have become “placeholders” for requirements for reconditioned equipment

- This placeholder location *(xxx.2)* was made possible by the movement of all definitions that used to reside in these sections to Article 100
- This will allow code-making panels the opportunity to place requirements for reconditioned equipment in sections of the *NEC* that they have purview over
- These changes will make the *NEC* a more user-friendly document

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Reconditioned Equipment

110.20 Reconditioned
110.21 Marking

210.2 Reconditioned Equipment
240.2 Reconditioned Equipment
242.2 Reconditioned Equipment
245.2 Reconditioned Equipment

362.2 Reconditioned Equipment
348.2 Reconditioned Equipment
350.2 Reconditioned Equipment
369.2 Reconditioned Equipment

404.16 Reconditioned Equipment
406.2 Reconditioned Equipment
408.2 Reconditioned Equipment
410.2 Reconditioned Equipment
411.2 Reconditioned Equipment
430.2 Reconditioned Motors
470.2 Reconditioned Equipment
495.2 Reconditioned Equipment
495.49 Reconditioned Switchgear

517.6 Patient Care-Related Electrical Equipment

660.10 Equipment Installations
695.2 Reconditioned Equipment

700.2 Reconditioned Equipment
701.2 Reconditioned Equipment
702.2 Reconditioned Equipment
708.2 Reconditioned Equipment
800.2 Reconditioned Equipment

Note: Not all Code Making Panels *(CMPs)* used xxx.2 for reconditioned equipment

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Medium Voltage Requirements

Several new articles appeared in the 2023 *NEC* regarding the inspection and installation requirements for medium voltage conductors and equipment

- **Article 235** Branch Circuits, Feeders and Services Over 1000 Volts ac, 1500 Volts dc, Nominal
- **Article 245** Overcurrent Protection for Systems Rated Over 1000 Volts AC, 1500 Volts DC
- **Article 305** Wiring Methods and Materials for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal
- **Article 315** Medium Voltage Conductors, Cable, Cable Joints, and Cable Terminations
- **Article 495** Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal

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Copper-Clad Aluminum *(CCA)*

- Copper-clad aluminum *(CCA)* underwent extensive review and testing overseen by the NFPA Bimetallics Task Group formed at the direction of the Standard's Council after the 2020 *NEC* cycle
- The Task Group represented industry stakeholders, and the testing data provided a direct comparison of the performance of 14 AWG CCA to 14 AWG copper at their respective 60 degree C ampacities, demonstrating the safety of CCA
- A new table was added to 210.24, identified as 210.24(2), which summarizes the branch circuit applications for aluminum and CCA as had been permitted for over 50 years, where only copper conductors had this summary information provided in previous code editions

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Copper-Clad Aluminum *(CCA)(cont.)*

- In addition to the listings for finished insulated conductors and cable assemblies, **conductors made with CCA must carry a listing for the bimetal itself [310.3(B)(4)]**
- The core of the CCA must be AA-8000 series aluminum **[310.3(B)(3)]**
- The copper of CCA must be a minimum of 10 percent of the cross-sectional area of a solid conductor or each strand of a stranded conductor **[310.3(B)(3)]**
- The marriage between copper and aluminum in CCA is such that a metallurgical bond exists between the aluminum core and the copper outer layer

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Copper-Clad Aluminum *(CCA)(cont.)*

- Listing will prove that it meets ASTM product design requirements
- The smallest standard size of overcurrent protection is 10 amperes due to more energy- efficient products such as LED lighting and in anticipation of 14 AWG CCA being added to the ampacity tables in Article 310
- Code-Making Panel 1 reconfirmed in Section 110.14, Electrical Connections, that CCA and copper are only dissimilar to single metal aluminum when intermixed but not to each other for the application of the requirement
- Parenthetical text “such as copper and aluminum, copper and copper-clad aluminum, or aluminum and copper-clad aluminum” was removed

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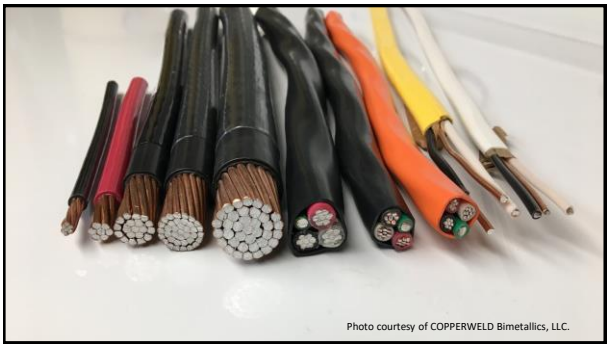

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New Articles for the 2023 *NEC*

Thirteen (13) new articles have been added to the 2023 *NEC*:

- **Article 235**
  - Branch Circuits, Feeders and Services Over 1000 Volts ac, 1500 Volts dc, Nominal
- **Article 245**
  - Overcurrent Protection for Systems Rated Over 1000 Volts ac, 1500 Volts dc
- **Article 305**
  - Wiring Methods and Materials for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal

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New Articles for the 2023 *NEC (cont.)*

Thirteen (13) new articles have been added to the 2023 *NEC*:

- **Article 315**
  - Medium Voltage Conductors, Cable, Cable Joints, and Cable Terminations
- **Article 335**
  - Instrumentation Tray Cable
- **Article 369**
  - Insulated Bus Pipe/Tubular Covered Conductors
- **Article 371**
  - Flexible Bus Systems

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New Articles for the 2023 *NEC (cont.)*

Thirteen (13) new articles have been added to the 2023 *NEC*:

- **Article 395**
  - Outdoor Overhead Conductors Over 1000 Volts
- **Article 495**
  - Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal
- **Article 512**
  - Cannabis Oil Equipment

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New Articles for the 2023 *NEC (cont.)*

Thirteen (13) new articles have been added to the 2023 *NEC*:

- **Article 722**
  - Cables for Power-Limited Circuits, Fault-Managed Power *(Class 4)* Circuits
- **Article 724**
  - Class 1 Power-Limited Circuits and Class 1 Power-Limited Remote-Control and Signaling Circuits
- **Article 726**
  - Class 4 *(CL4)* Power Systems

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Deleted Articles for the 2023 *NEC*

- **Article 311** Medium Voltage Conductors and Cables
  - *(contents moved to new Article 315)*
- **Article 510** Hazardous *(Classified)* Locations - Specific
- **Article 490** Equipment Over 1000 Volts, Nominal
  - *(contents moved to new Article 495)*
- **Article 712** Direct Current Microgrids
- **Article 720** Circuits and Equipment Operating at Less Than 50 Volts

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Article 100
Definitions

- **Covers all defined terms used in the *Code***

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Reconditioned Equipment

110.20 Reconditioned	404.16 Reconditioned Equipment	517.6 Patient Care-Related Electrical Equipment
110.21 Marking	406.2 Reconditioned Equipment	
	408.2 Reconditioned Equipment	
210.2 Reconditioned Equipment	410.2 Reconditioned Equipment	660.10 Equipment Installations
240.2 Reconditioned Equipment	411.2 Reconditioned Equipment	695.2 Reconditioned Equipment
242.2 Reconditioned Equipment	430.2 Reconditioned Motors	
245.2 Reconditioned Equipment	470.2 Reconditioned Equipment	700.2 Reconditioned Equipment
	495.2 Reconditioned Equipment	701.2 Reconditioned Equipment
362.2 Reconditioned Equipment	495.49 Reconditioned Switchgear	702.2 Reconditioned Equipment
348.2 Reconditioned Equipment		708.2 Reconditioned Equipment
350.2 Reconditioned Equipment		800.2 Reconditioned Equipment
369.2 Reconditioned Equipment		

Note: Not all Code Making Panels *(CMPs)* used xxx.2 for reconditioned equipment

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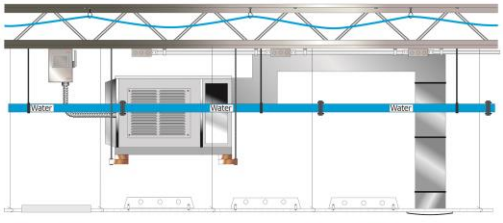
Article 100- Accessible *(applied to wiring methods)*

This helps to clarify that wiring and electrical equipment **cannot be made inaccessible** by piping, ductwork, drains, raceways, or other mechanical systems



Water piping in front of electrical equipment making it **inaccessible for maintenance**

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Article 100- Class 4 Circuit

A new definition for a Class 4 Circuit has been added as it applies to equipment and installations located in Article 726

- This was the result of the **Packet Energy Transfer** *(PET)* Systems Task Group tasked to provide guidance towards this new technology
- This emerging technology has been referred to in the past as Packet Energy Transfer *(PET)*, Digital Electricity *(DE)*, Pulsed Power, Smart Transfer Systems and Fault Managed Power (FMP)
- Involves a fault-managed system that verifies the powered device is present and operating correctly prior to a greater than Class 2 power being applied *(a fault would cause a termination of the output power)*
- Must ensure safety in the design, implementation, installation, and use of this technology
- There are now a total of six (6) definitions associated with this Class 4 technology

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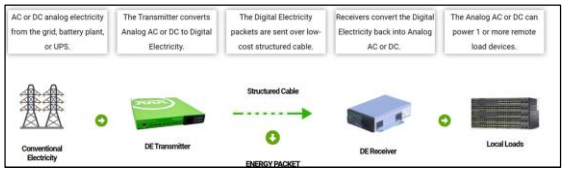
Article 100- Class 4 Circuit *(cont.)*

Flowchart describing how this process works *(courtesy of Voltserver)*



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Article 100- Class 4 Circuit *(cont.)*

Equipment associated with Class 4 Circuit distribution *(courtesy of Voltserver)*

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Article 100 Definitions- Counter *(Countertop)*

A new definition was added to help users of the *Code* understand what constitutes a **"Counter *(Countertop)*"** location

- There appears to be installer and enforcement **confusion**, as well as **frequent product misapplications** resulting from electrical equipment being installed incorrectly on these surfaces
- The key distinction between a work surface and a countertop is the **quantity of spillage** that the surfaces may be subjected *(Generally, a counter application assumes a greater volume of spillage)*
- The electrical professional will be directed to the industry standards that aid in the proper application of receptacles in these locations
- See **Informational Note No. 1** for a reference to *UL 498, Receptacles and Attachment Plugs*, and *UL 943, Ground-Fault Circuit-Interrupters*
- See **Informational Note No. 2** for information on receptacles for counters and countertops distinguished from receptacles for work surfaces

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Article 100 Definitions- Counter *(Countertop)*

The key distinction between a **work surface or a countertop** is the quantity of spillage that the surfaces may be subjected *(see Work Surface definition in upcoming slide)*

Features:
- listed for application
- flange raised above surface to prevent liquid from entering
- sealed when in the closed position to prevent liquid from entering
- only energized in the upright position
- GFCI protected

Courtesy of ABB, Thomas and Betts

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Article 100 Definitions- Work Surface

Work Surface	Countertop
• A container with **8 oz of saline solution**, with 8 g of table salt per liter of distilled water	• A container with **1/2 gallon of saline solution** with 0.28 ounce of table salt per liter of distilled water
• Container is placed on the counter surface 12 inches from the sample	• Container is placed on the counter surface 12 inches from the sample
• Container is tipped over all at once with an effort to direct the spill toward the most disadvantageous area of the assembly	• Container is tipped over all at once with an effort to direct the spill toward the most disadvantageous area of the assembly

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Article 100 Definitions- Work Surface

- ⚠ Reference 406.5(E), 406.5(G)(1), and 406.5(H) for information on receptacles for counters and countertops distinguished from receptacles for work surfaces
- ⚠ 2020 *NEC* introduced work surface and countertop recognizing the differences are important but there were no definitions for these terms *(210.11 & 210.52)*

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Article 100 Definitions- In Sight From

The definition of *"In Sight From (Within Sight From), (Within Sight)"* has been modified per requirements of the *NEC Style Manual*

- The *NEC Style Manual* states that definitions shall not contain requirements or recommendations
- See the new section for *"In Sight From (Within Sight From), (Within Sight)"* in 110.29 for requirements
- Definition revised for clarity and uniform enforcement
- Equipment that is visible and not more than 15 m *(50 ft.)* distant from other equipment is considered to be in sight from that other equipment

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Article 100- In Sight From *(Within Sight From, Within Sight)*

Distance is to be **visible** and not more than 15 m *(50 ft)* from the other equipment
[Note: see 110.29 for requirements for In Sight From (Within Sight From, Within Sight)]

Transformer disconnecting means is located in the electrical panel and is labeled

Transformer is labeled as to the panel and branch circuit it is controlled from

Always test for the presence of electricity before beginning the troubleshooting of electrical issues

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Article 100 Definitions- PV DC Circuit

New terms and revised definitions for PV System DC elements

- PV System Source Circuit and PV String Circuit subsets of a PV System DC Circuit
- **PV Source Circuit** is inclusive of the series and/or parallel dc circuit conductors between the modules and combiners, inverters or PV system dc disconnect
- **PV String Circuit** is inclusive of the series dc circuit conductors between the modules
- Previous terms and definitions were difficult to apply to current designs
- Decided to clarify these definitions as well as relocate all definitions to Article 100
- The definitions relocated to comply with the *NEC* Style manual requirements

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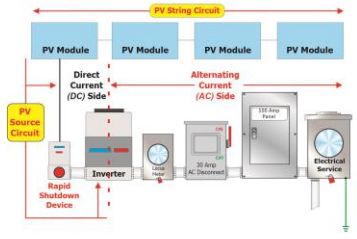
Article 100- PV DC Circuit

PV System Source Circuit and PV String Circuit are subsets of a PV System DC Circuit

PV String Circuit is the series dc circuit conductors between the modules

PV Source Circuit is the series and/or parallel dc circuit conductors between the modules and combiners, inverters or PV system dc disconnect



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Article 100 Definitions- Servicing

A new definition for servicing of electrical equipment to assist in maintenance and repair activities

- There has been confusion between what is considered reconditioning versus normal servicing, maintenance, and repair of electrical equipment
- This definition distinguishes the act of servicing and maintenance of electrical equipment from reconditioning of electrical equipment
- It will help assure the operational performance of the electrical equipment during the life of the equipment
- See *NEMA CS 100-2020, NEMA Technical Position on Reconditioned Electrical Equipment*, for additional information on the proper application of rules related to reconditioning

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Article 100- Servicing

Reconditioning and servicing of equipment is not the same

Switchboards and Switchgear Permitted to be reconditioned

Definition of "Servicing" helps to explain difference

To service equipment means to perform maintenance and repair of electrical equipment

Label shown that has been applied to the switchgear denoting it has also been reconditioned

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Article 100 Definitions- Storable Swimming, Wading, or Immersion Pools and Storable/Portable Spas and Hot Tubs

The definition was modified **removing the 42 in. depth language** thus aligning with current product manufacturing standards

- This new definition covers:
  - Storable Swimming, Wading, or Immersion Pools and
  - Storable/Portable Spa and Hot Tub
- The previous water depth limitations were based on typical storable pool construction at that time and not related to any electrical hazard associated with water depth
- AHJs were placed in a position of identifying a code violation when the 42-in depth was in the previous definitions *(even though there was not an electrical hazard)*
- This should eliminate the confusion and unnecessary requirements that an equipotential bonding system be installed

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Article 100 Definitions- Storable Swimming, Wading, or Immersion Pools and Storable/Portable Spas and Hot Tubs

The **42 in. depth** language has been removed

This now aligns with product manufacturing standards

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Article 100 Definitions- Work Surface

A new definition was added to help users of the *Code* understand what constitutes a **"Work Surface"** location

- There appears to be installer and enforcement **confusion** as well as **frequent product misapplications** resulting from electrical equipment being installed incorrectly on these surfaces *(Work surfaces involve lower volumes of spillage than countertops)*
- The key distinction between a work surface and a countertop is the **quantity of spillage** that the surfaces may be subjected
- The electrical professional will be directed to the industry standards that aid in the proper application of receptacles in these locations
- See **Informational Note No. 1** for UL 111, *Outline of Investigation for Multioutlet Assemblies*, and *UL 962A, Furniture Power Distribution Units*
- See **Informational Note No. 2** for information on receptacles for work surfaces distinguished from receptacles for counters and countertops

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Article 100 Definitions- Work Surface

Work Surface	Countertop
• A container with **8 oz of saline solution**, with 8 g of table salt per liter of distilled water	• A container with **1/2 gallon of saline solution** with 0.28 ounce of table salt per liter of distilled water
• Container is placed on the counter surface 12 inches from the sample	• Container is placed on the counter surface 12 inches from the sample
• Container is tipped over all at once with an effort to direct the spill toward the most disadvantageous area of the assembly	• Container is tipped over all at once with an effort to direct the spill toward the most disadvantageous area of the assembly

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Article 100 Definitions- Work Surface

- ⚠ Reference 406.5(E), 406.5(G)(1), and 406.5(H) for information on receptacles for counters and countertops distinguished from receptacles for work surfaces
- ⚠ 2020 NEC Introduced work surface and countertop recognizing the differences are important but there were no definitions for these terms *(210.11 & 210.52)*

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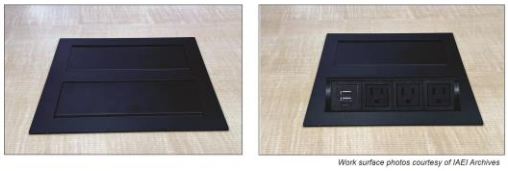
Work Surface Locations

Listing of **receptacle assemblies for work surfaces** is based on the amount of liquid spillage verses that of a counter top location



Work surface photos courtesy of IAEI Archives

Note: Need to know what type surface you are dealing with in order to install the correct receptacle assembly

See UL 111, Outline of Investigation for Multioutlet Assemblies, and UL 962A, Furniture Power Distribution Units

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110.3 Examination, Identification, Installation, Use, and Listing *(Product Certification)* of Equipment.

(A) Examination

List Item 8: Changes addresses cybersecurity for network-connected life safety equipment

- ⚠ Cybersecurity is a technology hazard that can cause many disturbances to electronic equipment
- ⚠ Cybersecurity must be considered when evaluating equipment for safety
- ⚠ Does not mandate that the electrical professional conduct a cybersecurity evaluation but to remember and recognize that it is a hazard

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110.3 Examination, Identification, Installation, Use, and Listing *(Product Certification)* of Equipment.

(A) Examination

⚠ **Informational Note No. 3** introduces the following valuable standards for consideration towards cybersecurity concerns for electrical equipment:

- IEC 62443 series of standards for Industrial Automation and Control Systems
- UL 2900 series of standards for Software Cybersecurity for Network-Connectable Products
- UL 5500, the Standard for Remote Software Updates

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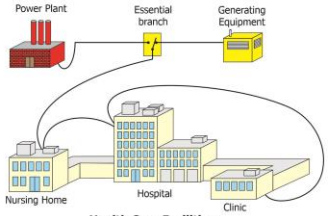
110.3 Examination, Identification, Installation, Use, and Listing *(Product Certification)* of Equipment

Addresses cybersecurity for network-connected life safety equipment in (A) Examination *(list item 8)*

Does not mandate the electrical professional to conduct a cybersecurity evaluation but remember and recognize that it is a hazard



Health Care Facilities

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110.3 Examination, Identification, Installation, Use, and Listing *(Product Certification)* of Equipment.

(B) Installation and Use

A new informational note was added allowing the use of a QR code to access installation instructions

- ⚠ QR codes are appearing on many different items
- ⚠ These allow the user to access vast amounts of information about a product
  - **An example:** Arc-Fault Circuit-Interrupters *(AFCIs)* allow the use of printed materials, **QR codes**, and internet addresses as avenues to find product information
- ⚠ New Informational Note assures the electrical professional that a QR code *(if available)* is allowable for use in finding this important information

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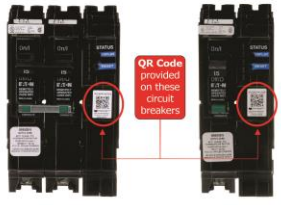
110.3 Examination, Identification, Installation, Use, and Listing *(Product Certification)* of Equipment

Use of QR codes are now addressed in the New I-Note following (B) Installation of Use

Assures the electrical professional that a QR code *(if available)* is allowable for use in finding this important information

In case you are wondering, QR stands for "quick response"



Photos courtesy of Eaton

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110.17 Servicing and Maintenance of Equipment

A new section addresses servicing and maintenance of electrical equipment and restricts this work to qualified persons trained to perform the work

- Requires the use of identified replacement parts that have been verified per applicable product standards
- A list of these options is provided for approval of these replacement parts
- Parts are to be provided by either the original equipment manufacturer *(OEM),* designed by an engineer with applicable experience, or as approved by the AHJ
- Manufacturer's instructions and any additional information included in the listing must be utilized
- The applicable industry standards should also be consulted for additional information
- See *NFPA 70B, The Recommended Practice for Electrical Equipment Maintenance*

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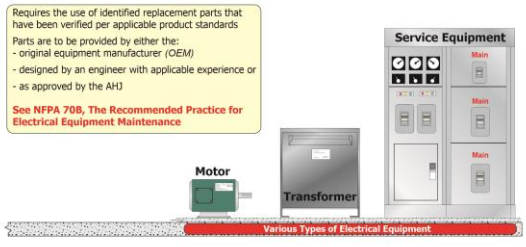
110.17 Servicing and Maintenance of Equipment

New section addresses servicing and maintenance of electrical equipment and **restricts this work to qualified persons trained to perform the work**

Requires the use of identified replacement parts that have been verified per applicable product standards

Parts are to be provided by either the:
- original equipment manufacturer *(OEM)*
- designed by an engineer with applicable experience or
- as approved by the AHJ

See NFPA 70B, The Recommended Practice for Electrical Equipment Maintenance



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Working safely is important!

Please disconnect electricity to equipment you are working on.

Refer to NFPA 70E for further information

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110.20 Reconditioned Equipment

A new section for the establishment of general requirements that will apply to all equipment that is reconditioned

- Requires the use of identified replacement parts verified under applicable standards, provided by the original equipment manufacturer *(OEM)* or designed by an engineer with applicable experience
- **When equipment is to be listed**, reconditioned equipment must be listed, or a field label applied stating it has been reconditioned using information from the OEM
- **When equipment is not required to be listed**, two options exist:
  - The first states that the equipment can be listed or field labeled as reconditioned
  - The second states that the equipment can be reconditioned per the instructions provided by the OEM

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110.20 Reconditioned Equipment *(cont.)*

A new section for the establishment of general requirements that will apply to all equipment that is reconditioned

- A third option (C) is permitted when either option (A) or (B) will not work:
  - The authority having jurisdiction (AHJ) is permitted to approve reconditioned equipment when listing, field labeling, and OEM guidance are not available
- This grants the AHJ the ability to review the documentation regarding the changes that have been made to the equipment
- Based on this review, the AHJ may be able to approve the equipment

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110.20 Reconditioned Equipment

New section for the establishment of general requirements that will apply to all equipment that is reconditioned

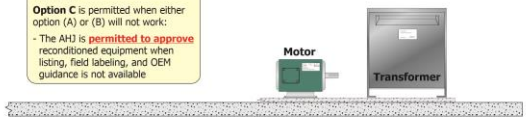
When equipment is not required to be listed, three options exist:

Option A
- it can be listed, or field labeled as reconditioned

Option B
- the equipment can be reconditioned per the instructions provided by the OEM

Option C is permitted when either option (A) or (B) will not work:
- The AHJ is **permitted to approve** reconditioned equipment when listing, field labeling, and OEM guidance is not available

When equipment is to be listed:
- reconditioned equipment must be listed or
- a field label applied stating it has been reconditioned using information from the OEM



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Major flooding resulted in damage to these circuit breakers.

Not all circuit breakers can be reconditioned.

(P.S.- the use of WD-40 is not the solution either!)

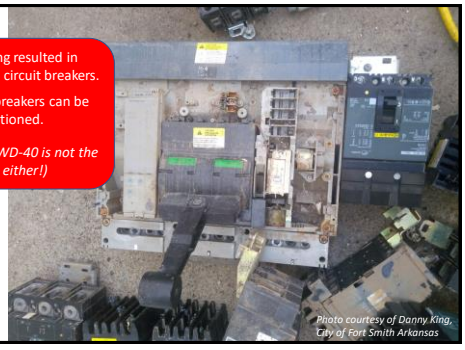

Photo courtesy of Danny King, City of Fort Smith Arkansas

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The harsh reality:

Sometimes, things just cannot be reconditioned and must be replaced

Large hail event- Plano, Texas

Photos courtesy of Bill McGovern

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110.21 Marking

(A) Marking- (2) Reconditioned Equipment

Has reorganized information into a list format and clarifies that the original listing mark is to be removed or made permanently illegible

- The information previously found in a sentence format has been placed into a list format making it easier to follow and understand
- Clarification that the original listing mark is to be removed or made permanently illegible
- Clarifies the misunderstanding by some that the nameplate should be removed
- This assures that important information stays with the equipment for future use
- Further clarifies that the approval of this equipment should not be based on the original listing mark

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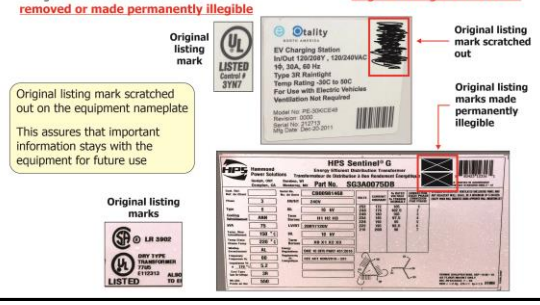
110.21(A)(2) Reconditioned Equipment

Reorganized information into a list format and clarifies that the original listing mark is to be removed or made permanently illegible



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110.26 Spaces About Electrical Equipment

This change concerns equipment doors and their interference with egress and access from the working space moved from 110.26(C)(2)

- Many instances of electrical equipment installations violate the previous *Code* language involving this working space *(entrapment when doors are open)*
- Worker entrapment by equipment doors can cause serious injury or death
- This change recognizes open equipment doors can impede egress from electrical equipment when dangerous situations arise *(arc blast, etc.)*
- Access and egress **are impeded** if an equipment door(s) is opened and **restricts** the working space access to less than 610 mm ***(24 in.)* wide** and 2.0 m ***(6 ½ ft)* high**
- This rule also applies to the space between two simultaneously opened doors on opposite sides of the aisleway

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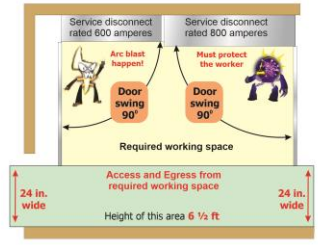
110.26 Spaces About Electrical Equipment

This change recognizes open equipment doors can impede egress from electrical equipment when dangerous situations arise *(arc blast, etc.)*



Open equipment doors **not to impede** the access or egress from the working space

Access and egress **is impeded if** an equipment door(s) is opened and restricts the working space access to **less than 610 mm (24 in.) wide and 2.0 m (6 ½ ft) high**

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110.26 Spaces About Electrical Equipment

(A) Working Space- (6) Grade, Floor, or Working Platform

Addresses the working space conditions of the floor at electrical equipment locations

- ⚠ Floor conditions were not addressed by the previous editions of the *Code*
- ⚠ This could be slope of grade or other impediments
- ⚠ These conditions are safety issues for workers that must perform work on electrical equipment
- ⚠ AHJ needed this guidance so that the initial installation is installed in a compliant manner

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110.26(A)(6) Grade, Floor, or Working Platform

Floor conditions can present safety issues for workers that must perform work on electrical equipment

This photo is a parking garage

Notice wheel stop in front of electrical equipment

Could pose a tripping hazard injuring the worker

Photo courtesy of IAEI Archives

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110.26(A)(6) Grade, Floor, or Working Platform

Floor conditions can present safety issues for workers that must perform work on electrical equipment

Exterior location with electrical service equipment

Surface grade appears to be in good shape to assure worker safety

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110.29 In Sight From *(Within Sight From, Within Sight)*

New Section 110.29 has been added to address electrical equipment and the term "In Sight From"

- "In sight from," "Within Sight From," and "Within Sight" appears several times throughout the *NEC*
- This sections adds applicability and useability of these phrases
- Addresses *NEC Style Manual* issues that state definitions shall not contain requirements or recommendations
- Distance is to be **visible** and **not more than 15 m *(50 ft)*** from the other equipment
- Reference defined term in Article 100: "In Sight From *(Within Sight From) (Within Sight)*"

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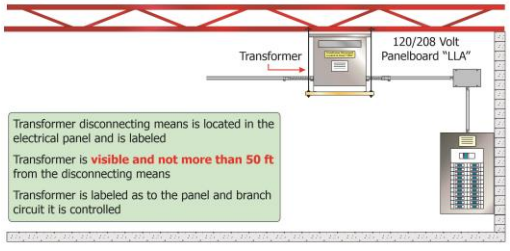
110.29 In Sight From *(Within Sight From, Within Sight)*

Distance is to be visible and not more than 15 m (50 ft) from the other equipment



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Chapter 2
Wiring and Protection
• Article 210
• Article 215
• Article 220
• Article 225
• Article 230
• Article 235
• Article 240
• Article 242
• Article 245
• Article 250
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Article 210
Branch Circuits Not Over 1000 Volts ac, 1500 Volts dc, Nominal
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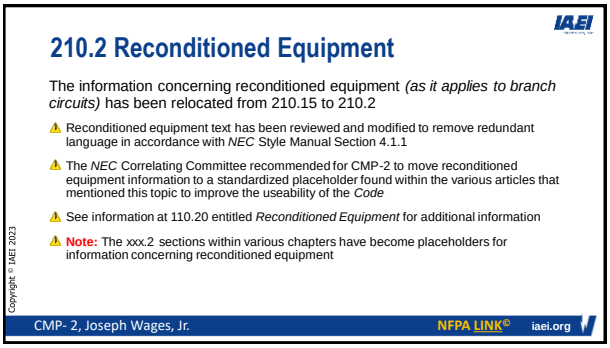
210.2 Reconditioned Equipment
The information concerning reconditioned equipment (as it applies to branch circuits) has been relocated from 210.15 to 210.2
Reconditioned equipment text has been reviewed and modified to remove redundant language in accordance with NEC Style Manual Section 4.1.1
The NEC Correlating Committee recommended for CMP-2 to move reconditioned equipment information to a standardized placeholder found within the various articles that mentioned this topic to improve the useability of the Code
See information at 110.20 entitled Reconditioned Equipment for additional information
Note: The xxx.2 sections within various chapters have become placeholders for information concerning reconditioned equipment
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210.2 Reconditioned Equipment

The information concerning reconditioned equipment has been relocated from 210.15 to 210.2

GFCI

GFCI/AFCI

The following **shall not be reconditioned**:

(1) Equipment that provides ground-fault circuit-interrupter *(GFCI)* protection for personnel

(2) Equipment that provides arc-fault circuit-interrupter *(AFCI)* protection

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210.8 Ground-Fault Circuit-Interruption Protection for Personnel

(A) Dwelling Units- (6) Kitchens

Ground-fault circuit-interrupter *(GFCI)* protection has been expanded to include any cord-and-plug equipment in the kitchen, regardless of whether the outlet serves the countertop

- There have been 104 electrocutions that have taken place from 2011 to 2022 based on the Consumer Products Safety Commission *(CPSC)* database
- Eighty-one percent of these accidents were from working on an appliance or other equipment
- GFCI protection is required within a kitchen for receptacles that are
  - 125-volt through 250-volt and
  - supplied by single-phase branch circuits rated 150 volts or less

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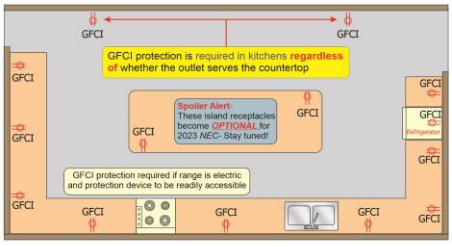
210.8(A)(6) Dwelling Unit Kitchens

Ground-fault circuit-interrupter *(GFCI)* protection required for receptacles in a kitchen
- All 125-volt through 250-volt receptacles
- single-phase branch circuits rated 150 volts or less to ground



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210.8 Ground-Fault Circuit-Interruption Protection for Personnel *(cont.)*

(A) Dwelling Units *(cont.)*

Exception 4: A new Exception No. 4 will help the electrical professional address ground-fault circuit-interrupter *(GFCI)* protection requirements for factory-installed exhaust fans and their receptacles

- There was confusion as to if a receptacle found within an exhaust fan installed in the bathroom required GFCI protection
- This receptacle is typically installed within a fan unit and is not accessible or interactable with people
- This will help reduce arguments and misunderstandings in the field
- Language specifies that exhaust fans are not readily accessible and that the receptacles be installed integral to the fan assembly

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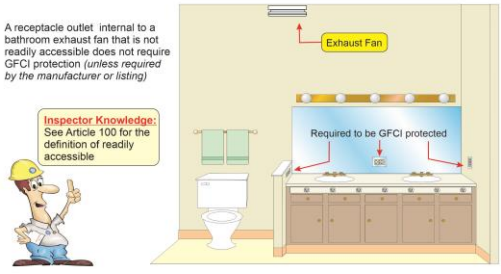
210.8(A) Ex. No. 4- GFCI Protection of Bathroom Receptacles

A receptacle outlet internal to a bathroom exhaust fan that is not readily accessible does not require GFCI protection *(unless required by the manufacturer or listing)*

Inspector Knowledge: See Article 100 for the definition of readily accessible



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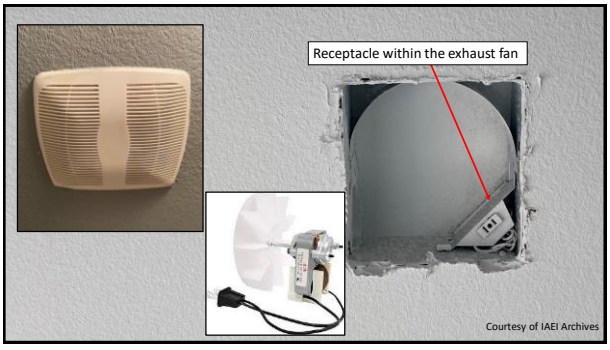

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210.8 Ground-Fault Circuit-Interruption Protection for Personnel- (B) Other Than Dwelling Units

A new list item (4) has been added for the addition of buffet serving areas to the list of locations requiring ground-fault circuit-interrupter *(GFCI)* protection

- All receptacles are to be GFCI protected if they are:
  - Single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, 125-volt through 250-volt
  - Three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less
- The buffet serving area typically contains various food wells which hold hot water
- Customers or staff members touching the stainless steel are subject to electric shock in the event of an accident
- It was demonstrated that these locations are similar in safety concerns to those surfaces which are in kitchens

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210.8 Ground-Fault Circuit-Interruption Protection for Personnel- (B) Other Than Dwelling Units

List item (7): Modified to address cord-and-plug-connected **fixed and stationary appliances** within 6 feet of a sink.

- The electrical hazard is typically not with the 125-volt through 250-volt receptacle supplying a fixed or stationary piece of equipment but from the equipment itself
- Equipment such as a refrigerator or range is typically constructed of metal and located within 6 feet of a sink
- A person at the sink making contact with these metal appliances has been injured or killed as a result
- This action was necessary to prevent needless electrocutions or shocks to people from occurring

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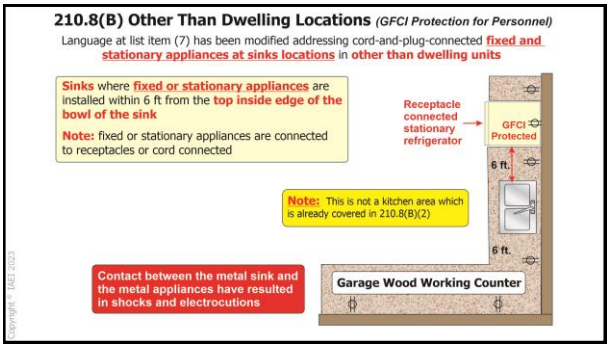
210.8(B) Other Than Dwelling Locations (GFCI Protection for Personnel)
Language at list item (7) has been modified addressing cord-and-plug-connected fixed and stationary appliances at sinks locations in other than dwelling units
Sinks where fixed or stationary appliances are installed within 6 ft from the top inside edge of the bowl of the sink
Note: fixed or stationary appliances are connected to receptacles or cord connected
Receptacle connected stationary refrigerator
GFCI Protected
6 ft.
6 ft.
Note: This is not a kitchen area which is already covered in 210.8(B)(2)
Contact between the metal sink and the metal appliances have resulted in shocks and electrocutions
Garage Wood Working Counter
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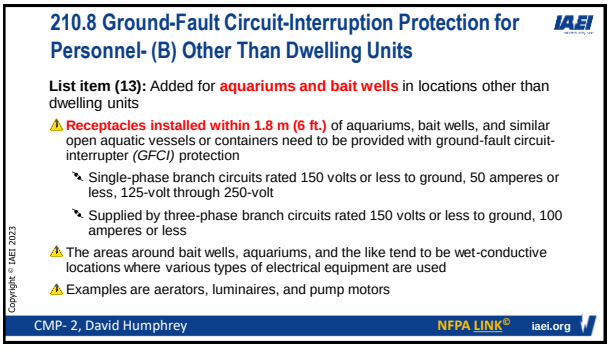
210.8 Ground-Fault Circuit-Interruption Protection for Personnel- (B) Other Than Dwelling Units
IAEI
List item (13): Added for aquariums and bait wells in locations other than dwelling units
Receptacles installed within 1.8 m (6 ft.) of aquariums, bait wells, and similar open aquatic vessels or containers need to be provided with ground-fault circuit-interrupter (GFCI) protection
Single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, 125-volt through 250-volt
Supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less
The areas around bait wells, aquariums, and the like tend to be wet-conductive locations where various types of electrical equipment are used
Examples are aerators, luminaires, and pump motors
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CMP- 2, David Humphrey
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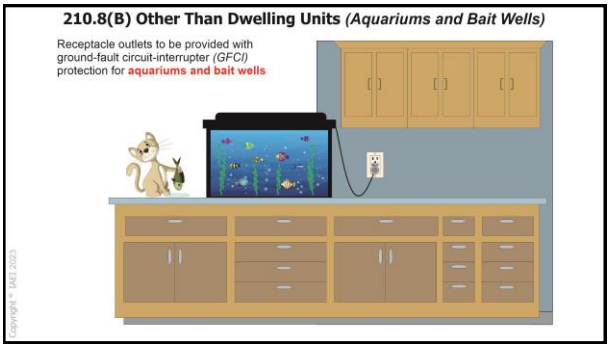
210.8(B) Other Than Dwelling Units (Aquariums and Bait Wells)
Receptacle outlets to be provided with ground-fault circuit-interrupter (GFCI) protection for aquariums and bait wells
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210.8(B) Other Than Dwelling Units *(Aquariums and Bait Wells)*

Examples:
Receptacle outlets to be provided with *GFCI* protection for **live minnow wells** used by fishing anglers

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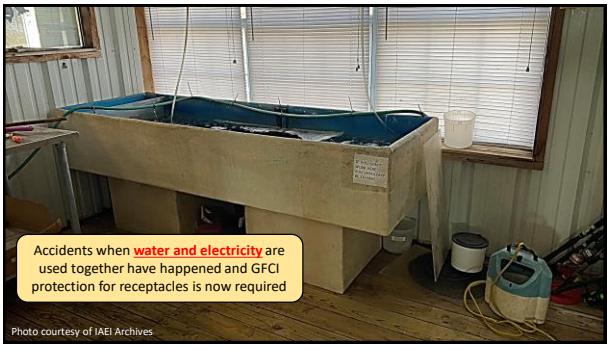

163

210.8 Ground-Fault Circuit-Interruption Protection for Personnel- (D) Specific Appliances

The appliances *(cord-and-plug and hard-wired)* requiring ground-fault circuit-interrupter *(GFCI)* protection were placed into a list format for easier use

- GFCI protection will apply to **outlets** supplied by a branch circuit of 150 volts or less to ground and 60 amperes or less in a single-phase system
- **New appliances** appear in **red text**:

- Automotive vacuum machines
- Drinking water coolers and bottle fill stations
- High-pressure spray washing machines
- Tire inflation machines
- Vending machines
- Sump pumps
- Dishwashers
- **Electric ranges**
- **Wall-mounted ovens**
- **Counter-mounted cooking units**
- **Clothes dryers**
- **Microwave ovens**

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210.8(D) Specific Appliances *(GFCI Protection)*

The appliances *(cord-and-plug and hard-wired)* requiring ground-fault circuit-interrupter *(GFCI)* protection were placed into a list format for easier use *(dwelling and other than dwelling unit locations)*

GFCI protection applies to **outlets supplied by a branch circuit** of **150 volts or less to ground** and **60 amperes or less** in a **single-phase system**

New list items include:
- electric ranges
- wall-mounted ovens
- counter-mounted cooking units
- clothes dryers
- microwave ovens

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New appliances include:

- electric ranges
- wall-mounted ovens
- counter-mounted cooking units
- clothes dryers
- microwave ovens

Photo courtesy of IAEI Archives

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210.8 Ground-Fault Circuit-Interruption Protection for Personnel- (F) Outdoor Outlets

Ground-fault circuit-interrupter *(GFCI)* protection is to be installed when the equipment supplied by an outlet covered under the requirements of this section is **replaced**

- ⚠ This addresses issues of **older existing outlets** that are **not GFCI protected**
- ⚠ Will require GFCI protection for dwelling outdoor outlets when the electrical equipment is replaced that receives power from that older existing outlet
- ⚠ This change will increase the overall level of safety by providing the same level of protection

Notice: **TIA 23-3** *(TIA Log #1664)* created **Exception No. 2** stating that GFCI protection not required for listed HVAC equipment

This exception will expire **September 1, 2026**

CMP- 2, David Humphrey NFPA LINK© iaei.org

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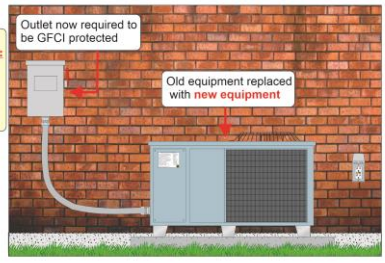
210.8(F) Outdoor Outlets *(GFCI)*

When **new electrical equipment** is installed, ground-fault circuit-interrupter *(GFCI)* protection method is required for the outlet serving the new equipment

Note from the Electrical Inspector:

NFPA has assigned a task group to look at interoperability issues between equipment and GFCI protection



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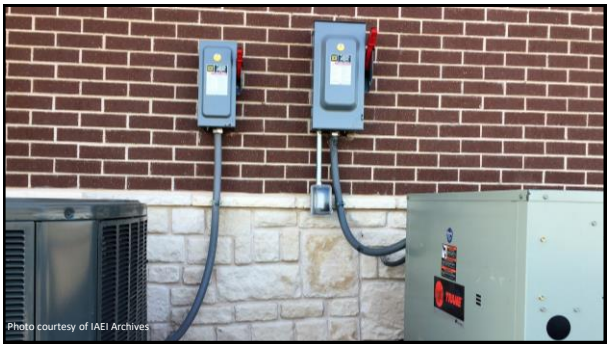

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210.11 Branch Circuits Required

(C) Dwelling Units- (4) Garage Branch Circuits

The text was clarified so that 15-ampere branch circuits are permitted to serve receptacle outlets installed in a dwelling unit garage

- If a 15-ampere branch circuit(s) is installed, it would be in addition to the 20-ampere circuit supplying the required garage receptacles
- This would not diminish the required 20-ampere circuit requirement found at 210.52(G)(1)
- Applies to garages of any size *(1,2,3,4, etc., vehicle bays)*
- Equipment such as a central vacuum unit or garage door opener is allowed to be supplied by a branch circuit that limits ampacity to 15 amperes
- This change will alleviate any confusion about garage branch circuit requirements

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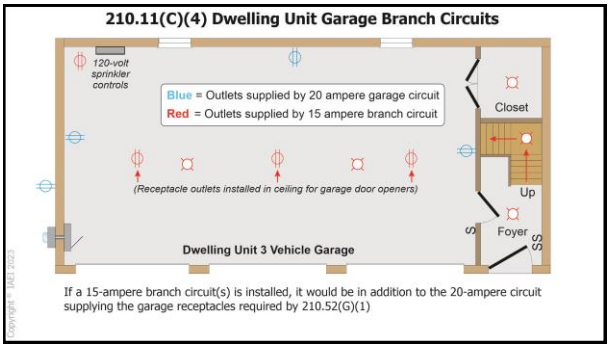

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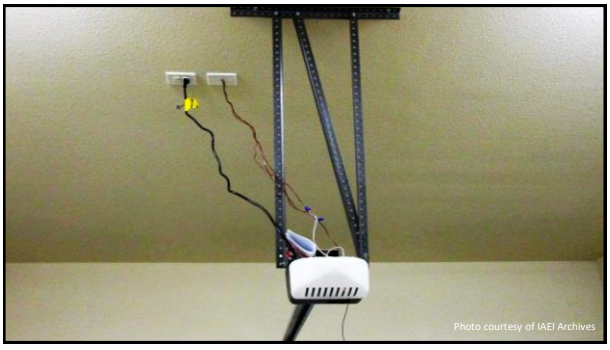

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210.11 Branch Circuits Required

(C) Dwelling Units- (4) Garage Branch Circuits

New Exception No. (2): Added to permit the 20-ampere branch circuit supplying a single vehicle bay garage to supply other equipment in accordance with requirements in 210.23(A)(1) and (A)(2)

- A single-bay garage is only mandated to be provided with one receptacle outlet on the 20-ampere branch circuit
- The branch circuit will provide adequate circuit capacity to supply other loads
- These loads are likely to be limited in number due to the reduced space availability in the garage

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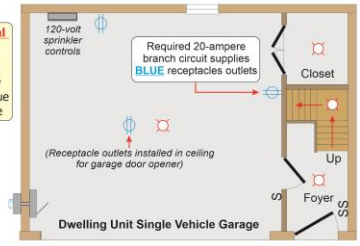
210.11(C)(4) Dwelling Unit Garage Branch Circuits

20-ampere circuit supplying the dwelling unit single vehicle bay garage receptacles as permitted by new Exception No. 4

Note from the Electrical Inspector:

The 20-ampere circuit will provide adequate capacity as the loads are limited due to the space of the garage



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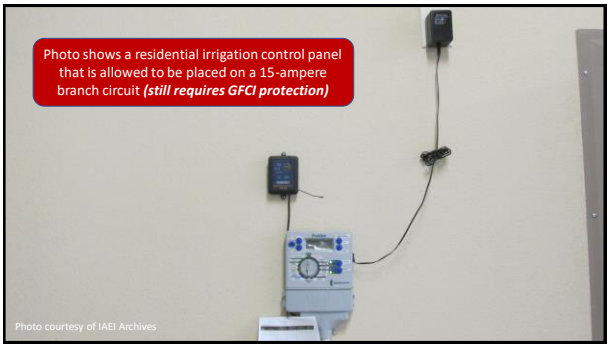

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210.12 Arc-Fault Circuit-Interrupter Protection *(AFCI)*

Reformatted for clarity making it easier to understand requirements

- ⚠ The **10-ampere branch circuit** was added to the branch circuit sizes allowed for these locations, and subdivisions were renamed
  - **(A) Means of Protection:** Now lists the protection methods available
  - **(B) Dwelling Units:** Includes the list of areas of the dwelling unit
  - **(C) Dormitory Units:** Specific requirements for dormitory units
  - **(D) Other Occupancies:** Includes expanded areas for AFCI protection
  - **(E) Branch Circuit Wiring Extensions, Modifications, or Replacements:** Clarity changes included this cycle

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210.12 Arc-Fault Circuit-Interrupter Protection *(AFCI)*

This section was **reformatted** making it easier to reference and utilize the requirements and a **10-ampere branch circuit added** to allowable branch circuit sizes

Section was reformatted for easier use:

- **Subdivision (A)**, Means of Protection
- **Subdivision (B)**, Dwelling Units
- **Subdivision (C)**, Dormitory Units
- **Subdivision (D)**, Other Occupancies
- **Subdivision (E)**, Branch Circuit Wiring Extensions/Modifications/Replacements

Cut Away AFCI Circuit Breaker

Photo courtesy of Eaton

AFCI System Combination Rated Device

Photo courtesy of Eaton

Dual function AFCI/GFCI Device

Photo courtesy of Legrand

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210.12 Arc-Fault Circuit-Interrupter Protection *(AFCI)*

(D) Other Occupancies

New List Item (3): Rooms designed exclusively as sleeping rooms in places such as firehouses, rescue squads, police departments, and similar locations are to be protected by one of the methods in 210.12(A)(1) through (A)(6)

- All 120-volt single-phase, 10, 15, and 20-ampere branch circuits supplying devices or outlets for these rooms are now required to be provided with arc-fault circuit-interrupter *(AFCI)* protection
- These rooms are occupied in much the same way as bedrooms of dwellings or as guest rooms of hotels and motels and should be provided with the same level of safety
- **Note:** Two new subsections were added in 210.12, and many existing subsections were modified for clarity and useability
  - In some cases, list items replaced long lines of text that detailed locations requiring AFCI protection

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210.12(D)(3) Other Occupancies *(AFCI Protection)*

All 120-volt single-phase, 10, 15, and 20-ampere branch circuits supplying devices or outlets for the following locations required to be provided with arc-fault circuit-interrupter *(AFCI)* protection

In **sleeping quarters** in places such as:

- firehouses
- ambulance stations
- rescue squads
- police departments
- ranger stations
- and similar locations

Photo courtesy of Bentonville Arkansas Fire Department

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210.23 Permissible Loads

Permissible Loads, Multiple-Outlet Branch Circuits **10 Ampere Branch Circuits**

- This change covers permitted and non-permitted use of a 10-ampere branch circuit
- Installation requirements were necessary for the use of a 10-ampere branch circuit if the installer chose to do so
- Advantages include lower cost due to smaller conductors with loads such as increased LED lighting installations
- A **10-ampere branch circuit can supply loads for** lighting outlets, lighting circuits for bathroom and laundry area exhaust fans within dwelling units, and a gas fireplace unit served by an individual branch circuit
- A **10-ampere branch circuit cannot supply loads for** receptacle outlets, fixed appliances *(except as permitted for individual branch circuits)*, garage door openers, or laundry equipment

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210.23 Permissible Loads

10 ampere branch circuits are now addressed in the *NEC*

A 10-ampere branch circuit can supply loads for:

- lighting outlets
- lighting circuits for bathroom and laundry area exhaust fans within dwelling units
- gas fireplace unit served by an individual branch circuit

A 10-ampere branch circuit cannot supply loads for:

- receptacle outlets
- fixed appliances (except as permitted for individual branch circuits)
- garage door openers
- laundry equipment

Installation requirements were necessary for the use of 10-ampere branch circuits if the installer chose to do so

Note: A 10-ampere receptacle configuration does not currently exist

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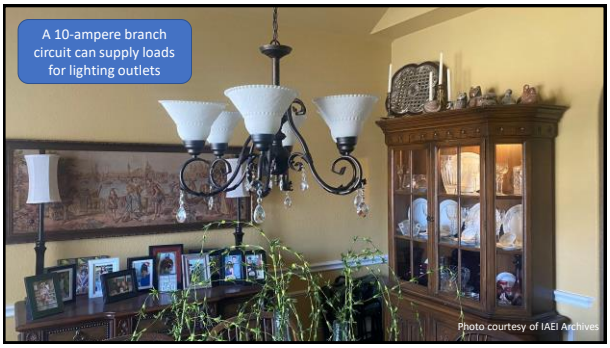

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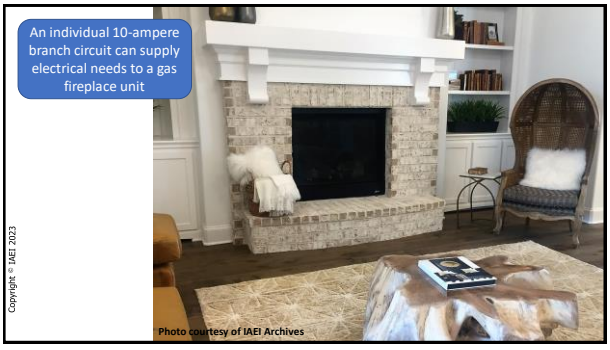
An individual 10-ampere branch circuit can supply electrical needs to a gas fireplace unit
Photo courtesy of IAEI Archives
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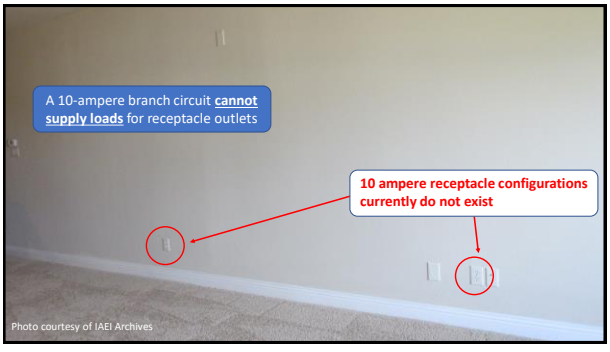
A 10-ampere branch circuit cannot supply loads for receptacle outlets
10 ampere receptacle configurations currently do not exist
Photo courtesy of IAEI Archives

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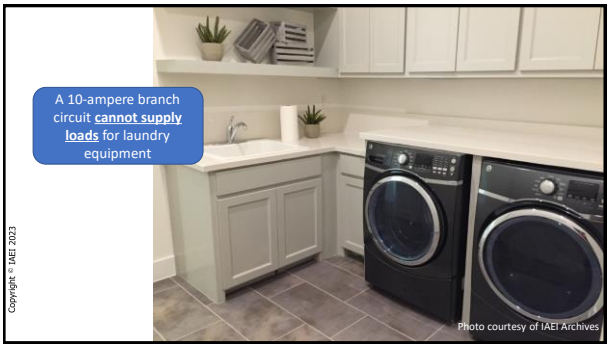
A 10-ampere branch circuit cannot supply loads for laundry equipment
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210.52 Dwelling Unit Receptacle Outlets

(C) Countertops and Work Surfaces

(2) Island and Peninsular Countertops and Work Surfaces

The requirement for receptacles serving the countertop or work surface of an island or peninsula has been **made optional**, but guidance for their location has been maintained when they are provided

- Data compiled by the Consumer Products Safety Commission *(CPSC)* document 45 reports of burns or other injuries between January 1991 and 2020
- An estimated 9,700 burns or other injuries were treated in U.S. hospital emergency rooms
- Most injuries were the result of hot contents being spilled from countertop cooking appliances on children who pulled the appliance cord

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210.52 Dwelling Unit Receptacle Outlets

(C) Countertops and Work Surfaces

(2) Island and Peninsular Countertops and Work Surfaces

- In the event a receptacle outlet is not provided, the electrical contractor must provide a method to the island or peninsula for the future addition of a receptacle outlet
- Some examples may include:
  - NM or UF cable in a box with cover
  - Unfinished basement access to below the island or peninsula

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210.52(C) Islands and Peninsular Receptacles- Dwelling Units

Receptacle outlets shall be installed **on or above** the countertops

Not permitted face-up in work surface or countertop [406.5(G)(1)]

Receptacle outlet assemblies **listed for the application** shall be permitted to be installed in countertops and work surface

Receptacle outlet **no longer allowed** to be installed below the countertop

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NEC History of Countertop Receptacle Placement

Before 1990 there was **no guidance or requirement** for receptacle placement for kitchen island and peninsular locations

This proposal to NFPA shows **IAEI was opposed to the receptacles being installed below countertops** due to possible accidents that are now well documented

Note: Jim Carpenter was a previous IAEI International Office CEO serving on CMP-2

2-222- (210-52(c)): Reject
SUBMITTER: Marlene Avigliano, IAEI
RECOMMENDATION: (Add) Receptacles required to service peninsular and island countertops shall not be located below the level of the countertop.
SUBSTANTIATION: Electrical cords from kitchen appliances extending over the end of a countertop expose children to a hazardous condition. Children pulling on a cord can pull hot coffee pots, skillets, etc., over the counter edge and onto themselves.
PANEL ACTION: Reject.
PANEL STATEMENT: Too restrictive. Incomplete technical substantiation to support the proposed change.
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11
NEGATIVE: Carpenter
EXPLANATION OF VOTE:
CARPENTER: Many manufacturers of kitchen appliances have included warnings on their products or in their literature concerning the hazards of placing an appliance too close to the counter edge letting the cord extend over the counter edge because of the hazard described in this proposal. Permitting receptacles below the level of the countertop promotes the misuse of these appliances.

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Receptacle outlets will now be **optional** for kitchen islands and peninsular locations

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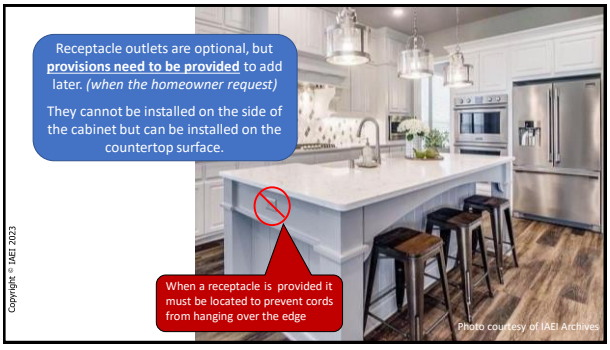
Receptacle outlets are optional, but **provisions need to be provided** to add later. *(when the homeowner request)*
They cannot be installed on the side of the cabinet but can be installed on the countertop surface.
When a receptacle is provided it must be located to prevent cords from hanging over the edge
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Photo courtesy of IAEI Archives

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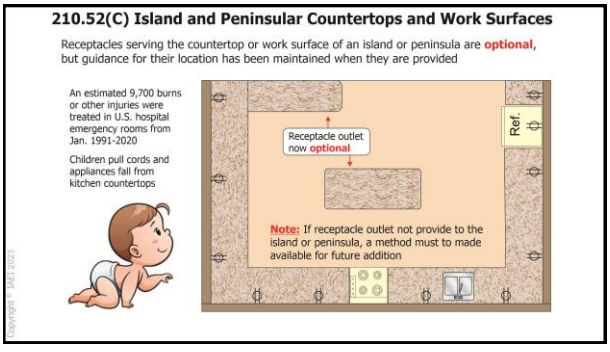
210.52(C) Island and Peninsular Countertops and Work Surfaces
Receptacles serving the countertop or work surface of an island or peninsula are optional, but guidance for their location has been maintained when they are provided
An estimated 9,700 burns or other injuries were treated in U.S. hospital emergency rooms from Jan. 1991-2020
Children pull cords and appliances fall from kitchen countertops
Receptacle outlet now optional
Ref.
Note: If receptacle outlet not provide to the island or peninsula, a method must to made available for future addition

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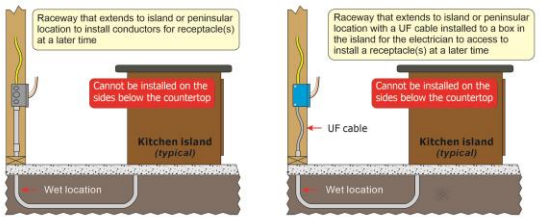
210.52(C) Island and Peninsular Countertops and Work Surfaces

Receptacles serving the countertop or work surface of an island or peninsula are **optional**, but guidance for their location has been maintained when they are provided

If a receptacle outlet is not provided, a method must to made available for future addition

Note: Below are two options to meet this requirement *(other options may be acceptable to the AHJ)*



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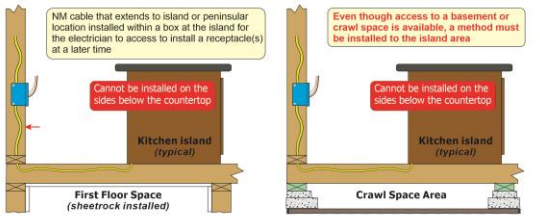
210.52(C) Island and Peninsular Countertops and Work Surfaces

Receptacles serving the countertop or work surface of an island or peninsula are **optional**, but guidance for their location has been maintained when they are provided

If a receptacle outlet is not provided, a method must to made available for future addition

Note: Below are two options to meet this requirement *(other options may be acceptable to the AHJ)*



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210.62 Show Windows

This change clarified the intent of the receptacle outlets is for **each show window location**

- There had been confusion by electrical professionals as to how the previous *Code* language was to be applied during electrical installations
- New language makes this requirement easier to understand for both the installer and the inspection authority *(AHJ)*

This change **was not included** in the IAEI Analysis of Changes book

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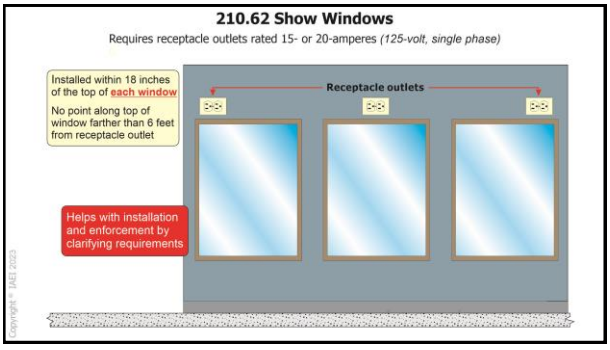
210.62 Show Windows
Requires receptacle outlets rated 15- or 20-amperes (125-volt, single phase)
Installed within 18 inches of the top of each window
No point along top of window farther than 6 feet from receptacle outlet
Receptacle outlets
Helps with installation and enforcement by clarifying requirements
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Article 215
Feeders
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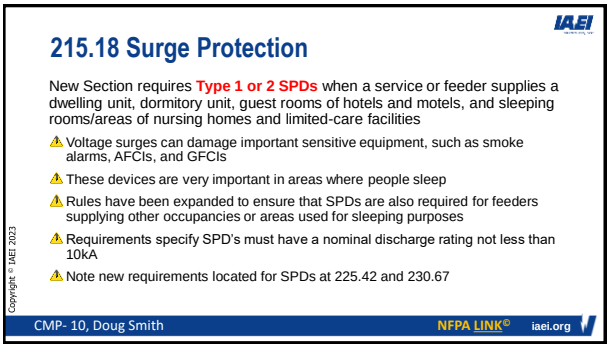
215.18 Surge Protection
New Section requires Type 1 or 2 SPDs when a service or feeder supplies a dwelling unit, dormitory unit, guest rooms of hotels and motels, and sleeping rooms/areas of nursing homes and limited-care facilities
Voltage surges can damage important sensitive equipment, such as smoke alarms, AFCIs, and GFCIs
These devices are very important in areas where people sleep
Rules have been expanded to ensure that SPDs are also required for feeders supplying other occupancies or areas used for sleeping purposes
Requirements specify SPD's must have a nominal discharge rating not less than 10kA
Note new requirements located for SPDs at 225.42 and 230.67
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215.18 Surge Protection (Feeders)
Type 1 or 2 SPDs required when a service or feeder supplies a dwelling unit, dormitory unit, guest rooms of hotels and motels, and sleeping rooms/areas of nursing homes and limited-care facilities
Voltage surges can damage important sensitive equipment, such as smoke alarms, AFCIs, GFCIs, and electronic equipment
Courtesy of Leviton
Courtesy of Eaton

217

Photo courtesy of IAEI Archives

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Photo courtesy of IAEI Archives

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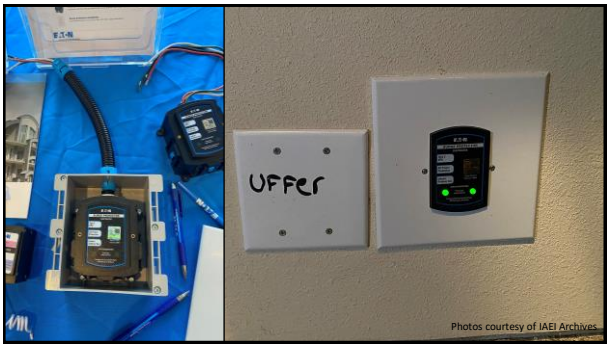

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Article 220
Branch-Circuit, Feeder, and Service Load Calculations

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220.5 Calculations

(C) Floor Areas

Areas such as **garages, or unfinished areas that can be adaptable for future use as a habitable room or occupiable space** are no longer excluded from the calculated floor area of the building, dwelling unit or other area

- A new subsection (C) was added to Section 220.5(C) entitled "Floor Areas"
- The previous text **"not adaptable for future use"** was considered subjective and reworded for clarity
- Garages and other spaces often are used as ancillary space to the habitable portions of the dwelling
- These spaces will now be included in dwelling, building, or other space square foot calculation

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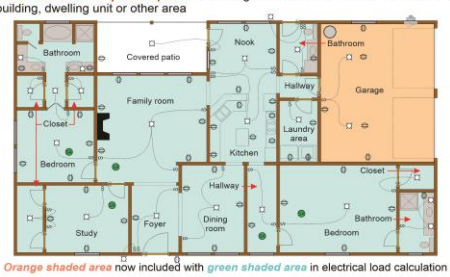
220.5(C) Floor Areas *(Calculations)*

Areas such as **garages, or unused or unfinished areas that can be adaptable for use as a habitable room or occupiable space** are no longer excluded from the calculated floor area of the building, dwelling unit or other area



Orange shaded area now included with *green shaded area* in electrical load calculation

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220.57 Electric Vehicle Supply Equipment *(EVSE)* Load

New Section 220.57 has been added to specify load calculations for Electric Vehicle Supply Equipment *(EVSE)*

- Electric Vehicle Supply Equipment *(EVSE)* is becoming more and more prevalent
- Charging infrastructure is necessary, and there was a need for the *NEC* to offer some direction as to load calculation requirements
- This language specifies the use of **7200 volt-amperes or the VA rating from the nameplate of the equipment**, whichever is the larger of the two
- A 7200 volt-ampere *(VA)* minimum requirement was chosen and is based on a 30 ampere, 240-volt, single-phase circuit

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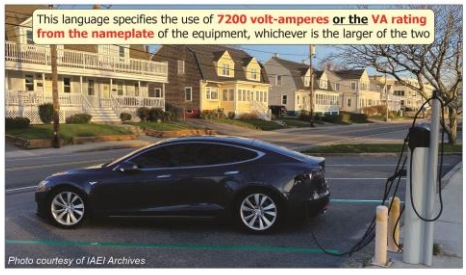
220.57 Electric Vehicle Supply Equipment *(EVSE)* Load

Section has been added to specify load calculations for Electric Vehicle Supply Equipment *(EVSE)*



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220.110 Receptacle Loads

New demand factors for receptacles added to Part VI, Health Care Facilities, for Category 1, 2, 3, and 4 patient care spaces

- **Table 220.110(1)** Demand Factors for Receptacles Supplied by General-Purpose Branch Circuits in **Category 1 and Category 2** Patient Care Spaces
- **Table 220.110(2)** Demand Factors for Receptacles Supplied by General-Purpose Branch Circuits in **Category 3 and Category 4** Patient Care Spaces
- The Correlating Committee and the Standards Council determined that CMP-2 has responsibility for occupancy-based load calculations and demand factors ***(Note: CC gave purview of this requirement to CMP-15 at CC Meeting)***
- The focus was concerning the large number of receptacles required in Category 1 and Category 2 patient care spaces
- New tables were developed, which included demand factor values to apply to receptacles used in a health care facility

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220.120 Receptacle Loads

Marinas, Boatyards, Floating Buildings, and Commercial and Noncommercial Docking Facilities

- Requirements of Section 555.6 have been **relocated** to Part VII 220.120
- This will not change the requirements for load calculations or demand factors
- Article 220 entitled *Branch Circuit, Feeder, and Service Load Calculations*, is the logical place for users of the *Code* to find information concerning these calculations

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Article 225
Outside Branch-Circuits and Feeders

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225.41 Emergency Disconnects

New requirements for an emergency disconnect at a readily accessible outdoor location for one-and two-family dwelling units that are served by feeders

- One-and two-family dwelling unit are not always fed by a service but instead by an outdoor feeder
- This ensures that all new one-and two-family dwelling units are provided with an emergency disconnect located at a **readily accessible outdoor location** on or **within sight of the dwelling unit** *(see definition of Within Sight in Article 100)*
- This disconnect to be marked as **"EMERGENCY DISCONNECT"**
- Plaque, or directory must also be provided adjacent to the emergency disconnect identifying the location(s) of any other energy source disconnect on the premises
- The disconnect must be on or within sight of the dwelling unit

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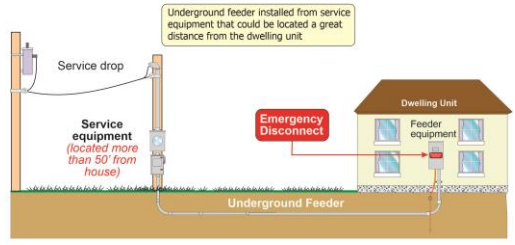
225.41 Emergency Disconnects

Requires an **emergency disconnect** at a readily accessible outdoor location for one-and two-family dwelling units that are **served by feeders**



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Article 230
Services

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230.62 Service Equipment- Enclosed or Guarded

(C) Barriers

Clarifies the requirements for barrier installation in service equipment **when the service disconnect is in the open position**

- Installed in such a way that no uninsulated, ungrounded busbars or terminals are exposed to inadvertent contact while load terminations are being serviced when the service disconnect is in the open position
- Main point of the barrier requirement is to provide insulation to busbars or terminals while load terminations are being serviced
- Barriers have proven to increase safety for electrical professionals working on service equipment

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230.62(C) Barriers

Clarifies the requirements for barrier installation in service equipment

Ensure no uninsulated, ungrounded busbars or terminals are exposed to **inadvertent contact** while load terminations are being serviced when the service disconnect is in the open position

Barrier requirement is to provide insulation to busbars or terminals while load terminations are being serviced

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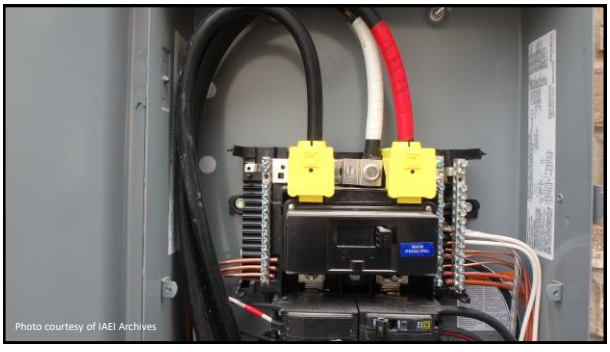

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230.67 Surge Protection

(A) Surge-Protective Device

Existing term "dwelling units" changed to "the following occupancies" and added a list of additional locations that now require protection by a surge-protective device *(SPD)*

- Service equipment can, at times, be subjected to surges that inflict damage on systems designed to provide life safety
- Recognized industry authorities such as NEMA, IEEE, and UL, have collected data showing surges cause significant damage
- Electronic life-saving equipment, such as fire alarm systems, GFCIs, AFCIs, and smoke alarms, could be rendered inoperable when a surge occurs *(Many times, this damage is undetected by the owner)*

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230.67 Surge Protection *(cont.)*

(A) Surge-Protective Device *(cont.)*

Existing term "dwelling units" changed to "the following occupancies" and added a list of additional locations that now require protection by a surge-protective device *(SPD)*

- Additional occupancies added include:
  - dormitory units,
  - guest rooms and guest suites of hotels and motels, and
  - areas of nursing homes and limited-care facilities used exclusively as patient sleeping rooms

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230.67(A) Surge-Protective Devices

Changed the existing term "dwelling units" to "the following occupancies" and added a list of additional locations that now require protection by a surge-protective device (SPD)

Additional occupancies now include:

- dormitory units
- guest rooms and guest suites of hotels and motels
- areas of nursing homes and limited-care facilities used exclusively as patient sleeping rooms

Electronic life-saving equipment such as fire alarm systems, GFCIs, AFCIs, and smoke alarms, could be rendered inoperable when a surge occurs

(Many times, this damage is undetected by the owner)

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Photo courtesy of Siemens

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240.1 Scope

Article 240 now only applies for installations not more than 1000 volts, nominal *(Medium voltage requirements relocated to Article 245)*

- **Parts I through VII:**
  - General requirements for overcurrent protection and overcurrent protective devices not more than 1000 volts, nominal
- **Part VIII:**
  - Overcurrent protection for supervised industrial installations operating at voltages of not more than 1000 volts, nominal
- **Article 245:**
  - Overcurrent Protection for Systems Rated Over 1000 Volts ac, 1500 Volts dc

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240.2 Reconditioned Equipment

The reconditioning requirements previously located at 240.62 and 240.88 were relocated to Section 240.2

- The xxx.2 sections have started becoming the placeholders for reconditioned equipment requirements
- Restrictions on using reconditioned GFPE or GFCI devices were added
- A new and listed device should be installed in its place upon failure of the device
- This complies with Correlating Committee recommendations
- Adds usability for the *NEC* user as this placeholder will be consistently located in each article

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240.2 Reconditioned Equipment

Reconditioning requirements previously located at 240.62 and 240.88 were relocated here

Consistent placeholder in the *Code*

Restrictions on using reconditioned GFPE or GFCI devices were added

New and listed device to be installed in place upon failure of the device

Reconditioning Permitted

Low Voltage Power Circuit Breakers

Electromechanical Relays and Current Transformers

Reconditioning Not Permitted

Courtesy of Pass & Seymour/Legrand — Courtesy of Eaton Corporation

Courtesy of Siemens Electric — Courtesy of Schneider Electric

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240.6 Standard Ampere Ratings

(A) Fuses and Fixed-Trip Circuit Breakers

Table 240.6(A) Standard Ampere Ratings, **10 ampere was added** to the list of standard ratings of overcurrent protection devices

- 10 ampere rated fuses and circuit breakers are available and being used in the field
- Clarifies that such devices are permitted to be used
- Table listing of ampere ratings is more user friendly that the lines of text that appeared in previous editions of the *NEC*
- Offers more flexibility to the electrical industry when choosing overcurrent protection devices for certain circuits

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Table 240.6(A) Standard Ampere Rating

10 ampere was added to the list of standard ratings of overcurrent protection devices

These 10- ampere fuses and circuit breakers are available and being used in the field

Table listing is more user friendly

Table type format showing the ampere ratings for fuses and circuit breakers *(10 ampere has been added)*

10	15	20	25	30
35	40	45	50	70
60	80	90	100	125
110	150	175	200	250
225	300	350	400	500
450	600	700	800	1200
1000	1600	2000	2500	4000
3000	5000	6000		

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240.6 Standard Ampere Ratings

(D) Remotely Accessible Adjustable-Trip Circuit Breakers

Allows for remote access to adjustable-trip circuit breakers through a direct local nonnetworked interface or a networked interface connection

- Due to SMART devices, provisions were needed to reduce likelihood of impact from cybersecurity attached for safety concerns
- When the connection is through a networked interface:
  - the circuit breaker and associated software must be evaluated for cybersecurity
  - **OR** a cybersecurity assessment of the network is required to be completed, and documentation of such assessment must be provided to those authorized to inspect, operate, and maintain the system

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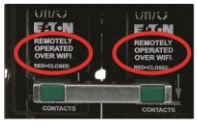
240.6(D) Remotely Accessible Adjustable-Trip Circuit Breakers

Allows for remote access to adjustable-trip circuit breakers through a direct local nonnetworked interface or a networked interface connection

Enhances protection of remotely accessible adjustable-trip circuit breakers **from cyberattacks**

Can **remotely access** circuit breakers via wifi allowing user to access valuable information without making a trip to the electrical room or panelboard loacation



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240.24 Location in or on Premises

(E) Not Located in Bathrooms

Overcurrent protective devices *(other than supplementary overcurrent devices)* are no longer allowed in **ANY** bathroom or in showering facilities or locker rooms having showering facilities

- Addresses the difficulty of accessing a bathroom when such bathroom is occupied
- No practical reason to continue with the permissive requirement of having overcurrent protective devices in bathrooms of any occupancy
- Overcurrent protective devices are also no longer allowed in showering facilities or locker rooms having showering facilities since such areas present similar hazards as a bathroom
- This will likely have the largest effect on facilities or occupancies having limited square footage
- Office buildings are occupancies where electrical panels can be found in bathrooms

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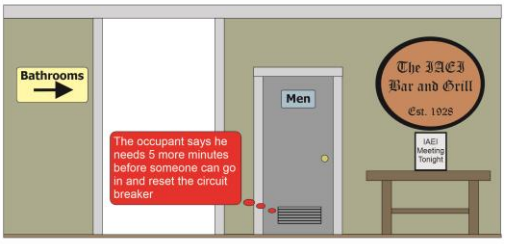
240.24(E) Not Located in Bathrooms

Overcurrent protective devices *(other than supplementary overcurrent devices)* are **no longer allowed in ANY bathroom** or in showering facilities or locker rooms having showering facilities



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Article 242
Overvoltage Protection

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242.2 Reconditioned Equipment

Surge protective devices *(SPDs)* and surge arresters cannot be reconditioned

- SPDs are not dependent on the specific equipment they are connected to
- When they reach the end of their usable life span, a new and listed SPD should be installed in its place
- Will add safety to the electrical system

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242.2 Reconditioned Equipment

Surge protective devices *(SPDs)* and surge arresters **can not be reconditioned**
(Replace when they have reached the end of their life)

Photo courtesy of Schieder Electric

Photo courtesy of Eaton

Photo courtesy of Siemens

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242.9 Indicating

New requirement added requiring all **surge-protective devices *(SPD)*** to be provided with an **indication notification** to the occupant that the SPD is in working order

- ⚠ Occupants of offices and other occupancies spend a lot of time trying to figure out why equipment is not working that is plugged into an SPD
- ⚠ An indication of some type is needed for the end user to determine if the SPD is working properly
- ⚠ Now addressed by the *Code* so that building occupants can identify whether an SPD is functioning properly or if such device needs to be replaced

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242.9 Indicating

Surge protective devices *(SPDs)* to have an indication that the **device is functioning properly**
(Replace when they have reached the end of their life)

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Article 250
Grounding and Bonding

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250.50 Grounding Electrode System, 250.52(A)(3)(1) Concrete- Encased Electrode, 250.52(B)(3) Not Permitted for Use as Grounding Electrodes

The term "reinforcing steel or rods" was replaced with "rebar"

- Revision was done in all three sections of the *Code* for consistency
  - 250.50 Grounding Electrode System
  - 250.52(A)(3)(1) Concrete- Encased Electrode
  - 250.52(B)(3) Not Permitted for Use as Grounding Electrodes
- Makes it easy to understand and adds consistency in the field and the construction industry *(many use the term "rebar")*
- Harmonizes the term to be consistent with the language preferred in 250.68(C)

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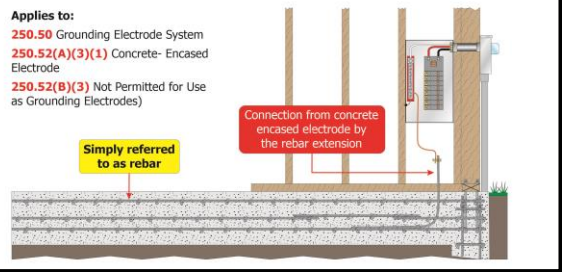
Section 250.50, 250.52(A)(3)(1), and 250.52(B)(3)

The term "reinforcing steel or rods" has been replaced with "rebar"
Easy to understand and adds consistency with the trades in the construction industry

Applies to:

250.50 Grounding Electrode System
250.52(A)(3)(1) Concrete- Encased Electrode
250.52(B)(3) Not Permitted for Use as Grounding Electrodes)



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250.70 Methods of Grounding and Bonding Conductor Connection to Electrodes

The section has been divided into two new first level subdivisions (A) and (B)

- The list of methods for connection to grounding electrodes has been eliminated
  - **(A) General**
  - **(B) Indoor Communications Systems**

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250.70 Methods of Grounding and Bonding Conductor Connection to Electrodes

- It was identified that there are no pipe fittings, pipe plugs or other device that screws into pipe that are suitable or identified for attaching a grounding electrode conductor and the list item has been removed
- The list item for communications system has been moved to the new list item (B) as a permitted method
- A new informational note was added to clarify to users that a connector or fitting that is listed as suitable for direct burial is also listed and suitable for concrete encasement
- See UL 467, *Standard for Safety Grounding and Bonding Equipment*, for additional information

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250.70 Methods of Grounding and Bonding Conductor Connection to Electrodes

The section has been divided into new subparts (A) and (B) and the **list of methods for connection to grounding electrodes has been eliminated**

New informational note was added to clarify that a connector or fitting that is listed as suitable for direct burial is also listed and suitable for concrete encasement

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250.140 Frames of Ranges and Clothes Dryers

Section 250.140 was revised to include two first level subdivision

- 250.140(A) is existing text that was relocated from the parent text
- 250.140(B) was the existing exception that was written into positive text
- 250.140(B)(5) adds a new list item to address the hazard of having neutral current on the metal normally non-current carrying parts *(objectional current)*
- Adds copper-clad aluminum as a permitted conductor type

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250.140(B)(5) Frames of Ranges and Clothes Dryers

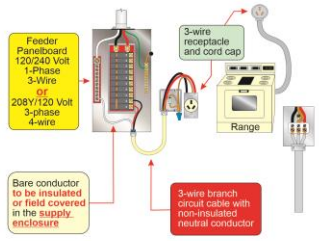
Grounded connector is to be **insulated or field covered** within the **supply enclosure** with a listed insulating material to prevent contact of an uninsulated conductor with any normally non-current carrying metal part of the equipment

Provides a safe alternative from having to replace existing 3-wire service entrance cables

Keeps current from getting on metal parts of equipment

In this scenario the bare conductor in the panelboard is wrapped with insulating tape

Reference 200.6(A) for marking options such as the use of white tape



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250.148 Continuity of EGCs and Attachment in Boxes

Modified subdivision (A) to specify that all equipment grounding conductors that are spliced or terminated within a box are required to be connected together regardless if they are for different circuits

- Clarification was needed regarding wire-type equipment grounding conductors *(EGCs)* within boxes
- There was spirited debate between installers and inspectors as to if all the EGCs within an electrical box were required to be connected together
- Also, list item (C) was revised providing the sizing requirements for the bonding connection to the metal box by the EGC or the equipment bonding jumper
- Size is based on Table 250.122 for the largest overcurrent device for any of the circuits entering the box

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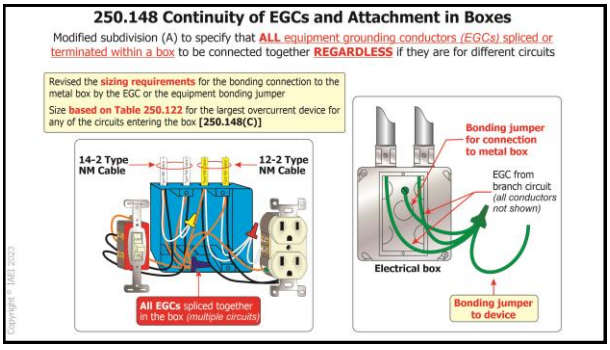
250.148 Continuity of EGCs and Attachment in Boxes
Modified subdivision (A) to specify that ALL equipment grounding conductors (EGCs) spliced or terminated within a box to be connected together REGARDLESS if they are for different circuits
Revised the sizing requirements for the bonding connection to the metal box by the EGC or the equipment bonding jumper
Size based on Table 250.122 for the largest overcurrent device for any of the circuits entering the box [250.148(C)]
14-2 Type NM Cable
12-2 Type NM Cable
All EGCs spliced together in the box (multiple circuits)
Bonding jumper for connection to metal box
EGC from branch circuit (all conductors not shown)
Electrical box
Bonding jumper to device
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IAEI
Chapter 3
Wiring Methods and Material
• Article 300 • Article 320 • Article 352
• Article 305 • Article 322 • Article 353
• Article 310 • Article 330 • Article 358
• Article 312 • Article 337 • Article 369
• Article 314 • Article 342 • Article 371
• Article 315 • Article 344 • Article 398
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Article 300
General Requirements for Wiring Methods and Materials
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300.2 Limitations

(A) Voltage

Section was modified to add 1500 volts dc requirements in 2 locations

- ⚠ This allows for wiring methods located within Chapter 3 to be used for 1000 volts ac, 1500 volts dc, nominal, or less installations if not limited in other locations of the *NEC*
- ⚠ Medium voltage *(MV)* requirements have been relocated to new Article 305 to enhance usability

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300.2 Voltage

This allows for wiring methods found within in Chapter 3 to be used for **1000 volts ac, 1500 volts dc, nominal,** or less installations *(if not limited in other locations of the NEC)*

Medium voltage *(MV)* requirements are being **reorganized**

MV is being installed by more and more electrical contractors

Installation of a motor control for over 1000 volts at the Denver Wastewater Facility

Photo courtesy of Rob Bowerman

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300.4 Protection Against Physical Damage

(E) Cables, Raceways, or Boxes Installed in or Under Metal-Corrugated Roof Decking

A new **Exception No. 2** has been added which **recognizes poured concrete** on top of the metal roof decking as a means of physical protection for cables, raceways, or boxes installed in or under metal-corrugated roof decking

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300.4 Protection Against Physical Damage *(cont.)*

(E) Cables, Raceways, or Boxes Installed in or Under Metal-Corrugated Roof Decking *(cont.)*

- Concrete limits screws from penetrating into the raceway system causing damage to the raceway and wiring
- When the metal-corrugated sheet roof decking is covered with a **minimum thickness 50 mm *(2 in.)* concrete slab**, the 38 mm *(1 ½ in.)* spacing is not necessary
- The concrete slab is measured from the top portion of the corrugated roofing
- This also recognizes the addition of **"listed steel or malleable iron fittings and boxes"** for Exception No. 1 which are used with rigid metal conduit *(RMC)* and intermediate metal conduit *(IMC)*

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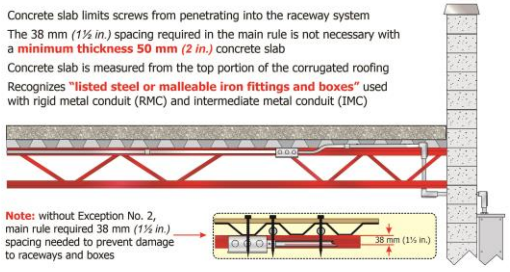
300.4(E) Cables, Raceways, or Boxes Installed in or Under Metal-Corrugated Roof Decking- Ex. No. 1 and 2

Concrete slab limits screws from penetrating into the raceway system

The 38 mm *(1½ in.)* spacing required in the main rule is not necessary with a **minimum thickness 50 mm *(2 in.)*** concrete slab

Concrete slab is measured from the top portion of the corrugated roofing

Recognizes **"listed steel or malleable iron fittings and boxes"** used with rigid metal conduit (RMC) and intermediate metal conduit (IMC)



Note: without Exception No. 2, main rule required 38 mm *(1½ in.)* spacing needed to prevent damage to raceways and boxes

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300.4 Protection Against Physical Damage

(G) Fittings

New language has been added requiring that protective fittings be installed to fittings "prior to the installation of conductors"

- The protective fitting needs to be in place before the installation of the conductors in order to provide protections to these conductors
- Installing this fitting after the conductors have been installed allows possible damage to occur to conductors being pulled into the raceway
- Determining if this fitting was installed before the installation of conductors may be hard for an AHJ to determine during an inspection *(sometimes there is no visible conductor damage)*
- There are fittings available on the market that are designed to be installed after the conductors have been installed

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300.4(G) Fittings

Protective fittings to be installed to raceways **"prior to the installation of conductors"**

Where raceways will **contain 4 AWG or larger** insulated circuit conductors, **prior to the installation of conductors**, the conductors are to be protected in one of the following ways:

- a fitting that has been identified and provides a smooth rounded insulating surface
- a metal fitting that's listed and has smoothly rounded edges
- use of an identified insulating material that is securely fastened in place to seperate the fitting or raceway
- threaded hubs or bosses that are an integral part of a raceway providing a smoothly rounded entry for conductors

These fittings can no longer be installed after the conductors have been installed

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300.5 Underground Installations

(A) Minimum Cover Requirements

Table 300.5(A) Minimum Cover Requirements

Electrical Metallic Tubing *(EMT)* has been added to Column 3 of the table to clearly indicate that it can be installed in an underground location

- EMT is permitted to be used in underground locations
- Supplementary corrosion protection is generally required for EMT in direct contact with earth, but not required in all cases *(Example: Stainless tubing)*
- *UL 797, Standard for Safety Electrical Metallic Tubing- Steel*, also indicates that EMT is permitted in underground installations
- A new note #6 was added to the bottom of the table to direct the *Code* user to 358.10 for additional information requirements for directly buried EMT

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Table 300.5(A) Column 3 *(EMT)*

Electrical metallic tubing *(EMT)* has been added to Table 300.5(A), Column 3 to indicate it can be installed in underground locations

Not a new change for the use of EMT

It has always been allowed with the use of supplementary corrosion protection

Some EMT such as stainless does not require the use of supplementary corrosion protection

Photo courtesy of IAEI Archives

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300.5 Underground Installations

(D) Protection from Damage

The words "direct buried" were removed from the heading leaving behind "conductors and cables"

- ⚠ The text reading as "direct buried conductors and cables," did not apply to buried raceways containing conductors
- ⚠ Only conductors that were directly buried were included in the 2020 *NEC* edition
- ⚠ This revision will provide both the installers and inspectors clarity as to requirements for underground conductor and cable installations

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300.5 (D) Protection From Damage

The words "direct buried" were removed from the heading leaving behind "conductors and cables"

Buried raceways containing electrical conductors require the same protection as buried cables

Utilize **Table 300.5** for the correct burial depths in order to pass an electrical inspection

Photo courtesy of Scott Humphrey

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300.6 Protection Against Corrosion and Deterioration

(A) Ferrous Metal Equipment

The informational note referencing field-cut threads has been removed and added into positive language

- Adding "anywhere other than at the factory where the product is listed" adds clarity
- Threads cut in the field are to be coated with an electrically conductive, corrosion-resistant compound that has been approved for that purpose
- If the threads are cut at the factory, the field installation of this protective coating does not apply
- Informational notes are not enforceable *(these are informative to the user of the Code)*
- Moving the requirements into the section language allows for enforcement

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300.6(A) Ferrous Metal Equipment

Electrical pipe **threads cut in the field** are to be coated with an electrically conductive, corrosion-resistant compound that has been approved for that purpose

If threads are **cut at the factory**, the field installation of a protective coating does not apply

Photos courtesy of Milwaukee Tools

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300.11 Securing and Supporting

(C) Raceways Used as Means of Support

Class 3 circuit conductors are permitted to be supported by the raceway containing power supply conductors that supplies the equipment

- Class 2 and Class 3 cables are now able to be supported by raceway
- Support to be provided by the raceway containing power supply conductors that supplies the equipment
- These cables are typically the same in size and weight so there should not be an issue
- This also aligns with 725.143, which recognizes Class 2 and Class 3 circuit conductors and points back to 310.11(C) for their installation

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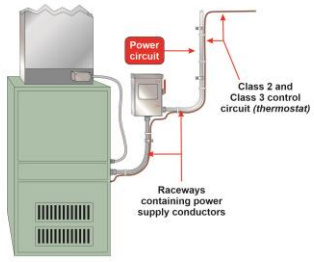
300.11(C) Raceways Used as Means of Support

Only raceways containing power supply conductors for electrically controlled equipment are allowed to support Class 2 and Class 3 circuit conductors or cables

Class 2 and 3 wiring must be used to control equipment powered by conductors running within the supporting raceway



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348

300.14 Length of Free Conductors at Outlets, Junctions, and Switch Points

Language has been added permitting free conductors to be spliced at outlet, junction, and switch point locations

- This clarifies that the conductor is permitted to be spliced with a shorter conductor to add length to it and meet the 6 inches required by this section
- Previously left up to interpretation as to if the free conductor had to be continuous or was permitted to be spliced and extended at the box
- When the drywall installer router damages the conductors within the box, some inspectors would not allow for the conductor to be spliced *(In some cases, the installer would be required to replace the NM cable to the box)*
- This caused misunderstanding and confusion between the installer and the inspector
- Additional issues could also arise where wall surfacing has been installed leaving the length of the free conductor less than the 6-inch requirement

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300.14 Length of Free Conductors at Outlets, Junctions, and Switch Points

Clarifies that the conductor **is permitted to be spliced** with a shorter conductor to add length to it and meet the 6 inches required by this section

Photo below shows a router being used to expose the device box that was covered with drywall

Photo on right shows a device box with numerous conductors that could be damaged by a careless router

Careless router operator could cause alot of damage to these conductors

Photo courtesy of IAEI Archives

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300.25 Exit Enclosures *(Stair Towers)*

An exception was added addressing egress lighting on outside exterior doorways

- Eliminated the term "be separated from the building" and added the words "have a fire resistance rating"
- "Fire resistance rating" is a defined term in the building code and, therefore, will clarify this requirement
- Outside exterior doorways are part of the means of egress and frequently require egress lighting to extend to the public way
- Without the addition of the exception, it was a *Code* violation to provide power to the required exterior egress lighting from the lighting circuit inside the exit enclosure

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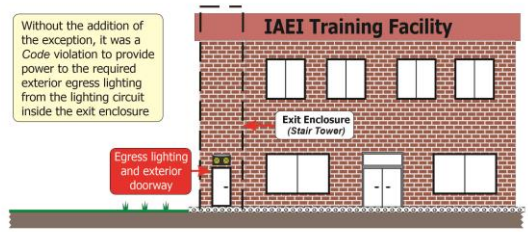
300.25 Exit Enclosures *(Stair Towers)*

Exception added addressing egress lighting on outside exterior doorways for stair towers



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Article 344
Rigid Metal Conduit *(RMC)*

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344.28 Reaming and Threading *(Rigid Metal Conduit)*

Clarifies that manufacturer's requirements for reaming and threading of PVC-coated rigid metal conduit *(RMC)* should be followed

- This change was brought about by NEMA due to the installer accidentally damaging PVC rigid metal conduit when they were reaming and adding threads to the conduit
- The use of proper threading and clamping tools specifically designed for PVC-coated conduit should be used so that the exterior PVC coating is not damaged
- Standard threading and clamping tools that are used with non-PVC coated RMC will damage the outside PVC coating and should not be used
- A new informational note was added to assist installers with this procedure
- Reference NECA 101-2013, *Standard for Installing Steel Conduits (Rigid, IMC, EMT)*

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344.28 Reaming and Threading *(Rigid Metal Conduit)*

Clarifies that **manufacturer's requirements** for reaming and threading of PVC-coated rigid metal conduit *(RMC)* **should be followed**

Proper threading and clamping tools specifically designed for PVC-coated conduit should be used so that the exterior PVC coating is not damaged when being field cut, reamed, or threaded

See NECA 101-2013, Standard for Installing Steel Conduits *(Rigid, IMC, EMT)*

Photos courtesy of Plastibond

PVC Rigid Metal Conduit vise for cutting, reaming, and threading

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Article 352
Rigid Polyvinyl Chloride Conduit *(PVC)*

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352.44 Expansion Fittings

- Requirements were added for an expansion fitting to be installed for underground runs of direct buried PVC conduit that emerge from the ground
- Separated into two first level subdivisions
  - **(A) Thermal Expansion and Contraction** – Existing language of 352.44 including Table 352.44(A) addresses the **thermal expansion and contraction** of a PVC conduit system
  - **(B) Earth Movement** – New content added to address **earth movement events**

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352.44(B) Earth Movement *(Expansion Fittings)*

(B) Earth Movement

Requirements were added for an expansion fitting to be installed for underground runs of direct buried PVC conduit that emerge from the ground

- PVC raceways and associated fitting are sometimes pulled away from the bottom of electrical enclosures due to earth movement
- In some cases, the raceway and fitting are pushed into the electrical enclosure or equipment
- This typically results from the settling of the soil because it was not compacted properly when the raceway was covered or from frost heave events during cold weather

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352.44(B) Earth Movement *(Expansion Fittings)*

Requirements were added for an expansion fitting to be installed for underground runs of direct buried PVC conduit that emerge from the ground

PVC expansion fittings installed in Wisconsin due to earth movement during cold weather

Photos courtesy of IAEI Archives

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404

Chapter 4
Equipment for General Use
• Article 404
• Article 406
• Article 408
• Article 409
• Article 410
• Article 422
• Article 424
• Article 425
• Article 426
• Article 427
• Article 430
• Article 440
• Article 450
• Article 470
• Article 495
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432

Article 404
Switches
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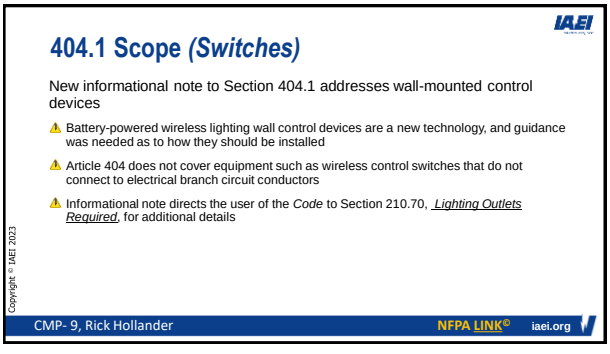
433


404.1 Scope (Switches)
New informational note to Section 404.1 addresses wall-mounted control devices
Battery-powered wireless lighting wall control devices are a new technology, and guidance was needed as to how they should be installed
Article 404 does not cover equipment such as wireless control switches that do not connect to electrical branch circuit conductors
Informational note directs the user of the Code to Section 210.70, Lighting Outlets Required, for additional details
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CMP- 9, Rick Hollander
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404.1 Scope *(Switches)*

New informational note to Section 404.1 addressing wall-mounted control devices

This is a relatively new technology and guidance was needed

This article **does not cover** equipment such as **wireless control switches** that do not connect to electrical branch circuit conductors

Informational note directs the user of the *Code* to **Section 210.70, Lighting Outlets Required,** for additional details

Example of a battery-powered wireless device

Photos courtesy of Apex Lighting

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404.14(D) Snap Switch Terminations

New language regarding 14 AWG solid coppers conductors used with snap switches resulted in section entitled **Snap Switch Terminations**

- Highlights this limitation for switches provided with push-in terminals
- New text provides for a future allowance for other conductors *(such as 14 AWG copper-clad aluminum)* to be installed using push-in type terminals where the additional evaluation to the applicable UL standards has been completed, and the listing and device markings permit the application
- 14 AWG copper-clad aluminum needs this limitation to ensure push-in terminals on wiring devices are installed according to their listing
- UL standard and associated guide information under category code *WJQR for Snap Switches with Push-In Terminals* permits only 14 AWG solid copper conductors to be used at this time
- This change does not mandate that the push-in terminals must be used *(optional)*

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404.14(D) Snap Switch Terminations

New requirements for 14 AWG solid coppers conductors used with snap switches

UL standard and associated guide information under category code **WJQR for Snap Switches with Push-In Terminals** permits only **14 AWG solid copper conductors** to be used at this time

Highlights this limitation for switches provided with push-in terminals

Does not mandate that the push-in terminals must be used ***(optional)***

Photos courtesy of Legrand

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404.16 Reconditioned Equipment

New section was added to address reconditioned electrical equipment

- Addresses control devices that can and can not be reconditioned after being damaged
- This damage might occur to this equipment after being subjected to water, fire, or products of combustion
- Safety, reliability or function of this equipment may be compromised if reconditioning of the items is attempted
- An inspector will have to be keen and alert to determine if the electrical equipment was damaged and if the affected items can be reconditioned

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404.16 Reconditioned Equipment

Switches covered in Article 404 **cannot be reconditioned** and must be replaced

Photos courtesy of Pass and Seymour/Legrand

Photo courtesy of IAEI Achieve

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404.30 Switch Enclosures with Doors

Clarifies the requirement for doors with switch mechanisms

- Switches of this type may allow access to live parts with the door open
- Access could allow unqualified persons to come in contact with energized equipment
- Injuries to children and other individuals who open these enclosures hve resulted
- Access to the interior of a switch in the closed position now **will require the use of a tool**
- An **approved design providing equivalent protection** is also allowed
- Approval is issued by the authority having jurisdiction *(AHJ)* per Article 100
- ***Note: An example of a product that might be approved:*** An Eaton brand switch that requires the simultaneous movement of two hands placed in different positions and acting against resistance in order to open *(Fred Hartwell comment)*

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440

404.30 Switch Enclosures with Doors

Access to the interior of a switch **in the closed position** now will require the **use of a tool**

Switches of this type **may allow access** to live parts with the door open

Access could allow **unqualified persons to come in contact** with energized equipment

Injuries to children and other individuals who open these enclosures has resulted

Use of tool required to open

Photo courtesy of Siemens

Photo courtesy of Eaton

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Article 406

Receptacles, Cord Connectors, and Attachment Plugs *(Caps)*

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406.2 Reconditioned Equipment

Relocated limitations for **reconditioned equipment** from 406.3(A) and 406.7 into new Section 406.2

- Add clarity for the user as to what can and cannot be reconditioned
- Provides one location concerning reconditioning requirements for receptacles, attachment plugs, cord connectors, and flanged surface devices
- Follows the code-wide xxx.2 "placeholder" location within the various articles
- Improves the useability of the *Code* for the electrical professional

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406.2 Reconditioned Equipment

Relocated reconditioned equipment requirements from 406.3(A) and 406.7

(Note: Follows the code wide xxx.2 "placeholder" location within the various articles)

Photo courtesy of Leisure RV

Photos courtesy of Hubbell

Photo courtesy of Leviton

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444

406.3(D) Receptacle Terminations

Is intended to emphasize the limitations for receptacles installed on 15-ampere branch circuits

- Task Group was formed with the direction of the NFPA Standards Council to review new requirements covering the use of copper-clad aluminum conductors
- Only **14 AWG copper conductors** used with **"push-in" type terminals** for receptacles are permitted
- Push-in type terminals are **not intended for use with** aluminum or copper-clad aluminum wire, 14 AWG-stranded copper wire, or 12 AWG solid or stranded copper wire
- This requirement is necessary to make sure receptacles are being installed according to their listing

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406.3(D) Receptacle Terminations

Only 14 AWG copper conductors used with "push-in" type terminals for receptacles are permitted

Push-in type terminals are not intended for use with aluminum or copper-clad aluminum wire, 14 AWG-stranded copper wire, or 12 AWG solid or stranded copper wire

This requirement is necessary to make sure receptacles are being installed according to their listing

Photos courtesy of Leviton

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406.4(D)(3) Ground-Fault Circuit-Interrupter Protection

Ground-fault circuit-interrupter *(GFCI)* receptacles are now required to be listed

- There was no such requirement in the *NEC* for GFCI devices to be listed
- Assures GFCI devices are listed and manufactured according to the minimum standards set forth in *UL 943, Ground-Fault Circuit-Interrupters*
- Removed the term "outlet," which improves and clarifies the intent of the current *Code* language

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406.4(D)(3) Ground-Fault Circuit Interrupter Protection

New requirement the ground-fault circuit-interrupter *(GFCI)* receptacles to be listed

Assures GFCI devices are listed and manufactured according to the minimum standards set forth in **UL 943, Ground-Fault Circuit-Interrupters**

Remember..... test monthly

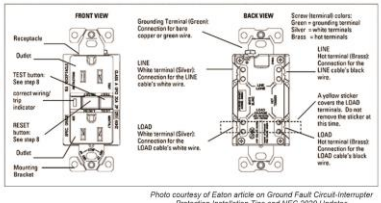

Photo courtesy of Eaton article on Ground Fault Circuit-Interrupter Protection Installation Tips and NEC 2020 Updates

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406.4(D)(8) Ground-Fault Protection of Equipment

Requires ground-fault protection of equipment *(GFPE)* to be provided for replacement receptacles that require GFPE protection by requirements found elsewhere in the *NEC*

- Needed to provide the ground-fault protection of equipment *(GFPE)* protection when modifications are made in areas such as marinas
- Will protect the people who use this electrical equipment and provide a safer electrical system
- Similar to existing requirements for receptacles being replaced such as tamper-resistant type receptacles, ground-fault circuit-interrupter (GFCI) protected receptacles, AFCI protection, and other similar safety improvements

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406.4(D)(8) Ground-Fault Protection of Equipment

Requires **ground-fault protection of equipment** *(GFPE)* to be provided **for replacement receptacles** that require GFPE protection by requirements found elsewhere in the *NEC*

(Photo shows **GFPE** and ground-fault circuit-interrupter *(GFCI)* protection at marina)

Photo courtesy of IAEI Achives

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451

406.6(D) Receptacle Faceplate with Integral Night Light /USB Charger

Limits the faceplates load to **one watt or less** and specifically requires the screws on the receptacles to be made only of brass or copper alloy

- No substantiation has been received reporting instances where these faceplates have caused any issues
- Spring-tensioned contacts have an excellent safety record based upon over 4 million of these installed in the field
- The screws are to be constructed of brass or copper alloy
- Concerns with steel screws and the uncertainty of their reliability over the long term
- An exception was added to have an effective date of January 1, 2026, allowing spring tension contacts if the receptacle faceplate is specifically listed and identified for connecting to steel screws on receptacles

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406.6(D) Receptacle Faceplates with Integral Night Light/USB Charger

Limits the faceplate's load to **one watt or less** and specifically requires the **screws on the receptacles** to be made only of **brass or copper alloy**

Photos courtesy of SnapPower

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406.9(C) Bathtub and Shower Space

This clarifies receptacle restrictions in and around bathtubs and showers

- The area below the bathtub rim was not included in the previous *Code* language
- Exception No. 4 was added to allow single receptacles within 36 inches of the tub or shower with limitations ***(for dwelling units)***
- Allows toilets with electronic seats or personal hygiene devices for people with physical limitations, which require 120-volt receptacles installed within the 36-inch zone
- Receptacle is required to be a single receptacle and not be located in the space between the bathtub or shower and the toilet or bidet
- The single receptacle in this location would need to be ground-fault circuit-interrupter *(GFCI)* protected

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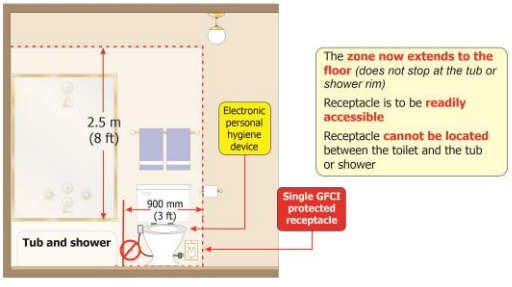
406.9(C) Bathtub and Shower Space

A **single, GFCI protected, receptacle** is allowed for electric presonal hygiene devices



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406.9(C) Bathtub and Shower Space

The single receptacle in this location would need to be ground-fault circuit-interrupter *(GFCI)* protected

Photo courtesy of Washlet Plus- Toto

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406.12 Tamper-Resistant Receptacles

Allows for an easier understanding of where tamper-resistant receptacles are required

- Additional areas and occupancies were added where tamper-resistant receptacles will now be required to help protect children
- Required for public transportation facilities such as bus stations, airports, and other areas such as gymnasiums, skating rinks, and fitness centers
- Required for agricultural buildings **accessible to the general public**, such as pumpkin patches, petting farms, Christmas tree farms, and similar venues
- Text for **clinics, medical, dental offices, and outpatient facilities** was revised to clarify the areas where these receptacles are to be installed

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406.12 Tamper-Resistant Receptacles

Additional areas and occupancies were added where tamper-resistant receptacles will now be required to help **protect children**

Required for public transportation facilities
- bus stations
- airports

Required for agricultural buildings *(accessible to the general public)*
- pumpkin patches
- petting farms
- Christmas tree farms
- similar venues

Other areas
- gymnasiums
- skating rinks
- fitness centers

Tamper-resistant (TR) receptacle courtesy of Legrand Pass and Seymour

Clinics, medical, dental offices, and outpatient facilities was revised to clarify the areas where these receptacles are to be installed

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Article 410 Part XVII- Germicidal Irradiation

Part XVII of Article 410 has been added to address the increasing use of germicidal luminaires for disinfecting purposes

- Germicidal irradiation has been used to disinfect air, water, and surfaces for many years
- There has been an increased interest in the application and installation of these luminaires due to the COVID-19 pandemic
- Possible eye and skin damage can occur to personnel if not installed as intended
- Germicidal irradiation luminaires are required to be listed
- Are typically not permitted for general lighting or to be installed permitted within dwelling units unless specifically listed
- Luminaires have minimum mounting heights, among other limitations

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Article 410 Part XVII- Germicidal Irradiation

New Part to article addressing the increasing use of germicidal luminaires for disinfecting purposes

Germicidal irradiation uses ultraviolet light to **kill microorganisms**

Used in environments such as:

- food production
- air purification
- water purification

Also an alternative to pesticide use

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410.184 GFCI Protection and SPGFCI Protection

Revised to clarify when GFCI protection is required for horticultural lighting, with an exception added concerning Special Purpose Ground-Fault Circuit Interrupter *(SPGFCI)* requirements

- The revisions will clarify that GFCI or SPGFCI protection is required for lighting equipment employing flexible cords that are hard-wired
- Although not specifically specified in this section, cord-connected installations would also have to be in accordance with 410.62(C)(1)(b) or (c)
- A new exception was added to require SPGFCI protection on circuits exceeding 150 volts to ground
- An Informational Note was also added directing users of the *Code* to UL 943C, *Outline of Investigation for Special Purpose Ground-Fault Circuit-Interrupters*, for further information on SPGFCI devices

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Article 422
Appliances

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422.16(B)(2) Built-in Dishwashers and Trash Compactors

Provisions were added for supply cords to trash compactors and dishwashers that pass through a wood cabinet to be provided with protection that incorporates "smoothed edges"

- In many installations, cords passed through holes in wood cabinet separations
- While grommets and bushings are practical solutions in metal cabinet separations, those fittings were not practical with wood cabinets
- Eliminates the need for a judgment call in the field between the AHJ and the installer when a solution exists *(install protection with "smoothed edges")*

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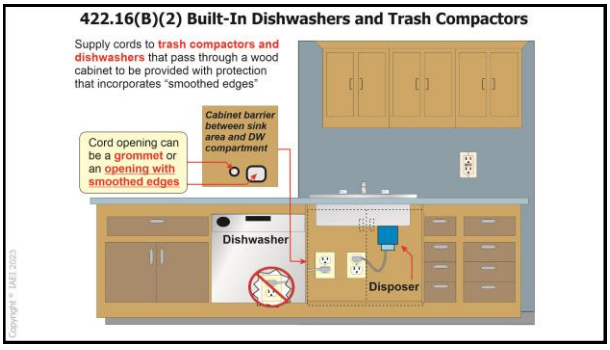
422.16(B)(2) Built-In Dishwashers and Trash Compactors
Supply cords to trash compactors and dishwashers that pass through a wood cabinet to be provided with protection that incorporates "smoothed edges"
Cabinet barrier between sink area and DW compartment
Cord opening can be a grommet or an opening with smoothed edges
Dishwasher
Disposer
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Article 424
Fixed Electric Space-Heating Equipment
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Article 440
Air-Conditioning and Refrigerating Equipment
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440.8 Single Machine and Location

New language has been added indicating that **air-conditioning and refrigeration equipment such as** mini-split unit heating and cooling systems are not to be installed in a tub or shower zone

- This equipment is being installed in bathtub and shower spaces due to a lack of wall space
- Occurring in older homes with smaller bathrooms
- Creates a clear danger to the occupants
- Now **prohibits the installation** of these units in the zone around bathtub and shower spaces
- The dimensions of the zone are consistent with *Code* requirements for other electrical equipment or devices *(3 feet horizontally and 8 feet vertically from the top of a bathtub rim or shower stall threshold)*

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440.8 Single Machine and Location

Mini-split heating and cooling systems are **not to be installed** in a tub or shower zone

Photo courtesy of Casey Littlefield

If you don't have room for this item to be installed, the *NEC* does not allow it and the inspector will not accept it

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440.11 General

Added additional language requiring disconnects with covers exposing live parts to **require a tool to open or be capable of being locked** *(if readily accessible to unqualified persons)*

- Requires air-conditioning and refrigerating equipment disconnects that have hinged covers, and, when open, have exposed live parts, be locked to prevent children and unqualified people from accidental contact
- CMP generally agreed that knife blade type disconnects pose the biggest hazard even if properly maintained
- CMP also made it clear that a lock would be anything that required a tool to open
- "Zip-ties" would require the use of a tool to remove the cover
- This practice *(zip-ties) is* already used by many electrical and mechanical contractors
- Talk to the local AHJ and make sure he/she is on board with the use of zip ties for this purpose

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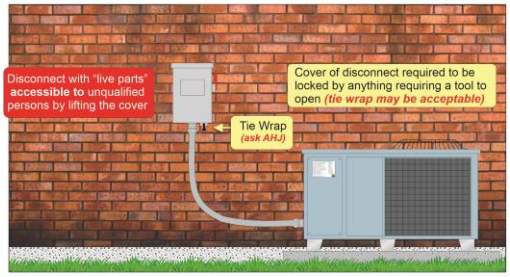
440.11 General *(Air-Conditioning and Refrigerating Equipment)*



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440.14 Location

Adds a reference to 110.26(A), which makes it clear that working space clearances are required for air-conditioning and refrigerating equipment

- HVAC contractors install their equipment per the manufacturer's specifications
- Some are not aware of the minimum required clearances in 110.26 for disconnects that require servicing
- Adds clarity for the inspector and installer that minimum clearances must be maintained at air-conditioning and refrigerating disconnects

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440.14 Location *(Air-Conditioning and Refrigerating Equipment)*

Must observe working space clearances located at 110.26

Photo details:
Bushes are in the working space
Disconnect located in panel

Photo courtesy of IAEI Archives

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440.14 Location ***(Air-Conditioning and Refrigerating Equipment)***

Must observe working space clearances located at 110.26

Photo details:
AC unit violates the working space
Disconnect located in panel

Photo courtesy of IAEI Archives

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The IAEI would like to thank the membership for their dedication and commitment to electrical safety

- Since 1928, IAEI members have promoted and advanced electrical safety
- We are known throughout the electrical trade as "The Electrical Safety Leaders" for a reason
- Thousands of past IAEI members are depending on you to carry on their legacy and move forward the daunting task of ensuring electrical safety
- The IAEI is the **electrical line of defense** keeping families electrically safe
- You, **the electrical professional**, make a difference in the electrical safety of the world
- If you are not a member of the IAEI, please consider joining us in our endeavor of **"Keeping You and Your Families Electrically Safe"**

From the IAEI Board of Directors iaei.org

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File Attachments for Item:

EC-14 2023 NEC Code Changes Chapters 1-4 (Matthews Electrical Services)

All certifications (4 hours)

BIOGRAPHY
Henry P. Matthews PE, CPE, CESCP, PVA

Henry has over 31 years of experience in the electrical design, construction, engineering and safety fields. He has a passion for teaching and mentoring.

Henry obtained his Bachelor of Science degree in Electrical Engineering from Penn State University in 1989.

He also earned a Master of Business Administration from Bowling Green State University in 2003.

In addition, Henry earned several certificates including:

- Plumbing and Electrician from Penn Foster Career School
- Welding from Owens Community College in Findlay, Ohio
- Residential Solar PV Systems from Solar Engineering International

Henry currently holds the following licenses, and memberships:

- Licensed Electrical Contractor in Ohio
- Licensed Training Agency in Ohio
- Licensed Professional Engineer in Ohio, Michigan, Kentucky, Indiana, Illinois, Wisconsin
- Certified Plant Engineer (CPE)
- Certified Building Operator (CBO)
- Certified Electrical Compliance Safety Professional (CESCP) by NFPA
- Solar PV Associate by the North American Board of Certified Energy Practitioners
- Electric Vehicle Infrastructure Training Program (EVITP) certification
- Senior Member of the Institute of Electrical and Electronic Engineers (IEEE)
- Member of the International Association of Electrical Inspectors (IAEI)
- Member of the National Fire Protection Association (NFPA)

Henry is currently employed as an Advanced Senior Engineer for Marathon Petroleum Company in Findlay, Ohio. During his 16 years at Marathon, Henry has worked as an Electrical Design Engineer, Project Engineer, Engineering Supervisor and currently as a Reliability Engineer.

Henry is also the owner of Matthews Electrical Services, a small, but full-service electrical contractor company.

Prior to this, he worked 13 years as an Electrical Engineer and a Plant Engineering Manager in at Cooper Standard Automotive, a major automotive parts supplier in Bowling Green, Ohio

Henry is the past co-chair of American Petroleum Institute Recommended Practice 545 Lightning Protection for Above Ground Storage Tanks.

He was also past president of the Fostoria Toastmaster club.

2023 NEC Significant Code Changes Chapters 1 -4

Outline

NEC Chapters and sections covered

- Scope: Article 90
- Chapters 1-4

Other Resources:

- 2021 NFPA 70E
- 2023 NFPA 70B
- NFPA 79

Referenced Websites:

- www.NFPA.org
  www.IAEI.org (International Association of Electrical Inspectors)
- www.mikeholt.com
- www.esfi.org Electrical Safety Foundation International)
- Various motor and transformer manufacturer websites.

Course Content:

- NEC Chapter 1 General
- NEC Chapter 2 Wiring and Protection
- NEC Chapter 3 Wiring Methods and Materials
- NEC Chapter 4 Equipment for General Use

2023 NEC Significant Code Changes Chapters 1 - 4

Syllabus

1. Welcome
2. Attendance and eligibility verification
3. Training session rules
4. Agenda review
5. Resources Used
6. Review of key points from NEC Overview
7. Chapters 1 – 4 Code Changes
    a. New Articles
    b. Deleted articles and sections
    c. Discussion on key changes
8. Question and Answers
9. Wrap-up: post-class expectations (credits, certificates etc.)
10. Dismissal

APPLICATION FOR CONTINUING EDUCATION APPROVAL
COURSE CONDITIONS AND GUIDELINES

The Ohio Board of Building Standards is committed to the ongoing education and professional development of board-certified personnel through the delivery of high-quality, accurate and engaging professional continuing education content. To this end, the Board reviews and approves Continuing Education Courses for building department personnel.

Board approval is granted for course instruction on current codes and standards, including the OBC, OMC, OPC, and RCO, and any other content areas directly related to the responsibilities of the certification for which credit is being requested.

Promotion: Any person or organization promoting an approved course is required to make full and accurate disclosure regarding course title, course approval number, number of credit hours, categories for which the BBS has approved the class, and fees in promotion materials and advertising. ***The Board does not grant retroactive approval. It is recommended that courses be submitted for approval well in advance of any scheduling of classes and advertising***. Advertising may not falsely state BBS approval before approval is granted. Course providers may state that BBS approval is pending.

Application Submission: All Applications and associated materials shall be submitted by email in .pdf format. Instructions for completing the application are attached.

Certificate of Completion: Course providers shall provide participants a certificate of completion containing the following information:

- Name of participant
- Title of approved courses
- BBS approval #
- BBS approved certifications
- Date of the continuing education program
- Number of approved credit hours awarded, and
- Signature of authorized sponsor or instructor.

Any person or organization administering an approved course shall return a completed BBS Course Attendance form by email.

Participants: Participants must attend the complete course as presented by the instructor to receive credit hours approved by the Board. The organization or instructor of online courses shall plan and execute methods to verify the individual's attendance and completion of the course. No partial credit will be given to any participant who failed to complete the entire course as approved.

Board approval: All courses are approved for the calendar year in which application is made. Courses may be renewed so long as the referenced code is in effect, and the CEUs, certification and content remain unchanged. When the referenced code is updated, courses must be updated, and new approvals obtained.

Facility/training area: BBS Course may be delivered in person or online, or both, at the sponsor's option.
Course facilities shall include the following:

In Person Classes:
Sufficient seating capacity
ADA accessible facilities
Appropriate Audio/Visual devices for delivery
Writing surfaces for participants

Online Classes:
Web-accessible
ADA accessible delivery
Tech support available
Live and recorded courses permitted

In-person facilities shall comfortably and safely seat at least the number of attendees present in the room and shall be climate controlled, non-smoking, and sound controlled so that outside noise will not interfere with the training.

Ohio | Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Henry P. Matthews

Organization: Matthews Electrical Services

Address: 1203 McKinley Place; Fostoria, Ohio 4830

E-mail: hpmatthews@matthewselectrical.net Telephone: 419-575-3488

Website: www.matthewselectrical.net

Conference Sponsor (if applicable)_____ Conference Email:_____

Check here if Course Renewal:_____Prior course number _____ (*i.e. BBS2018-429*)

Renewals will only be granted for identical content and certifications, within the current code cycle.
Attach a copy of prior course approval letter for confirmation. No further information is required.

New Course Information:

Course title: 2023 NEC Code Changes Chapters 1-4

Course instructor: Henry P. Matthews

Course description: This course will cover some of the more significant code changes from Chapter 1-4 in the 2023 NEC.

Instructional hours per session: 4 Number of Sessions: at least one per quarter

Course Date(s) and Location:_____

Special Content:

Code Administration:_____ Conference Course: _____

Existing Buildings: _____ Conference Name: _____

Electrical Instruction: _____ Conference location:_____

Plumbing Instruction:_____

Course to be offered online?__✓___ **On Demand**_____ **Webinar**__✓___

Course Website: www.matthewselectrical.net

Detail online course participation confirmation method *(i.e. test, quizlets, participant activity confirmation)*:
Surveys, polls, and roll call after each break will be conducted.

Course applicable for the following certifications

Residential Certifications Only: __✓___ Commercial Certifications: __✓___

Administrative Course, All Certifications: _____

Application materials included:

__✓___ Course Outline or Course Learning Objectives
__✓___ Presentation Materials/Slides (not required for roundtable courses)
__✓___ Assessment Materials (for online courses)
__✓___ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least on commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review. Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content. Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

Course applicable for the following certifications

This section represents a major change from previous BBS course approval forms.

1. If the course is only for residential certifications, check 'Residential Certifications Only'. The course, if approved, will be approved for all residential certifications.
2. If the course is appropriate for any commercial certifications, check Commercial Certifications. The course, if approved, will be approved for all commercial certification **AND** all residential certifications.
3. If the course is intended to meet required instruction in Code Administration (Chapter 1) or Existing Buildings (commercial or residential) check 'Administrative Course, All Certifications'.

Application Materials Included

This is a checklist for the course submitter's use, to be sure all materials necessary for review are included with the application. All materials should be submitted in .pdf format, along with the application, via email to Michael.Lane@com.ohio.gov or BBS@com.ohio.gov

Welcome and Good Morning!

MATTHEWS ELECTRICAL SERVICES

2023 NEC Code Changes Chapters 1 - 4

OCILB Course number: 4871438

OBBS Course number: Not yet approved

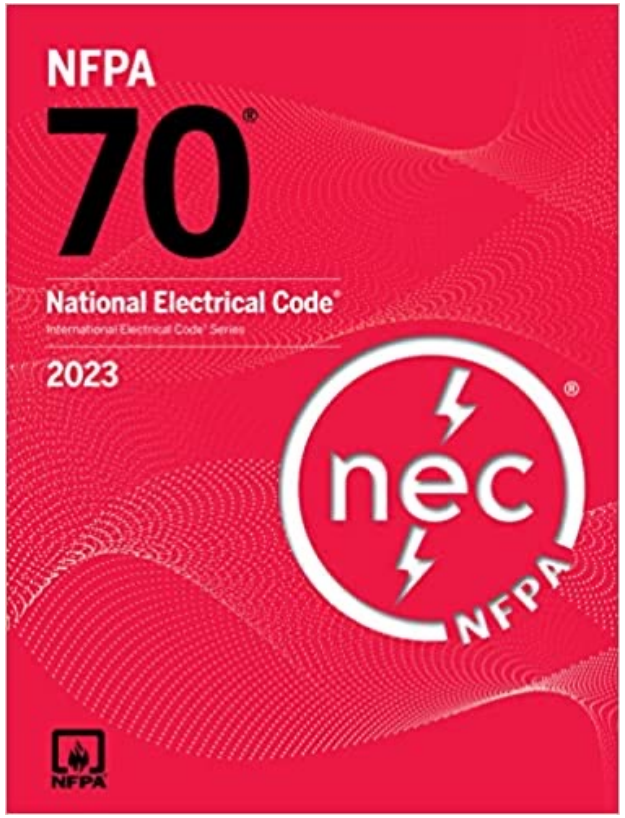
Please Accept Invitation to be a Panelist!

You will not be asked to present. This allows the host to verify your attendance and allows us to interact with each other like a classroom

Please mute your microphone

*Text me at cell no. **419-575-3488** for any problems*

Thank You!



FOR INFORMATIONAL PURPOSES ONLY. NOT CURRENT CODE IN OHIO

Notice!

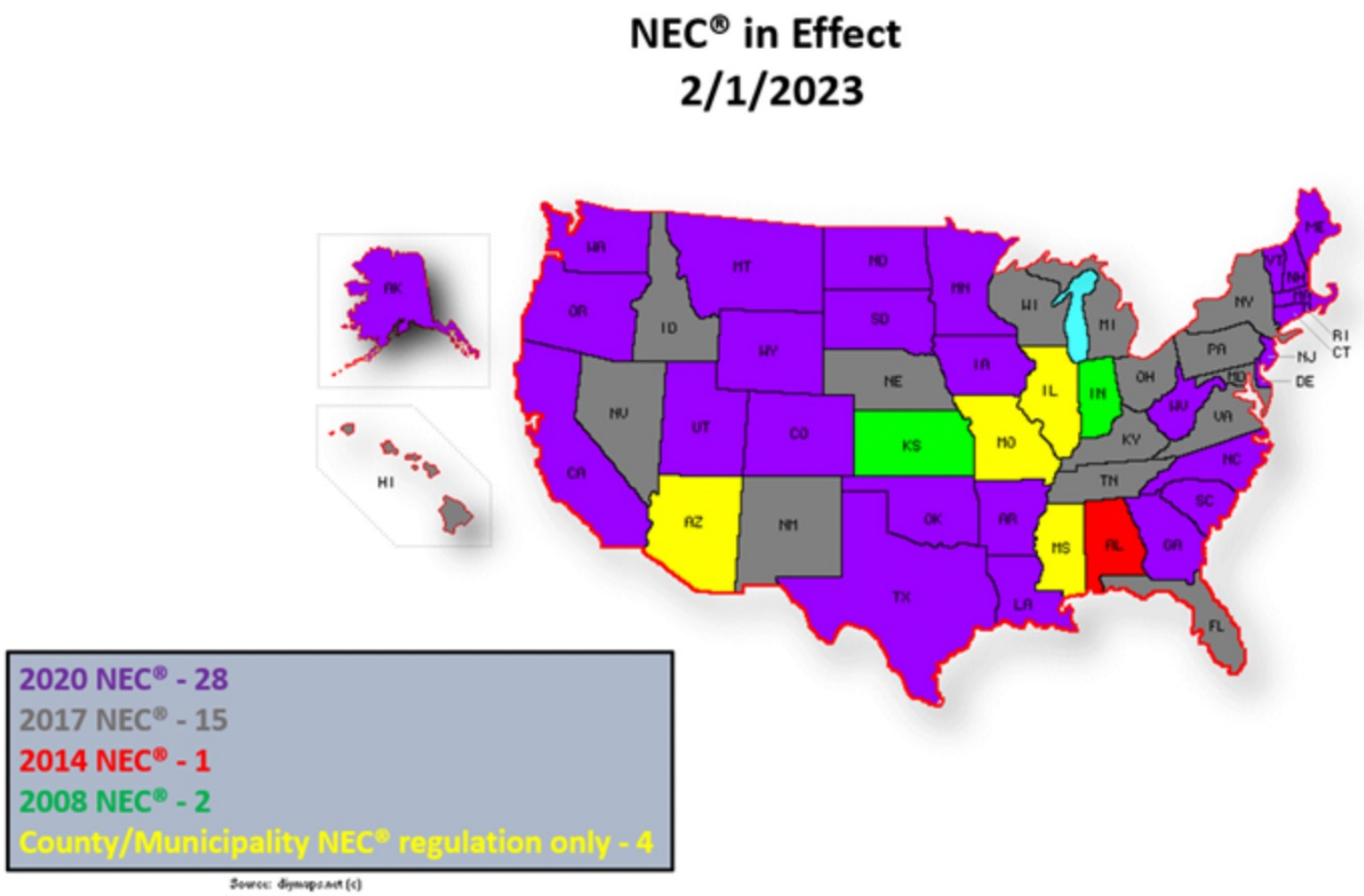
This course is based on the 2023 NEC.

The 2023 NEC has not been adopted in Ohio

Presented for INFORMATIONAL PURPOSES ONLY.

Why Teach the 2023 NEC Now?

Current NEC Adoption



Source: www.nfpa.org

- *The 2022 California Electrical Code, California Code of Regulations Title 24, Part 3 is based on the 2020 edition of NFPA 70®, National Electrical Code®.*
- *The 2011 New York City Electrical Code is based on the 2008 edition of NFPA 70®, National Electrical Code®.*

Mike DeWine
Governor

Sheryl Maxfield
Director

Ohio Construction Industry Licensing Board
Approved Training Agency

MATTHEWS ELECTRICAL SERVICES

Training Agency License: **48714**

Expiration Date: **10/17/2023**

Carol A. Ross
Board Secretary

William Koester
Administrative Chairman

FOR INFORMATIONAL PURPOSES ONLY. NOT CURRENT CODE IN OHIO

CERTIFICATE OF COMPLETION

THIS CERTIFIES THAT

BILL CODIE

OCILB License no: 12345 (EL,HV,PL,RE, HY)

HAS SUCCESSFULLY COMPLETED THE TRAINING REQUIREMENTS FOR

2023 NEC Significant Code Changes Overview

OCILB COURSE NO: 4871437

4 CODE CREDIT HOURS

April 15, 2023

DATE

MATTHEWS ELECTRICAL SERVICES

Agency #48714

HENRY P. MATTHEWS PE, CESCP

INSTRUCTOR

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Disclaimer

- I don’t know everything!
- It will be IMPOSSIBLE to learn all of the changes in 4 hours!
- But we’ll try to cover the main points

Disclaimer #2

The views and opinions presented in this class are those of Matthews Electrical Services and not necessarily those of the various entities the presenter represents or has previously or currently works for.

The material used in this class is based on documented publicly-available information (NFPA, OSHA, IEEE etc.)

The interpretation of this material is based on the presenter's experience and training of the subject matter.

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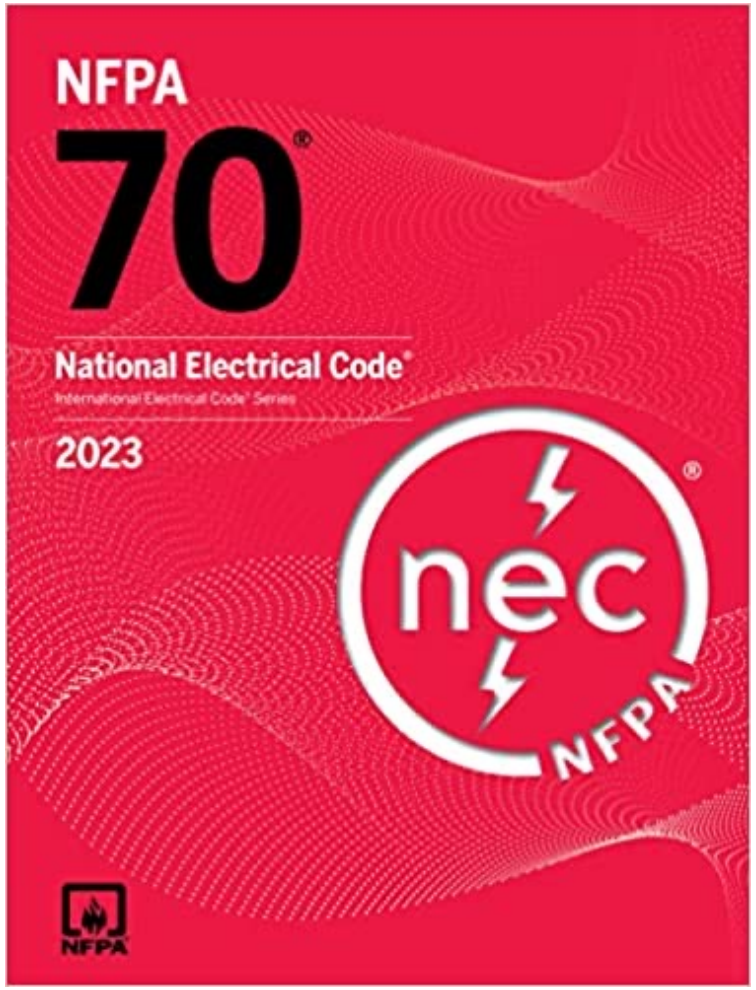
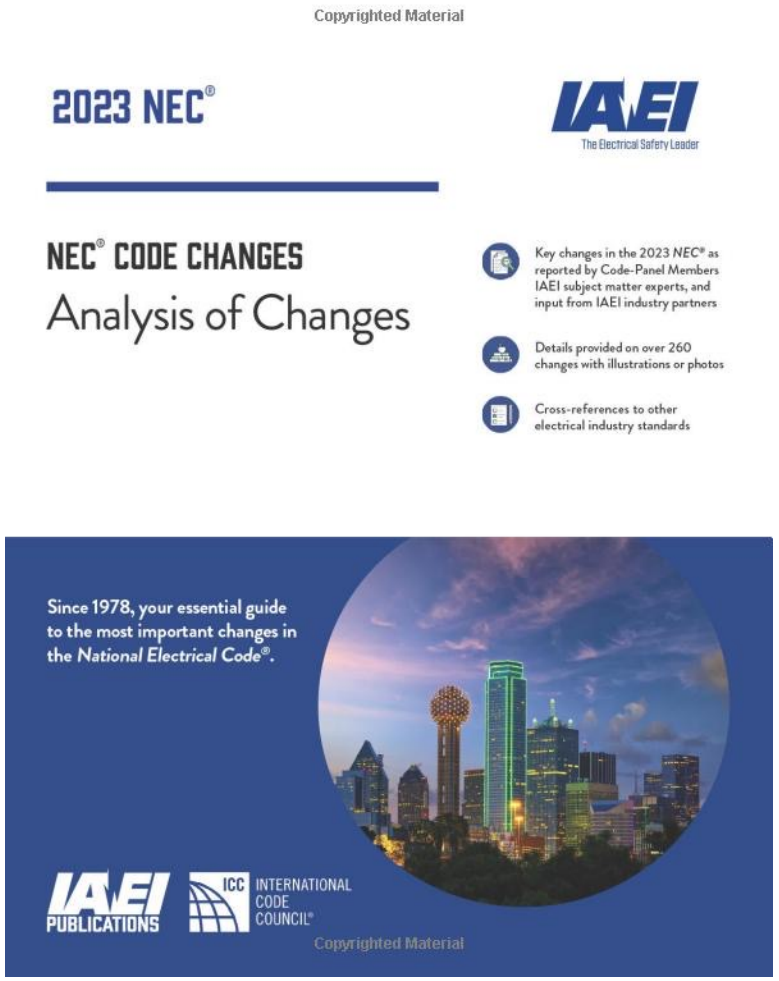
Disclaimer #3

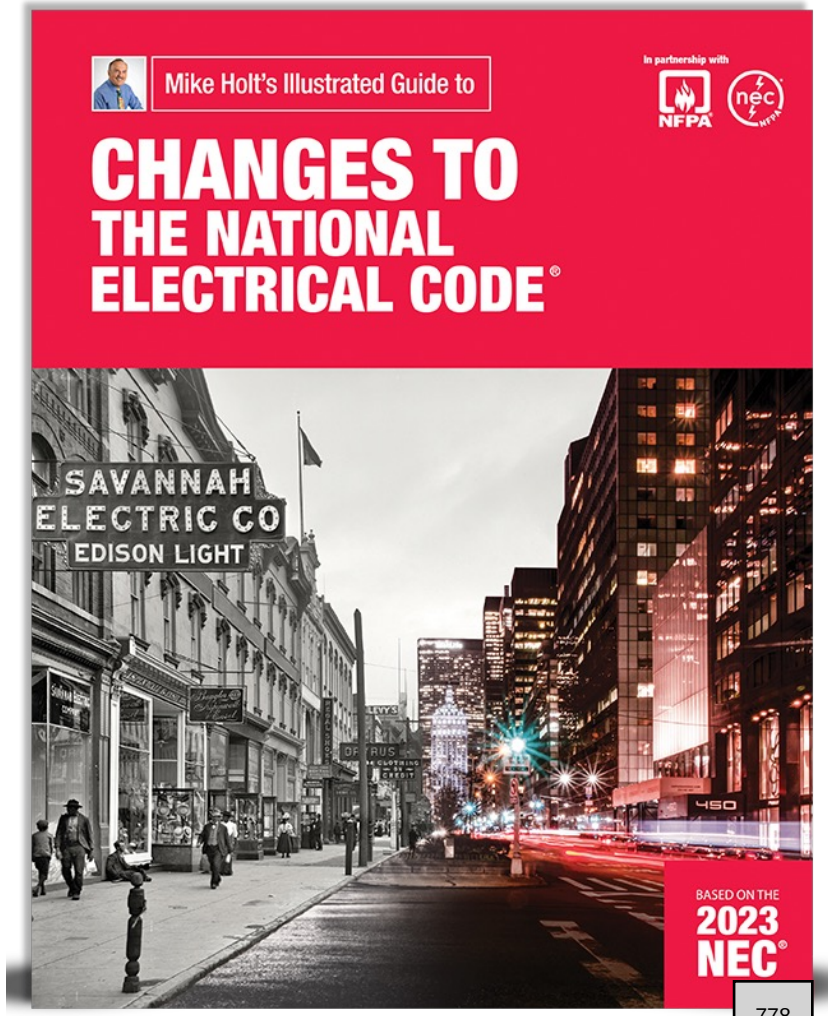
This presentation uses video and props from various electrical equipment manufacturers. This is not intended to endorse any particular products, vendors or manufacturers.

The content is shown for educational purposes only.

Resources

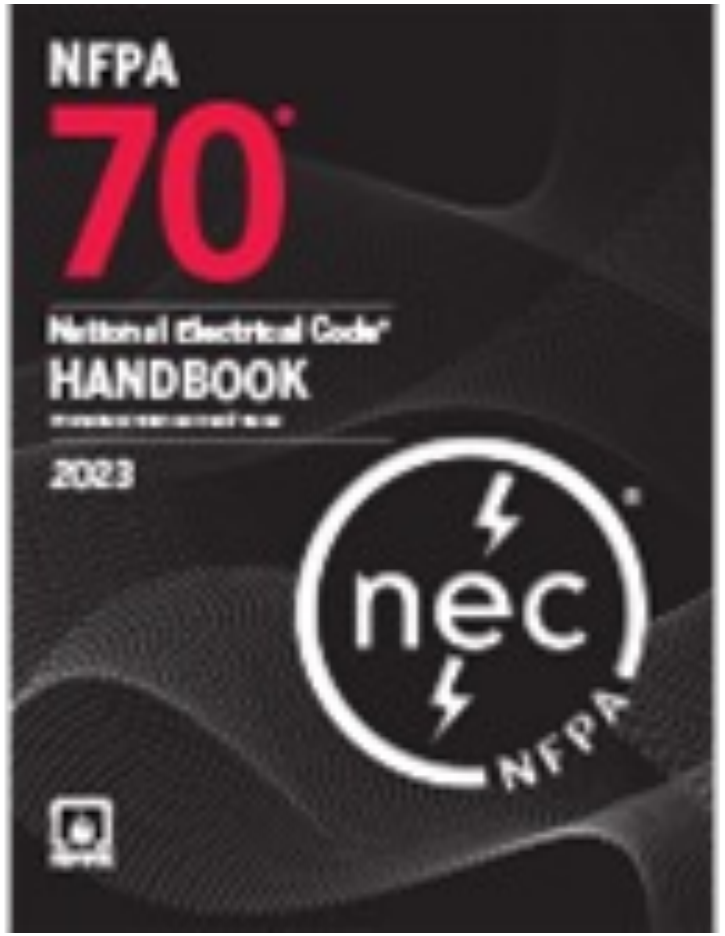






FOR INFORMATIONAL PURPOSES ONLY. NOT CURRENT CODE IN OHIO

Resources



NFPA LiNK®

Code-Making Panel No. 2

Articles 210, 220 Parts I through V, Annex D Examples D1 through D6

David G. Humphrey, *Chair*
County of Henrico, Virginia, VA [E]
Rep. International Association of Electrical Inspectors

Mathher Abbassi, New York City Department Of Buildings, NY [E]

Charles L. Boynton, Dow/The DuPont Company, Inc., TX [U]
Rep. American Chemistry Council

Daniel Buuck, National Association of Home Builders (NAHB), DC [U]
Rep. National Association of Home Builders (NAHB)

Steve Campolo, Leviton Manufacturing Company, Inc., NY [M]

Mark Daniel Cook, Faith Technologies Electrical Contracting, WI [IM]

Thomas A. Domitrovich, Eaton Corporation, MO [M]
Rep. National Electrical Manufacturers Association

Nehad El-Sherif, MNKYBR Technologies Inc., Canada [U]
Rep. IEEE-IAS/PES JTCC

Thomas L. Harman, University of Houston-Clear Lake, TX [SE]

David W. Johnson, CenTex IEC, TX [IM]
Rep. Independent Electrical Contractors, Inc.

Alan Manche, Schneider Electric, KY [M]

John McCamish, NECA IBEW Electrical Training Center, OR [L]
Rep. International Brotherhood of Electrical Workers

Fred Neubauer, Neubauer Electric Inc., CA [IM]
Rep. National Electrical Contractors Association

Christopher J. Pavese, Duke Energy, KY [UT]
Rep. Electric Light & Power Group/EEI

Frederick P. Reyes, UL LLC, NY [RT]

Alternates

William B. Crist, Jr., IES Residential Inc., TX [IM]
(Alt. to David W. Johnson)

Timothy M. Croushore, FirstEnergy, PA [UT]
(Alt. to Christopher J. Pavese)

Andrew Kriegman, Leviton Manufacturing Company, Inc., NY [M]
(Alt. to Steve Campolo)

Brett Larson, Schneider Electric, IA [M]
(Alt. to Alan Manche)

Cesar Lujan, National Association of Home Builders (NAHB), DC [U]
(Alt. to Daniel Buuck)

Daniel J. Naughton, JATC of Greater Boston, MA [L]
(Alt. to John McCamish)

Robert D. Osborne, UL LLC, NC [RT]
(Alt. to Frederick P. Reyes)

Irozenell Pruitt, Corteva Company, Inc. /The DuPont Company, Inc., TX [U]
(Alt. to Charles L. Boynton)

Brian E. Rock, Hubbell Incorporated, CT [M]
(Alt. to Thomas A. Domitrovich)

Joseph J. Wages, Jr., International Association of Electrical Inspectors, TX [E]
(Alt. to David G. Humphrey)

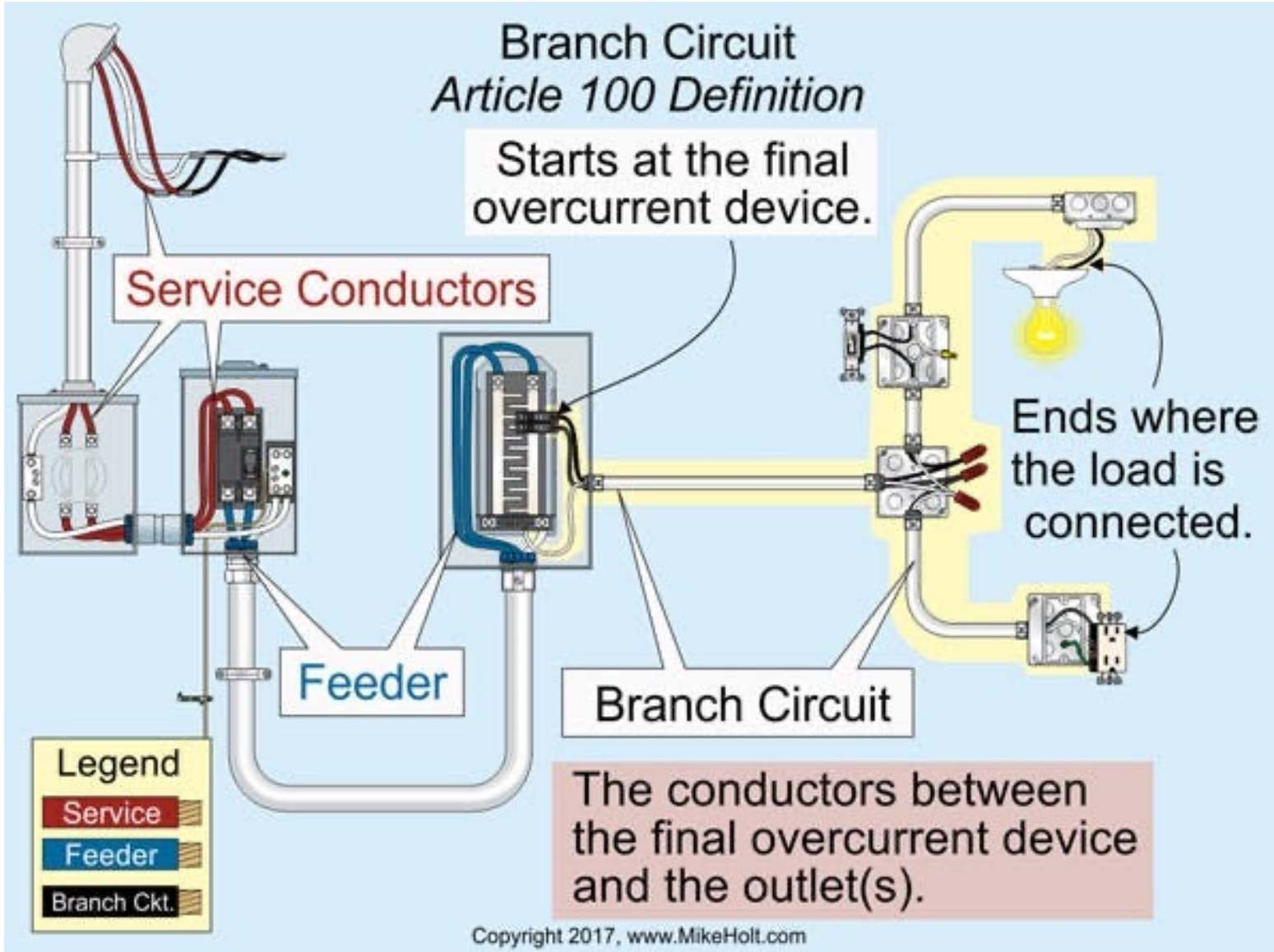
Michael Weaver, M&W Electric, OR [IM]
(Alt. to Fred Neubauer)

Mike Holt

NEC Global Changes

Review!

Service, Feeders and Branch Circuits



783

Review:
Receptacles, Outlets, Receptacle Outlets

Outlet

Receptacle

Receptacle Outlet

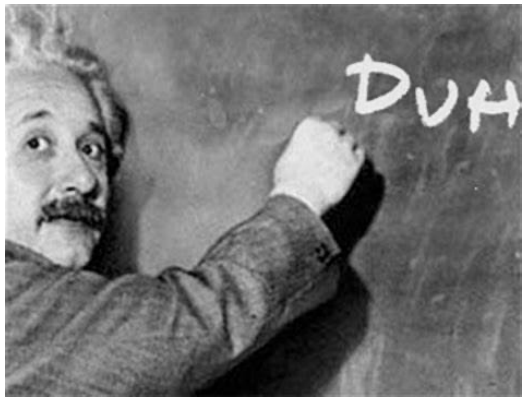
Symbols I will use for emphasis!

The NEC has tried many times
To get this right

Change that has major impact!

Head scratcher or
Revolutionary idea

Attention Please!



Should be
Obvious!

785

Chapter 1 General

Article 90

Article 100

Article 110

Article 100

- All definitions moved to the front

787

Article 100 Definitions- Counter *(Countertop)*

A new definition was added to help users of the *Code* understand what constitutes a **"Counter *(Countertop)*"** location

- There appears to be installer and enforcement **confusion,** as well as **frequent product misapplications** resulting from electrical equipment being installed incorrectly on these surfaces
- The key distinction between a work surface and a countertop is the **quantity of spillage** that the surfaces may be subjected *(Generally, a counter application assumes a greater volume of spillage)*
- The electrical professional will be directed to the industry standards that aid in the proper application of receptacles in these locations
- See **Informational Note No. 1** for a reference to *UL 498, Receptacles and Attachment Plugs*, and *UL 943, Ground-Fault Circuit-Interrupters*
- See **Informational Note No. 2** for information on receptacles for counters and countertops distinguished from receptacles for work surfaces

NFPA LINK©

Article 100 Definitions- Counter *(Countertop)*

The key distinction between a **work surface or a countertop** is the quantity of spillage that the surfaces may be subjected *(see Work Surface definition in upcoming slide)*

Features:

- listed for application
- flange raised above surface to prevent liquid from entering
- sealed when in the closed position to prevent liquid from entering
- only energized in the upright position
- GFCI protected

Courtesy of ABB, Thomas and Betts

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Article 100- Impedance Grounding Conductor

Substantiation was submitted for the creation of a new definition for *Grounding Conductor, Impedance*

- There was no definition until the 2023 *NEC* for a conductor that made a connection between the neutral point for an impedance grounded system and the grounding impedance device
- The impedance grounding conductor will carry fault current that has been reduced by a designated impedance
- This conductor did not meet the definition of a neutral conductor as it is not intended to carry current under normal conditions
- It also did not meet the definition of a *grounding electrode conductor*

Review

- Impedance denoted by Z, measured in ohms
- Impedance is made up of Resistance, Inductance and Capacitance
- Impedance equation:

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

Z = impedance

R = resistance

X_L = inductive reactance

X_C = capacitive reactance

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Article 100- Impedance Grounding Conductor

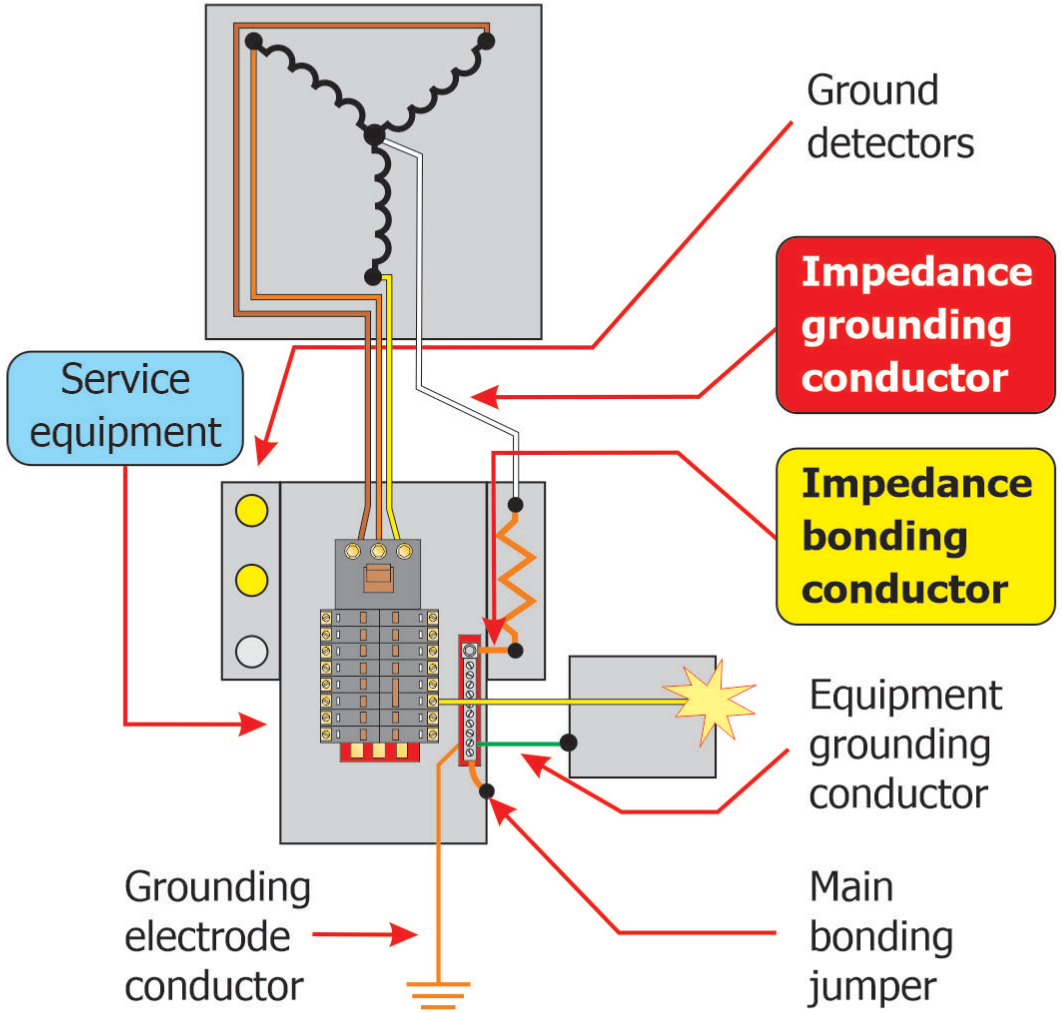
New definition for **"impedance grounding conductor"** was created to replace the phrase "grounded system conductor"

A Word from Engineer Nic:

There was no definition until the 2023 *NEC*

This conductor makes a connection between the neutral point for an impedance grounded system and the grounding impedance device

The impedance grounding conductor will carry fault current that has been reduced by a designated impedance



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Article 100- Impedance Grounded System

Substantiation was submitted for the creation of a new definition for *Grounded System, Impedance*

- There was no definition for an *impedance grounded system* before the 2023 *NEC* code cycle
- This resulted in an inconsistent use and understanding of these systems as they applied with high impedance grounded neutral systems and impedance grounded neutral systems
- Electrical professionals will have a new definition that is accurate and consistently defines elements that make up this system

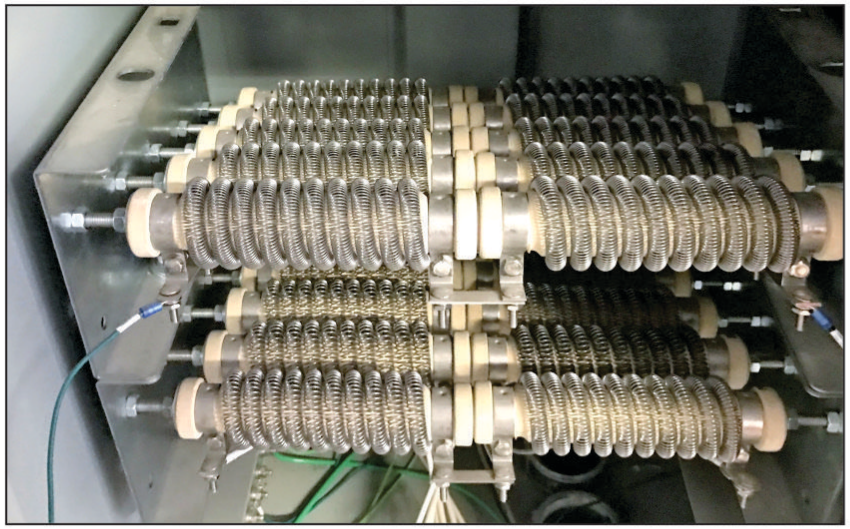
Article 100- Impedance Grounded System

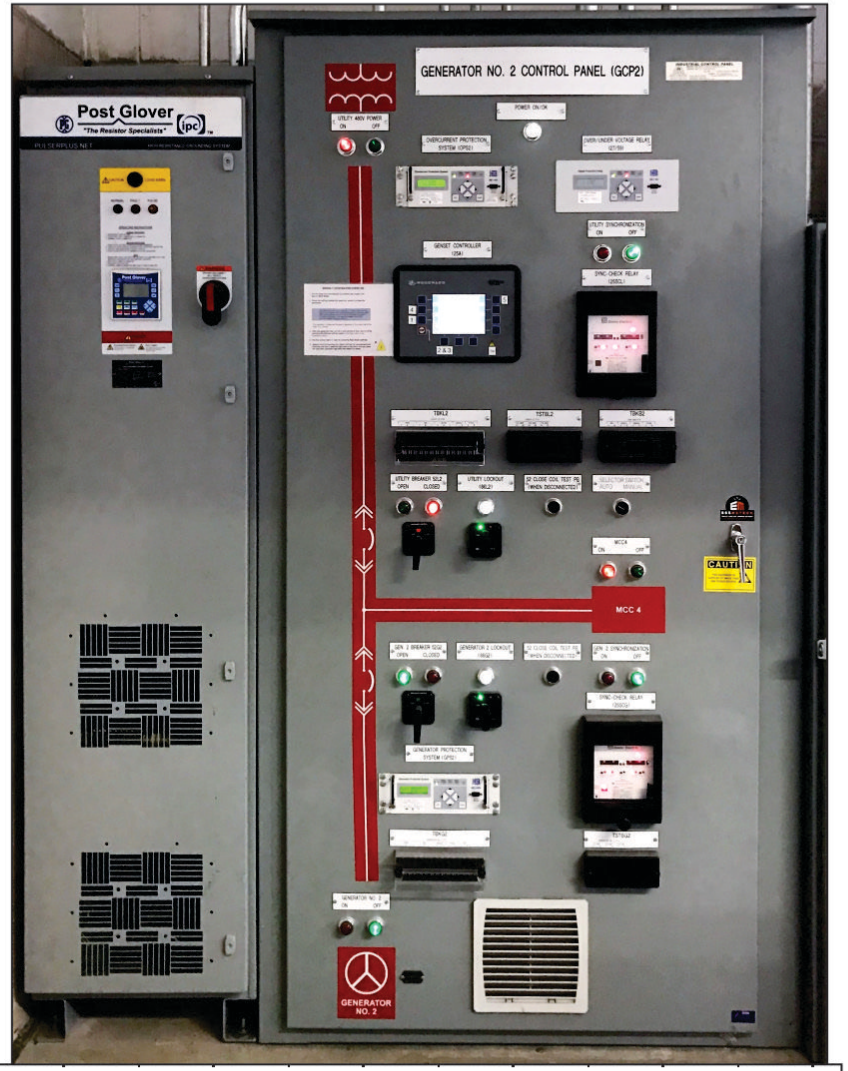
Substantiation was submitted for the creation of a new definition for Grounded System, Impedance

Engineer Beth says:

No definition for an impedance grounded system before the 2023 *NEC*

This resulted in an **inconsistent use** and understanding of these systems as it applied with high impedance grounded neutral systems and impedance grounded neutral systems





Photos courtesy of Rob Bowman

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Article 100- Impedance Grounded System

Photo shows the typical ground detection and alarm system associated with an impedance grounded system

Has visual as well as audible alarm features

These systems help maintain continuity of power, and are recognized in NFPA 70E as a method of reducing arc flash severity

Manufactured by Post Grover

Photo courtesy of Rob Bowman

110.17 Servicing and Maintenance of Equipment

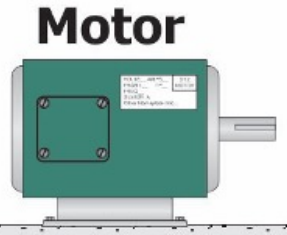
New section addresses servicing and maintenance of electrical equipment and **restricts this work** to **qualified persons trained to perform the work**

Engineer Beth says:

Requires the use of identified replacement parts that have been verified per applicable product standards

Parts are to be provided by either the:
- original equipment manufacturer *(OEM)*
- designed by an engineer with applicable experience or
- as approved by the AHJ

*See **NFPA 70B**, The Recommended Practice for Electrical Equipment Maintenance*



Various Types of Electrical Equipment

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Article 100 Definitions- In Sight From

The definition of *"In Sight From (Within Sight From), (Within Sight)"* has been modified per requirements of the *NEC Style Manual*

- The *NEC Style Manual* states that definitions shall not contain requirements or recommendations
- See the new section for *"In Sight From (Within Sight From), (Within Sight)"* in 110.29 for requirements
- Definition revised for clarity and uniform enforcement
- Equipment that is visible and not more than 15 m *(50 ft.)* distant from other equipment is considered to be in sight from that other equipment

"Keep Trying" until they get it right

NFPA LINK©

Article 100- In Sight From *(Within Sight From, Within Sight)*

Distance is to be **visible** and not more than 15 m ***(50 ft)*** from the other equipment

[Note: see 110.29 for requirements for In Sight From (Within Sight From, Within Sight)]

A Word from Electrician Jeff

Transformer disconnecting means is located in the electrical panel and is labeled

Transformer is labeled as to the panel and branch circuit it is controlled from

Always test for the presence of electricity before beginning the troubleshooting of electrical issues

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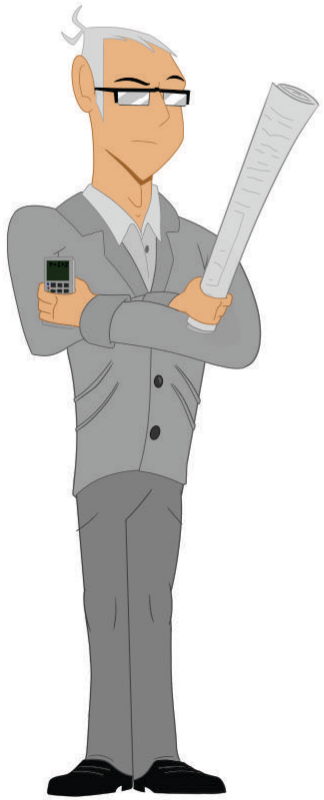
Article 100- Likely to Become Energized

Substantiation was submitted for the creation of a new definition explaining the phrase *Energized, Likely to Become*

- There was no definition of this phrase that appears 25 times within the *NEC*
- Annex B of the *NEC Style Manual* defines “likely to become energized” as a “failure of insulation on” *(Annex B is units of measure)*
- There is a very important distinction between what can become energized compared to what is likely to become energized
- Likely to become energized was up to interpretation with opinions that differed from jurisdiction to jurisdiction
- This caused frustration among electrical professionals when applying requirements from the *NEC*

Article 100- Energized, Likely to Become

Likely to become energized was up to interpretation with opinions that differed from jurisdiction to jurisdiction



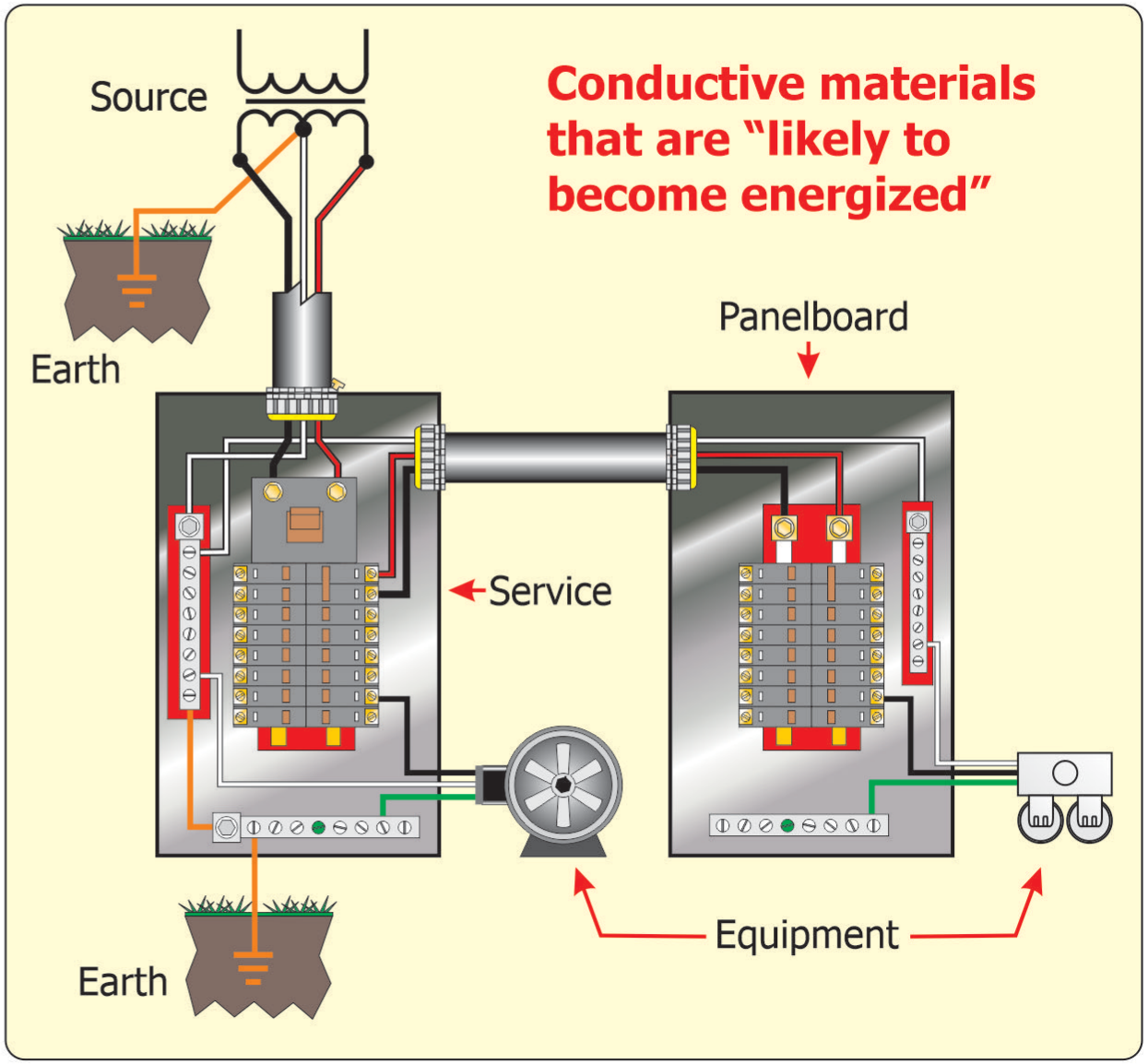
Engineer Nic

Annex B of the NEC Style Manual defines "likely to become energized" as a "failure of insulation on"

Many people have never heard of an *NEC Style Manual*

Definition factors:

- a conductive material
- this conductive material could become energized
- could be due to failure of electrical insulation or electrical spacing



Article 100 Definitions- PV DC Circuit

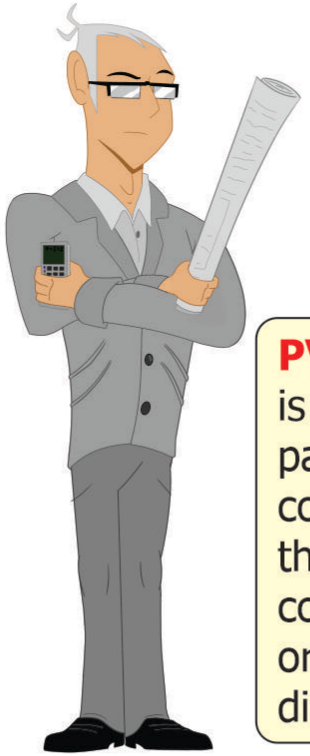
New terms and revised definitions for PV System DC elements

- PV System Source Circuit and PV String Circuit subsets of a PV System DC Circuit
- **PV Source Circuit** is inclusive of the series and/or parallel dc circuit conductors between the modules and combiners, inverters or PV system dc disconnect
- **PV String Circuit** is inclusive of the series dc circuit conductors between the modules
- Previous terms and definitions were difficult to apply to current designs
- Decided to clarify these definitions as well as relocate all definitions to Article 100
- The definitions relocated to comply with the *NEC* Style manual requirements

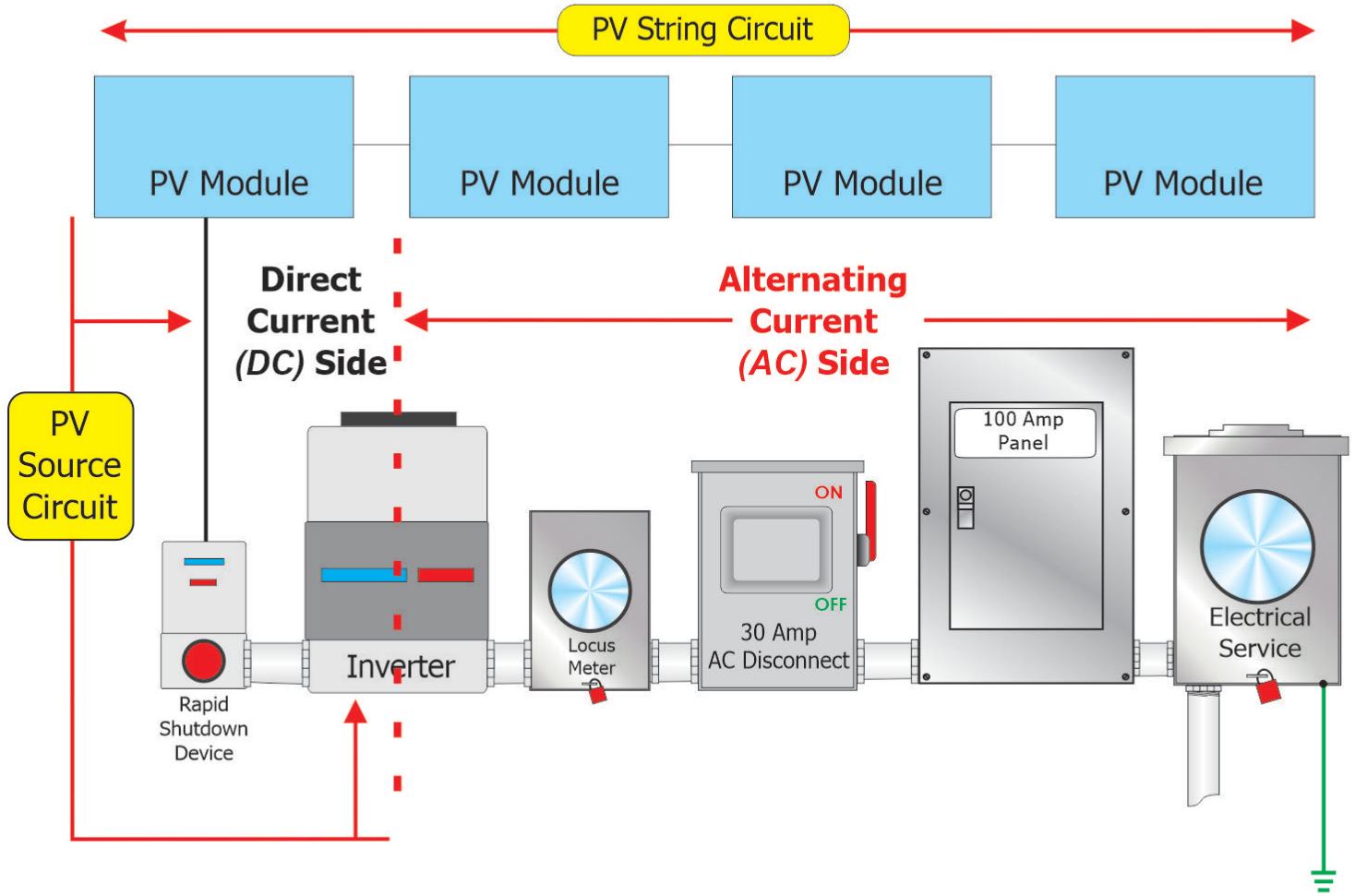
Article 100- PV DC Circuit

PV System Source Circuit and PV String Circuit are subsets of a PV System DC Circuit

PV String Circuit is the series dc circuit conductors between the modules



PV Source Circuit is the series and/or parallel dc circuit conductors between the modules and combiners, inverters or PV system dc disconnect



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Article 100 Definitions- Short Circuit

A new definition for “short circuit” has been added to the *Code* by CMP-10

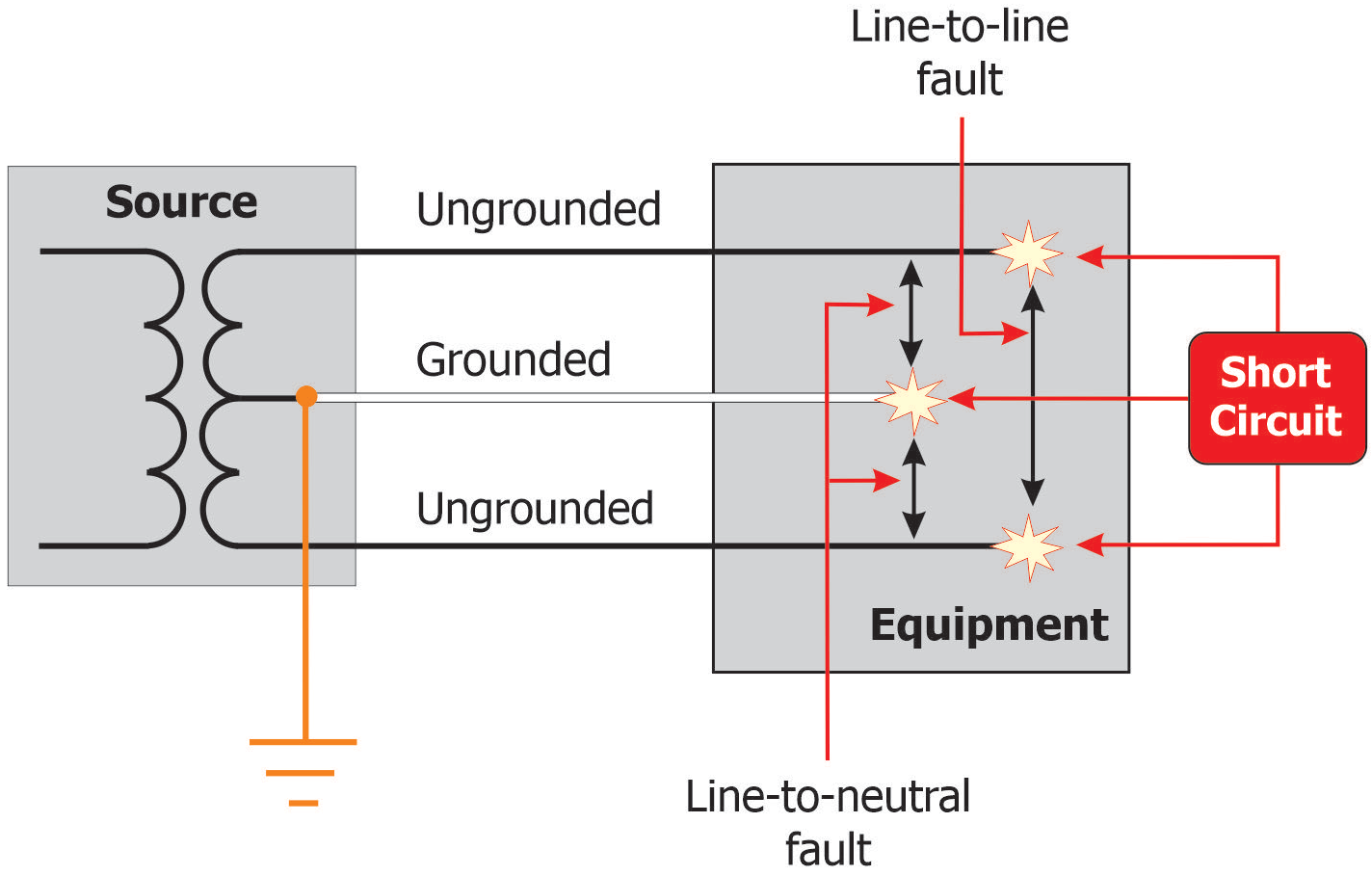
- Short circuit is used several times throughout the *NEC*
- The definition is added to improve the usability of the code
- Previously, the user of the *Code* had to rely on other industry standards to determine the definition of this term, such as the *IEEE 100-1992, The New IEEE Standard Dictionary of Electrical and Electronic Terms, 5th Edition*

Definition: Short Circuit

Characteristics of a Short Circuit:

- It is a conducting connection
- can exists between any of the conductors of an electrical system
- either from line-to-line or from line to the grounded conductor
- can be accidental or intentional

Random Current
(Larry)



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Article 100 Definitions- Work Surface

A new definition was added to help users of the *Code* understand what constitutes a **"Work Surface"** location

- There appears to be installer and enforcement **confusion** as well as **frequent product misapplications** resulting from electrical equipment being installed incorrectly on these surfaces *(Work surfaces involve lower volumes of spillage than countertops)*
- The key distinction between a work surface and a countertop is the **quantity of spillage** that the surfaces may be subjected
- The electrical professional will be directed to the industry standards that aid in the proper application of receptacles in these locations
- See **Informational Note No. 1** for UL 111, *Outline of Investigation for Multioutlet Assemblies*, and *UL 962A, Furniture Power Distribution Units*
- See **Informational Note No. 2** for information on receptacles for work surfaces distinguished from receptacles for counters and countertops

NFPA LINK©

Article 100 Work Surface

New definition due to misapplications resulting from electrical equipment installed incorrectly on these surfaces

The electrical professional needs to consult industry standards that assists with proper application of receptacles

Key difference between a work surface and countertop is the **quantity of spillage** the surface is subjected

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110.3 Examination, Identification, Installation, Use, and Listing *(Product Certification)* of Equipment. (A) Examination.

Substantiation was submitted that addresses cybersecurity for network-connected life safety equipment *(list item 8)*

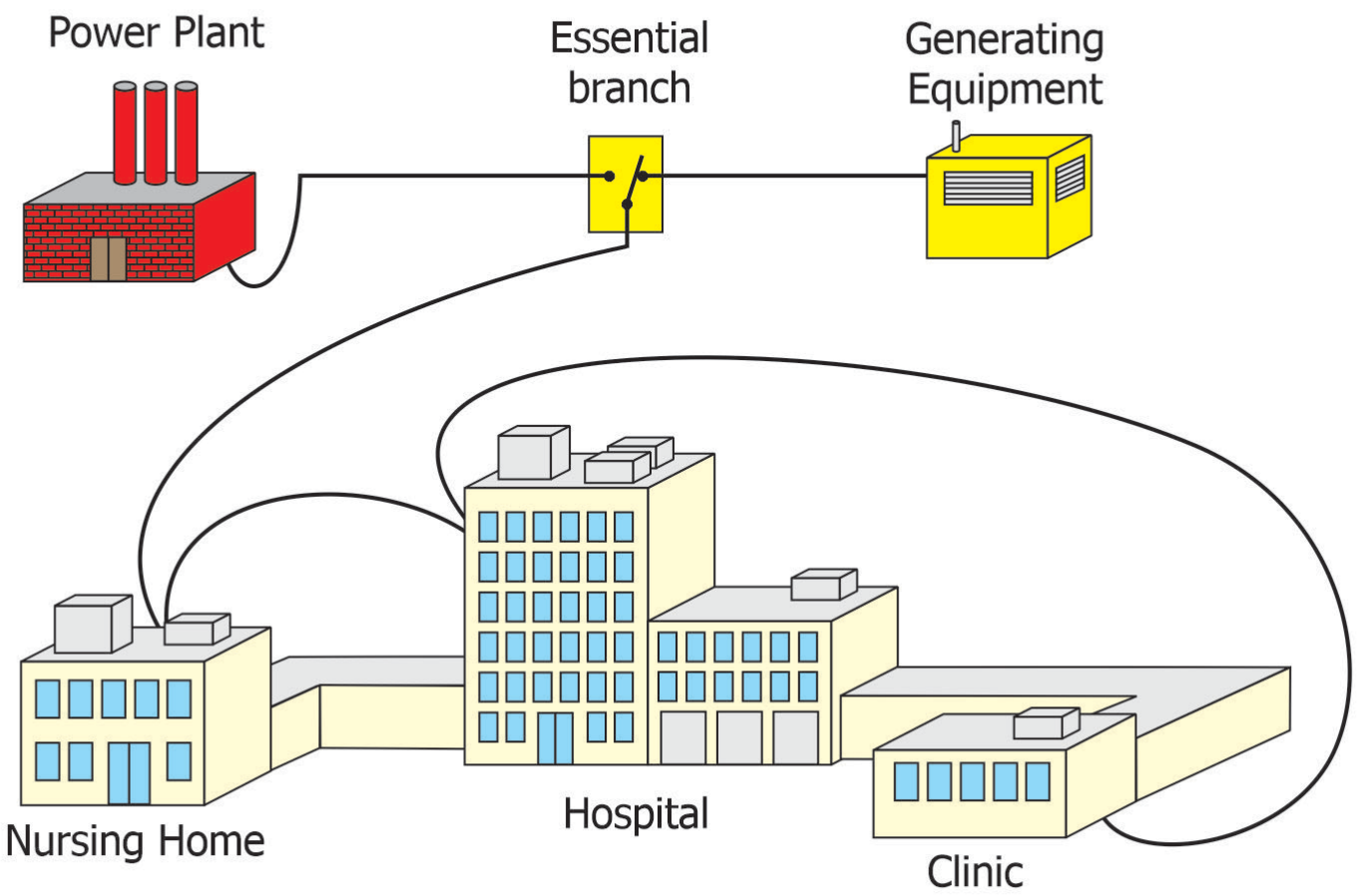
- Cybersecurity is a technology hazard that can cause many disturbances to electronic equipment
- It needs to be considered when evaluating equipment for safety
- Does not mandate that the electrical professional conduct a cybersecurity evaluation but to remember and recognizes that it is a hazard
- Informational Note No. 3 introduces the following valuable standards for consideration towards cybersecurity concerns for electrical equipment:
  - IEC 62443 series of standards for Industrial Automation and Control Systems
  - UL 2900 series of standards for Software Cybersecurity for Network-Connectable Products
  - UL 5500, the Standard for Remote Software Updates

110.3 Examination, Identification, Installation, Use, and Listing *(Product Certification)* of Equipment

Addresses cybersecurity for network-connected life safety equipment in (A) Examination *(list item 8)*

Engineer Beth says:

Does not mandate the electrical professional to conduct a cybersecurity evaluation but remember and recognize that it is a hazard



Health Care Facilities

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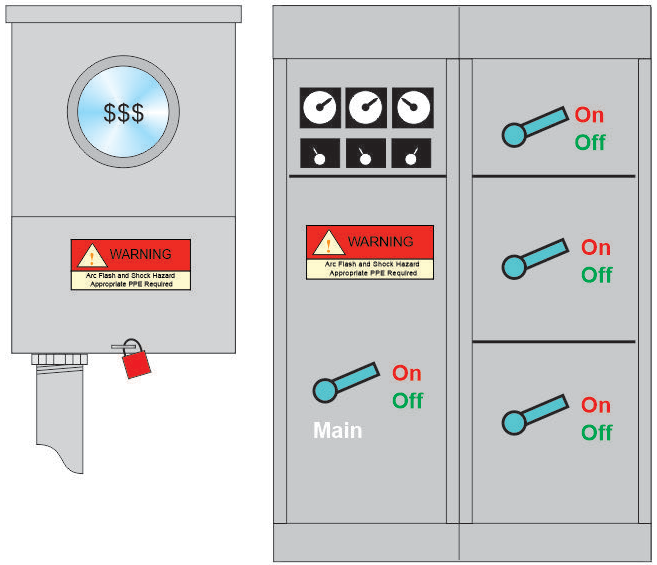
110.16(B) Service Equipment/Feeder Supplied Equipment

This adds “Feeder Supplied Equipment” to the title, adds the phrase “arc flash” for the type of permanent label required, and reduces 1200 to 1000 amperes for equipment rating amperes

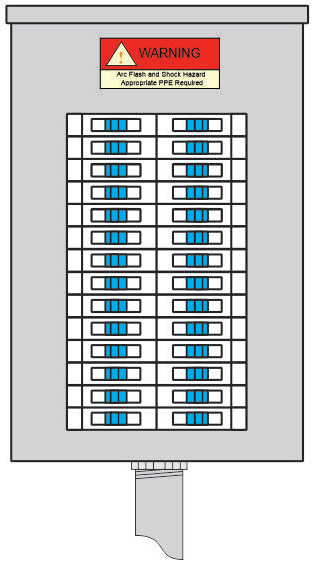
- Clarifies that the requirements apply to both service equipment and feeder-supplied equipment
- It was necessary to add the phrase “arc flash” to clarify the type of permanent label required for this equipment
- The revision from 1200 to 1000 amperes will protect worker safety
- The four previous list items and exception were deleted, and now references label to meet applicable industry practice

110.16(B) Service Equipment/Feeder Supplied Equipment

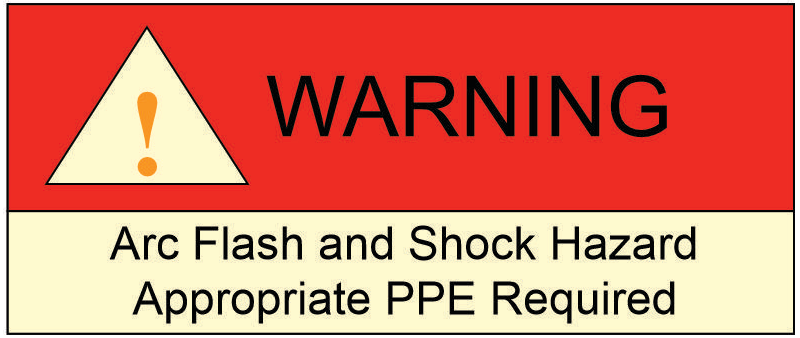
"Feeder Supplied Equipment" added to the title, "arc flash" added for the type of permanent label required, and reduced 1200 to 1000 amperes



Service Equipment



Feeder Equipment



**Not all required warning labels shown*

A Word from Engineer Nic

Clarifies that the requirements apply to both service equipment and feeder-supplied equipment

Made sure that the electrical professional understood the label was for an "arc flash"

Revised **1200 amperes down to 1000 amperes** to provide greater safety to the worker

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110.16(B) Service Equipment/Feeder Supplied Equipment

"Feeder Supplied Equipment" added to the title, "arc flash" added for the type of permanent label required, and reduced 1200 to 1000 amperes

WARNING

Arc Flash and Shock Hazard

Failure to comply can result in death or serious injury.
Refer to NFPA 70E. Appropriate PPE Required.

Nominal System Voltage: 480 VAC

Available Fault Current: 23.3 kA

Clearing Time of Service OCPD: 0.03 sec (2 cycles)

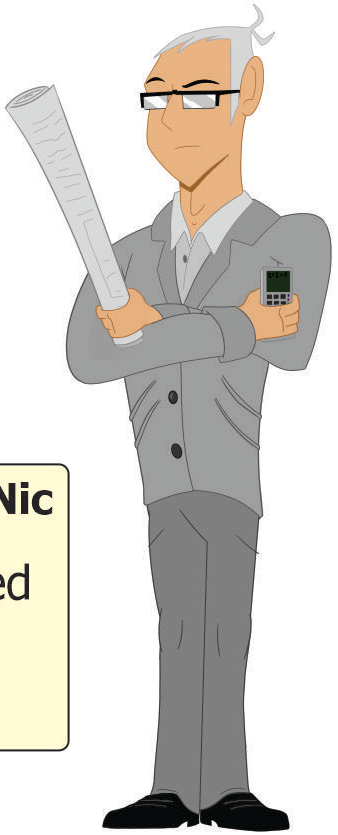
Date Label Applied: 08/01/16

Equipment ID: Cannabis Production Panel 420

Sidewinder Electrical Contractors Celina, TX 800-444-1212

A Word from Engineer Nic

Arc flash label is required to contain the following information



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110.26 Spaces About Electrical Equipment

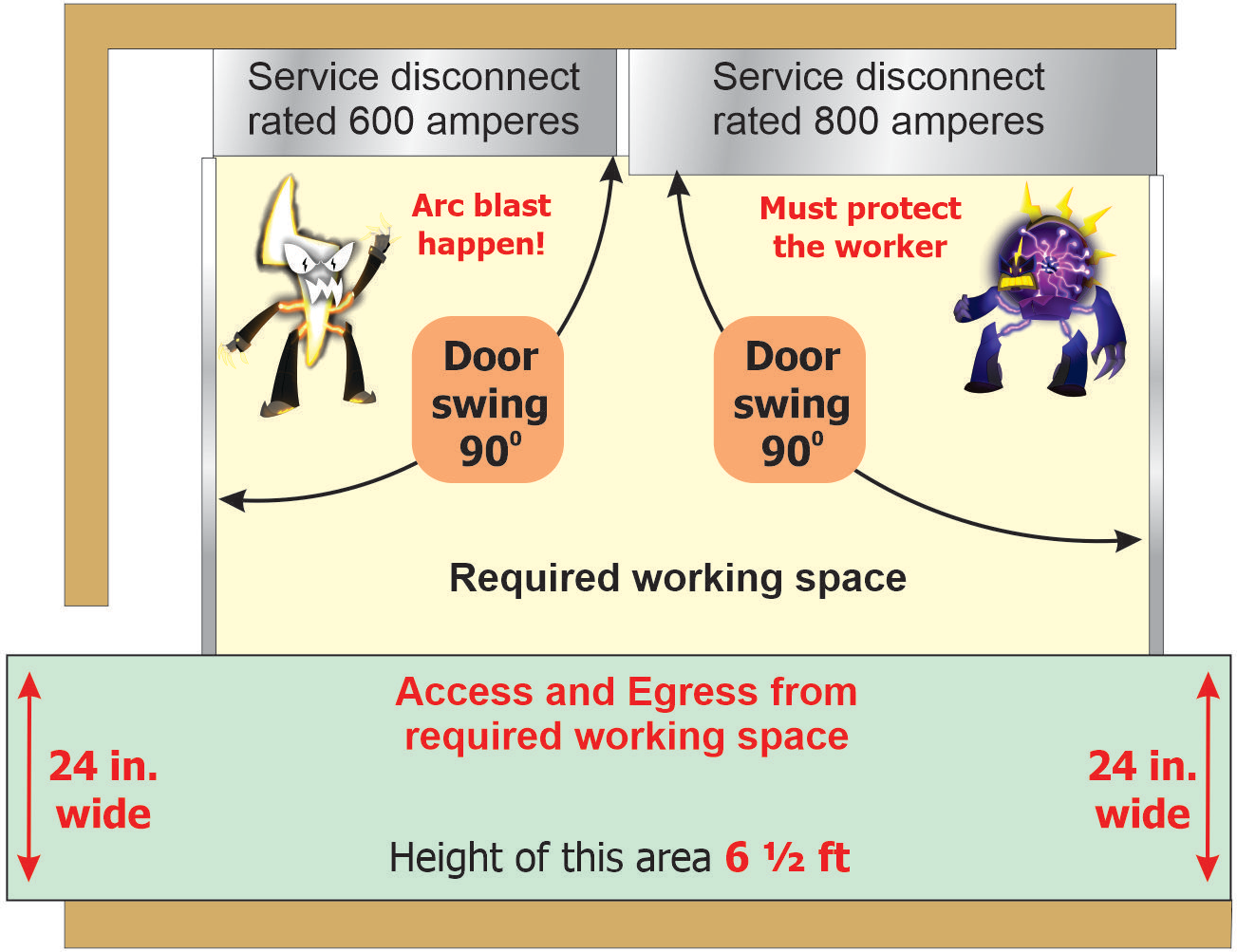
This change concerns equipment doors and their interference with egress and access from the working space

- Many instances of electrical equipment installations violate the previous *Code* language involving this working space *(entrapment when doors are open)*
- Worker entrapment by equipment doors can cause serious injury or death
- This change recognizes open equipment doors can impede egress from electrical equipment when dangerous situations arise *(arc blast, etc.)*
- Access and egress **are impeded** if an equipment door(s) is opened and **restricts** the working space access to less than 610 mm ***(24 in.)*** **wide** and 2.0 m ***(6 ½ ft)*** **high**
- This rule also applies to the space between two simultaneously opened doors on opposite sides of the aisleway

NFPA LINK©

110.26 Spaces About Electrical Equipment

This change recognizes open equipment doors can impede egress from electrical equipment when dangerous situations arise *(arc blast, etc.)*



A Word from Engineer Nic

Open equipment doors **not to impede** the access or egress from the working space

Access and egress **is impeded if** an equipment door(s) is opened and restricts the working space access to **less than 610 mm (24 in.) wide and 2.0 m (6 ½ ft) high**

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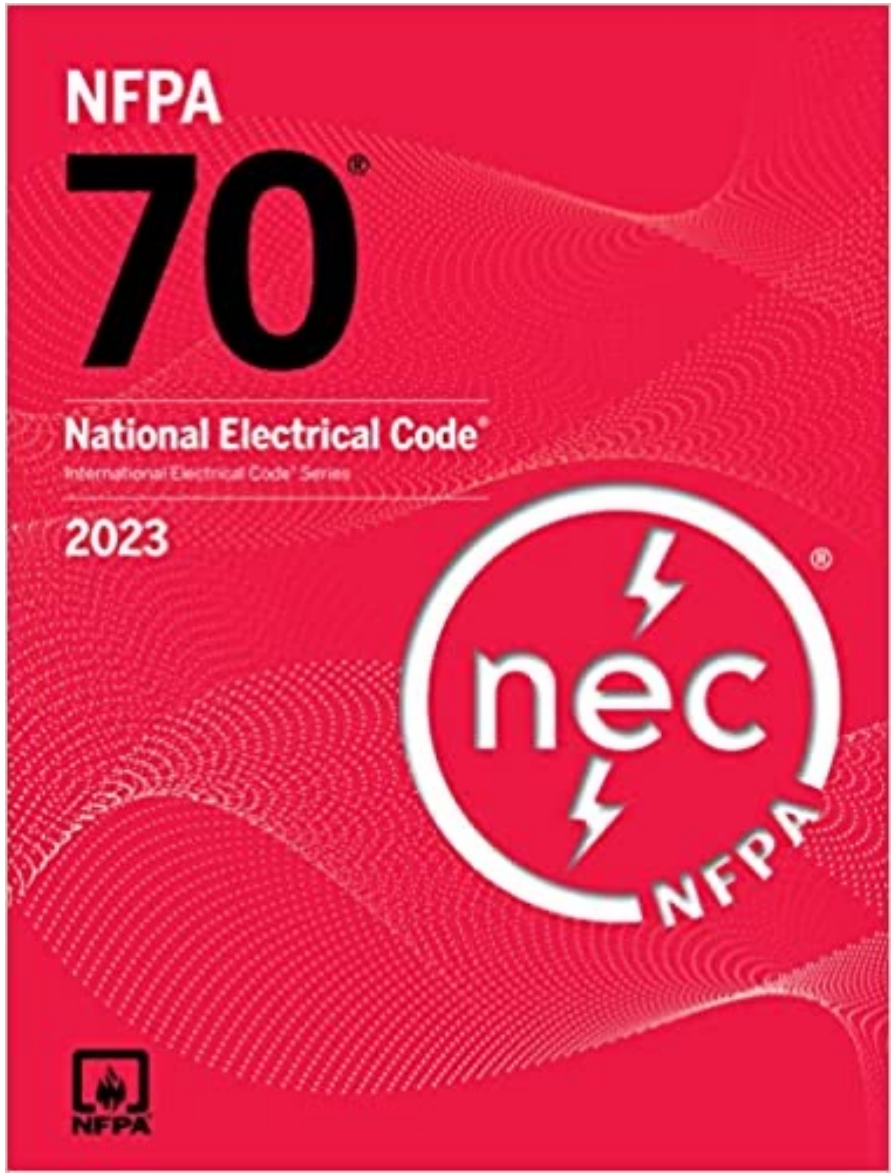
440.14 Location

Adds a reference to 110.26(A), which makes it clear that working space clearances are required for air-conditioning and refrigerating equipment

- HVAC contractors install their equipment per the manufacturer's specifications
- Some are not aware of the minimum required clearances in 110.26 for disconnects that require servicing
- Adds clarity for the inspector and installer that minimum clearances must be maintained at air-conditioning and refrigerating disconnects

Next Week: Chapters 5-9



CONGRATULATIONS!

FOR INFORMATIONAL PURPOSES ONLY. NOT CURRENT CODE IN OHIO

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Next Steps

A Certificate of Completion will be emailed to those who successfully completed course

4 hours of Code Class Hours will be reported to the OCILB fand OBBS or Code Continuing Education Credits

Contact instructor at hpmatthews@matthewselectrical.net for any questions or comments

Make sure you completely sign out of webinar after the next slide!

THANK YOU

File Attachments for Item:

EC-15 2023 NEC Code Changes Chapters 5-9 (Matthews Electrical Services)

All certifications (4 hours)

2023 NEC Significant Code Changes Chapters 5-9

Outline

NEC Chapters and sections covered

- Scope: Article 90
- Chapters 5 - 9

Other Resources:

- 2021 NFPA 70E
- 2023 NFPA 70B
- NFPA 79

Referenced Websites:

- www.NFPA.org
  www.IAEI.org (International Association of Electrical Inspectors)
- www.mikeholt.com
- www.esfi.org Electrical Safety Foundation International)
- Various motor and transformer manufacturer websites.

Course Content:

- NEC Chapter 5 Special Occupancies
- NEC Chapter 6 Special Equipment
- NEC Chapter 7 Special Conditions
- NEC Chapter 8 Communication Systems
- NEC Chapter 9 Tables

2023 NEC Significant Code Changes Chapters 5 - 9

Syllabus

1. Welcome
2. Attendance and eligibility verification
3. Training session rules
4. Agenda review
5. Resources Used
6. Review of key points from NEC Overview
7. Chapters 5 -9Code Changes
    a. New Articles
    b. Deleted articles and sections
    c. Discussion on key changes
8. Question and Answers
9. Wrap-up: post-class expectations (credits, certificates etc.)
10. Dismissal

APPLICATION FOR CONTINUING EDUCATION APPROVAL
COURSE CONDITIONS AND GUIDELINES

The Ohio Board of Building Standards is committed to the ongoing education and professional development of board-certified personnel through the delivery of high-quality, accurate and engaging professional continuing education content. To this end, the Board reviews and approves Continuing Education Courses for building department personnel.

Board approval is granted for course instruction on current codes and standards, including the OBC, OMC, OPC, and RCO, and any other content areas directly related to the responsibilities of the certification for which credit is being requested.

Promotion: Any person or organization promoting an approved course is required to make full and accurate disclosure regarding course title, course approval number, number of credit hours, categories for which the BBS has approved the class, and fees in promotion materials and advertising. ***The Board does not grant retroactive approval. It is recommended that courses be submitted for approval well in advance of any scheduling of classes and advertising***. Advertising may not falsely state BBS approval before approval is granted. Course providers may state that BBS approval is pending.

Application Submission: All Applications and associated materials shall be submitted by email in .pdf format. Instructions for completing the application are attached.

Certificate of Completion: Course providers shall provide participants a certificate of completion containing the following information:

- Name of participant
- Title of approved courses
- BBS approval #
- BBS approved certifications
- Date of the continuing education program
- Number of approved credit hours awarded, and
- Signature of authorized sponsor or instructor.

Any person or organization administering an approved course shall return a completed BBS Course Attendance form by email.

Participants: Participants must attend the complete course as presented by the instructor to receive credit hours approved by the Board. The organization or instructor of online courses shall plan and execute methods to verify the individual's attendance and completion of the course. No partial credit will be given to any participant who failed to complete the entire course as approved.

Board approval: All courses are approved for the calendar year in which application is made. Courses may be renewed so long as the referenced code is in effect, and the CEUs, certification and content remain unchanged. When the referenced code is updated, courses must be updated, and new approvals obtained.

Facility/training area: BBS Course may be delivered in person or online, or both, at the sponsor's option.
Course facilities shall include the following:

In Person Classes:

Sufficient seating capacity
ADA accessible facilities
Appropriate Audio/Visual devices for delivery
Writing surfaces for participants

Online Classes:

Web-accessible
ADA accessible delivery
Tech support available
Live and recorded courses permitted

In-person facilities shall comfortably and safely seat at least the number of attendees present in the room and shall be climate controlled, non-smoking, and sound controlled so that outside noise will not interfere with the training.

Ohio Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Henry P. Matthews

Organization: Matthews Electrical Services

Address: 1203 McKinley Place; Fostoria, Ohio 4830

E-mail: hpmatthews@matthewselectrical.net Telephone: 419-575-3488

Website: www.matthewselectrical.net

Conference Sponsor (if applicable)_____ Conference Email:_____

Check here if Course Renewal:_____Prior course number _____ (*i.e. BBS2018-429*)

Renewals will only be granted for identical content and certifications, within the current code cycle.
Attach a copy of prior course approval letter for confirmation. No further information is required.

New Course Information:

Course title: 2023 NEC Codes Changes Chapter 5-9

Course instructor: Henry P. Matthews

Course description: This course will cover some of the more significant code changes from Chapter 5-9 in the 2023 NEC.

Instructional hours per session: 4 Number of Sessions: at least one per quarter

Course Date(s) and Location:_____

Special Content:

Code Administration:_____ Conference Course: _____

Existing Buildings: _____ Conference Name: _____

Electrical Instruction: _____ Conference location:_____

Plumbing Instruction:_____

Course to be offered online?__✓___ **On Demand**_____ **Webinar**__✓___

Course Website: www.matthewselectrical.net

Detail online course participation confirmation method *(i.e. test, quizlets, participant activity confirmation*):
Surveys, polls, and roll call after each break will be conducted.

Course applicable for the following certifications

Residential Certifications Only: __✓___ Commercial Certifications: __✓___

Administrative Course, All Certifications: _____

Application materials included:

__✓___ Course Outline or Course Learning Objectives

__✓___ Presentation Materials/Slides (not required for roundtable courses)

__✓___ Assessment Materials (for online courses)

__✓___ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least on commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review. Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content. Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

Course applicable for the following certifications

This section represents a major change from previous BBS course approval forms.

1. If the course is only for residential certifications, check 'Residential Certifications Only'. The course, if approved, will be approved for all residential certifications.
2. If the course is appropriate for any commercial certifications, check Commercial Certifications. The course, if approved, will be approved for all commercial certification **AND** all residential certifications.
3. If the course is intended to meet required instruction in Code Administration (Chapter 1) or Existing Buildings (commercial or residential) check 'Administrative Course, All Certifications'.

Application Materials Included

This is a checklist for the course submitter's use, to be sure all materials necessary for review are included with the application. All materials should be submitted in .pdf format, along with the application, via email to Michael.Lane@com.ohio.gov or BBS@com.ohio.gov

BIOGRAPHY
Henry P. Matthews PE, CPE, CESCP, PVA

Henry has over 31 years of experience in the electrical design, construction, engineering and safety fields. He has a passion for teaching and mentoring.

Henry obtained his Bachelor of Science degree in Electrical Engineering from Penn State University in 1989.

He also earned a Master of Business Administration from Bowling Green State University in 2003.

In addition, Henry earned several certificates including:

- Plumbing and Electrician from Penn Foster Career School
- Welding from Owens Community College in Findlay, Ohio
- Residential Solar PV Systems from Solar Engineering International

Henry currently holds the following licenses, and memberships:

- Licensed Electrical Contractor in Ohio
- Licensed Training Agency in Ohio
- Licensed Professional Engineer in Ohio, Michigan, Kentucky, Indiana, Illinois, Wisconsin
- Certified Plant Engineer (CPE)
- Certified Building Operator (CBO)
- Certified Electrical Compliance Safety Professional (CESCP) by NFPA
- Solar PV Associate by the North American Board of Certified Energy Practitioners
- Electric Vehicle Infrastructure Training Program (EVITP) certification
- Senior Member of the Institute of Electrical and Electronic Engineers (IEEE)
- Member of the International Association of Electrical Inspectors (IAEI)
- Member of the National Fire Protection Association (NFPA)

Henry is currently employed as an Advanced Senior Engineer for Marathon Petroleum Company in Findlay, Ohio. During his 16 years at Marathon, Henry has worked as an Electrical Design Engineer, Project Engineer, Engineering Supervisor and currently as a Reliability Engineer.

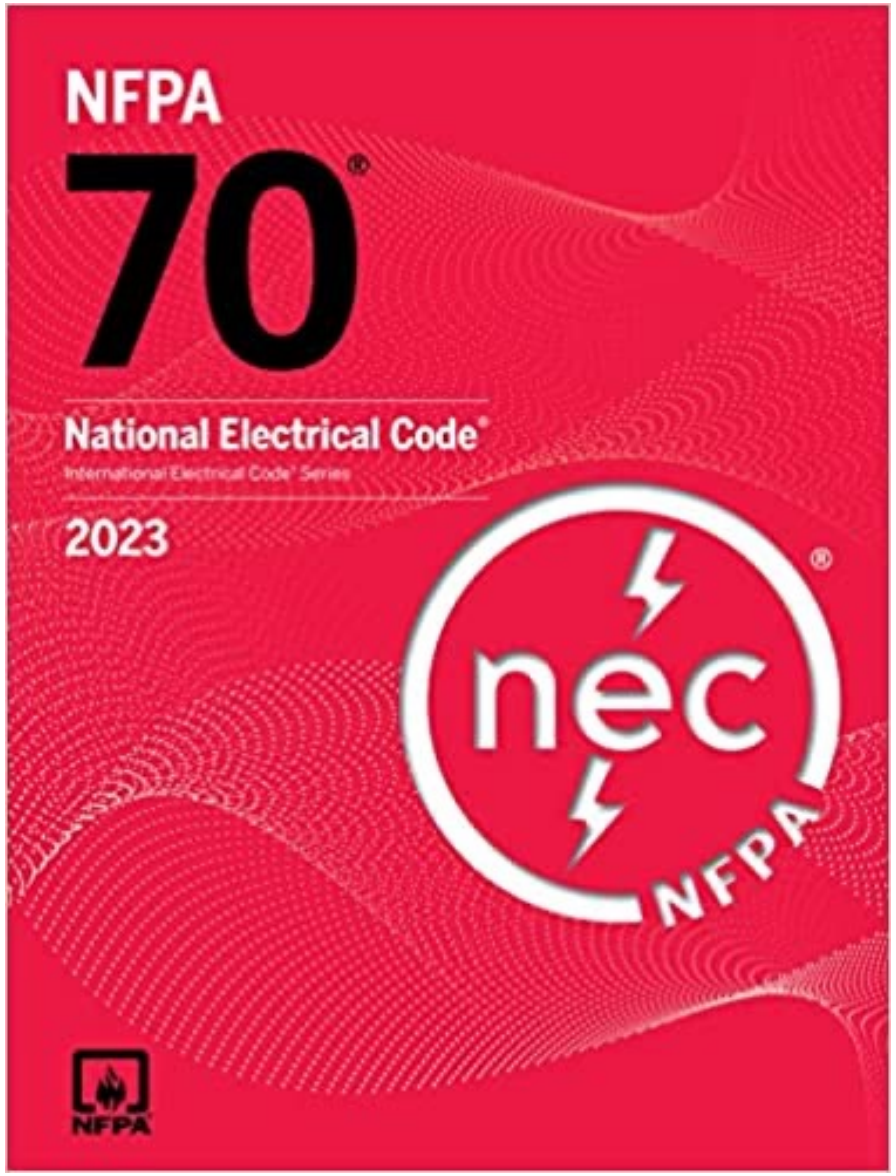
Henry is also the owner of Matthews Electrical Services, a small, but full-service electrical contractor company.

Prior to this, he worked 13 years as an Electrical Engineer and a Plant Engineering Manager in at Cooper Standard Automotive, a major automotive parts supplier in Bowling Green, Ohio

Henry is the past co-chair of American Petroleum Institute Recommended Practice 545 Lightning Protection for Above Ground Storage Tanks.

He was also past president of the Fostoria Toastmaster club.

Chapters 5-9



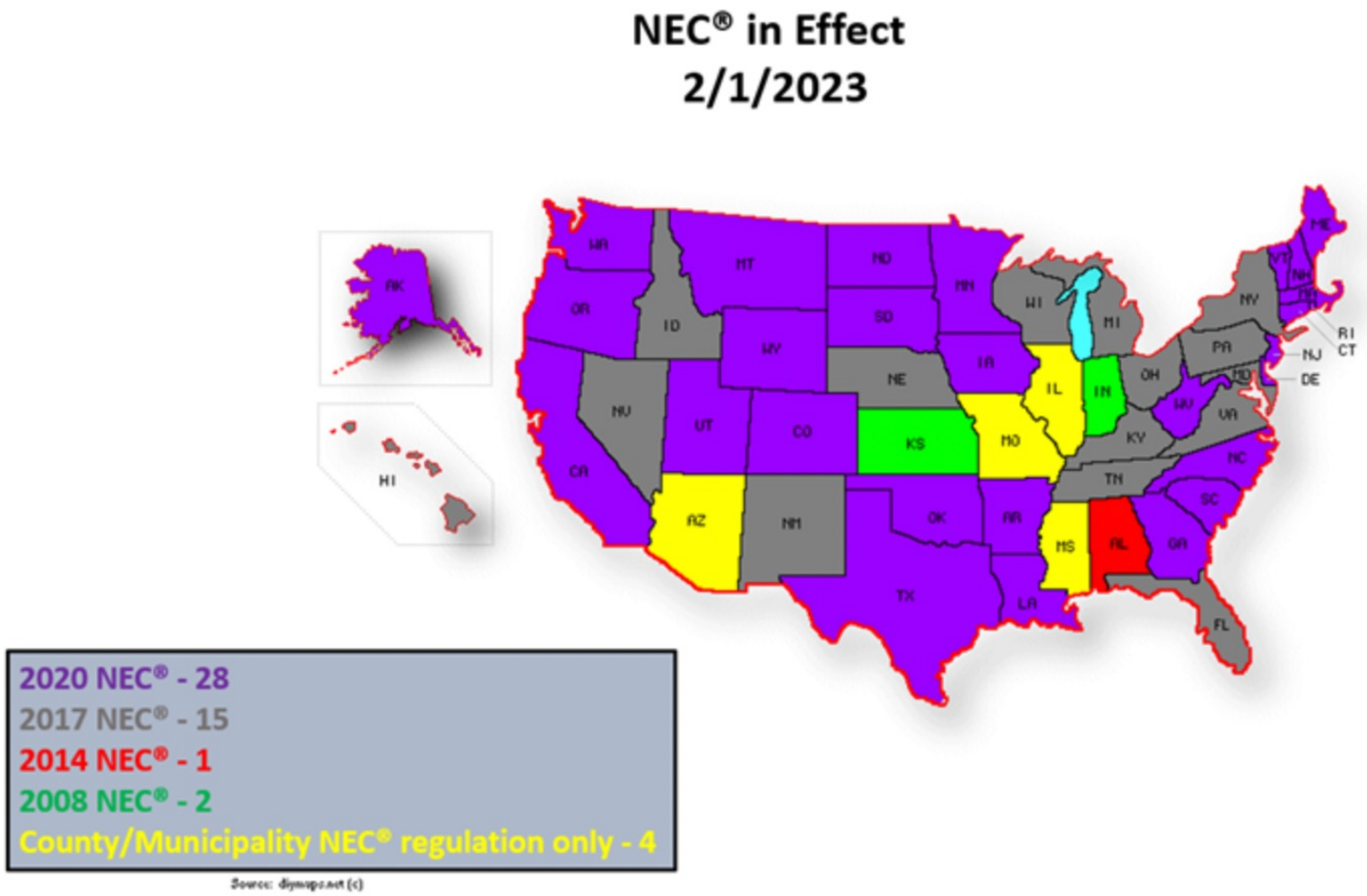
Notice!

This course is based on the 2023 NEC.

The 2023 NEC has not been adopted in Ohio

Presented for INFORMATIONAL PURPOSES ONLY.

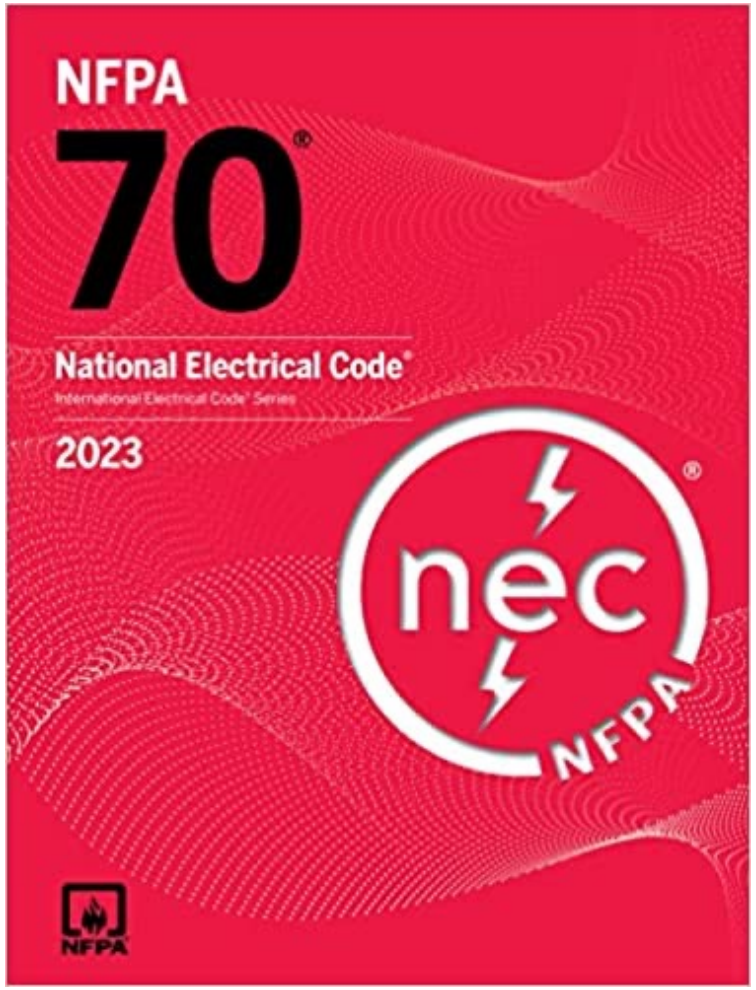
Current NEC Adoption

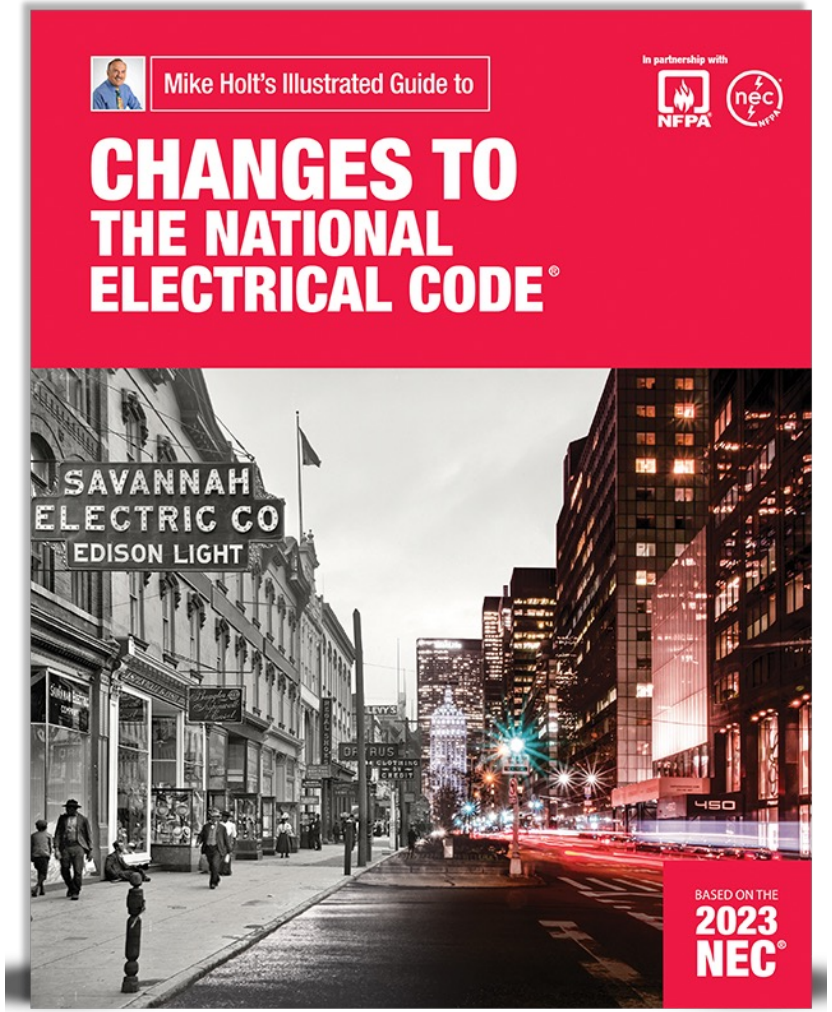


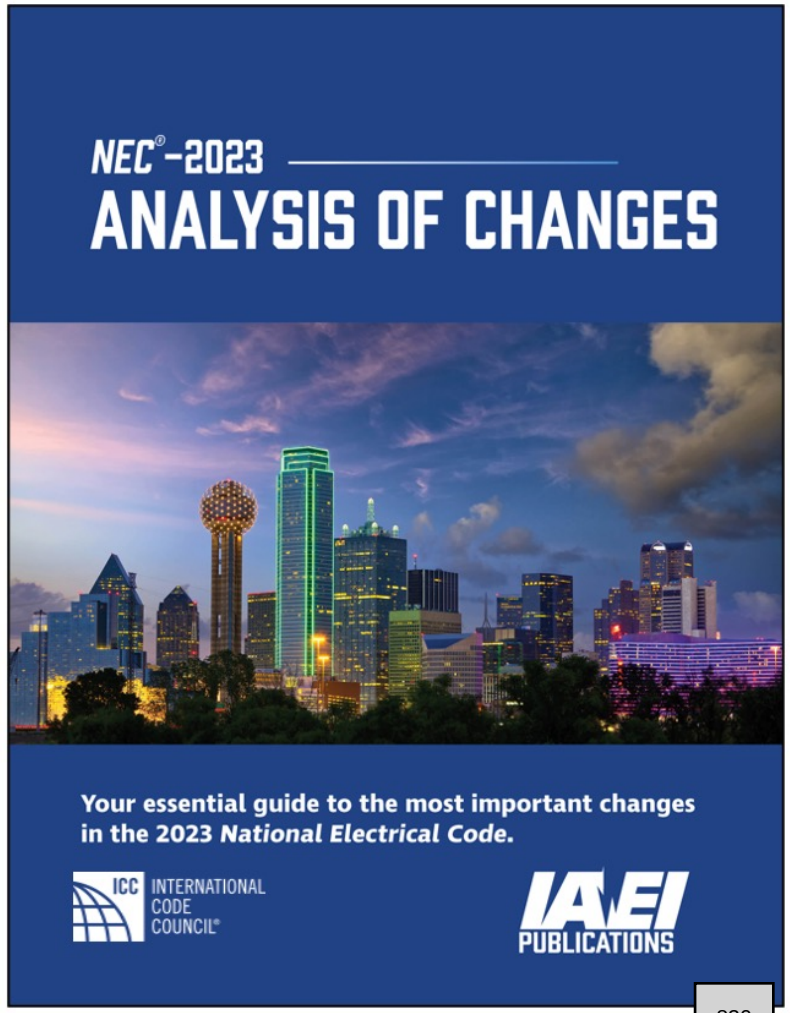
Source: www.nfpa.org

- *The 2022 California Electrical Code, California Code of Regulations Title 24, Part 3 is based on the 2020 edition of NFPA 70®, National Electrical Code®.*
- *The 2011 New York City Electrical Code is based on the 2008 edition of NFPA 70®, National Electrical Code®.*

Resources







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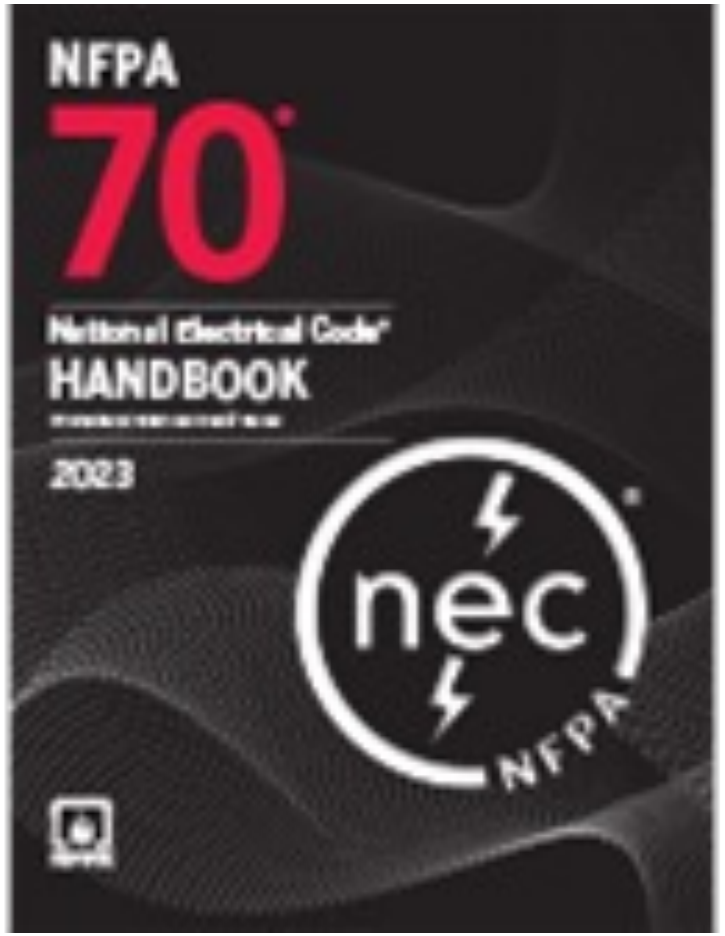
Resources



NFPA LiNK®

Terms Used During the Presentation

AHJ- Authority Having Jurisdiction

CMP- Code Making Panel

CPSC- Consumer Products Safety Commission

IAEI- International Association of Electrical Inspectors

ICSC- IAEI Codes and Standards Committee

NEC- National Electrical Code

NECA- National Electrical Contractors Association

NEMA- National Equipment Manufacturers Association

NFPA- National Fire Protection Association

UL- Underwriters Laboratories

Listed!

ARL
BACL
CSA
US
FM
IAPMO
EGS
US
ETL
Intertek
C
MET
US
US
N
NSF
QAI
PS
US
CERTIFIED
ELECTRICAL SAFETY
SwRI
TÜVRheinland
C
US
TÜV
NRTL
UL

833

Chapter 5
Equipment for General Use

- Chapter 500
- Chapter 505
- Chapter 515
- Chapter 517
- Chapter 530
- Chapter 547
- Chapter 550
- Chapter 551
- Chapter 555
- Chapter 590

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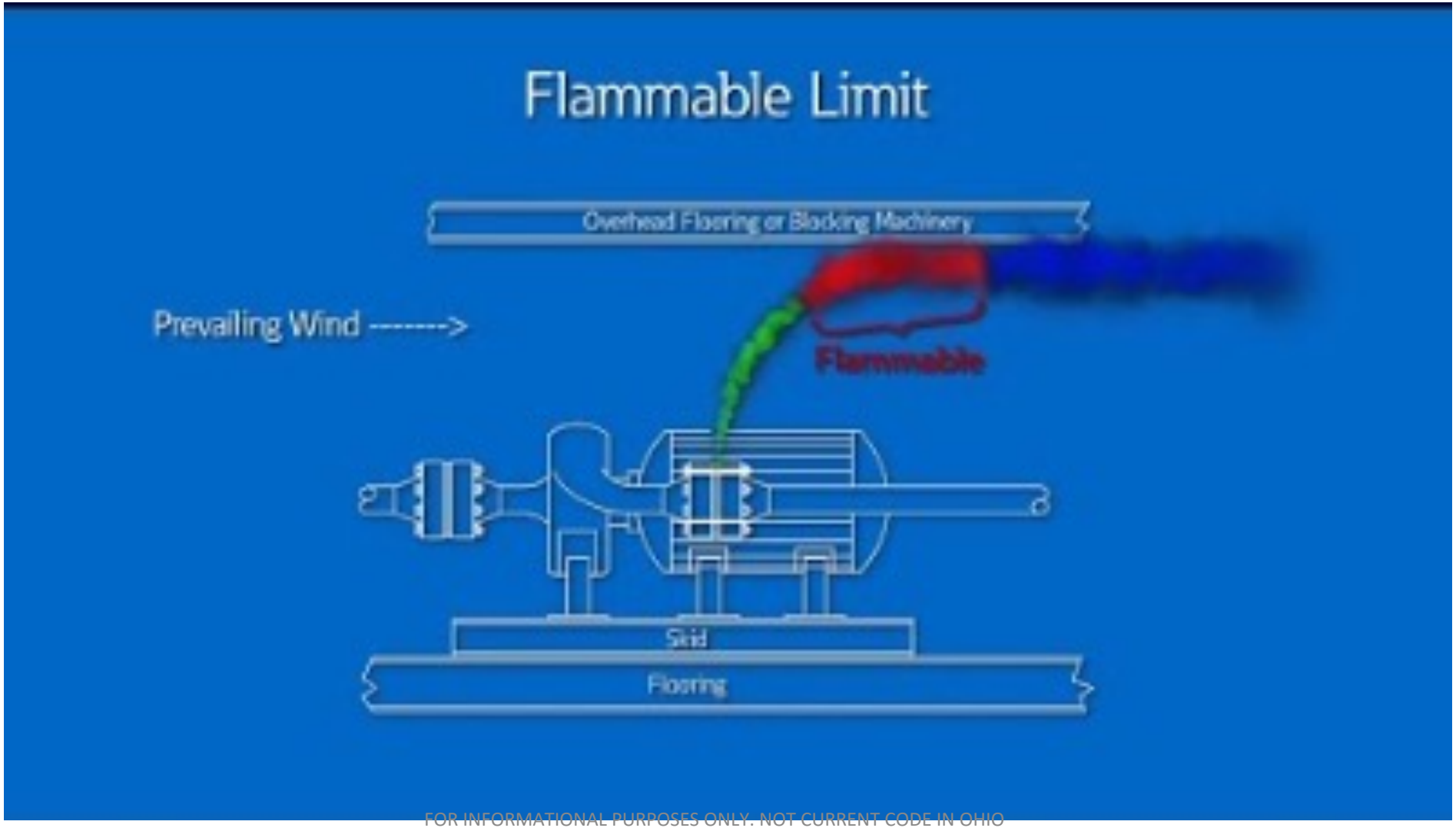
Mike Holt

Chapter 5

Hazardous Locations



500.4 Documentation

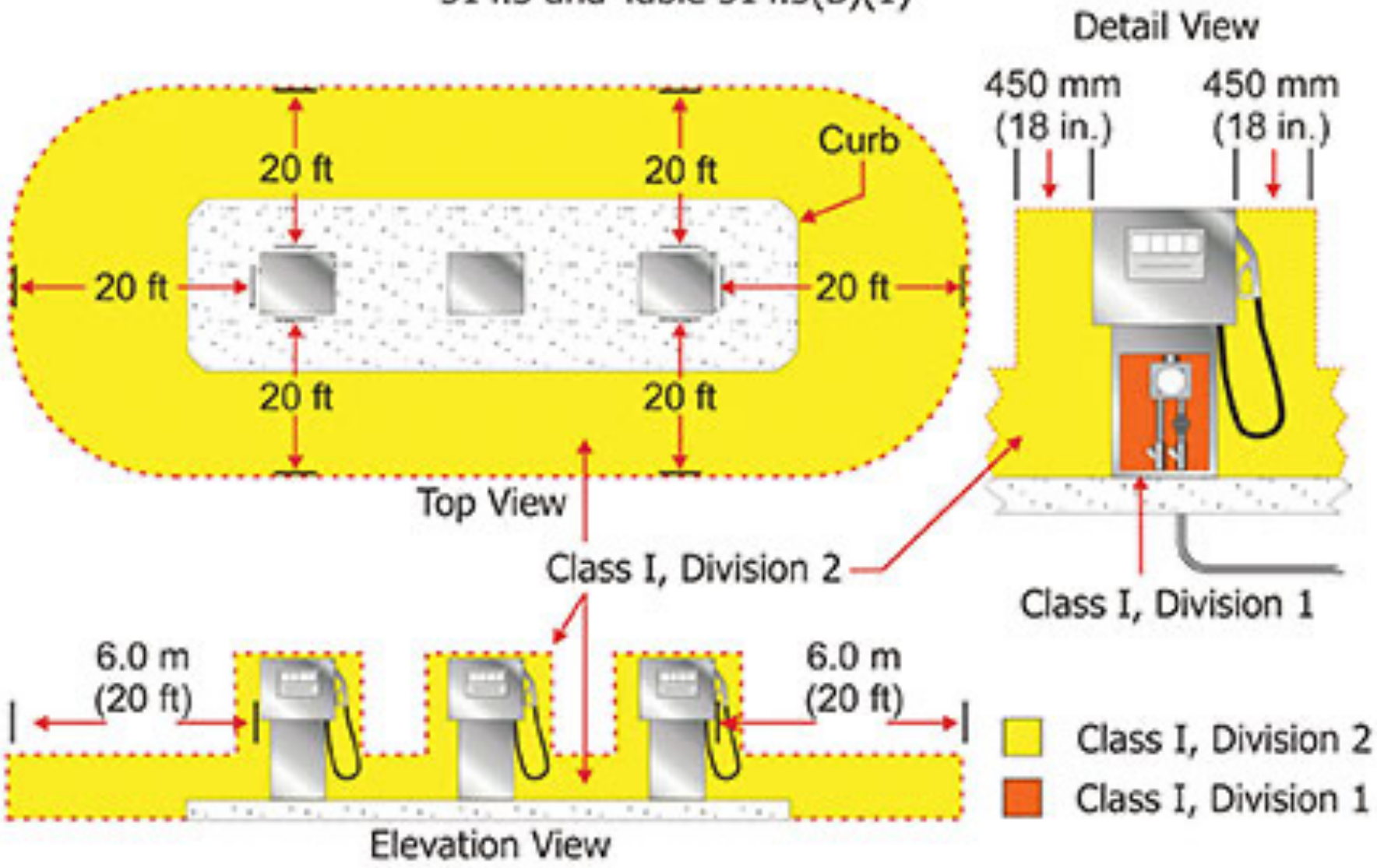
Added additional language to assist the authority having jurisdiction *(AHJ)* for requirements on documentation for hazardous *(classified)* locations

- Revised to require that the documentation provided includes an **area classification drawing**
- Will **create a consistent method** of documenting hazardous *(classified)* locations
- Documentation will clearly indicate the boundaries between the classified areas and unclassified areas
- New language will assist the electrical plans examiner, inspector, and installer verify the installation meets *NEC* requirements for all hazardous *(classified)* locations

NFPA LINK©

Motor Fuel Dispensing Facilities Area Classification

514.3 and Table 514.3(B)(1)



838

500.5(D)(1)(a) Combustible Fibers/Flyings

Previous language has been completely reworded to align with the new definition for combustible fibers/flyings and the edits for combustible dust

- Change involving Class III locations resulted from members of several technical committees as part of a Task Group
- Members from *NFPA 70, NFPA 499, NFPA 652, and NFPA 654* worked to develop new definitions that would provide consistency in all the documents
- Necessary for correlation with changes to *NEC Articles 502, 503, and 506* and with other *NFPA* dust-related standards
- Will help the industry determine the type of hazardous *(classified)* locations that exist

500.5(D)(1)(a) Combustible Fibers/Flyings

For information on Class III, Division 1 locations see 500.5(D)(1)(a) and (D)(1)(b)

Engineer Beth

See (a) for **combustible fibers/flyings**

See (b) for **ignitable fibers/flyings**

Photo courtesy of IAEI Achives

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Combustible Fibers and Flyings

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2020

(D) Class III Locations.

Class III locations shall be locations meeting the requirements of **500.5(D)(1)** and (D)(2).

(1) Class III, Division 1.

Class III, Division 1 locations shall include those locations specified in 500.5(D)(1)(a) and (D)(1)(b).

(a) *Combustible Fibers/Flyings.* Locations where nonmetal combustible fibers/flyings are in the air under normal operating conditions in quantities sufficient to produce explosible mixtures or where mechanical failure or abnormal operation of machinery or equipment might cause combustible fibers/flyings to be produced and might also provide a source of ignition through simultaneous failure of electrical equipment, through operation of protection devices, or from other causes shall be classified as Class III, Division 1. Locations where metal combustible fibers/flyings are present shall be classified as Class II, Division 1, Group E.

Informational Note No. 1: Such locations usually include some parts of rayon, cotton, and other textile mills; associated manufacturing and processing plants; cotton gins and cotton-seed mills; flax-processing plants; clothing manufacturing plants; woodworking plants; and establishments and industries involving similar hazardous processes or conditions.

Informational Note No. 2: Combustible fibers/flyings include flat platelet-shaped particulate such as metal flakes and fibrous board such as particle board.

2023

(D) Class III Locations.

Class III locations shall be locations meeting the requirements of **500.5(D)(1)** and (D)(2).

(1) Class III, Division 1.

Class III, Division 1 locations shall include those locations specified in **500.5(D)(1)(a)** and (D)(1)(b).

(a) *Combustible Fibers/Flyings.* Locations where nonmetal combustible fibers/flyings are in the air under normal operating conditions in quantities sufficient to produce explosible mixtures or where mechanical failure or abnormal operation of machinery or equipment might cause combustible fibers/flyings to be produced and might also provide a source of ignition through simultaneous failure of electrical equipment, through operation of protection devices, or from other causes shall be classified as Class III, Division 1. Locations where metal combustible fibers/flyings are present shall be classified as Class II, Division 1, Group E.

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Informational Note No. 2: Combustible fibers/flyings include flat platelet-shaped particulates, such as metal flakes, and fibrous board, such as particle board.

505.9(C) Equipment Suitable for Hazardous *(Classified)* Locations

The text was deleted at 505.9(C)(2)(4) referencing Table 505.9(C)(2)(4) with new text added to reference the new Chapter 9 Table 13

- The requirements at 505.9(C)(2)(4) discuss zone equipment marking requirements
- The new Table 13 in Chapter 9 provides a complete list of the types of protection for hazardous *(classified)* locations
- The table also improves the readability of 505.9(C)(2)(4)
- This new table was determined by the CMP to be a vast improvement over the previous Table 505.9(C)(2)(4)
- This table will assist the designer, contractors, and the AHJ in verifying compliance with the Code and the manufacturer's listing of the equipment installed in a hazardous *(classified)* location

505.9(C) Equipment Suitable for Hazardous *(Classified)* Locations Chapter 9 Table 13

Created a new Table 13 in Chapter 9 entitled Equipment Suitable for Hazardous *(Classified)* Locations

The requirements at 505.9(C)(2)(4) discuss zone equipment marking requirements was deleted

Table 13 in Chapter 9 provides a complete list of the types of protection for hazardous *(classified)* locations and improves the readability of 505.9(C)(2)(4) *[Zone Equipment- Protection]*

Table 13 will assist the electrical industry by providing an improved list of equipment suitable for various locations

Table 13 Equipment Suitable for Hazardous *(Classified)* Locations *(Example of Table Contents)*

	Area Classification	Type *(Level)* of Protection
Class I, Division 1	Pressurized Enclosures	Type X, for Class I
	Encapsulation *(Group II)*	ma
	Optical system with interlock	op sh, with EPL Ga^2
	Special protection *(Group II)*	sa

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Article 512 Cannabis Oil Equipment

Created a new article, which covers cannabis oil extraction equipment, booths, postprocessing equipment, and systems using flammable materials in commercial and industrial facilities

- The authorities having jurisdiction *(AHJ)* and other industry members have expressed concerns about safety
- Several fire and explosion hazards are associated with equipment used to process and extract plant oils from cannabis
- Flammable solvents such as butane, pentane, hexane, propane, and ethanol can be released during the processing and extraction of plant oils
- This includes high temperatures and high pressures, which increase the risk of fire and explosion
- This information is intended to address the hazards associated with the extraction of cannabis oil

Article 512 Cannabis Oil Equipment

Covers cannabis oil extraction equipment, booths, post processing equipment, and systems using flammable materials in commercial and industrial facilities

Article 512 Cannabis Oil Equipment and Cannabis Oil Systems Using Flammable Materials

Part I. General

512.1 Scope.

This article covers cannabis oil preparatory equipment, extraction equipment, booths, post-processing equipment, and systems using flammable materials (flammable gas, flammable liquid–produced vapor, combustible liquid–produced vapor) in commercial and industrial facilities.

Informational Note No. 1: See ANSI/UL 1389, *Plant Oil Extraction Equipment for Installation and Use in Ordinary (Unclassified) Locations and Hazardous (Classified) Locations*, for information on cannabis oil equipment and systems for hazardous (classified) locations.

Informational Note No. 2: See NFPA 1, *Fire Code*; NFPA 55, *Compressed Gases and Cryogenic Fluids Code*; NFPA 58, *Liquefied Petroleum Gas Code*; and ICC IFC, *International Fire Code*, together with the manufacturer's installation instructions, for information on the installation of cannabis oil equipment and systems.

FOR INFORMATIONAL PURPOSES ONLY. NOT CURRENT CODE IN OHIO

City of Walkabout Stumbling

Commercial Cannabis Business License 2022

Leslie's Fine Cannabis, Hookah and Fishing Tours
(with locations in Colorado, California and Pakistan)

Owner: Leslie Tokenoften
Location: Walkabout Stumbling, Texas

Type of Permit
- Cultivation
- Sales
- Dining
- Fishing

Annual Inspection and Renew of Cannabis Operation

April 20, 2023

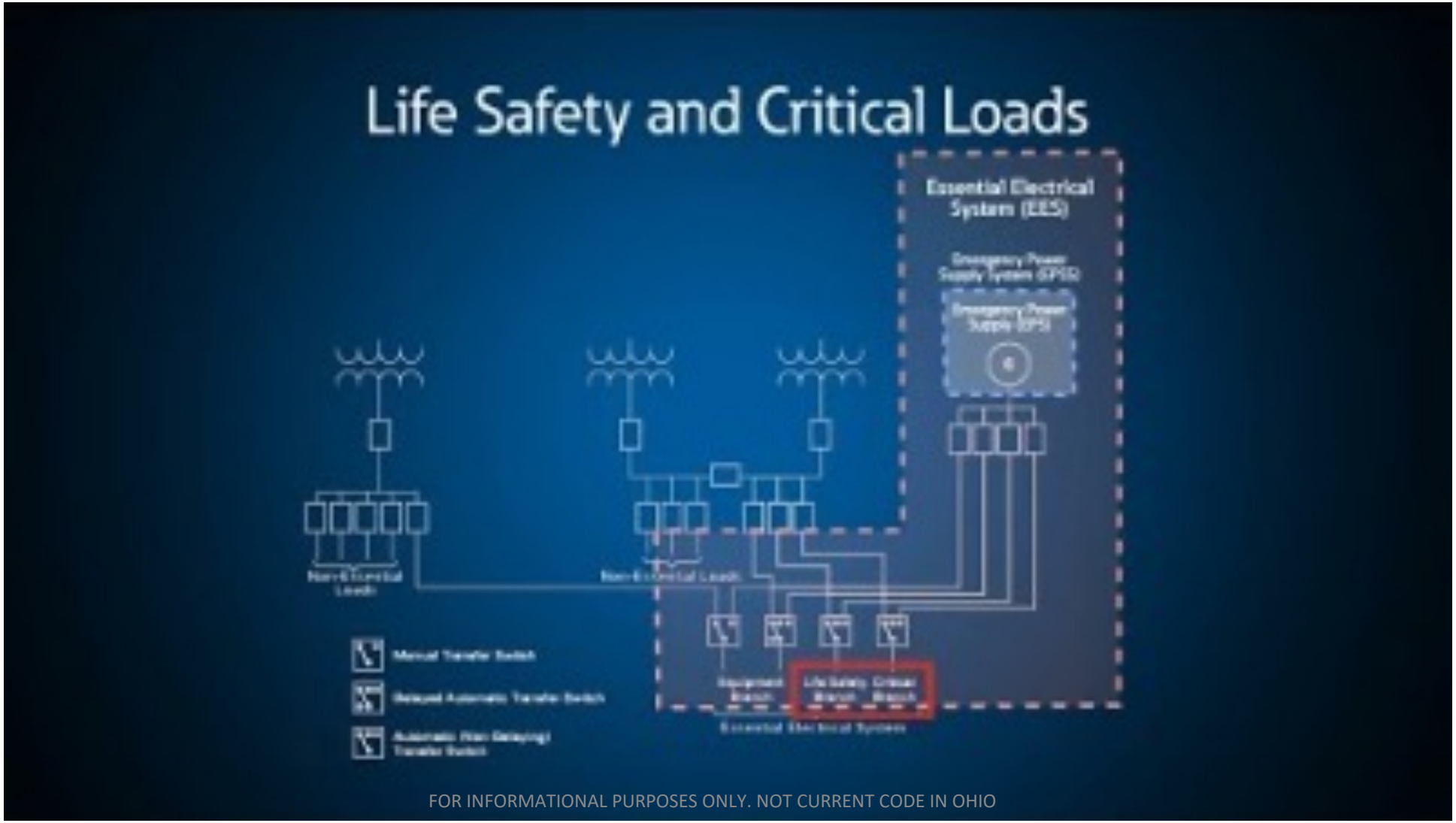
Annual Permit fee: $4,200.00

By Order of: *Kumar Vansmokin*

This processing facility has the proper city, state and federal permits to grow and sale the plants you see in this photo.

Photo courtesy of Steve Thomas

Article 517 Health Care Facilities

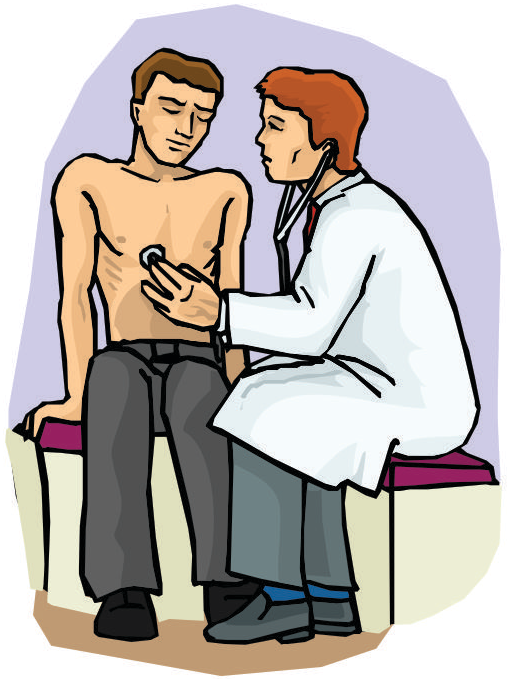


Article 517 Health Care Facilities

This edition of the *NEC* has completed the phased approach of changing the references from critical, general, basic, and support spaces to Category 1, 2, 3, and 4 Spaces.

- Starting with the 2014 *NEC*, the migration from the previous terms started
- For the 2017 *NEC*, the Category terms as parenthetical references were included, and then the order of parenthetical references was reversed in the 2020 *NEC*
- This "phased approach" of aligning with NFPA 99 *(Health Care Facilities Code)* was completed this cycle, and the parenthetical references were deleted, leaving only the Category space references
- This will allow for harmony between the two documents with fewer conflicts between designers and installers/inspectors
- Consistent use of the terminology related to patient care and support spaces will bring better useability to the *Code*

Article 517 Health Care Facilities



Category 1 Space:
- Special care units patient rooms used for critical care
- Intensive care
- Special care treatment rooms
  - Angiography laboratories
  - Cardiac catheterization labs
  - Delivery rooms
  - Operating rooms
  - Post-anesthesia care units
  - Trauma rooms

Category 2 Space:
- Inpatient bedrooms
- Dialysis rooms
- In vitro fertilization rooms
- Procedural rooms
- Similar rooms

Category 3 Space:
- Examination or treatment rooms in clinics
- Medical and dental offices
- Nursing homes
- Limited care facilities

Category 4 Space:
- Anesthesia work rooms
- Sterile supply
- Laboratories
- Morgues
- Waiting rooms
- Utility rooms
- Lounges

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517.6 Patient Care-Related Electrical Equipment

Reconditioning requirements found elsewhere in the *Code* **do not apply** to patient care-related electrical equipment

- This electrical equipment is different from the other electrical equipment
- It will be reconditioned or recertified in accordance with U.S. Federal Food, Drug, and Cosmetic Act *(FDCA)* when relocated
- Marking and labeling requirements found at 110.21(A)(2) and other restrictions on the use of reconditioned equipment **will not apply** to electrical equipment used in these locations

NFPA LINK©

517.6 Patient Care-Related Electrical Equipment

Reconditioning requirements for electrical equipment located in health care facilities

Reconditioning requirements found elsewhere in the *NEC* do not apply to patient care-related electrical equipment within a health care facility

Note: For the 2023 *NEC* the xxx.2 sections will become placeholders in the various article that contain requirements for reconditioning of electrical equipment

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517.22 Demand Factors *(Health Care Facilities)*

2 New Tables

Table 220.110(1) - Demand Factors for Receptacles Supplied by General-Purpose Branch Circuits in Category 1 and Category 2 Patient Care Spaces

Table 220.110(2) - Demand Factors for Receptacles Supplied by General-Purpose Branch Circuits in Category 3 and Category 4 Patient Care Spaces

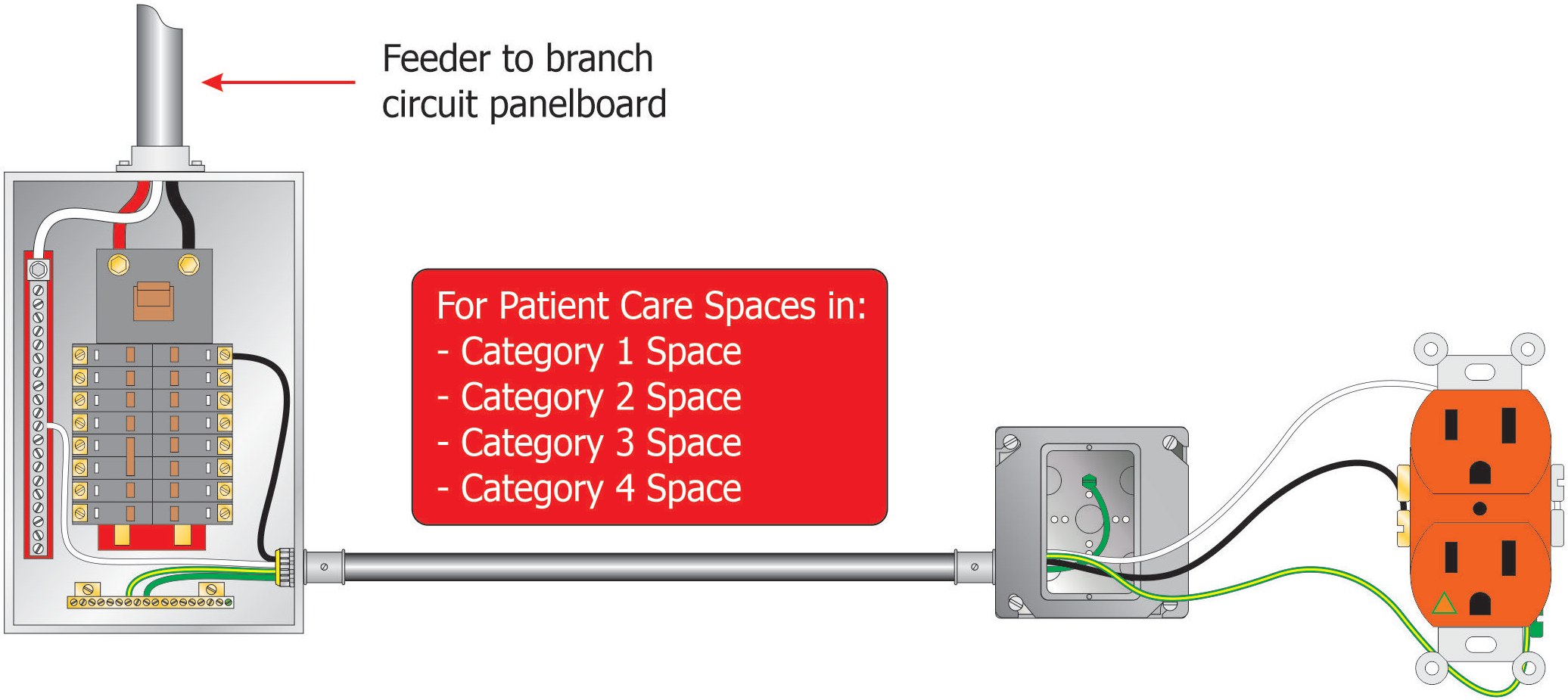

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Table 220.110(1) Demand Factors for Receptacles Supplied by General-Purpose Branch Circuits in Category 1 and Category 2 Patient Care Spaces	
Portion of Receptacle Load to Which Demand Factor Applies (Volt-Amperes)	**Demand Factor (%)**
First 5000 or less	100
From 5001 to 10,000	50
Remainder over 10,000	25

N

Table 220.110(2) Demand Factors for Receptacles Supplied by General-Purpose Branch Circuits in Category 3 and Category 4 Patient Care Spaces	
Portion of Receptacle Load to Which Demand Factor Applies (Volt-Amperes)	**Demand Factor (%)**
First 10,000 or less	100
Remainder over 10,000	50

Essential Electrical System.

A system comprised of alternate power sources and all connected distribution systems and ancillary equipment, designed to ensure continuity of electrical power to designated areas and functions of a health care facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system. [**99**:3.3.52] (517) (CMP-15)

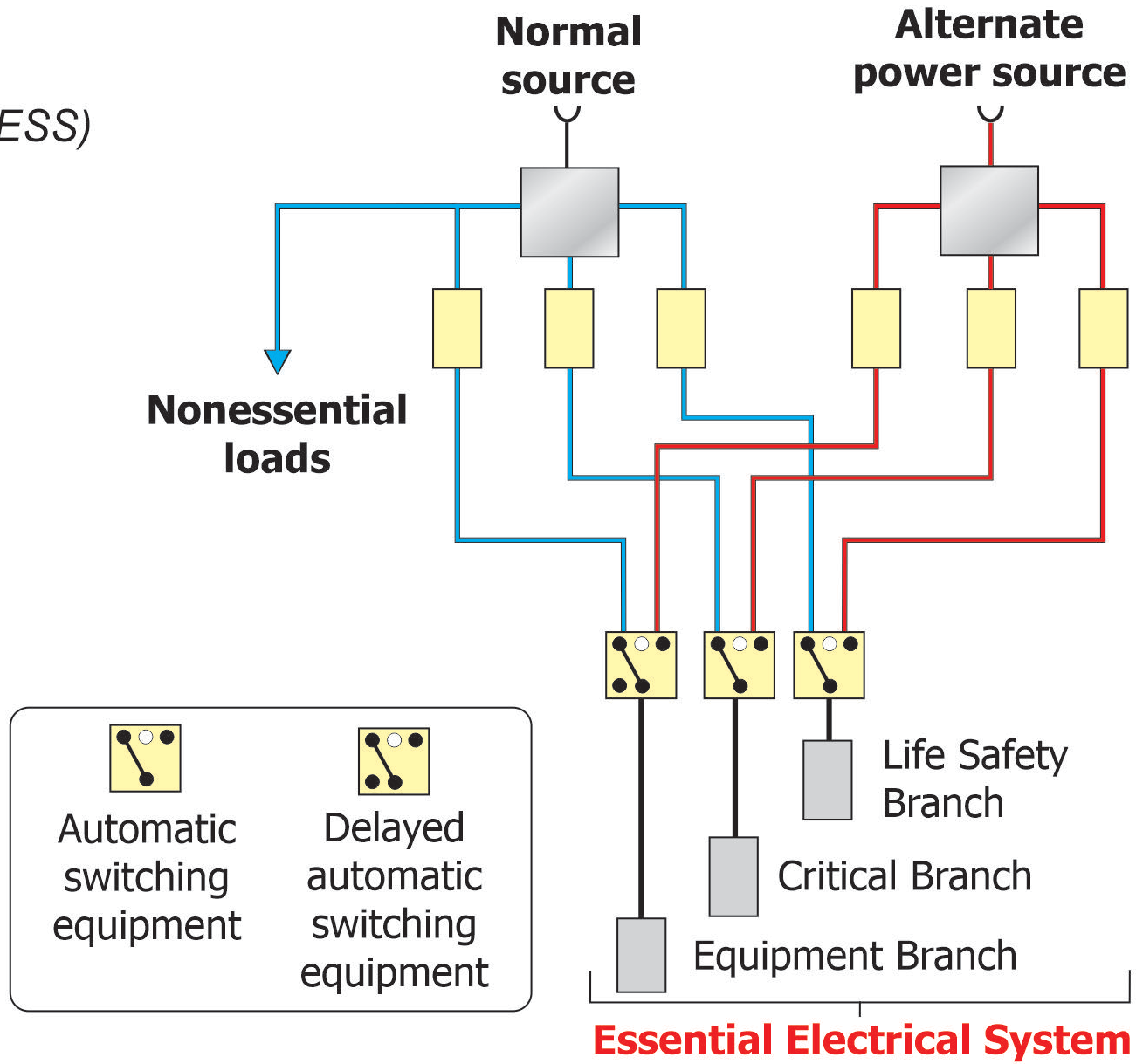
517.30 Sources of Power *(Health Care Facilities)*

Revisions were also made to clarify that the Essential Electrical System *(ESS)* must have two independent sources

- one on-site
- one off-site

Two new list items added at 517.30(B)(4) and (5) for:

- Energy Storage Systems
- Health Care Microgrids



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518.2 General Classification- (A) Examples

Casinos and gaming facilities are now included in the list of **assembly occupancy** examples

- Substantiation shows that casinos and gaming facilities are more prevalent than some of the assembly occupancies already included in the list of current examples
- Electrical equipment that is suitable for use in exhibition halls is also installed in casinos and similar gaming facilities
- Including these items in the list format will ensure that there is no confusion or misapplications of *NEC* requirements for these locations

Photo courtesy of IAEI Archives

518.5 Supply *(Assembly Occupancies)*

The section was reorganized for clarity and revised which included new requirements for commercial appliance outlet centers and panelboard orientation

- Revisions to specifically reference commercial outlet appliance centers
- Outlet appliance centers have unique features, such as panelboards in a face face-up position
- Section 408.43 no longer permits the mounting of panelboards in a face face-up position
- It was necessary to permit the orientation for listed commercial appliance outlet centers designed for in-floor mounting
- Marking requirements for use by qualified persons, identifying the disconnecting means location, and a shock hazard warning requiring disconnection before servicing were all included to provide additional safety to the worker

518.5 Supply *(Assembly Occupancies)*

Outlet appliance centers have unique features such as panelboards in a face-up position

It was necessary to permit the orientation for **listed commercial appliance outlet centers** designed for in-floor mounting

90.3 Code Arrangement

CHAPTER 1 - General
CHAPTER 2 - Wiring and Protection
CHAPTER 3 - Wiring Methods and Materials
CHAPTER 4 - Equipment for General Use

Applies generally to all electrical installations

CHAPTER 5 - Special Occupancies
CHAPTER 6 - Special Equipment
CHAPTER 7 - Special Conditions

Supplements or modifies Chapters 1 through 7

(Interior View)

Photos courtesy of Hubbell Incoporated

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518.5 Supply *(Assembly Occupancies)*

Outlet appliance centers have unique features such as panelboards in a face face-up position

It was necessary to permit the orientation for **listed commercial appliance outlet centers** designed for in-floor mounting

90.3 Code Arrangement

CHAPTER 1 - General
CHAPTER 2 - Wiring and Protection
CHAPTER 3 - Wiring Methods and Materials
CHAPTER 4 - Equipment for General Use

Applies generally to all electrical installations

CHAPTER 5 - Special Occupancies
CHAPTER 6 - Special Equipment
CHAPTER 7 - Special Conditions

Supplements or modifies Chapters 1 through 7

Panelboards not be installed in the **face-up position**

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N **(A) Power Outlets and Commercial Appliance Outlet Centers.**

(1) Overcurrent Protection.

Power outlets and commercial appliance outlet centers shall provide overcurrent protection or shall be protected by overcurrent devices.

(2) Accessibility.

Overcurrent devices, power outlets, and commercial appliance outlet centers shall not be accessible to the general public.

(3) Equipment Grounding Conductor Connections.

Connecting means for an equipment grounding conductor shall be provided.

(4) Markings.

Power outlets and commercial appliance outlet centers shall be marked as follows:

FOR USE BY QUALIFIED PERSONS ONLY. RISK OF ELECTRIC SHOCK.
DISCONNECT ALL POWER BEFORE SERVICING. DISCONNECTING MEANS LOCATION:

(5) Panelboard Orientation.

A panelboard installed in a listed commercial appliance outlet center designed for in-floor mounting shall be permitted to be orientated in the face-up position, if such orientation is part of the listing, and **408.43** shall not apply.

Section 547.26
Physical Protection (Agricultural Buildings)

- Nonmetallic cables will be prohibited from being concealed within walls and above ceilings of buildings that are connected or attached to livestock confinement areas.
- Rodents and pests can damage wiring

865

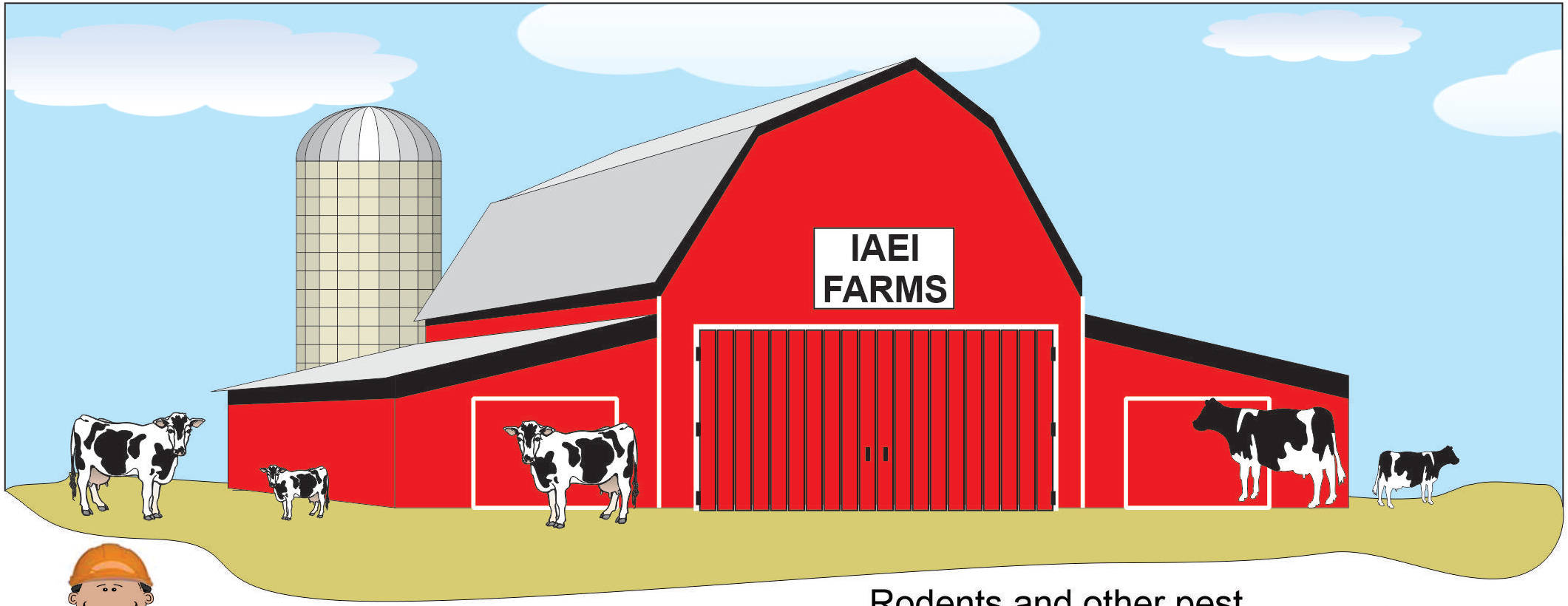
547.26 Physical Protection *(Agricultural Buildings)*

Nonmetallic cables will be prohibited from being concealed within walls and above ceilings of buildings that are contiguous with or physically adjoin livestock confinement areas

- It has been substantiated that rodents and other pests have caused damage to wiring systems such as nonmetallic sheathed cables
- There is also a requirement that protection is to be provided for all types of electrical wiring that are subject to physical damage
- Electrical wiring installed in this environment should be protected against physical damage

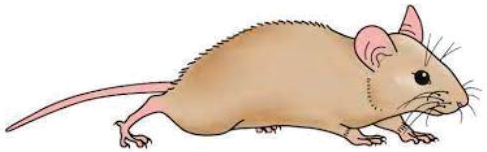
547.26 Physical Protection *(Agricultural Buildings)*

Nonmetallic cables will be prohibited from being concealed within walls and above ceilings of buildings that are **contiguous with or physically adjoin** livestock confinement areas



All types of electrical wiring requires protection from physical damage

Rodents and other pest damage wiring systems



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2020

2023

547.26 Physical Protection.

All electrical wiring and equipment subject to physical damage shall be protected.

Nonmetallic cables shall not be permitted to be concealed within walls and above ceilings of buildings (i.e., offices, lunchrooms, ancillary areas, etc.) or portions thereof, which are contiguous with or physically adjoined to livestock confinement areas.

Informational Note: Rodents and other pests are common around such installations and will damage nonmetallic cable by chewing the cable jacket and conductor insulation concealed within walls and ceilings of livestock containment areas of agricultural buildings.

868

547.44 Equipotential Planes and Bonding of Equipotential Planes

Clarifies the indoor and outdoor locations requiring equipotential planes and specifies the bonding locations for these planes at **agricultural buildings**

- Text provides clarification on where the equipotential plane can be connected in agricultural environments
- Bonding should take place to the following items:
  - a circuit equipment grounding conductor *(EGC)*
  - any metal part connected to a circuit equipment grounding conductor
  - the grounding electrode conductor *(GEC)*
  - any grounding electrode of the grounding electrode system *(GEC)* or
  - the equipment-grounding terminal in a panelboard

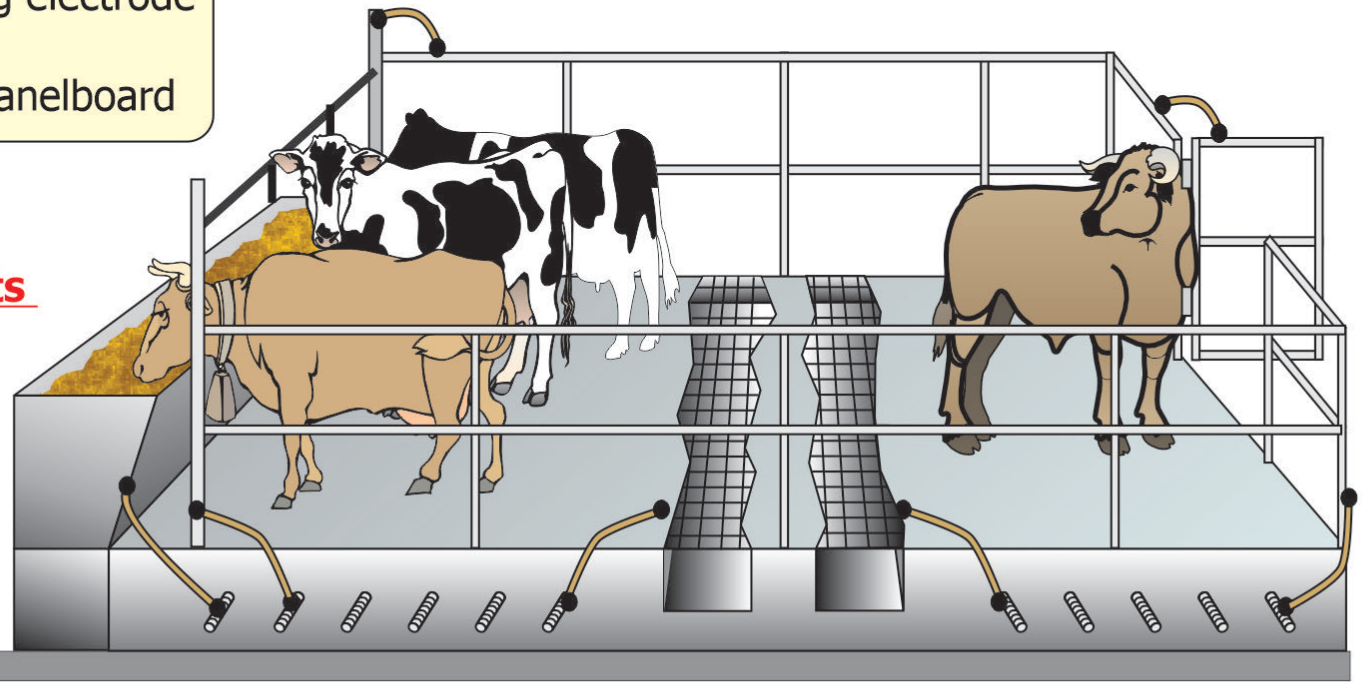
547.44 Equipotential Planes and Bonding of Equipotential Planes

Clarifies the indoor and outdoor locations requiring equipotential planes and specifies the bonding locations for these planes at **agricultural buildings**

Bonding should take place to the following items:

- a circuit equipment grounding conductor *(EGC)*
- any metal part connected to a circuit equipment grounding conductor
- the grounding electrode conductor *(GEC)*
- any grounding electrode of the grounding electrode system *(GEC)* or
- the equipment-grounding terminal in a panelboard

Livestock are very susceptible to currents in the agricultural environment



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Episode 23
How can Step Voltage Accidents be Prevented?

Mobile Homes, Manufactured Homes and Mobile Home Parks

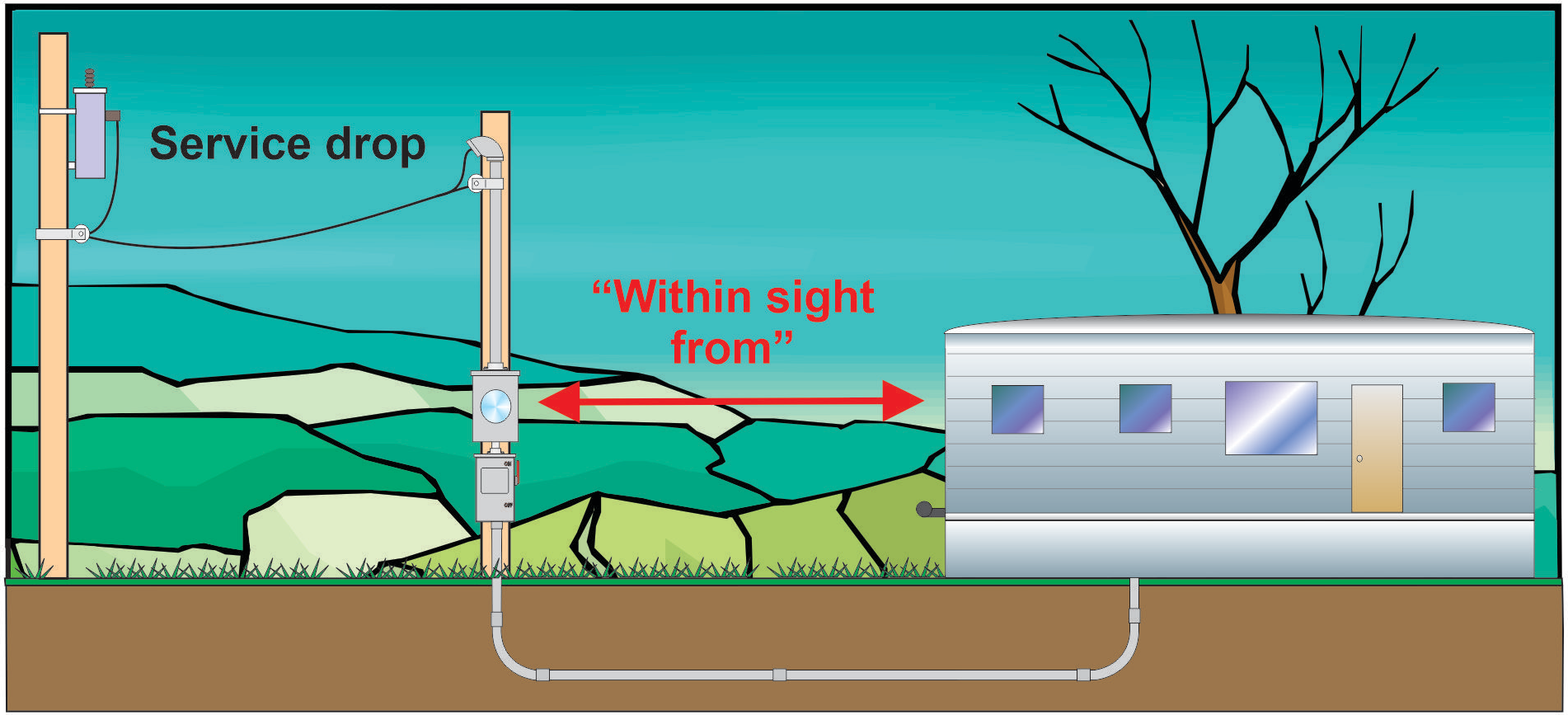
550.32(A) Service Equipment

The electrical service disconnect can now be located **“within sight from”** the mobile home as opposed to the previously required 30 feet

- Service equipment cannot be installed in or on mobile homes
- The service disconnect can also serve as the emergency disconnect *(230.85)*
- “Within sight from” is a defined term in Article 100 *[see In Sight From (Within Sight From, Within Sight)(purview of CMP-1)]*
  - Visible and not more than 15 m *(50 feet)*
- Reference 250.32 in the *NEC* for requirements concerning grounding
- **Note:** Manufactured homes *(with permanent foundation)* are not required to have remote service equipment

NFPA LINK©

550.32(A) Service Equipment *(Mobile Homes)*



Note from the Electrical Inspector:

- Service equipment cannot be installed in or on the mobile home
- Can serve as the emergency disconnect per 230.85
- Must be "within sight from" the mobile home *(see Article 100)*

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Next Steps

A Certificate of Completion will be emailed to those who successfully completed course

4 hours of Code Class Hours will be reported to the OCILB for Code Continuing Education Credits

Contact instructor at hpmatthews@matthewselectrical.net for any questions or comments

Make sure you completely sign out of webinar after the next slide!

THANK YOU

File Attachments for Item:

EC-16 2023 NEC Significant Changes Overview (Matthews Electrical Services)

All certifications (4 hours)

BIOGRAPHY
Henry P. Matthews PE, CPE, CESCP, PVA

Henry has over 31 years of experience in the electrical design, construction, engineering and safety fields. He has a passion for teaching and mentoring.

Henry obtained his Bachelor of Science degree in Electrical Engineering from Penn State University in 1989.

He also earned a Master of Business Administration from Bowling Green State University in 2003.

In addition, Henry earned several certificates including:

- Plumbing and Electrician from Penn Foster Career School
- Welding from Owens Community College in Findlay, Ohio
- Residential Solar PV Systems from Solar Engineering International

Henry currently holds the following licenses, and memberships:

- Licensed Electrical Contractor in Ohio
- Licensed Training Agency in Ohio
- Licensed Professional Engineer in Ohio, Michigan, Kentucky, Indiana, Illinois, Wisconsin
- Certified Plant Engineer (CPE)
- Certified Building Operator (CBO)
- Certified Electrical Compliance Safety Professional (CESCP) by NFPA
- Solar PV Associate by the North American Board of Certified Energy Practitioners
- Electric Vehicle Infrastructure Training Program (EVITP) certification
- Senior Member of the Institute of Electrical and Electronic Engineers (IEEE)
- Member of the International Association of Electrical Inspectors (IAEI)
- Member of the National Fire Protection Association (NFPA)

Henry is currently employed as an Advanced Senior Engineer for Marathon Petroleum Company in Findlay, Ohio. During his 16 years at Marathon, Henry has worked as an Electrical Design Engineer, Project Engineer, Engineering Supervisor and currently as a Reliability Engineer.

Henry is also the owner of Matthews Electrical Services, a small, but full-service electrical contractor company.

Prior to this, he worked 13 years as an Electrical Engineer and a Plant Engineering Manager in at Cooper Standard Automotive, a major automotive parts supplier in Bowling Green, Ohio

Henry is the past co-chair of American Petroleum Institute Recommended Practice 545 Lightning Protection for Above Ground Storage Tanks.

He was also past president of the Fostoria Toastmaster club.

APPLICATION FOR CONTINUING EDUCATION APPROVAL
COURSE CONDITIONS AND GUIDELINES

The Ohio Board of Building Standards is committed to the ongoing education and professional development of board-certified personnel through the delivery of high-quality, accurate and engaging professional continuing education content. To this end, the Board reviews and approves Continuing Education Courses for building department personnel.

Board approval is granted for course instruction on current codes and standards, including the OBC, OMC, OPC, and RCO, and any other content areas directly related to the responsibilities of the certification for which credit is being requested.

Promotion: Any person or organization promoting an approved course is required to make full and accurate disclosure regarding course title, course approval number, number of credit hours, categories for which the BBS has approved the class, and fees in promotion materials and advertising. ***The Board does not grant retroactive approval. It is recommended that courses be submitted for approval well in advance of any scheduling of classes and advertising***. Advertising may not falsely state BBS approval before approval is granted. Course providers may state that BBS approval is pending.

Application Submission: All Applications and associated materials shall be submitted by email in .pdf format. Instructions for completing the application are attached.

Certificate of Completion: Course providers shall provide participants a certificate of completion containing the following information:

- Name of participant
- Title of approved courses
- BBS approval #
- BBS approved certifications
- Date of the continuing education program
- Number of approved credit hours awarded, and
- Signature of authorized sponsor or instructor.

Any person or organization administering an approved course shall return a completed BBS Course Attendance form by email.

Participants: Participants must attend the complete course as presented by the instructor to receive credit hours approved by the Board. The organization or instructor of online courses shall plan and execute methods to verify the individual's attendance and completion of the course. No partial credit will be given to any participant who failed to complete the entire course as approved.

Board approval: All courses are approved for the calendar year in which application is made. Courses may be renewed so long as the referenced code is in effect, and the CEUs, certification and content remain unchanged. When the referenced code is updated, courses must be updated, and new approvals obtained.

Facility/training area: BBS Course may be delivered in person or online, or both, at the sponsor's option.
Course facilities shall include the following:

In Person Classes:
Sufficient seating capacity
ADA accessible facilities
Appropriate Audio/Visual devices for delivery
Writing surfaces for participants

Online Classes:
Web-accessible
ADA accessible delivery
Tech support available
Live and recorded courses permitted

In-person facilities shall comfortably and safely seat at least the number of attendees present in the room and shall be climate controlled, non-smoking, and sound controlled so that outside noise will not interfere with the training.

Ohio Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Henry P. Matthews

Organization: Matthews Electrical Services

Address: 1203 McKinley Place; Fostoria, Ohio 4830

E-mail: hpmatthews@matthewselectrical.net Telephone: 419-575-3488

Website: www.matthewselectrical.net

Conference Sponsor (if applicable)_____ Conference Email:_____

Check here if Course Renewal:_____Prior course number _____ (*i.e. BBS2018-429*)

Renewals will only be granted for identical content and certifications, within the current code cycle.
Attach a copy of prior course approval letter for confirmation. No further information is required.

New Course Information:

Course title: 2023 NEC Significant Code Changes Overview

Course instructor: Henry P. Matthews

Course description: This course will cover approximately 30 of the most significant code changes in the 2023 NEC

Instructional hours per session: 4 Number of Sessions: at least one per quarter

Course Date(s) and Location:_____

Special Content:

Code Administration:_____ Conference Course: _____

Existing Buildings: _____ Conference Name: _____

Electrical Instruction: _____ Conference location:_____

Plumbing Instruction:_____

Course to be offered online?__✓___ **On Demand**_____ **Webinar**__✓___

Course Website: www.matthewselectrical.net

Detail online course participation confirmation method *(i.e. test, quizlets, participant activity confirmation*):

Surveys, polls, and roll call after each break will be conducted.

Course applicable for the following certifications

Residential Certifications Only: __✓___ Commercial Certifications: __✓___

Administrative Course, All Certifications: _____

Application materials included:

__✓___ Course Outline or Course Learning Objectives

__✓___ Presentation Materials/Slides (not required for roundtable courses)

__✓___ Assessment Materials (for online courses)

__✓___ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least on commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review. Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content. Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

Course applicable for the following certifications

This section represents a major change from previous BBS course approval forms.

1. If the course is only for residential certifications, check 'Residential Certifications Only'. The course, if approved, will be approved for all residential certifications.
2. If the course is appropriate for any commercial certifications, check Commercial Certifications. The course, if approved, will be approved for all commercial certification **AND** all residential certifications.
3. If the course is intended to meet required instruction in Code Administration (Chapter 1) or Existing Buildings (commercial or residential) check 'Administrative Course, All Certifications'.

Application Materials Included

This is a checklist for the course submitter's use, to be sure all materials necessary for review are included with the application. All materials should be submitted in .pdf format, along with the application, via email to Michael.Lane@com.ohio.gov or BBS@com.ohio.gov

2023 NEC Significant Code Changes Overview

Outline

NEC Chapters and sections covered

- Scope: Article 90
- Chapters 1-9
- Annexes

Other Resources:

- 2021 NFPA 70E
- 2023 NFPA 70B
- NFPA 79

Referenced Websites:

- www.NFPA.org
  www.IAEI.org (International Association of Electrical Inspectors)
- www.mikeholt.com
- www.esfi.org Electrical Safety Foundation International)
- Various motor and transformer manufacturer websites.

Course Content:

- How to be involved in the code-making process
- How changes are integrated into the NEC
- Focus areas of the 2023 NEC
- Scope changes
- Format changes
- Significant changes in Chapters 1-9
    - Note: detailed changes will be covered in separate classes or webinars

2023 NEC Significant Code Changes Overview

MATTHEWS ELECTRICAL SERVICES

884

Notice!

This course is based on the 2023 NEC.

The 2023 NEC has not been adopted in Ohio

Presented for INFORMATIONAL PURPOSES ONLY.

WELCOME!

- Goals
  - Promote learning
  - Make session engaging
    - Discussion
    - Videos
    - Case Studies
    - Polls
  - Make 4 hours as productive as possible!

FOR INFORMATIONAL PURPOSES ONLY. NOT CURRENT CODE IN OHIO

Your Instructor: Henry Matthews

- Advanced Senior Engineer (Current): Oil and Gas Company (16 yrs)
- Plant Engineering Manager: Cooper Standard Automotive (13 yrs)
- Electrical Designer: Toledo Engineering Company (4 yrs)
- BS Electrical Engineering – Penn State University
- MBA – Bowling Green State University
- Registered Professional Engineer – OH, IN, KY, WI, MI, IL,WV
- Certified Professional Engineer – CPE
- Certified Electrical Safety Compliance Professional (CESCP) by NFPA
- Licensed Electrical Contractor – OH
- Registered Training Agency – OCILB OH #48714
- Registered Training Agency – Ohio Board of Building Standards (BBS)
- Senior Member of IEEE
- Member of NFPA – Builders and Architects division
- Member of International Association of Electrical Inspectors (IAEI)
- Member of Association of Facility Engineers (AFE)
- Co-chair API RP 545 – Lightning Protection for Above Ground Storage Tanks
- Over 29 years in the electrical design, construction and standards industry

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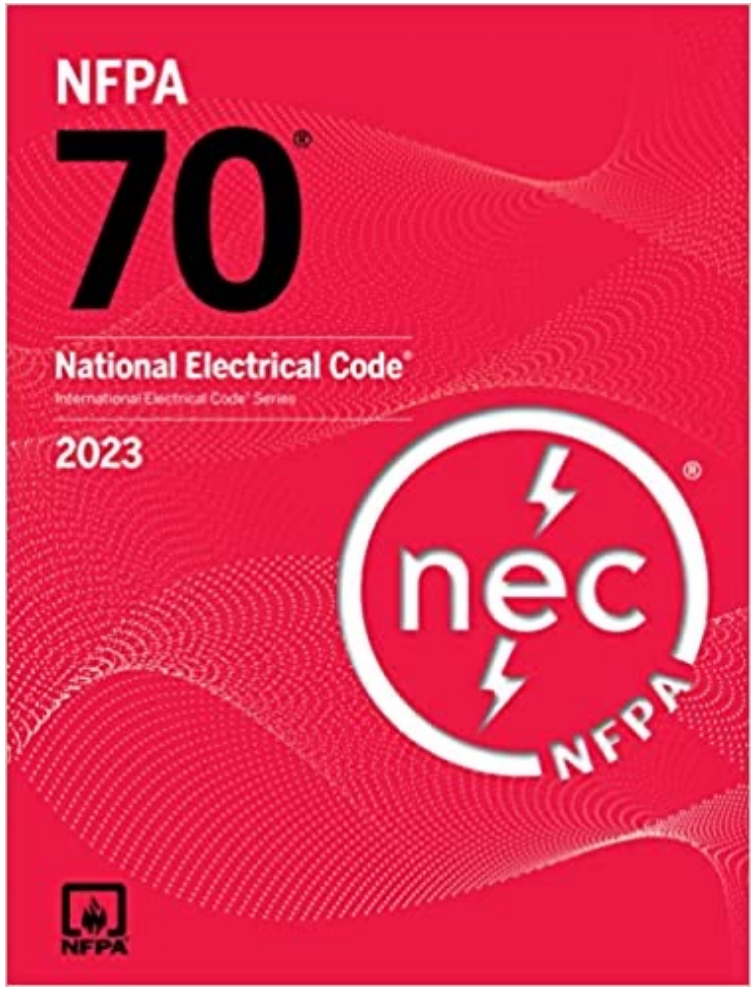
Resources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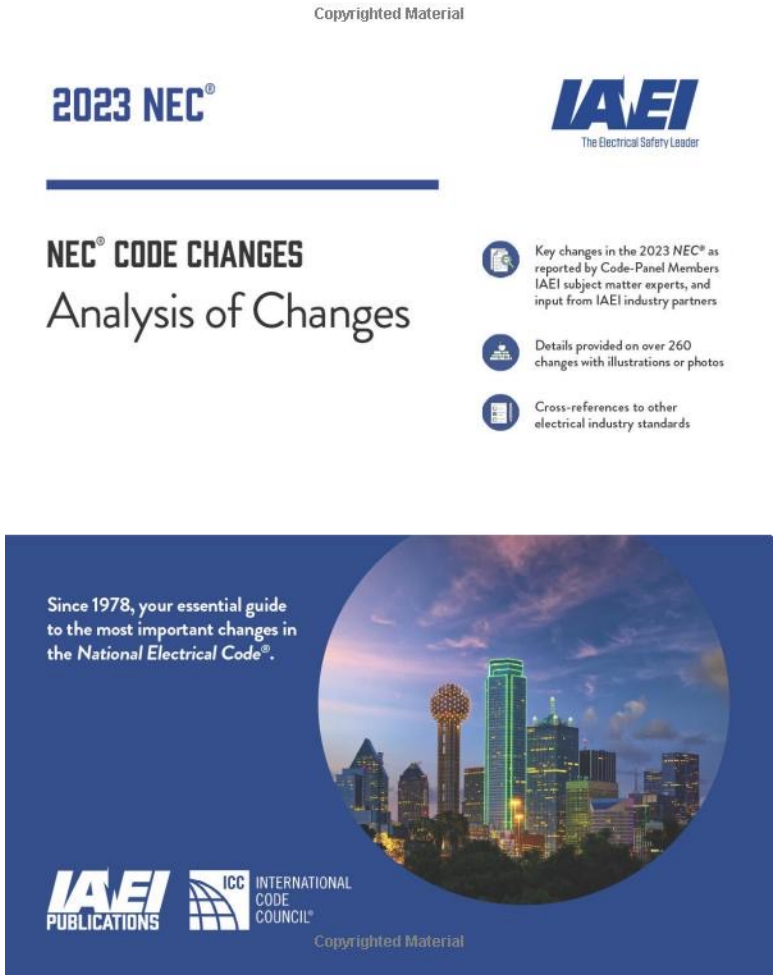
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IAEI
The Electrical Safety Leader
NEC® CODE CHANGES
Analysis of Changes
Key changes in the 2023 NEC® as reported by Code-Panel Members IAEI subject matter experts, and input from IAEI industry partners
Details provided on over 260 changes with illustrations or photos
Cross-references to other electrical industry standards
Since 1978, your essential guide to the most important changes in the National Electrical Code®.
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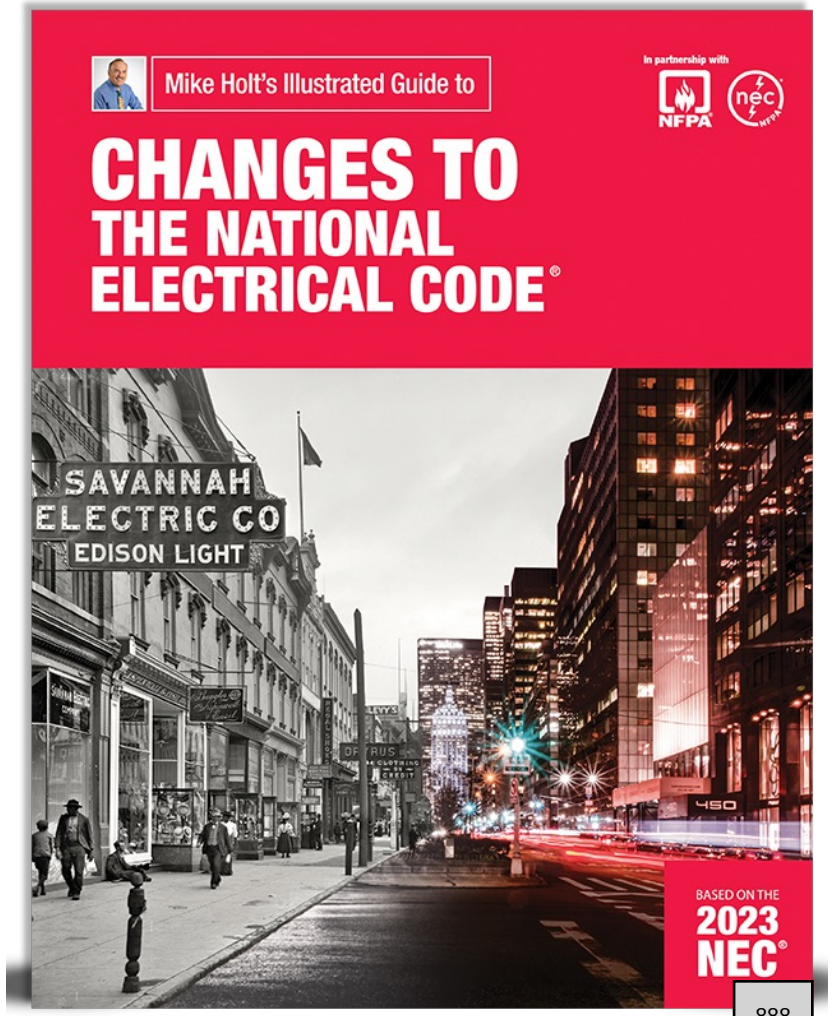
Mike Holt's Illustrated Guide to
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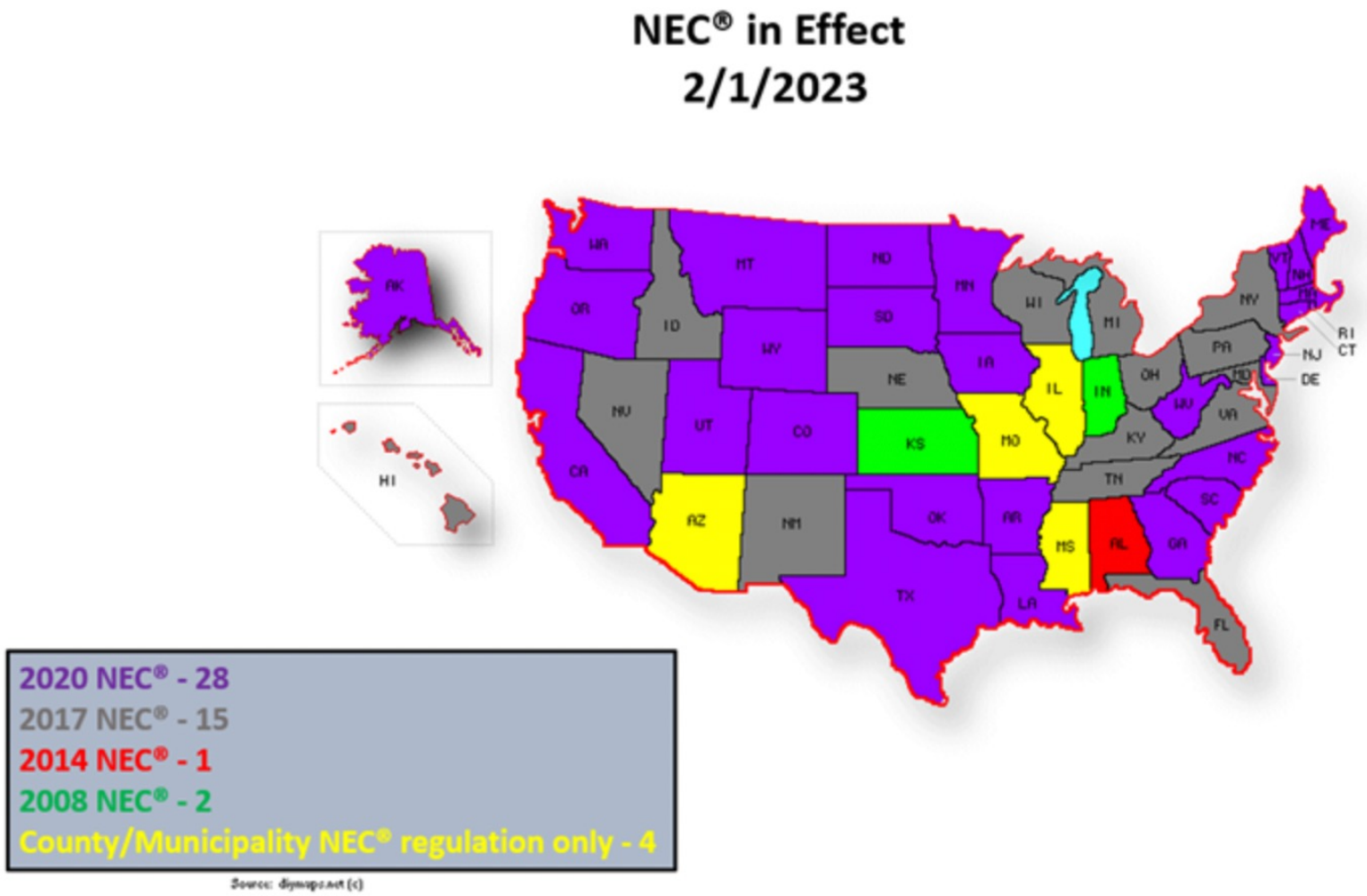
NFPA
nec
CHANGES TO THE NATIONAL ELECTRICAL CODE®
SAVANNAH ELECTRIC CO
EDISON LIGHT
BASED ON THE 2023 NEC®

Current NEC Adoption



Source: www.nfpa.org

- *The 2022 California Electrical Code, California Code of Regulations Title 24, Part 3 is based on the 2020 edition of NFPA 70®, National Electrical Code®.*
- *The 2011 New York City Electrical Code is based on the 2008 edition of NFPA 70®, National Electrical Code®.*

The Development of the 2023 *NEC*

Interesting information about this revised document

- IAEI provided 36 members as CMP representatives to the *NEC* revision process
- IAEI Codes and Standards Committee vetted and submitted IAEI endorsed Public Inputs and Public Comments to NFPA for consideration
- NFPA *NEC* First and Second Draft meetings were conducted virtually instead of in person
- Code Making Panel Task Group meetings were also conducted virtually
- There following were submitted to NFPA for this edition of the *Code*:
  - **4006 Public Inputs**
  - **1805 First Revisions**
  - **1956 Public Comments**
  - **900 Second Revisions**
  - **441 Correlating Notes**
  - **55 Certified Amending Motions**
- Several IAEI members served on NFPA Correlating Committee Task Groups to work on issues needing to be resolved

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https://www.youtube.com/watch?v=uKZXkXgMsfo&t=1s

How to Get Involved in the Code-Making Process

891

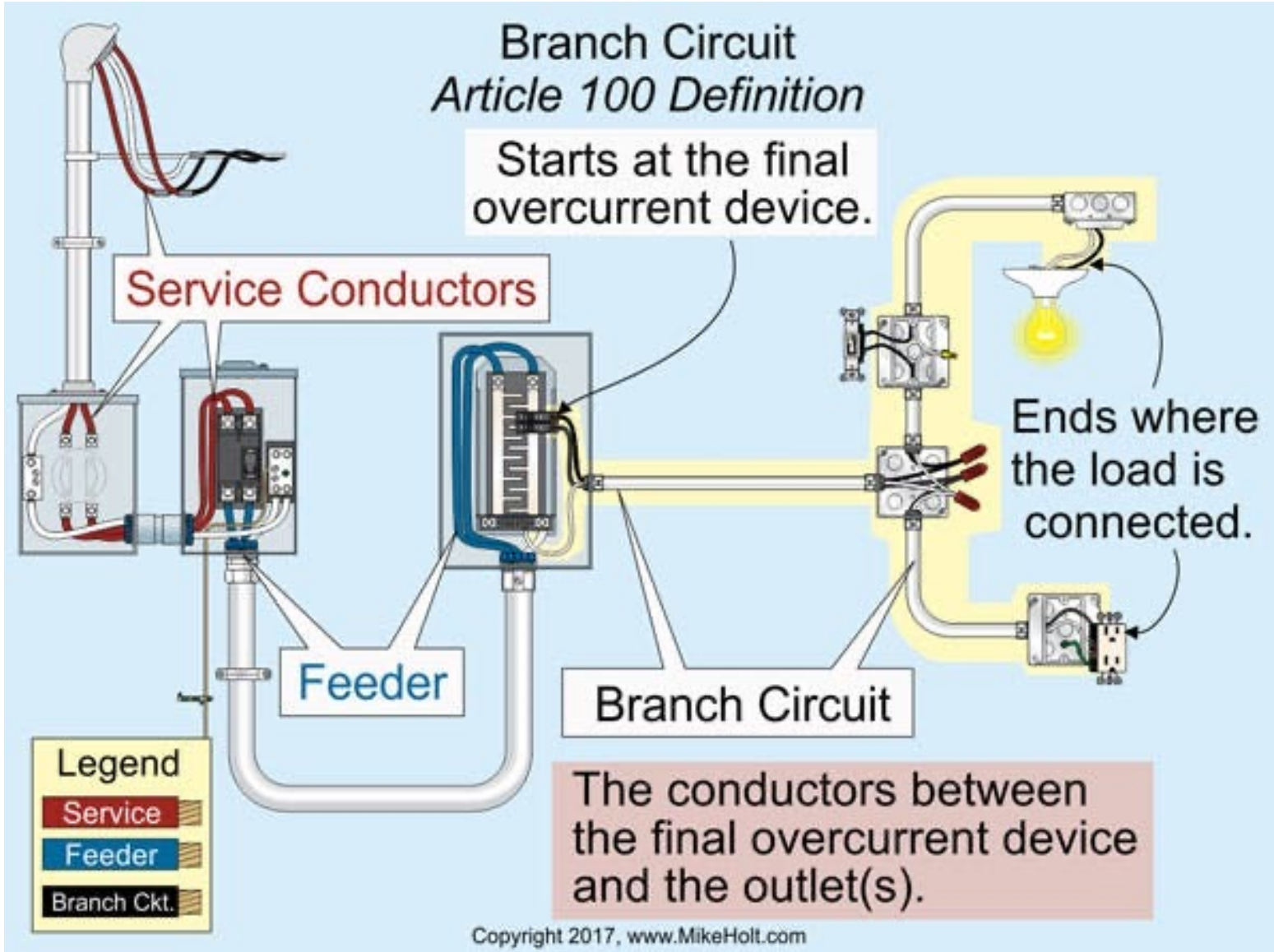
2023 NEC Themes and Focus

GFCI, Ground Fault, AFCI Expansion
Continuation of External Disconnects
Medium Voltage Expansion
Listing of Equipment
Extending some Service requirements to Feeders
Addressing flaws of 2020 NEC
Gearing up for communication and renewables
Introduction of the Special Purpose GFCI (SPGFCI) for circuits with voltage > 150V to ground

892

Review!

Service, Feeders and Branch Circuits



893

New Articles (Medium Voltage)

- Article 235: Branch Circuits, Feeders, and Services over 1000 vac, 1500 vdc, nominal
- Article 245: Overcurrent Protection for Systems Rated Over 1000 vac, 1500 vdc
- Article 305: General Requirements for Wiring Methods and Materials for Systems Rated Over 1000 vac, 1500 vdc, nominal
- Article 315: Medium Voltage Conductors, Cable, Cable Joints, and Cable Terminations
- Article 495: Equipment Over 1000 vac, 1500 vdc, nominal

New Articles

- Article 369: Insulated Bus Pipe (IBP)/Tubular Covered Conductors (TCC) Systems
- Article 371: Flexible Bus Systems
- Article 722: Cables for Power-Limited Circuits, Fault-Managed Power Circuits and Optical Fiber
- Article 724: Class 1 Power-Limited Circuits and Class 1 Power-Limited Remote-Control and Signaling Circuits
- Article 726: Class 4 Fault Managed Power Systems

2023 NEC Key Changes

- Scope: 90.4 “Special Permission”. This term has been removed from many sections because the scope in 90.4 gives the AHJ to waive certain NEC requirements.

- Can use QR (Quick Response) codes to find information regarding equipment

2023 NEC Key Changes

Article 110: Cybersecurity provisions

Introducing My Top 25 Code Changes!

(In chronological order)

#1. Article 100

- All definitions moved to the front

899

Definitions

Definitions were relocated to Article 100 and arranged in alphabetical order with no parts

- Article 100 now contains approximately 840 definitions
- Additional definition structure requirements were also added to this *Code* cycle
- This allows the *NEC* to follow the same layout as other *NFPA* documents that have all definitions in one chapter
- Similar terms and acronyms may be used along with provisions for electronic searching
- Relocation revealed multiple terms defined differently in the code, which were also addressed with the *NEC Style Manual* revision
- An article number appearing after the defined term indicates the definition only applies to that article

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#2. Section 110.17

- New Section!
- Servicing and Maintenance of Equipment
- Emphasizing importance of maintenance
- Promotes alignment with NFPA 70E and NFPA 70B

901

110.17 Servicing and Maintenance of Equipment

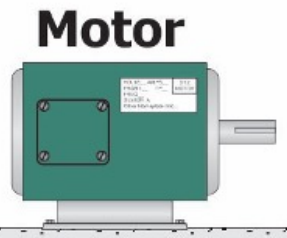
New section addresses servicing and maintenance of electrical equipment and **restricts this work** to **qualified persons trained to perform the work**

Engineer Beth says:

Requires the use of identified replacement parts that have been verified per applicable product standards

Parts are to be provided by either the:
- original equipment manufacturer *(OEM)*
- designed by an engineer with applicable experience or
- as approved by the AHJ

*See **NFPA 70B**, The Recommended Practice for Electrical Equipment Maintenance*



Various Types of Electrical Equipment

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110.17 Servicing and Maintenance of Equipment.

Servicing and electrical preventive maintenance shall be performed by qualified persons trained in servicing and maintenance of equipment and shall comply with the following:

(1) The servicing and electrical preventive maintenance shall be performed in accordance with the original equipment manufacturer's instructions and information included in the listing information, applicable industry standards, or as approved by the authority having jurisdiction.

(2) The servicing and electrical preventive maintenance shall be performed using identified replacement parts that are verified under applicable product standards. The replacement parts shall comply with at least one of the following:

a. Be provided by the original equipment manufacturer

b. Be designed by an engineer experienced in the design of replacement parts for the type of equipment being serviced or maintained

c. Be approved by the authority having jurisdiction

Informational Note No. 1: For equipment that is not listed or field labeled, or for which components are no longer available from the original equipment manufacturer, one way to determine suitability is to review the documentation that accompanies the replacement parts.

Informational Note No. 2: See NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*, for information related to preventive maintenance for electrical, electronic, and communication systems and equipment.

903

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#3. Section 210.8(A)(6) Dwelling Unit Kitchens

- GFCI protection has been expanded to include any cord and plug equipment in the kitchen!
- It no longer matters if it serves the countertop or not

Major Impact!

904

210.8(A)(6) Dwelling Units- Kitchens

Ground-fault circuit-interrupter *(GFCI)* protection has been expanded to include any cord-and-plug equipment in the kitchen, regardless of whether the outlet serves the countertop

- There have been 104 electrocutions that have taken place from 2011 to 2022 based on the Consumer Products Safety Commission *(CPSC)* database
- Eighty-one percent of these accidents were from working on an appliance or other equipment
- GFCI protection is required within a kitchen for receptacles that are
  - 125-volt through 250-volt and
  - supplied by single-phase branch circuits rated 150 volts or less

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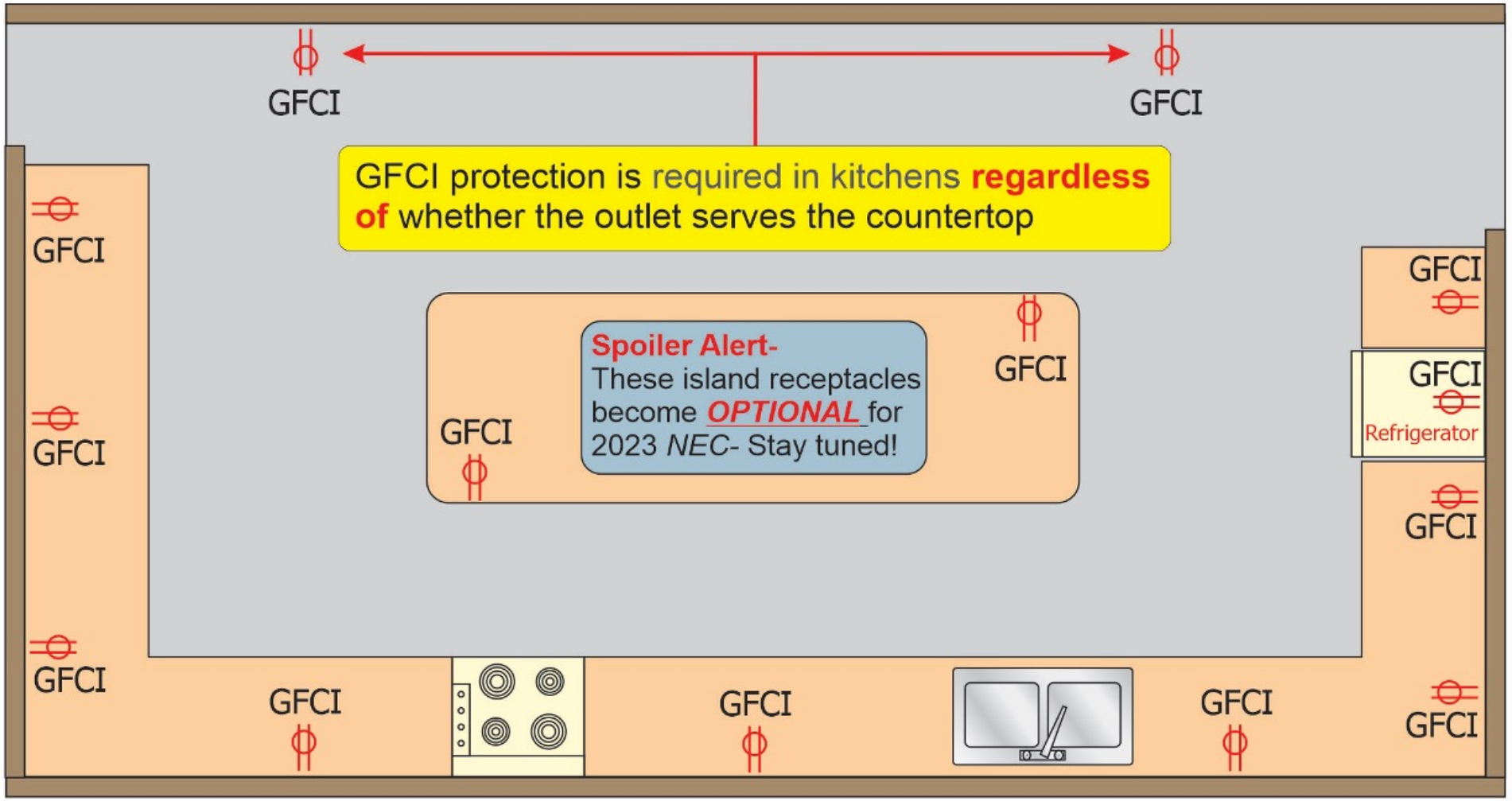
210.8(A)(6) Dwelling Unit Kitchens

Ground-fault circuit-interrupter *(GFCI)* protection required for receptacles in a kitchen
- All 125-volt through 250-volt receptacles
- single-phase branch circuits rated 150 volts or less to ground



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2020

(A) Dwelling Units.

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.

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

*Exception to (3): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with **426.28** or **427.22**, as applicable.*

(4) Crawl spaces — at or below grade level

(5) Basements

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

Informational Note: See 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.

Receptacles installed under the exception to **210.8(A)**(5) shall not be considered as meeting the requirements of **210.52(G)**.

(6) Kitchens — where the receptacles are installed to serve the countertop surfaces

2023

(A) Dwelling Units.

All 125-volt through 250-volt receptacles installed in the following locations and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel:

(1) Bathrooms

(2) Garages and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use

(3) Outdoors

(4) Crawl spaces — at or below grade level

(5) Basements

(6) Kitchens

https://www.youtube.com/watch?v=nho3X2FHGPk&t=9s

908

#4. Section 210.8(B)

Multiple changes involving GFCIs for Other than Dwelling Units

210.8(B) Other Than Dwelling Locations

A new list item (4) has been added for the addition of buffet serving areas to the list of locations requiring ground-fault circuit-interrupter *(GFCI)* protection

- All receptacles are to be GFCI protected if they are:
  - Single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, 125-volt through 250-volt
  - Three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less
- The buffet serving area typically contains various food wells which hold hot water
- Customers or staff members touching the stainless steel are subject to electric shock in the event of an accident
- It was demonstrated that these locations are similar in safety concerns to those surfaces which are in kitchens

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2020

(B) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the locations specified in **210.8(B)(1)** through (B)(12) shall have ground-fault circuit-interrupter protection for personnel.

(1) Bathrooms

(2) Kitchens or areas with a sink and permanent provisions for either food preparation or cooking

(3) Rooftops

Exception: Receptacles on rooftops shall not be required to be readily accessible other than from the rooftop.

(4) Outdoors

*Exception No. 1 to (3) and (4): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with **426.28** or **427.22**, as applicable.*

*Exception No. 2 to (4): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in **590.6(B)(2)** shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power is interrupted or having a design that is not compatible with GFCI protection.*

(5) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

Exception No. 1 to (5): In industrial laboratories, receptacles used to supply equipment where removal of power would introduce a greater hazard shall be permitted to be installed without GFCI protection.

*Exception No. 2 to (5): Receptacles located in patient bed locations of Category 2 (general care) or Category 1 (critical care) spaces of health care facilities shall be permitted to comply with **517.21**.*

2023

(B) Other Than Dwelling Units.

All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the following locations shall be provided with GFCI protection:

(1) Bathrooms

(2) Kitchens

(3) Areas with sinks and permanent provisions for food preparation, beverage preparation, or cooking

(4) Buffet serving areas with permanent provisions for food serving, beverage serving, or cooking

(5) Rooftops

912

2020

(6) Indoor damp and wet locations

(7) Locker rooms with associated showering facilities

(8) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(9) Crawl spaces — at or below grade level

(10) Unfinished areas of basements

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

(11) Laundry areas

(12) Bathtubs and shower stalls — where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

2023

(6) Outdoors

(7) Sinks where receptacles or cord-and-plug-connected fixed or stationary appliances are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink

(8) Indoor damp or wet locations

(9) Locker rooms with associated showering facilities

(10) Garages, accessory buildings, service bays, and similar areas other than vehicle exhibition halls and showrooms

(11) Crawl spaces at or below grade level

(12) Unfinished areas of basements

(13) Aquariums, bait wells, and similar open aquatic vessels or containers, such as tanks or bowls, where receptacles are installed within 1.8 m (6 ft.) from the top inside edge or rim or from the conductive support framing of the vessel or container

(14) Laundry areas

(15) Bathtubs and shower stalls where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall

913

210.8(B) Other Than Dwelling Locations

Language at list item (7) has been modified, addressing cord-and-plug-connected fixed and stationary appliances at **sink** locations in other than dwelling units

- The electrical hazard is typically not with the 125-volt through 250-volt receptacle supplying a fixed or stationary piece of equipment but from the equipment itself
- Equipment such as a refrigerator or range is typically constructed of metal and located within 6 feet of a sink
- A person at the sink making contact with these metal appliances has been injured or killed as a result
- This action was necessary to prevent needless electrocutions or shocks to people from occurring

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Important!

- Note: in 2020 NEC, the **receptacle** had to be located within 6 ft of a sink
- Now in the 2023 NEC, it is the receptacle **or the equipment** within 6 ft of a sink – whichever is closest!

Major Impact!

Six Foot Rule Amended

- 6 ft used to be defined as distance from the edge of sink to the receptacle
- However, the shock hazard is not the receptacle, but the energized frame of the appliance

210.8(B) Other Than Dwelling Locations *(GFCI Protection for Personnel)*

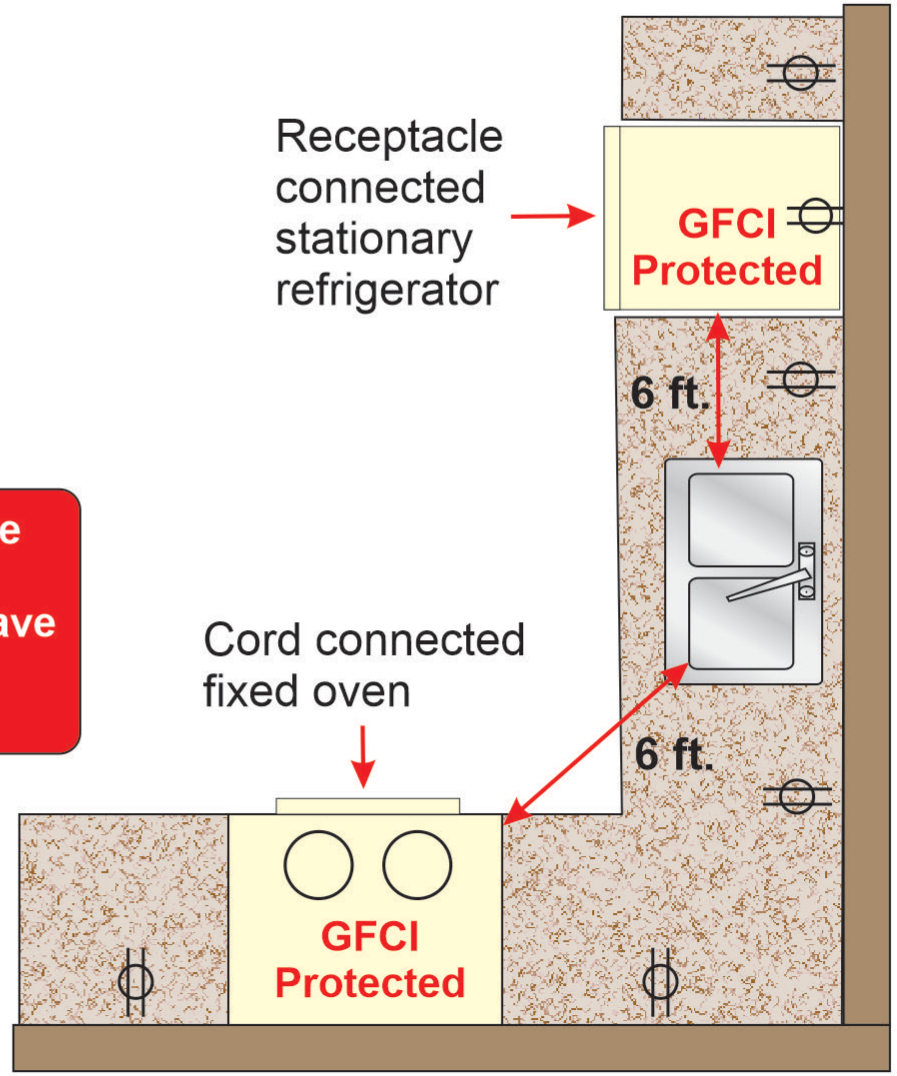
Language at **list item (7)** has been modified addressing cord-and-plug-connected fixed and stationary appliances at sinks locations in **other than dwelling units**

A word from Inspector Ivan:

Sinks where **fixed or stationary appliances** are installed within 6 ft from the **top inside edge of the bowl of the sink**

Note: fixed or stationary appliances are connected to receptacles or cord connected

Contact between the metal sink and the metal appliances have resulted in shocks and electrocutions



Note: **This is not a kitchen which is already covered in 210.8(B)(2)**

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210.8(B) Other Than Dwelling Locations

A new list item (13) has been added for **aquariums and bait wells** in locations other than dwelling units

- **Receptacles installed within 1.8 m (6 ft.)** of aquariums, bait wells, and similar open aquatic vessels or containers need to be provided with ground-fault circuit-interrupter *(GFCI)* protection
  - Single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, 125-volt through 250-volt
  - Supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less
- The areas around bait wells, aquariums, and the like tend to be wet-conductive locations where various types of electrical equipment are used
- Examples are aerators, luminaires, and pump motors
- GFCI protection of the receptacle provides a level of protection from accidental electrical shock

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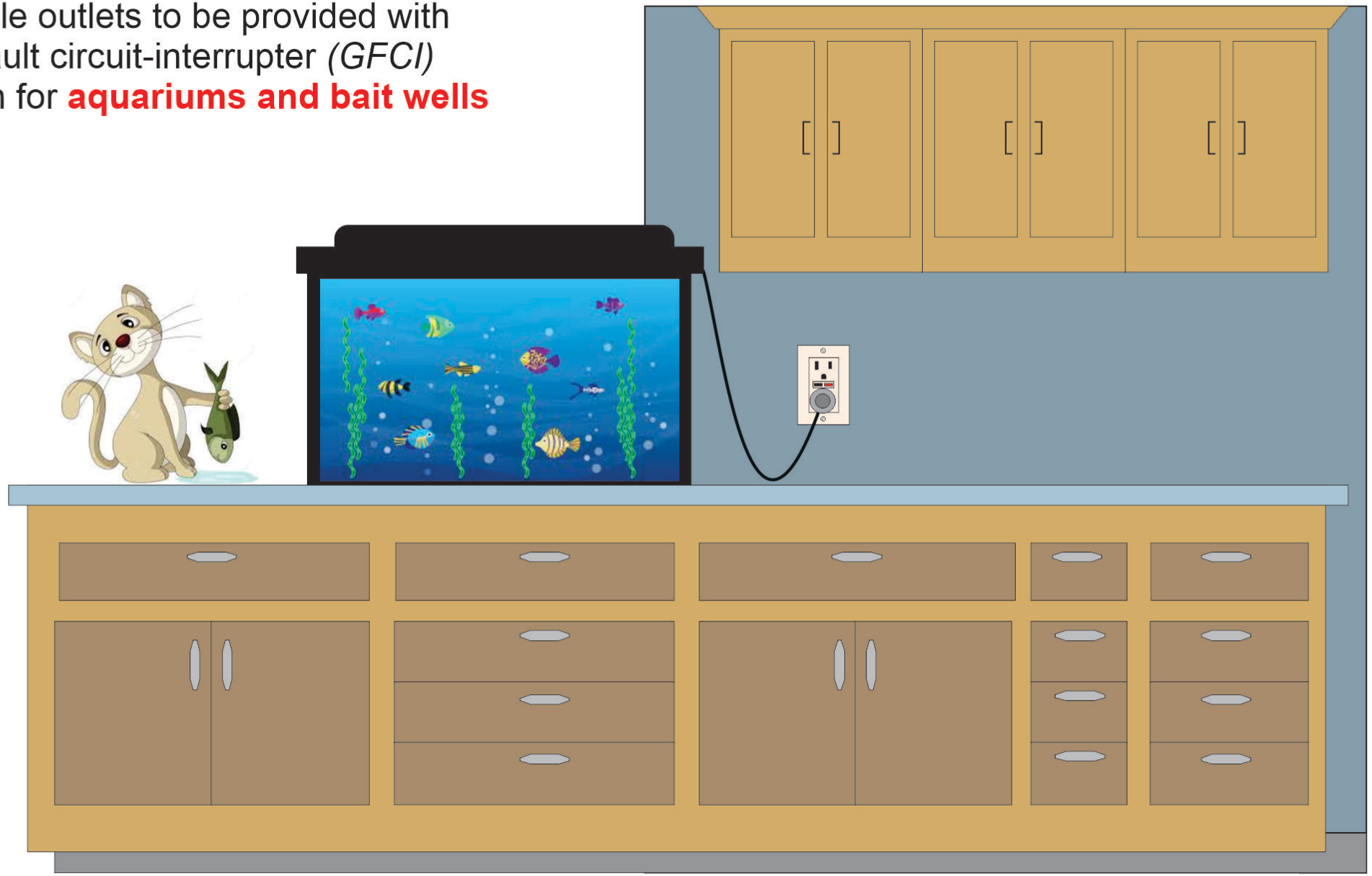
210.8(B) Other Than Dwelling Units *(Aquariums and Bait Wells)*

Receptacle outlets to be provided with ground-fault circuit-interrupter *(GFCI)* protection for **aquariums and bait wells**



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210.8(B) Other Than Dwelling Units *(Aquariums and Bait Wells)*

Examples:
Receptacle outlets to be provided with *GFCI* protection for **live minnow wells** used by fishing anglers

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Accidents when water and electricity are used together have happened and GFCI protection for receptacles is now required
IF YOU DON'T WORK HERE YOU SHOULDN'T BE IN HERE
Angler of the Year 2022
Photo courtesy of IAEI Archives
922

Bonus Slide: Honorable Mention

210.8(F) Outdoor Outlets

Ground-fault circuit-interrupter *(GFCI)* protection is to be installed when the equipment supplied by an outlet covered under the requirements of this section is **replaced**

- This addresses issues of **older existing outlets** that are **not GFCI protected**
- Will require GFCI protection for dwelling outdoor outlets when the electrical equipment is replaced that receives power from that older existing outlet
- This change will increase the overall level of safety by providing the same level of protection

Notice: **TIA 23-3** *(TIA Log #1664)* created **Exception No. 2** stating that GFCI protection not required for listed HVAC equipment

This exception will expire **September 1, 2026**

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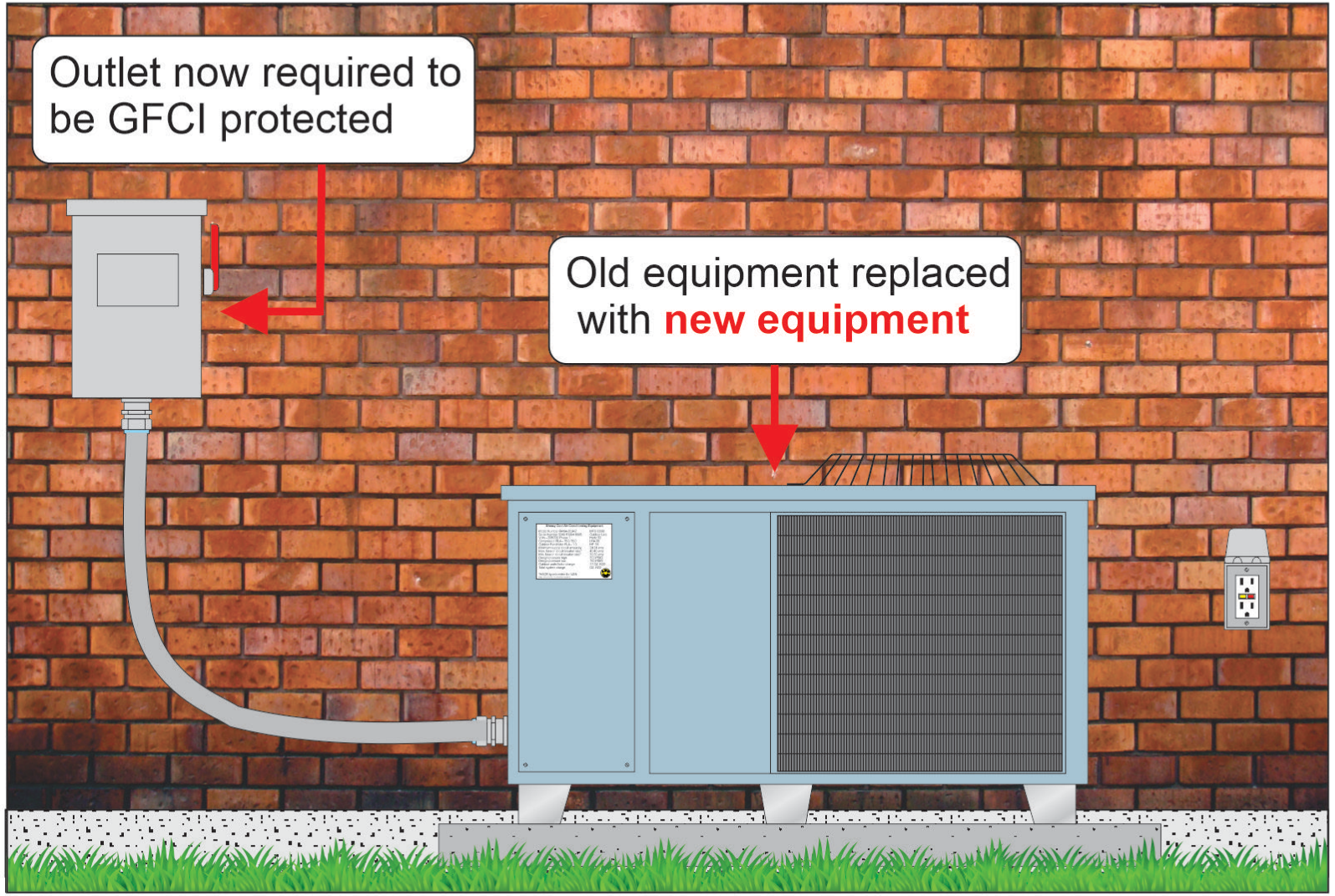
210.8(F) Outdoor Outlets *(GFCI)*

When **new electrical equipment** is installed, ground-fault circuit-interrupter *(GFCI)* protection method is required for the outlet serving the new equipment

Note from the Electrical Inspector:

NFPA has assigned a task group to look at interoperability issues between equipment and GFCI protection



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Bonus Slide: Honorable Mention

Section 210.23 Permissible Loads

Until the release of the 2023 NEC, the smallest branch circuit recognized by the NEC for power and lighting circuits has been 15 amps.

The NEC now recognizes 10-ampere branch circuits for select power and lighting loads

This is significant for the NEC and the industry as a whole.

The decision by the NEC to recognize 10-amp branch circuit conductors and overcurrent devices is likely in response to the availability of new higher efficiency lighting systems.

210.23 Permissible Loads

Permissible Loads, Multiple-Outlet Branch Circuits 10 Ampere Branch Circuits

- This change covers permitted and non-permitted use of a 10-ampere branch circuit
- Installation requirements were necessary for the use of a 10-ampere branch circuit if the installer chose to do so
- Advantages include lower cost due to smaller conductors with loads such as increased LED lighting installations
- A **10-ampere branch circuit can supply loads for** lighting outlets, lighting circuits for bathroom and laundry area exhaust fans within dwelling units, and a gas fireplace unit served by an individual branch circuit
- A **10-ampere branch circuit cannot supply loads for** receptacle outlets, fixed appliances *(except as permitted for individual branch circuits)*, garage door openers, or laundry equipment

NFPA LINK©

210.23 Permissible Loads

10 ampere branch circuits are now addressed in the *NEC*

A 10-ampere branch circuit <u>can</u> supply loads for:

- lighting outlets
- lighting circuits for bathroom and laundry area exhaust fans within dwelling units
- gas fireplace unit served by an individual branch circuit

A 10-ampere branch circuit <u>cannot</u> supply loads for:

- receptacle outlets
- fixed appliances *(except as permitted for individual branch circuits)*
- garage door openers
- laundry equipment

Installation requirements were necessary for the use of 10-ampere branch circuits if the installer chose to do so

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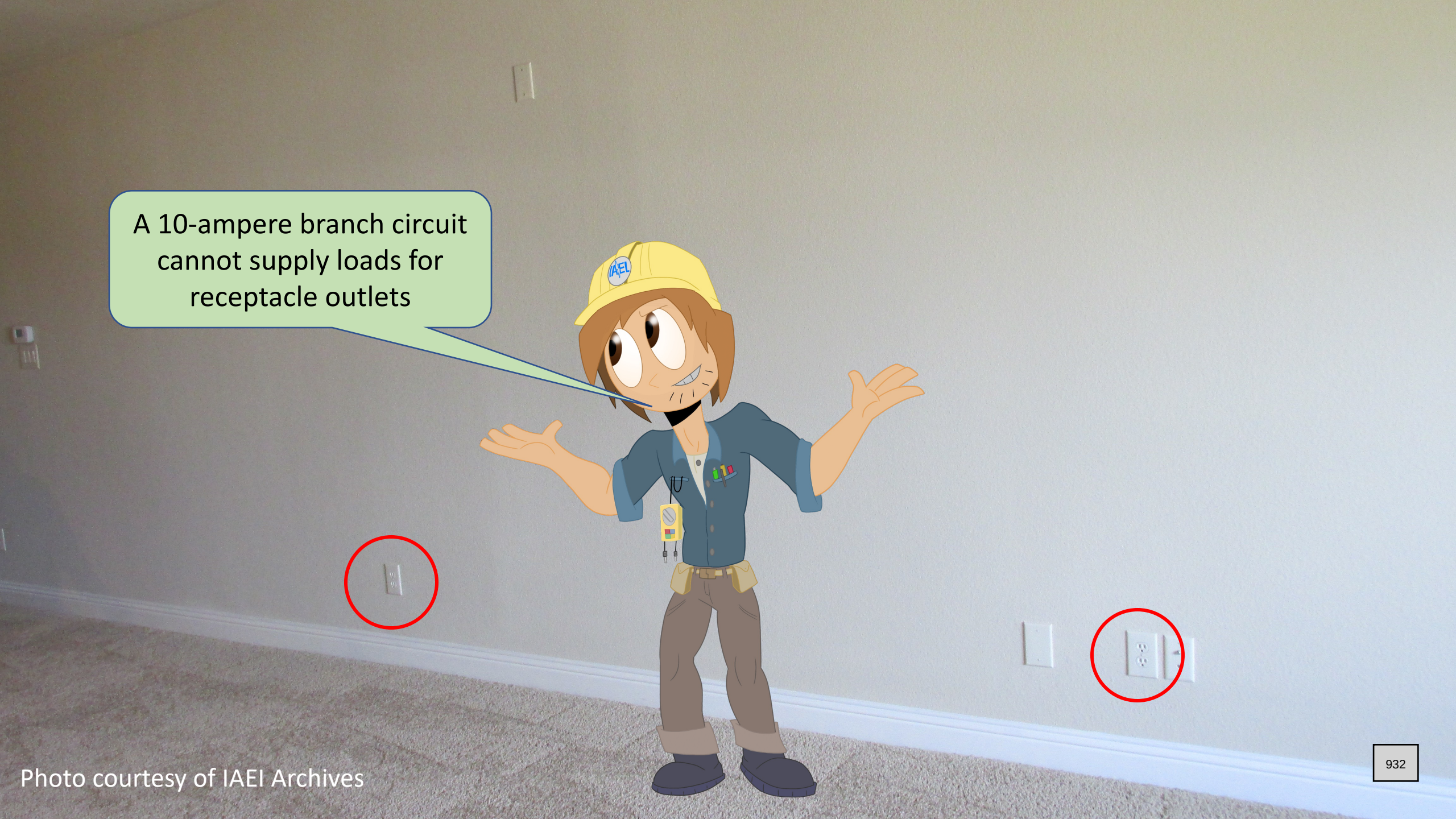

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#5 Section 210.52(C): Islands and Peninsulas

Island and Peninsular Countertops and Work

AGAIN!

934

CONGRATULATIONS!

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935

Next Steps

A Certificate of Completion will be emailed to those who successfully completed course

4 hours of Code Class Hours will be reported to the OCILB and OBBS for Code Continuing Education Credits

Contact instructor at hpmatthews@matthewselectrical.net for any questions or comments

Make sure you completely sign out of webinar after the next slide!

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File Attachments for Item:

EC-17 Motors, Transformers, and the 2020 NEC (Matthews Electrical Services)

All certifications (4 hours)

BIOGRAPHY
Henry P. Matthews PE, CPE, CESCP, PVA

Henry has over 31 years of experience in the electrical design, construction, engineering and safety fields. He has a passion for teaching and mentoring.

Henry obtained his Bachelor of Science degree in Electrical Engineering from Penn State University in 1989.

He also earned a Master of Business Administration from Bowling Green State University in 2003.

In addition, Henry earned several certificates including:

- Plumbing and Electrician from Penn Foster Career School
- Welding from Owens Community College in Findlay, Ohio
- Residential Solar PV Systems from Solar Engineering International

Henry currently holds the following licenses, and memberships:

- Licensed Electrical Contractor in Ohio
- Licensed Training Agency in Ohio
- Licensed Professional Engineer in Ohio, Michigan, Kentucky, Indiana, Illinois, Wisconsin
- Certified Plant Engineer (CPE)
- Certified Building Operator (CBO)
- Certified Electrical Compliance Safety Professional (CESCP) by NFPA
- Solar PV Associate by the North American Board of Certified Energy Practitioners
- Electric Vehicle Infrastructure Training Program (EVITP) certification
- Senior Member of the Institute of Electrical and Electronic Engineers (IEEE)
- Member of the International Association of Electrical Inspectors (IAEI)
- Member of the National Fire Protection Association (NFPA)

Henry is currently employed as an Advanced Senior Engineer for Marathon Petroleum Company in Findlay, Ohio. During his 16 years at Marathon, Henry has worked as an Electrical Design Engineer, Project Engineer, Engineering Supervisor and currently as a Reliability Engineer.

Henry is also the owner of Matthews Electrical Services, a small, but full-service electrical contractor company.

Prior to this, he worked 13 years as an Electrical Engineer and a Plant Engineering Manager in at Cooper Standard Automotive, a major automotive parts supplier in Bowling Green, Ohio

Henry is the past co-chair of American Petroleum Institute Recommended Practice 545 Lightning Protection for Above Ground Storage Tanks.

He was also past president of the Fostoria Toastmaster club.

Motors, Transformers and the NEC

Outline

Relevant NEC Chapters and Articles (Based on the 2020 NEC)

- Article 430 Motors, Motor Circuits and Controllers
- Article 450 Transformers and Transformer vaults
- Article 240 Overcurrent Protection
- Article 250 Grounding and Bonding
- Chapter 3 Wiring Methods and Materials
- Chapter 9 Tables

Other Resources:

- NFPA 70E (2021) Electrical Safety in the Workplace
- OSHA 1910 Subpart S Electrical Safety

Referenced Websites:

- www.NFPA.org
  www.IAEI.org (International Association of Electrical Inspectors)
- www.mikeholt.com
- www.esfi.org Electrical Safety Foundation International)
- www.Eaton.com
- Various motor and transformer manufacturer websites.

Course Content:

- History of Motors
- Definitions
- Motor and generator theory
- Types of motors and applications
- How to apply article 430 to motor installations
- History of Transformers
- Definitions
- Transformer theory
- Types of transformers
- How to apply article 450 to transformer installations
- Transformer system grounding per Article 250

APPLICATION FOR CONTINUING EDUCATION APPROVAL
COURSE CONDITIONS AND GUIDELINES

The Ohio Board of Building Standards is committed to the ongoing education and professional development of board-certified personnel through the delivery of high-quality, accurate and engaging professional continuing education content. To this end, the Board reviews and approves Continuing Education Courses for building department personnel.

Board approval is granted for course instruction on current codes and standards, including the OBC, OMC, OPC, and RCO, and any other content areas directly related to the responsibilities of the certification for which credit is being requested.

Promotion: Any person or organization promoting an approved course is required to make full and accurate disclosure regarding course title, course approval number, number of credit hours, categories for which the BBS has approved the class, and fees in promotion materials and advertising. ***The Board does not grant retroactive approval. It is recommended that courses be submitted for approval well in advance of any scheduling of classes and advertising***. Advertising may not falsely state BBS approval before approval is granted. Course providers may state that BBS approval is pending.

Application Submission: All Applications and associated materials shall be submitted by email in .pdf format. Instructions for completing the application are attached.

Certificate of Completion: Course providers shall provide participants a certificate of completion containing the following information:

- Name of participant
- Title of approved courses
- BBS approval #
- BBS approved certifications
- Date of the continuing education program
- Number of approved credit hours awarded, and
- Signature of authorized sponsor or instructor.

Any person or organization administering an approved course shall return a completed BBS Course Attendance form by email.

Participants: Participants must attend the complete course as presented by the instructor to receive credit hours approved by the Board. The organization or instructor of online courses shall plan and execute methods to verify the individual's attendance and completion of the course. No partial credit will be given to any participant who failed to complete the entire course as approved.

Board approval: All courses are approved for the calendar year in which application is made. Courses may be renewed so long as the referenced code is in effect, and the CEUs, certification and content remain unchanged. When the referenced code is updated, courses must be updated, and new approvals obtained.

Facility/training area: BBS Course may be delivered in person or online, or both, at the sponsor's option.
Course facilities shall include the following:

In Person Classes:
Sufficient seating capacity
ADA accessible facilities
Appropriate Audio/Visual devices for delivery
Writing surfaces for participants

Online Classes:
Web-accessible
ADA accessible delivery
Tech support available
Live and recorded courses permitted

In-person facilities shall comfortably and safely seat at least the number of attendees present in the room and shall be climate controlled, non-smoking, and sound controlled so that outside noise will not interfere with the training.

Ohio Department of Commerce

Mike DeWine, Governor
Jon Husted, Lt. Governor

Sheryl Maxfield, Director

Board of Building Standards

Application for Continuing Education Course Approval

Provider Information:

Name: Henry P. Matthews

Organization: Matthews Electrical Services

Address: 1203 McKinley Place; Fostoria, Ohio 4830

E-mail: hpmatthews@matthewselectrical.net Telephone: 419-575-3488

Website: www.matthewselectrical.net

Conference Sponsor (if applicable)_____ Conference Email:_____

Check here if Course Renewal:_____Prior course number _____ (*i.e. BBS2018-429*)

Renewals will only be granted for identical content and certifications, within the current code cycle.
Attach a copy of prior course approval letter for confirmation. No further information is required.

New Course Information:

Course title: Motors, Transformers and the NEC

Course instructor: Henry P. Matthews

Course description: This course will cover important motor terms and installation requirement from article 430 in NEC. It will also cover terms and installation requirements for transformers in article 450.

Instructional hours per session: 4 Number of Sessions: at least one per quarter

Course Date(s) and Location:_____

Special Content:

Code Administration:_____ Conference Course: _____

Existing Buildings: _____ Conference Name: _____

Electrical Instruction: _____ Conference location:_____

Plumbing Instruction:_____

Course to be offered online?__✓___ **On Demand**_____ **Webinar**__✓___

Course Website: www.matthewselectrical.net

Detail online course participation confirmation method *(i.e. test, quizlets, participant activity confirmation)*:
Surveys, polls, and roll call after each break will be conducted.

Course applicable for the following certifications

Residential Certifications Only: __✓___ Commercial Certifications: __✓___

Administrative Course, All Certifications: _____

Application materials included:

__✓___ Course Outline or Course Learning Objectives

__✓___ Presentation Materials/Slides (not required for roundtable courses)

__✓___ Assessment Materials (for online courses)

__✓___ Presenter Bio

Please submit application and materials in .pdf format to: michael.lane@com.ohio.gov or BBS@com.ohio.gov

Instructions for new Continuing Education Approval form

Provider Information

1. Please include all contact information.
2. If course is not part of a conference, leave conference sponsor and email blank.

Course Renewal

1. Indicate if the course is being submitted for renewal. Include prior approval letter and write in prior course number.
2. Certification approval for courses has now changed: all existing courses being renewed will be approved within the new classification system.
    a. Courses previously approved for only residential certifications will be approved for all residential certifications.
    b. Courses previously approved for at least on commercial certification will now be approved for all commercial certifications and all residential certifications.
    c. Courses on required instruction topics, Ohio Ethics, Code Administration and Existing Buildings, will be noted as Administrative Courses and be approved for all certifications.
3. Courses being renewed should skip the New Course information section and are not required to submit outline, agenda, slides or other instructional materials for review. Skip to Special Content, and mark any item that applies to the course.

New Course Information

1. Enter course title, name of instructor, and a brief description of the course content. Learning objectives may be substituted for course description, if desired.
2. Number of instructional hours per session is the length of instructional time.
3. Number of sessions: can be 1 or the number of sessions planned.
4. Course date(s) and location: not necessary at this time, enter if known.

Special Content

1. Indicate if the course will meet instructional time in Code Administration or Existing Buildings.
2. Indicate if the course is a plumbing or electrical course, for ESIAC review and trainee course tracking.
3. If the course is associated with a conference, indicate the conference name and location, as this will allow BBS to coordinate approvals with the conference provider.
4. If the course will be offered online, specify whether it will be on demand or offered as a virtual webinar, or both. Include website where the course will be provided.

Course applicable for the following certifications

This section represents a major change from previous BBS course approval forms.

1. If the course is only for residential certifications, check 'Residential Certifications Only'. The course, if approved, will be approved for all residential certifications.
2. If the course is appropriate for any commercial certifications, check Commercial Certifications. The course, if approved, will be approved for all commercial certification **AND** all residential certifications.
3. If the course is intended to meet required instruction in Code Administration (Chapter 1) or Existing Buildings (commercial or residential) check 'Administrative Course, All Certifications'.

Application Materials Included

This is a checklist for the course submitter's use, to be sure all materials necessary for review are included with the application. All materials should be submitted in .pdf format, along with the application, via email to Michael.Lane@com.ohio.gov or BBS@com.ohio.gov

Motors and Transformers

Matthews Electrical Services

Ohio Training Agency #48714

Henry Matthews, PE, CPE, CESCP

MATTHEWS ELECTRICAL SERVICES

WELCOME!

- Goals
  - Review electrical theory
  - Review important NEC Calculations
  - Make session engaging
    - Discussion
    - Videos
    - Polls
  - Make 4 hours as productive as possible!

946

Your Instructor: Henry Matthews

- Advanced Senior Engineer (Current): Oil and Gas Company (17 yrs)
- Plant Engineering Manager: Cooper Standard Automotive (13 yrs)
- Electrical Designer: Toledo Engineering Company (4 yrs)
- BS Electrical Engineering – Penn State University
- MBA – Bowling Green State University
- Registered Professional Engineer – OH, IN, KY, WI, MI, IL,WV
- Certified Professional Engineer – CPE
- Certified Electrical Safety Compliance Professional (CESCP) by NFPA
- Licensed Electrical Contractor – OH
- Registered Training Agency – OCILB OH #48714
- Registered Training Agency – Ohio Board of Building Standards (BBS)
- Senior Member of IEEE
- Member of NFPA – Builders and Architects division
- Member of International Association of Electrical Inspectors (IAEI)
- Member of Association of Facility Engineers (AFE)
- Co-chair API RP 545 – Lightning Protection for Above Ground Storage Tanks
- Over 29 years in the electrical design, construction and standards industry

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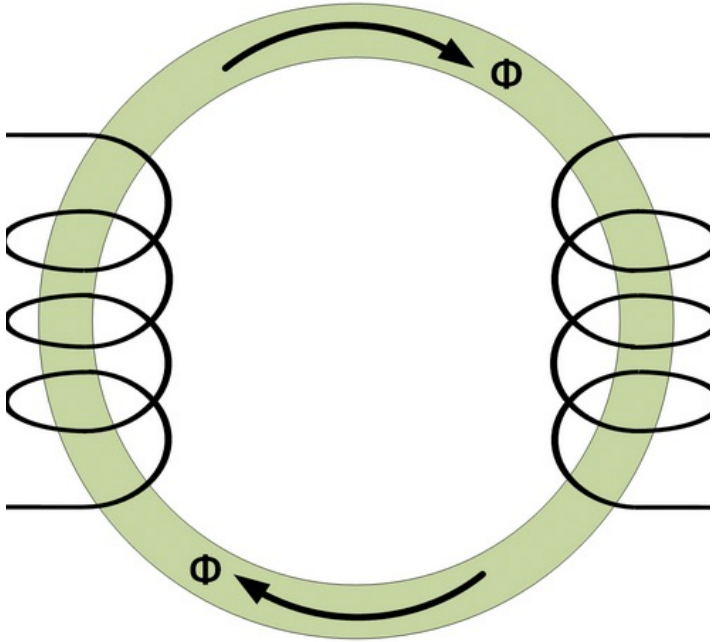
Agenda

- Applicable Codes and NEC Standards
- Motor Theory
- Transformer Theory
- Article 430 Motors
- Article 450 Transformers

948

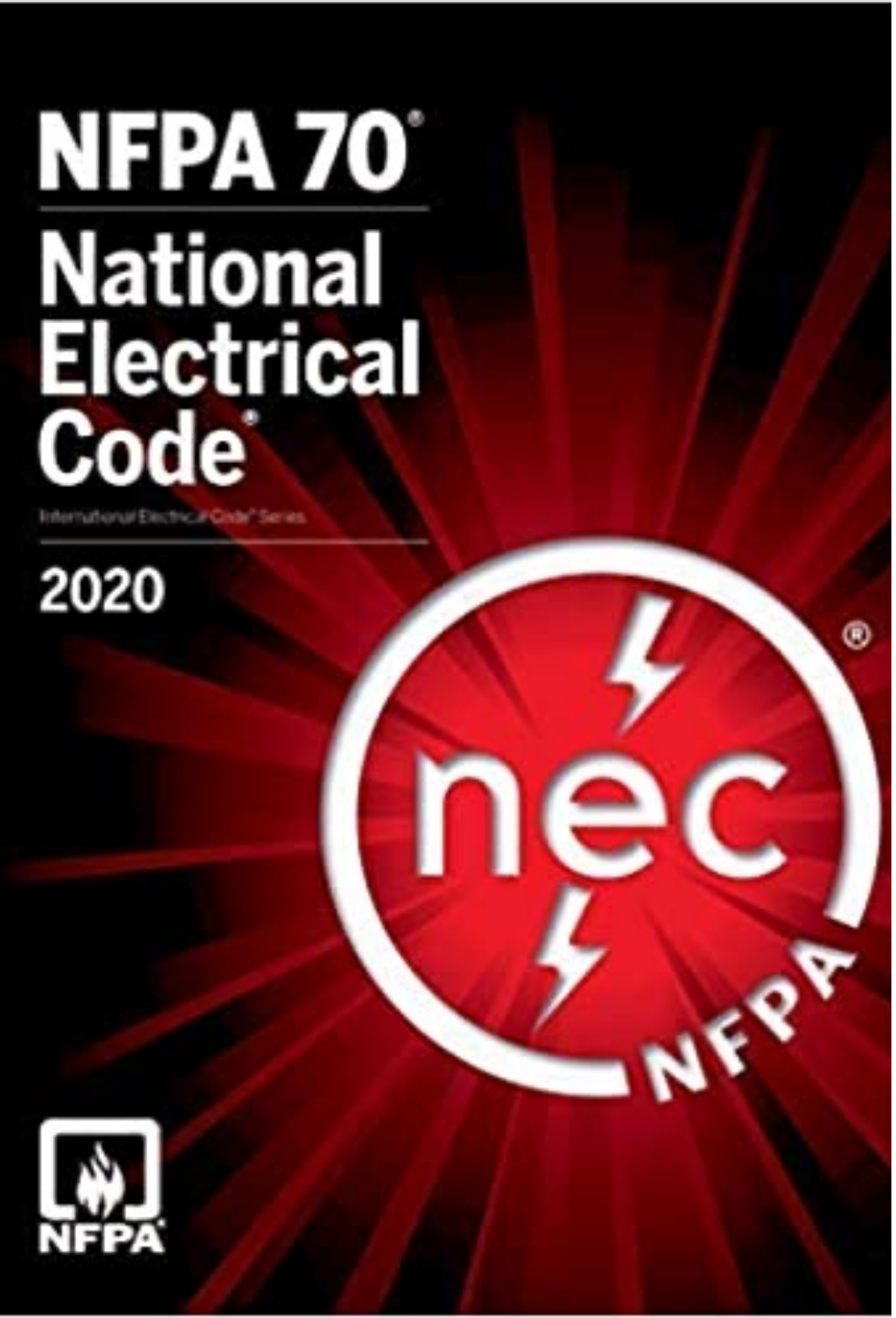
Why Motors and Transformers?

- Both use mutual induction and magnetism
- Transformer: stationary magnetic field
- Motors: rotating magnetic field
- Motors are similar to generators
  - Motors require electric power to create work
  - Generator require work to create electric power



Goal:

Take the Mystery out of Motors and Transformers



Motors and Transformers

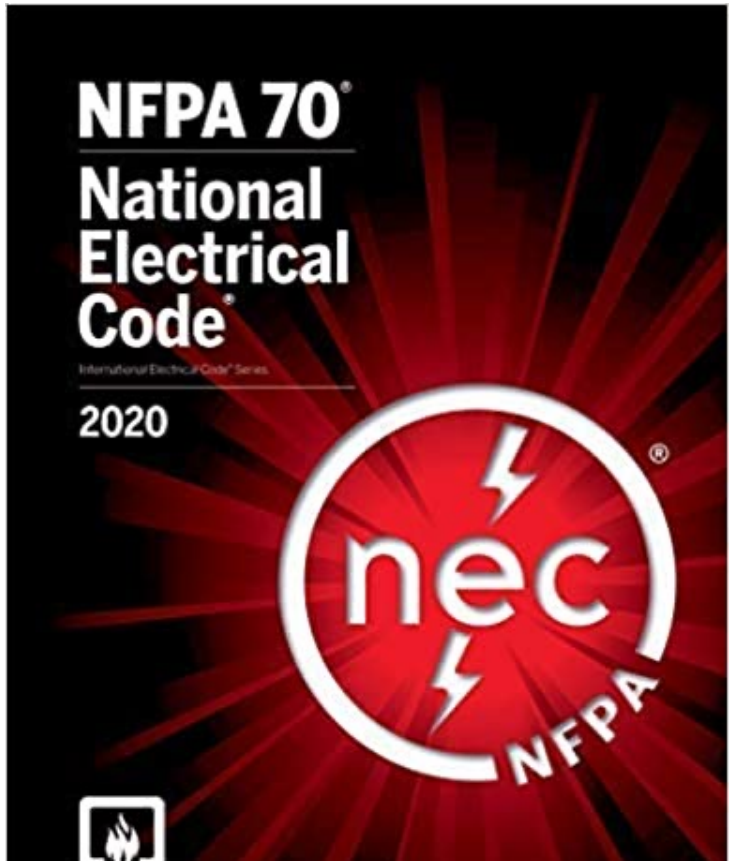
Motors: Article 430

- 27 pages

Transformers: Article 450

- 7 pages

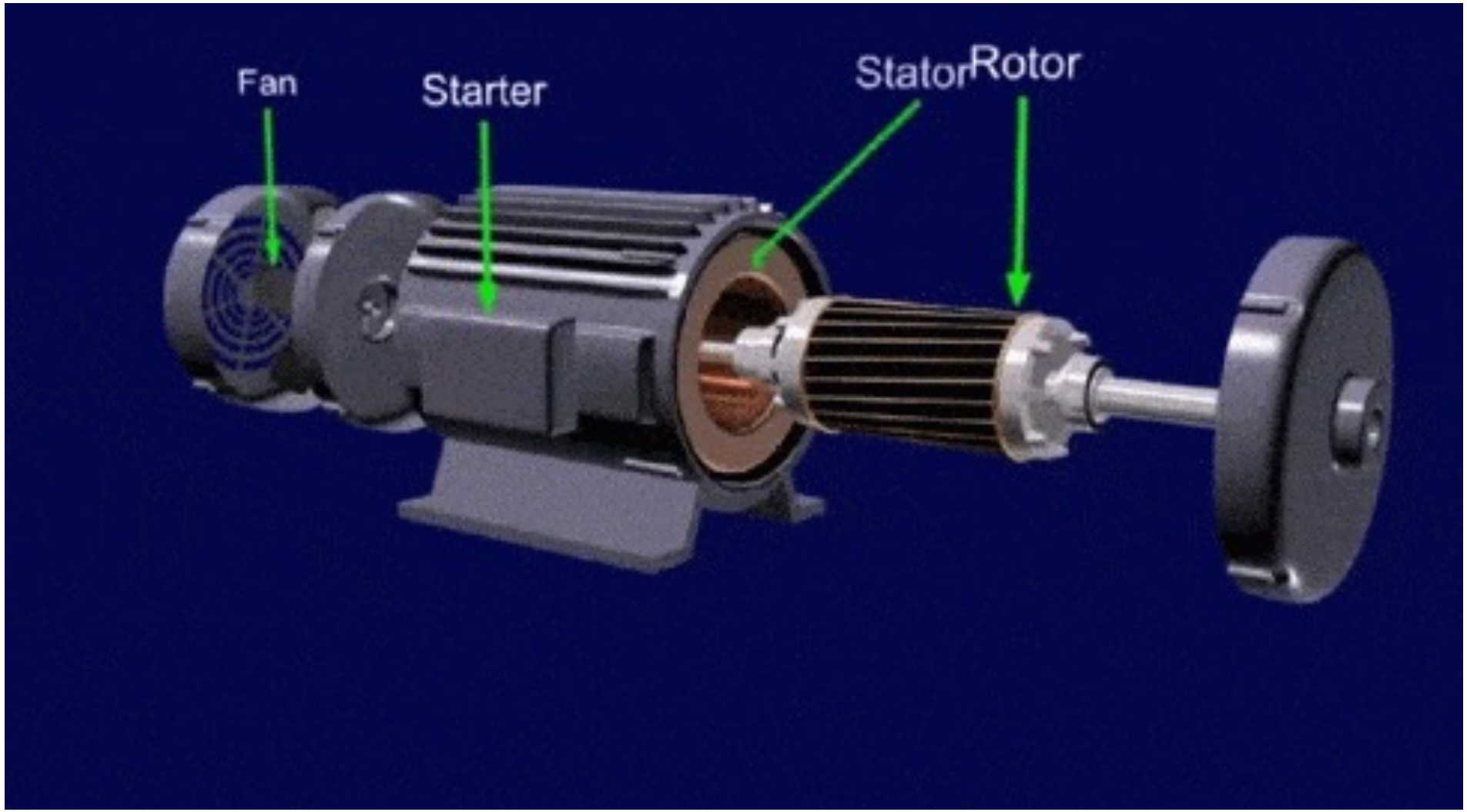
Recommendations for This Course

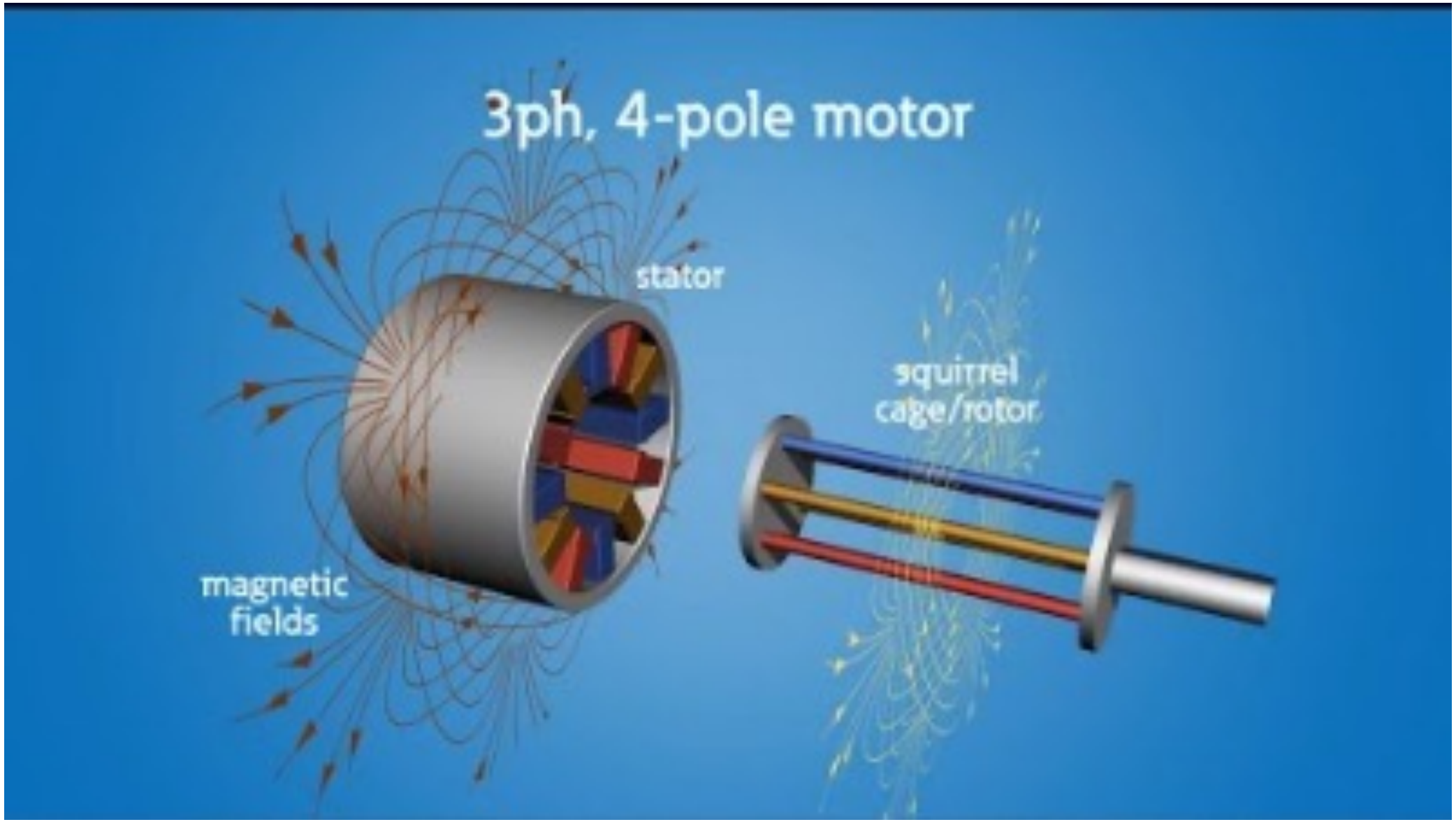


- Have copy of NEC for reference
- Grab a basic calculator perform simple calculations
- Advise me to slow down if something is not clear
- Don’t be afraid to question something if you don’t agree

952

Motors! Article 430




3ph, 4-pole motor
stator
squirrel
cage/rotor
magnetic
fields

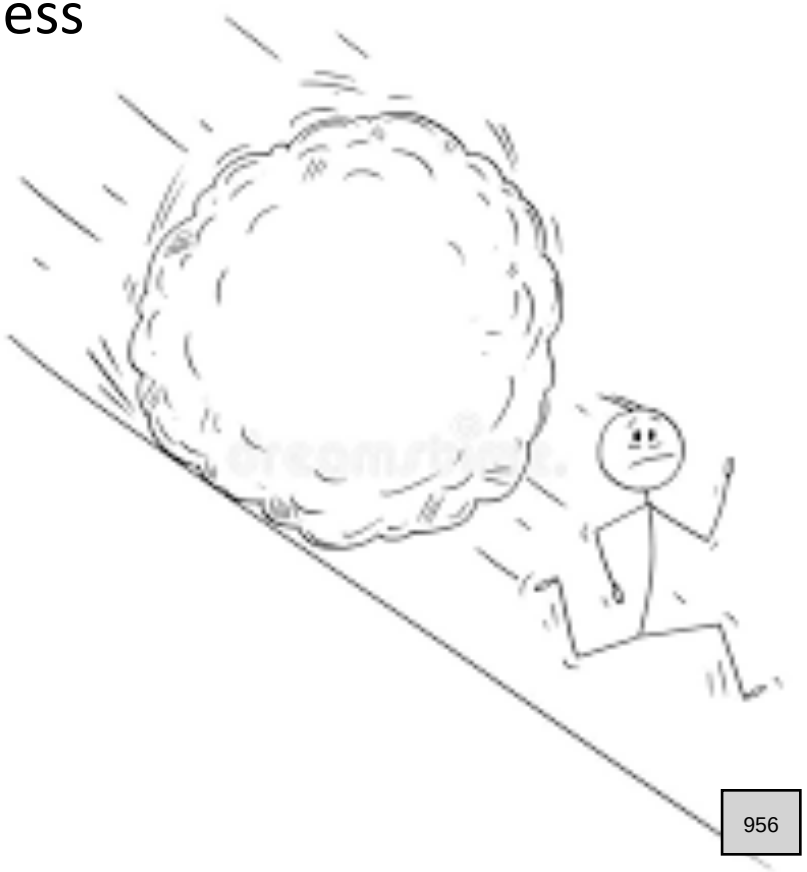
Motor Challenges

- Motors present unique challenges
  - High starting (inrush current)
    - How to start motor without tripping circuit breaker
  - Motors are very expensive – protection motor is a priority in many cases
  - Adequately protecting motor feeder
  - Multiple motors on a circuit
  - High Inertia

Newton's First Law: Inertia

Newton's first law states that **every object will remain at rest or in uniform motion in a straight line unless compelled to change its state by the action of an external force.**

In other words… an object in motion will stay in motion unless acted upon by another force



Motors have a lot of rotational inertia

Motor Challenges

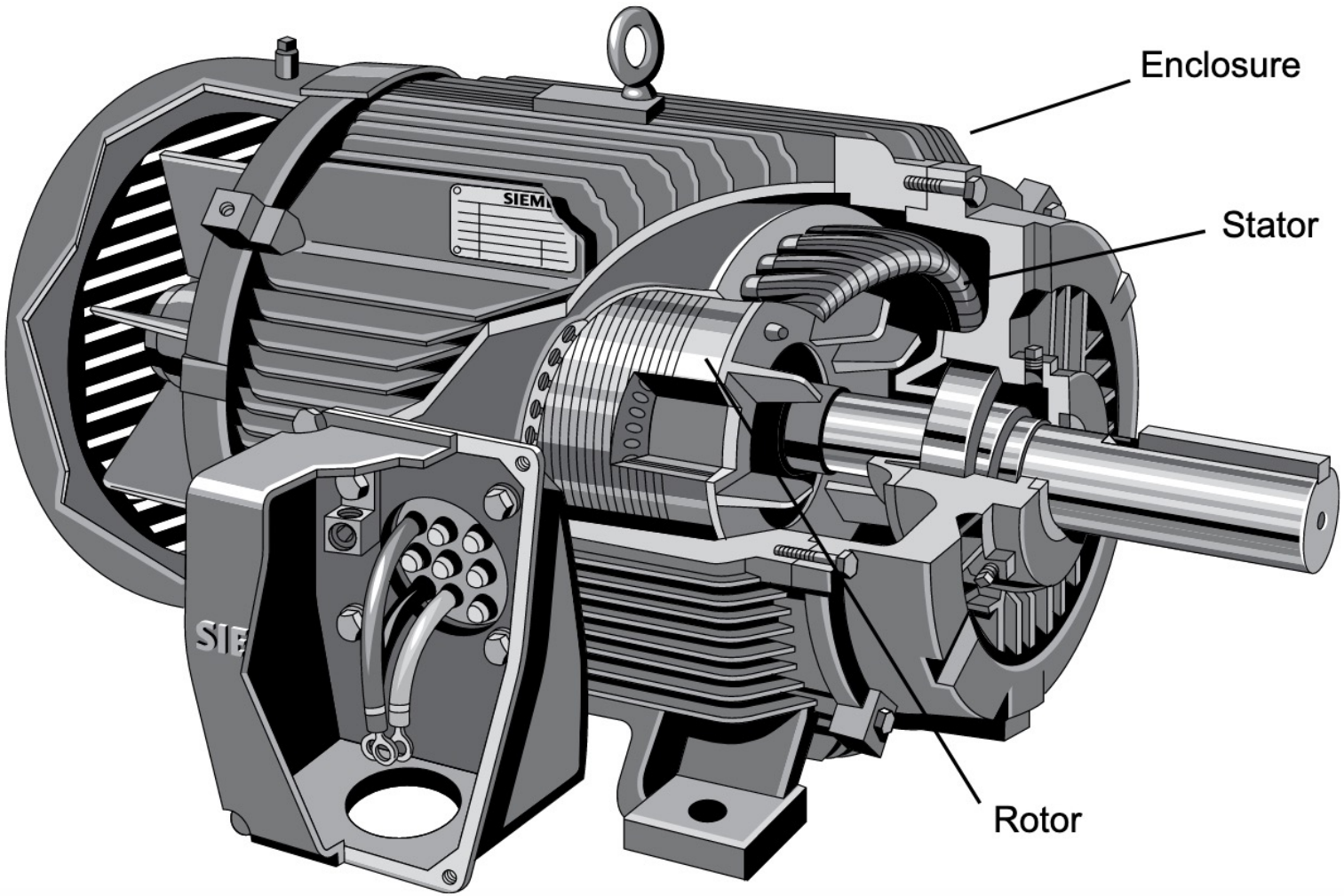
- Safety: stopping, torque, speed control, guarding moving parts
- Lots of energy: inductive
- Produce heat
- Vibration: impacts connections and cabling
- Impacts power factor
- What is a motor running backwards?

Goals

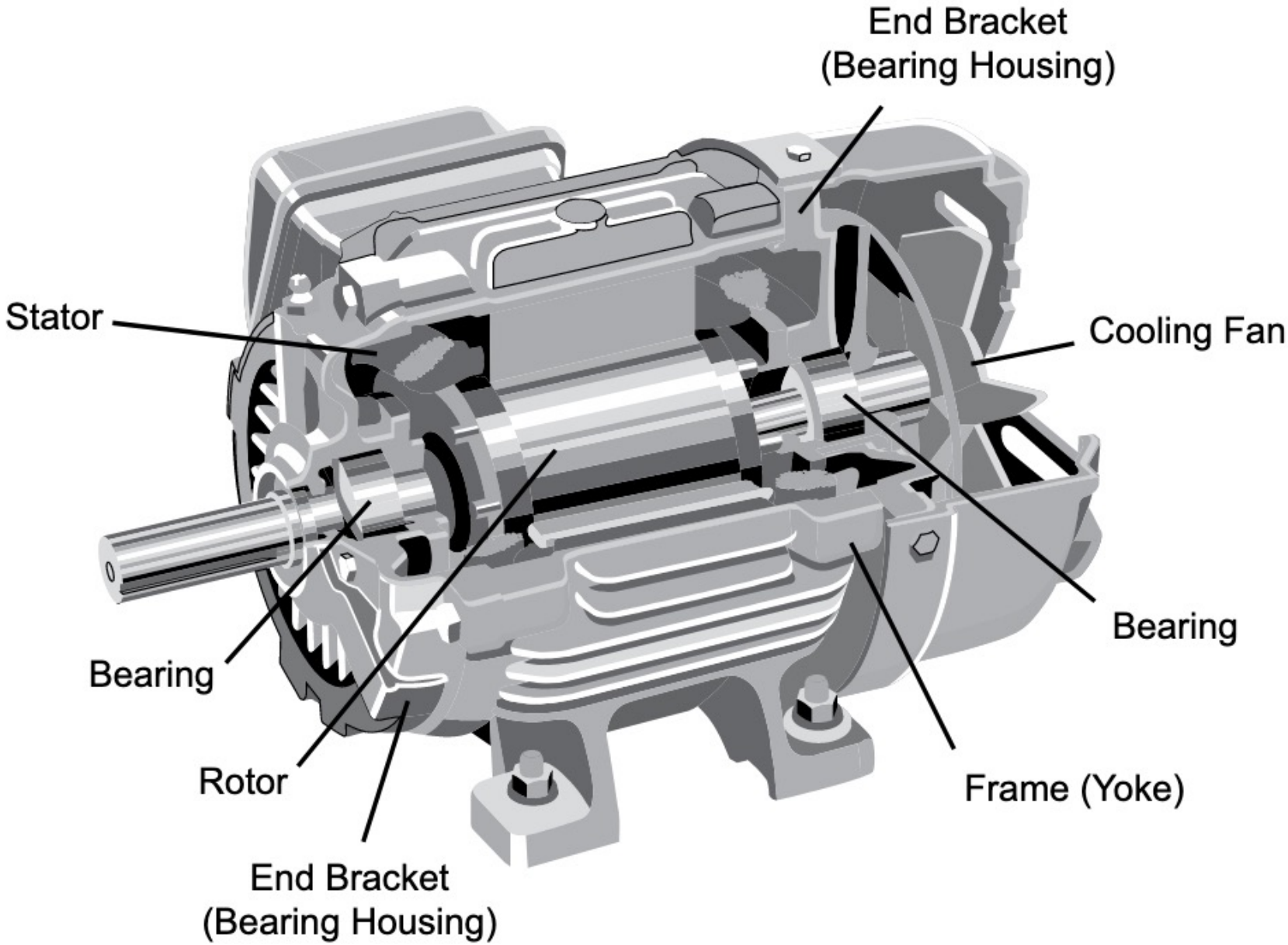
- Protect motor from overcurrent (short-circuits and ground faults)
- Protect motor from overload (heat, excessive current from overloads)
- Protect motor conductors
- Protect people (shocks, arc flash, burns etc.). Also see NFPA 70E

Definitions (Not in NEC)

- Torque: rotational force
- Slip: the difference between the rotating magnetic field and the rotor



Courtesy of Siemens



Cutaway View of Motor

Courtesy of Siemens

Motor Nameplate Information

- HP (Horsepower): Rotational Power of a motor
- Voltage: Rated voltage of a motor
- Frequency: Number of cycles/sec of the incoming power (design)
  - 60 Hz for USA, 50 Hz for Europe
- RPM (Revolutions per Minute): speed of a motor
  - Determined by number of poles and motor frequency
  - RPM = (120 x F)/number of poles of motor
  - For example: What is the speed of a 60HZ, 2 pole induction motor?
  - RPM = (120 x 60)/2 = 7200/2 = 3600 rpm
  - Note: the more poles a motor has, the lower the RPM

Motor Nameplate Continued

- Full load Amps (FLA)
  - The current the motor draws when running at rated voltage, frequency and RPM
- Frame size: provides information on
  - Size of motor
  - Mounting of motor
  - Connection to load (C-face, gearbox, coupling etc.)

Motor Nameplate Information

- Service Factor:
  - The percentage of overloading the motor can handle for short periods
  - Example: a 10 hp motor with a service factor of 1.15 could provide 10 x 1.15 = 11.5 hp for a short time.

- Locked rotor amps and code:
  - The KVA (kilo-volt-amps) of a motor when starting. This is usually 6 to 8 times the full load current.
  - KVA can be converted to amps to determine the locked rotor amps. Can be used to help size the overcurrent protective devices (fuses and circuit breakers)

Motor Nameplate Information

- Locked Rotor amps (cont.)
  - Code Letters: A-H, J-N, P-V
  - Used to help size the overcurrent protection of a motor
- See Table 430.7(B)
- Example: What is the Locked Rotor Amps of a 3-phase, 20 HP, 208V motor with a code letter B?

Code Letter and Locked Rotor Amps

- 20 HP
- 208 volts, 3 phase
- Code letter B:
  - 3.15 - 3.54 per Table 430.7(B)
  - Use 3.54 for worst case

- Amps = KVA per HP x 1000/(Volts x 1.732)
- Amps = 3.54 x 20 x 1000/(208 x 1.732)
- Amps = 196.52

Pin Header

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

Temperature (T-Codes)

Maximum Temperature		Temperature Class (T-Code)
Degrees C	Degrees F	
450	842	T1
300	572	T2
280	536	T2A
260	500	T2B
230	446	T2C
215	419	T2D
200	392	T3
180	356	T3A
165	329	T3B
160	320	T3C
135	275	T4
120	248	T4A
100	212	T5
85	185	T6

ties, is provided in Table 4.4.2.

Table 4.4.2 Selected Chemicals

Chemical	CAS No.	Class I Division Group	Type[a]	Flash Point (°C)	AIT (°C)	%LFL	%UFL	Vapor Density (Air = 1)	Vapor Pressure[b] (mm Hg)	Class I Zone Group[c]	MIE (mJ)	MIC Ratio	MESG (mm)
Acetaldehyde	75–07–0	C[d]	I	–38	175	4.0	60.0	1.5	874.9	IIA	0.37	0.98	0.92
Acetic Acid	64–19–7	D[d]	II	39	426		19.9	2.1	15.6	IIA		2.67	1.76
Acetic Acid-tert-Butyl Ester	540–88–5	D	II			1.7	9.8	4.0	40.6				
Acetic Anhydride	108–24–7	D	II	49	316	2.7	10.3	3.5	4.9	IIA			1.23
Acetone	67–64–1	D[d]	I	–20	465	2.5	12.8	2.0	230.7	IIA	1.15	1.00	1.02
Acetone Cyanohydrin	75–86–5	D	IIIA	74	688	2.2	12.0	2.9	0.3				
Acetonitrile	75–05–8	D	I	6	524	3.0	16.0	1.4	91.1	IIA			1.50
Acetylene	74–86–2	A[d]	GAS		305	2.5	100	0.9	36600	IIC	0.017	0.28	0.25
Acrolein (Inhibited)	107–02–8	B(C)[d]	I		235	2.8	31.0	1.9	274.1	IIB	0.13		
Acrylic Acid	79–10–7	D	II	54	438	2.4	8.0	2.5	4.3	IIB			0.86
Acrylonitrile	107–13–1	D[d]	I	0	481	3	17	1.8	108.5	IIB	0.16	0.78	0.87
Adiponitrile	111–69–3	D	IIIA	93	550			1.0	0.002				
Allyl Alcohol	107–18–6	C[d]	I	22	378	2.5	18.0	2.0	25.4	IIB			0.84
Allyl Chloride	107–05–1	D	I	–32	485	2.9	11.1	2.6	366	IIA		1.33	1.17
Allyl Glycidyl Ether	106–92–3	B(C)[e]	II		57			3.9					
Alpha-Methyl Styrene	98–83–9	D	II		574	0.8	11.0	4.1	2.7				
n-Amyl Acetate	628–63–7	D	I	25	360	1.1	7.5	4.5	4.2	IIA			1.02
sec-Amyl Acetate	626–38–0	D	I	23		1.1	7.5	4.5		IIA			
Ammonia	7664–41–7	D[d,f]	GAS		651	15	28	0.6	7498.0	IIA	680	6.85	3.17
Aniline	62–53–3	D	IIIA	70	615	1.2	8.3	3.2	0.7	IIA			
Benzene	71–43–2	D[d]	I	–11	498	1.2	7.8	2.8	94.8	IIA	0.20	1.00	0.99
Benzyl Chloride	98–87–3	D	IIIA		585	1.1		4.4	0.5				
Bromopropyne	106–96–7	D	I	10	324	3.0							
n-Butane	106–97–8	D[d,g]	GAS		288	1.9	8.5	2.0		IIA	0.25	0.94	1.07
1,3-Butadiene	106–99–0	B(D)[d,e]	GAS		420	2.0	11.5	1.9		IIB	0.13	0.76	0.79
1-Butanol	71–36–3	D[d]	I	36	343	1.4	11.2	2.6	7.0	IIA			0.91
Butyl alcohol(s) (butanol-2)	78–92–2	D[d]	I	23.8	405	1.7	9.8	2.6		IIA			

57 deg C = 134.6 deg F

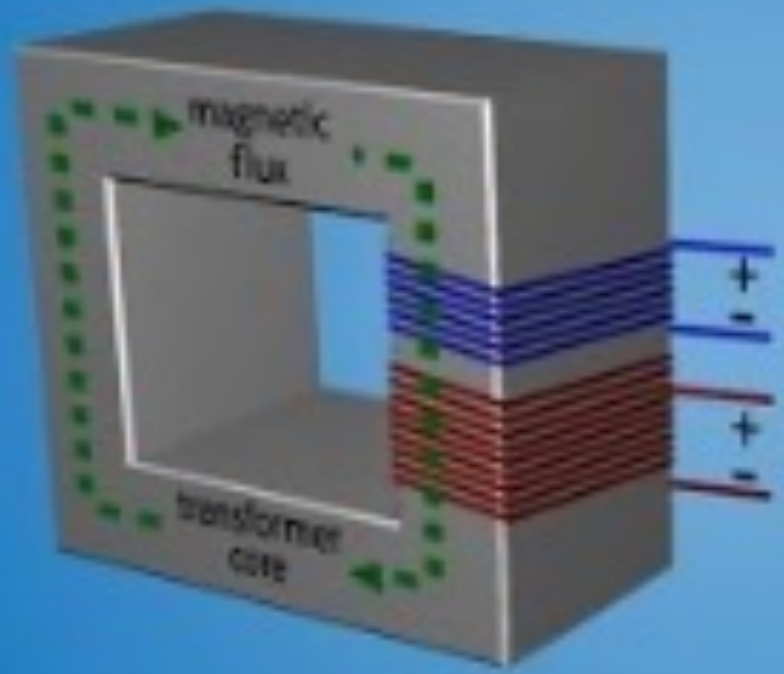
(continues)

Nameplate Information

- Hazardous location classification
  - Gives information for what locations this motor can be used
  - Class I, Class II, Class III; Divisions 1 and 2 for example
- Altitude:
  - Standard motors are designed to operate below 3300 feet. Above 3300 feet, air is thinner and the ability to dissipate heat is not as good.
  - Most motors must be derated for altitudes above 3300 feet.
  - The derating factor may or may not be stamped on the motor nameplate. Check manufacturing manual for more information.

Article 450: Transformers and Transformer Vaults

Transformer construction



secondary current

\+ secondary winding −

Loads, <5kV large machinery, lighting,residential

\+ primary winding −

primary current

Medium voltage 5kV-35kV

Transformer Basics

- Works on the principle of mutual induction
- Power measured in VA (Volts-Amps)
- Can be single phase or three phase
- Typically have a primary and secondary winding
- Current in one winding induces a current in another winding
- Voltage and current determined by the number of turns of wire in the windings
- Can step up or step down voltage and current
- Used for circuit isolation
- Windings require protection from damage

Issues with Transformer Installations

- Inrush current
  - Allowing transformer to start without tripping, similar to motors
- Dealing with two sets of voltages and currents
- Confusing overcurrent protection requirements
  - Primary only
  - Primary and secondary
  - Supervised
  - Unsupervised
- Can be extremely high fault currents on the secondary of the transformer due to low impedance

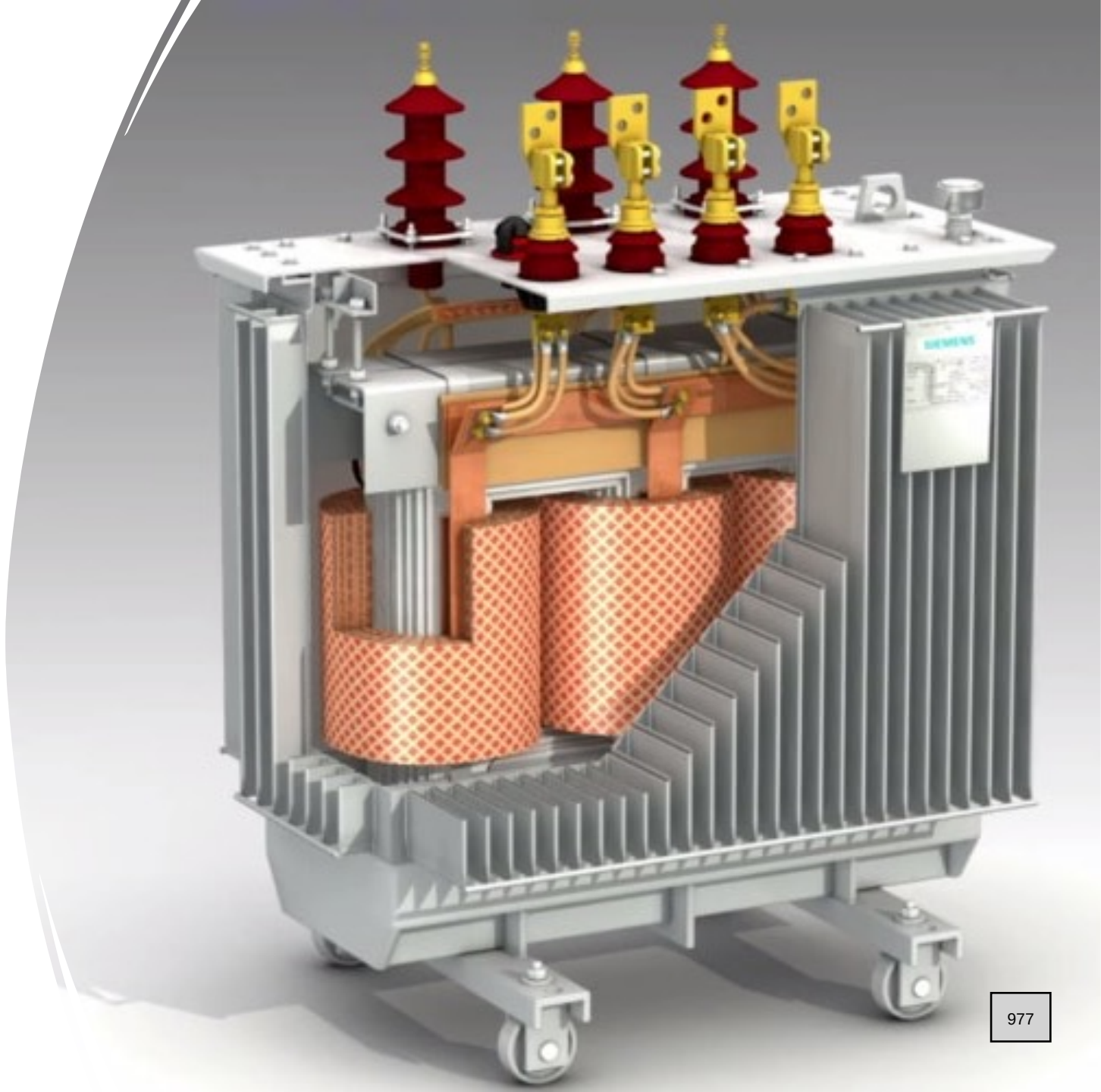
Issues with Transformer Installations

- Heat: cooling
- Grounding and bonding – can be complicated
- Environment, many installed outdoors
- Environmental, some are oil-filled, leaks
- Noise
- Security, recent issues with shootings of transformers
- Expensive
- Large, heavy, hard to transport and maneuver
- Vibration

Overcurrent Protection

- Article 450: goal is to protect the TRANSFORMER, not the conductors
- Article 240: goal is to protect the transformer FEEDERS
- The overcurrent protection requirements of 450 may also protect the feeders
- The overcurrent protection requirements of 240 may also protect the transformer
- BUT they may not!

Transformers Protected According to Article 450



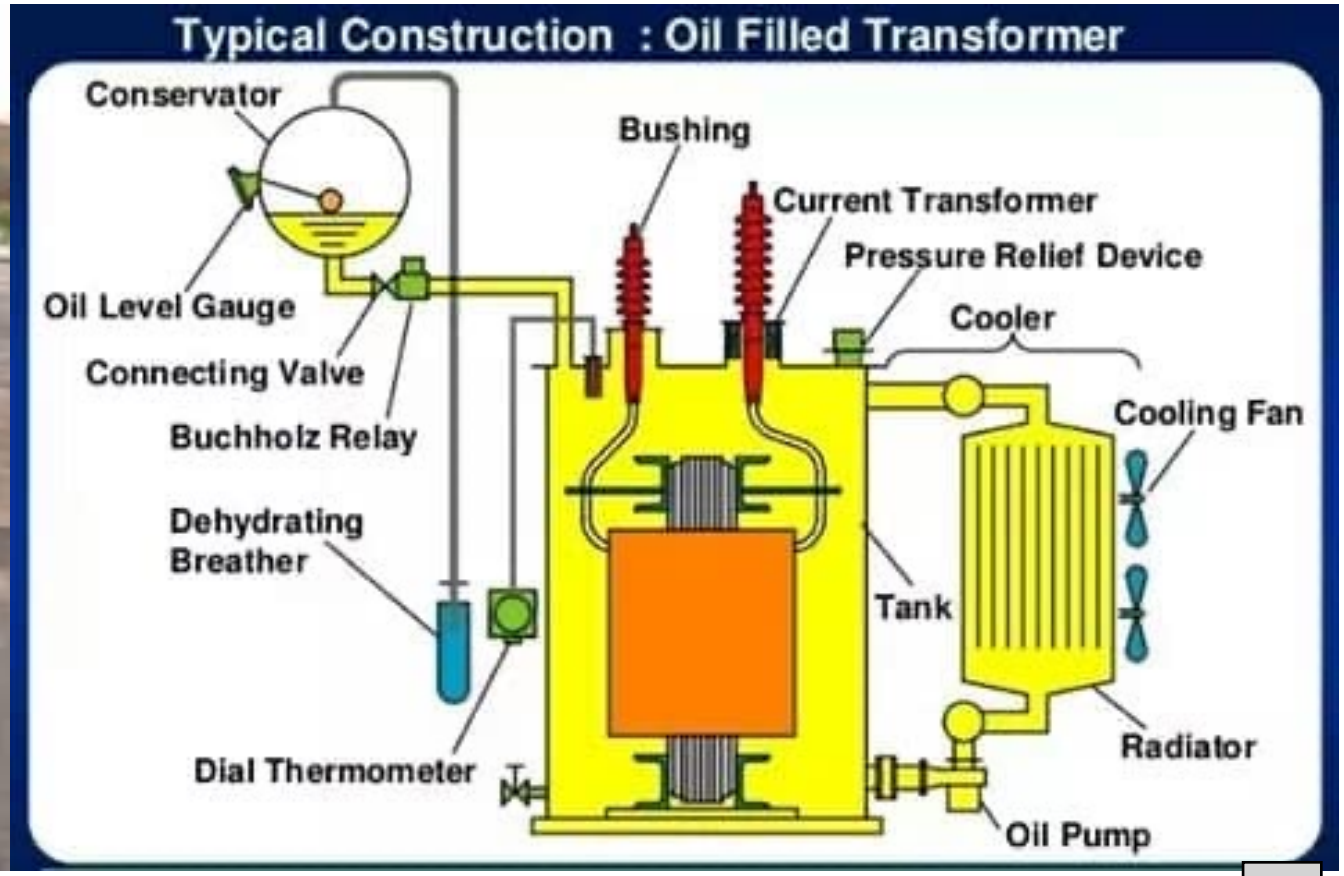
Transformer Secondary Feeder Protection

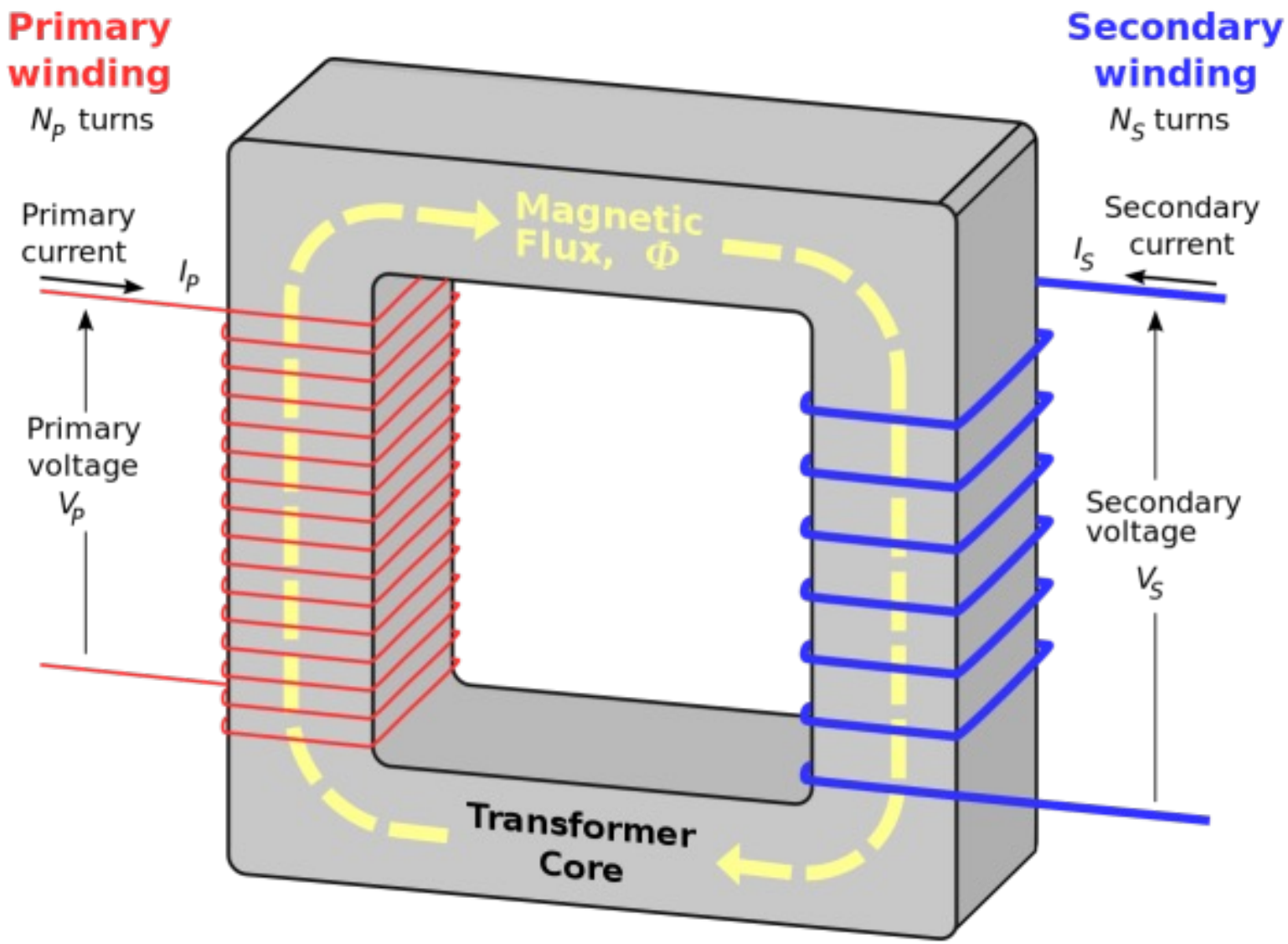
- Required with few exceptions
- Primary side protection of secondary feeders is allowed when requirements of 240.21(C)(1) are met
- Secondary OCPD is not required when the conductor is short and meets the tap rule requirements in 240.21(C)(2), (3) (5) and (6)
- Secondary OCPD is not required for outside conductors when the requirements of 240.21(C)((4) are met (another tap rule)

Types

- Dry-type

Oil -Filled


Typical Construction : Oil Filled Transformer
Conservator
Bushing
Current Transformer
Pressure Relief Device
Cooler
Oil Level Gauge
Connecting Valve
Buchholz Relay
Cooling Fan
Dehydrating Breather
Tank
Radiator
Dial Thermometer
Oil Pump


Primary winding
N_P turns
Secondary winding
N_S turns
Primary current
I_P
Magnetic Flux, Φ
Secondary current
I_S
Primary voltage
V_P
Secondary voltage
V_S
Transformer Core

Guarding 450.8

- Mechanical protection shall be provided to minimize the possibility of damage to transformers, examples: barriers, bollards, fencing, walls etc.

- Exposed energize parts shall be guarded

- Voltage warning labels or other types of identification shall be installed to indicate the operating voltage of the transformer

Ventilation (450.9)

- Transformers shall be installed such that vents won’t be blocked by walls or other obstacles

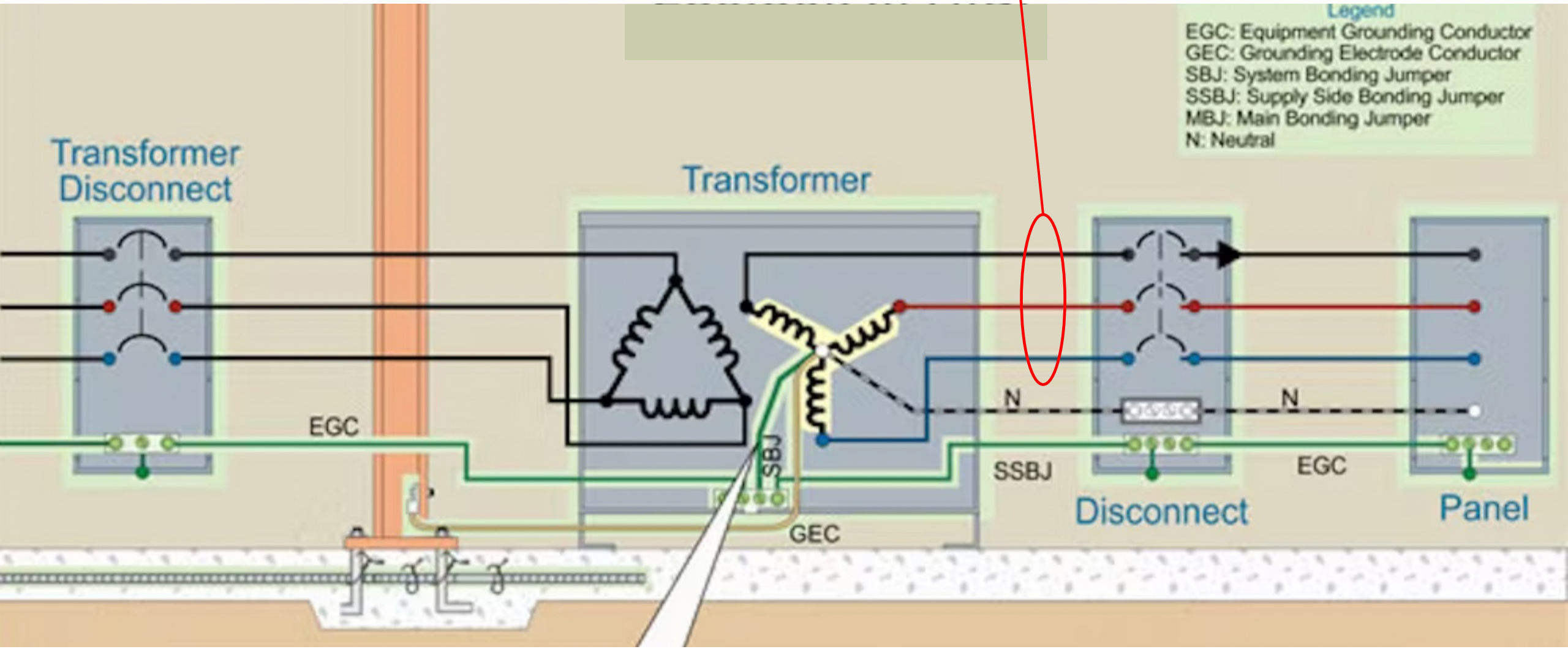
Marking Requirements (450.11)

- Name of manufacturer
- Rated Kilovolt-amperes
- Frequency
- Primary and secondary voltage
- Impedance of transformers 25 kva and larger
- Required clearances for transformers with ventilation openings
- Amount and kind of insulating liquid where used
- For dry-type transformers, temperature class for the insulating system.

Where would you put a circuit breaker or a fuse on the secondary side (X1, X2, X3)?

Next available location is the service-rated disconnect down stream from the transformer

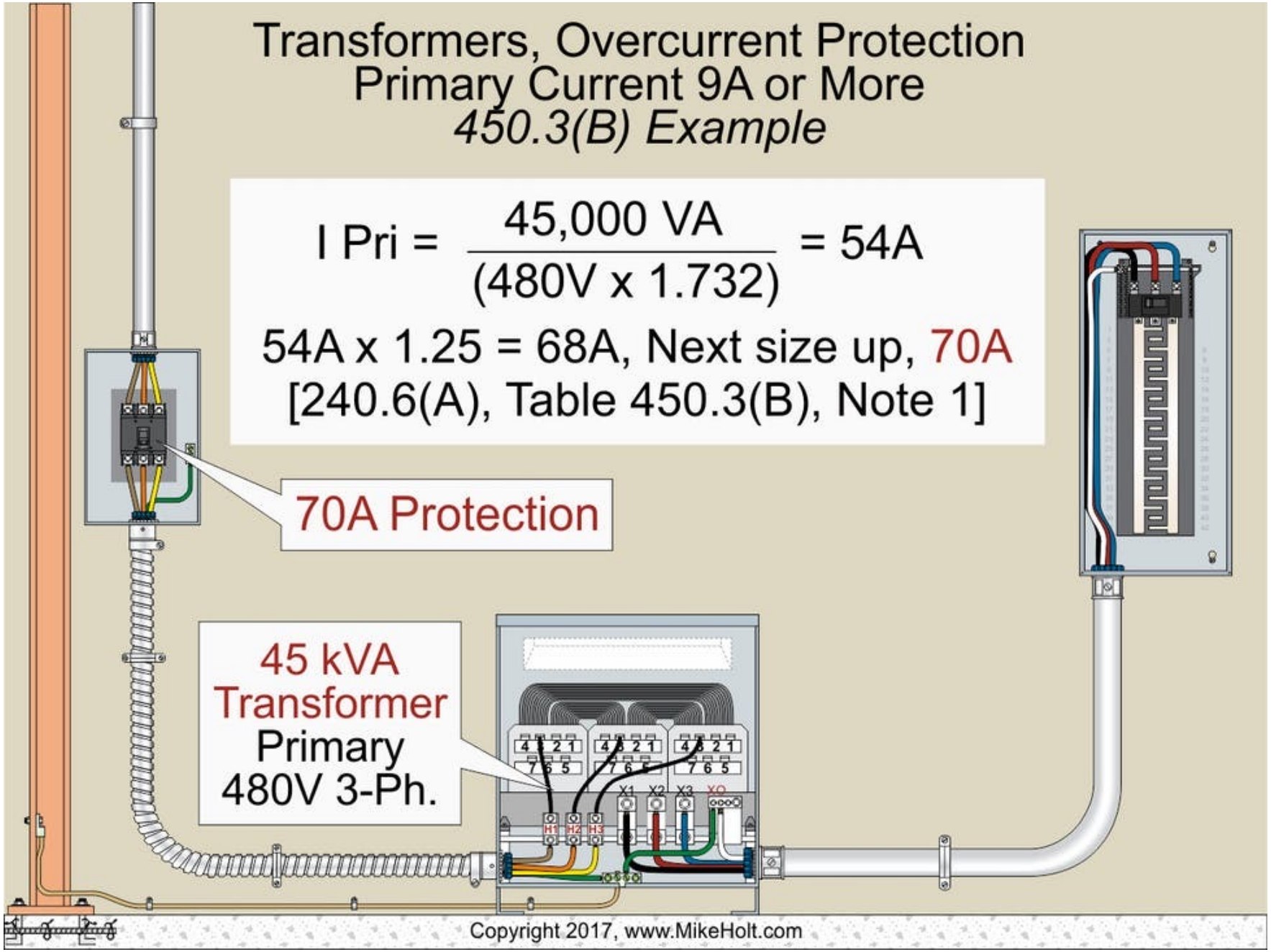
These wires are unprotected



Transformer Overcurrent Protection

- Objective: To protect the windings, not the conductors
- Reference section 450.3(B)

Table 450.3(B) Primary Protection Only 1000V and Less	
Primary Current Rating	Maximum Protection
9A or more	125%, note 1
Less than 9A	167%
Less than 2A	300%
Note 1: Where 125% of the primary current doesn't correspond to a standard rating of a fuse or nonadjustable circuit breaker, the next higher rating is permitted[240.6(A)]	


Transformers, Overcurrent Protection
Primary Current 9A or More
450.3(B) Example
I Pri = 45,000 VA / (480V x 1.732) = 54A
54A x 1.25 = 68A, Next size up, 70A
[240.6(A), Table 450.3(B), Note 1]
70A Protection
45 kVA
Transformer
Primary
480V 3-Ph.
H1 H2 H3
X1 X2 X3 XO
Copyright 2017, www.MikeHolt.com

Transformer Primary Conductor Sizing

- Conductors must be sized no less than 125% of the continuous loads, plus 100 percent of the noncontinous loads, based on the terminal temperature rating ampacities as listed in Table 310.15(B)(16) before and ampacity adjustment [210.19(A)(1)]

Pin Header

Table 450.3(A) Maximum Rating or Setting of Overcurrent Protection for Transformers Over 1000 Volts (as a Percentage of Transformer-Rated Current)

		Primary Protection over 1000 Volts		Secondary Protection (See Note 2.)		
				Over 1000 Volts		1000 Volts or Less
Location Limitations	Transformer Rated Impedance	Circuit Breaker (See Note 4.)	Fuse Rating	Circuit Breaker (See Note 4.)	Fuse Rating	Circuit Breaker or Fuse Rating
Any location	Not more than 6%	600% (See Note 1.)	300% (See Note 1.)	300% (See Note 1.)	250% (See Note 1.)	125% (See Note 1.)
	More than 6% and not more than 10%	400% (See Note 1.)	300% (See Note 1.)	250% (See Note 1.)	225% (See Note 1.)	125% (See Note 1.)
Supervised locations only (See Note 3.)	Any	300% (See Note 1.)	250% (See Note 1.)	Not required	Not required	Not required
	Not more than 6%	600%	300%	300% (See Note 5.)	250% (See Note 5.)	250% (See Note 5.)
	More than 6% and not more than 10%	400%	300%	250% (See Note 5.)	225% (See Note 5.)	250% (See Note 5.)

Notes:

1. Where the required fuse rating or circuit breaker setting does not correspond to a standard rating or setting, a higher rating or setting that does not exceed the following shall be permitted:

a. The next higher standard rating or setting for fuses and circuit breakers 1000 volts and below, or

b. The next higher commercially available rating or setting for fuses and circuit breakers above 1000 volts.

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

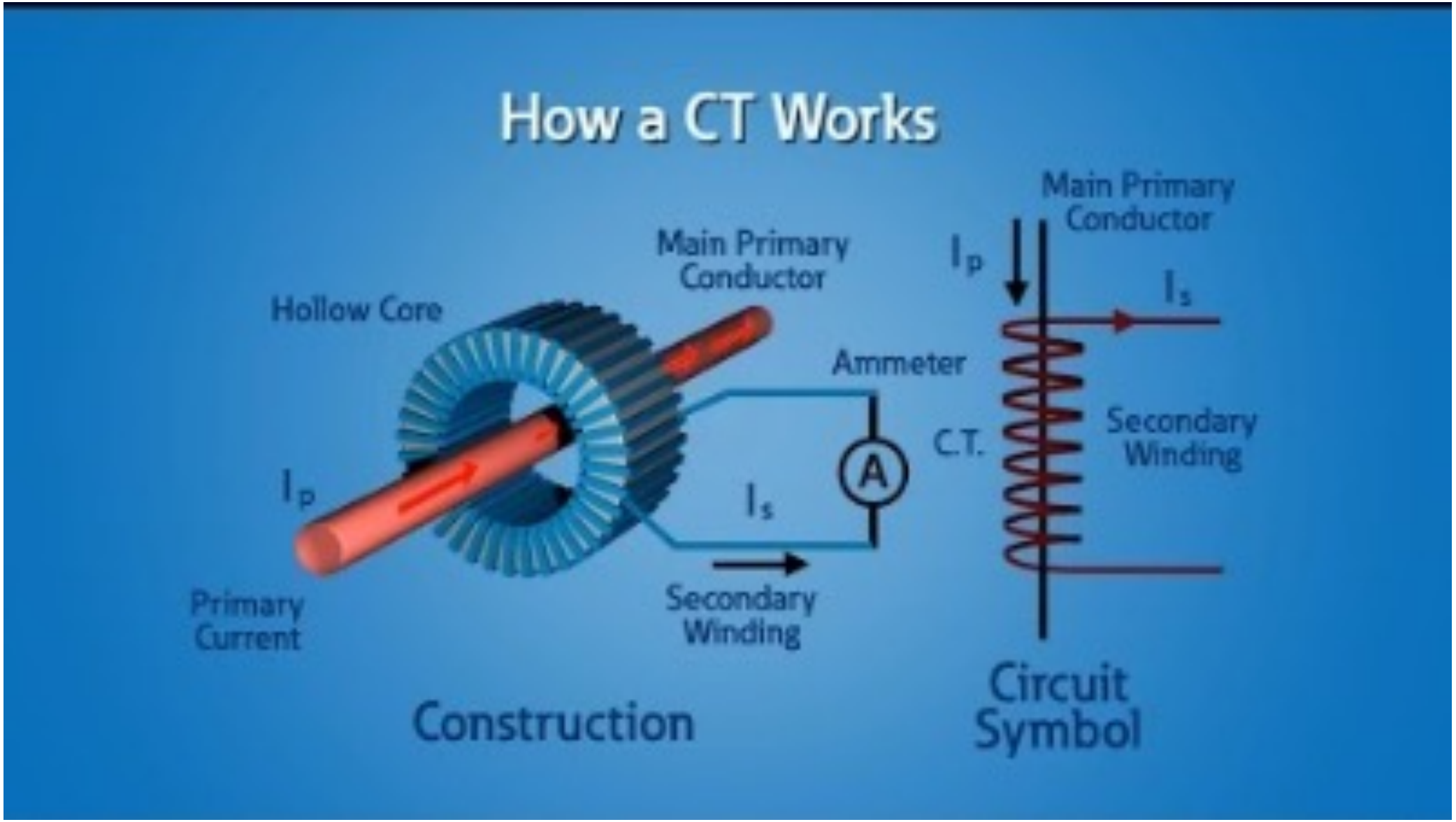
3. A supervised location is a location where conditions of maintenance and supervision ensure that only qualified persons monitor and service the transformer installation.

4. Electronically actuated fuses that may be set to open at a specific current shall be set in accordance with settings for circuit breakers.

5. A transformer equipped with a coordinated thermal overload protection by the manufacturer shall be permitted to have separate secondary protection omitted.

Current Transformers

- Safely converts electrical current into a voltage signal
- Used for metering, relays, test instruments etc.
- Can read positive and negative flow
- Correct orientation to indicate proper current direction is important


How a CT Works
Main Primary Conductor
Hollow Core
Ammeter
I_p
I_s
A
Primary Current
Secondary Winding
Construction
Main Primary Conductor
I_p
I_s
C.T.
Secondary Winding
Circuit Symbol

CONGRATULATIONS!

993

994

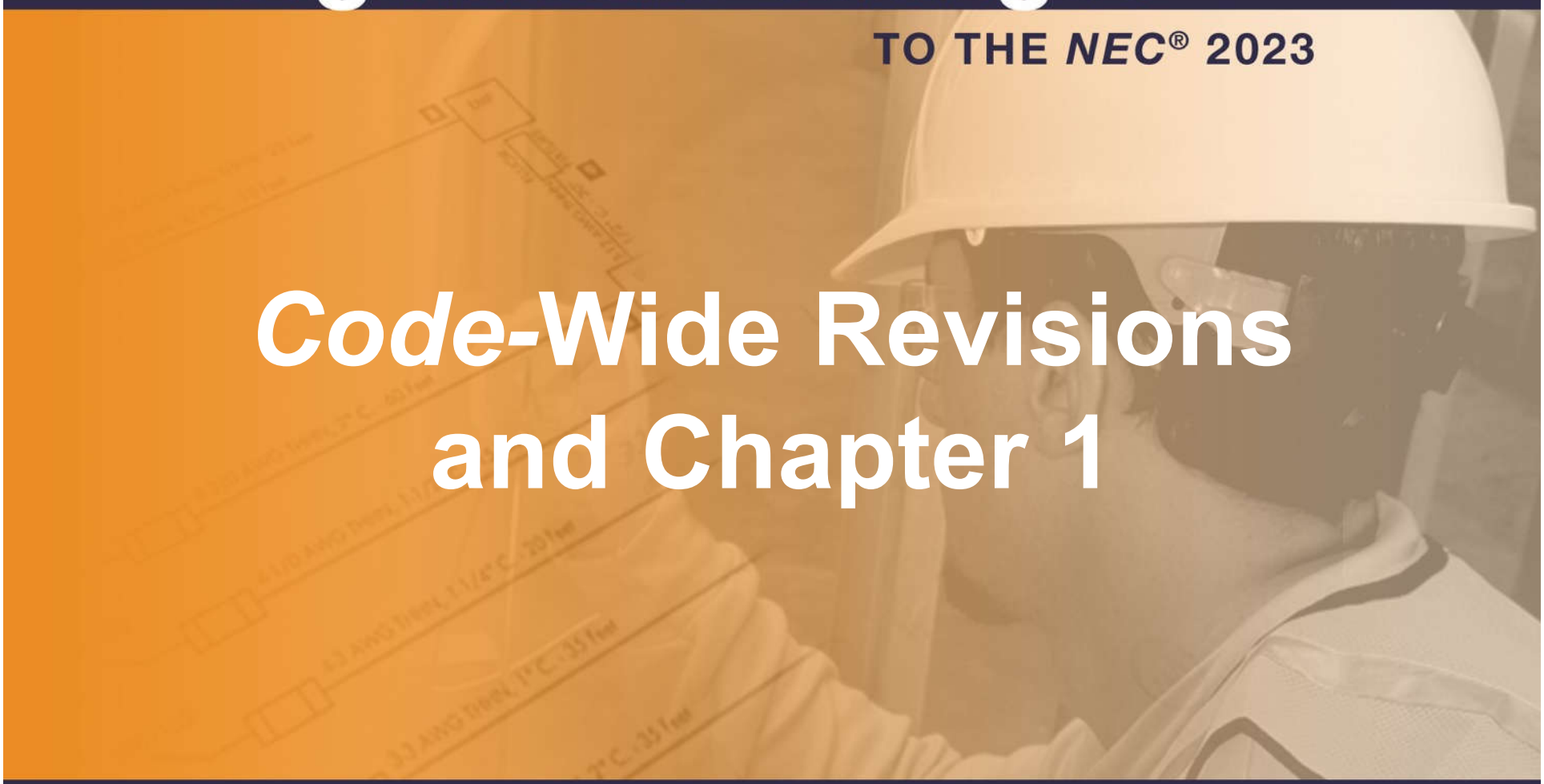
File Attachments for Item:

EC-18 Significant Changes to the 2023 NEC (Dayton Area Electrical JATC)

All certifications (12 hours, two 6-hour sessions)

Significant Changes

TO THE *NEC*® 2023



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*.
- The second section of some articles (XXX.2) is now reserved for any requirements that either permit or prohibit reconditioning of equipment that is covered by the article.

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Code-Wide Revisions

Definitions

Change Summary

- Article 100 now contains all definitions. No definitions will be in the other articles of the *Code*.
- Article 100 will no longer be divided into parts.
- Definitions are assigned to code-making panels based on the articles assigned to the panel and how closely the panel aligns with the definition. The responsible panel is indicated in each definition.
- Some definitions only apply to a single article. Where that is the case, the article number appears toward the end of the definition.
- In a few cases, multiple definitions continue to be required.

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Code-Wide Revisions

New, Deleted, and Relocated Articles and Revised Article Titles for the 2023 NEC

Change Summary

- Some Articles are new, three were deleted, some had title revisions, and others were relocated.
  - 110 General Requirements for Electrical Installations (Revised title)
  - 210 Branch Circuits, Not Over 1000 Volts ac, 1500 Volts dc, Nominal (Revised title)
  - 235 Branch Circuits, Feeders, and Services Over 1000 Volts ac, 1500 Volts dc, Nominal (New)
  - 245 Overcurrent Protection for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal (New)
  - 305 General Requirements for Wiring Methods and Materials for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal (New)

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Code-Wide Revisions

New, Deleted, and Relocated Articles and Revised Article Titles for the 2023 NEC (continued)

Change Summary

- 315 Medium Voltage Conductors, Cable, Cable Joints, and Cable Terminations (Revised title and relocated)
- 335 Instrument Tray Cable: Type ITC (Relocated)
- 369 Insulated Bus Pipe (IBP)/Tubular Covered Conductors (TCC) Systems (New)
- 371 Flexible Bus Systems (New)
- 395 Outdoor Overhead Conductors over 1000 Volts (Relocated)
- 480 Stationary Standby Batteries (Revised title)
- 495 Equipment Over 1000 Volts ac, 1500 Volts dc, Nominal (Revised title and Relocated)
- 510 Hazardous (Classified) Locations-Specific (Deleted)

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Code-Wide Revisions

New, Deleted, and Relocated Articles and Revised Article Titles for the 2023 NEC (continued)

Change Summary

- 512 Cannabis Oil Equipment and Cannabis Oil Systems Using Flammable Materials (New)
- 712 Direct Current Microgrids (Deleted)
- 720 Circuits and Equipment Operating at Less Than 50 Volts (Deleted)
- 722 Cables for Power-Limited Circuits and Fault-Managed Power Circuits (New)
- 724 Class 1 Power-Limited Circuits and Class 1 Power-Limited Remote Control and Signaling Circuits (New)
- 725 Class 2 and Class 3 Power-Limited Circuits (Revised title)
- 726 Class 4 Fault-Managed Power Systems (New)
- 810 Antenna Systems (Revised title)

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Code-Wide Revisions

NEC Style Manual Changes

Change Summary

- A new version of the style manual was issued in 2020.
- Text was simplified to avoid long paragraphs and long sentences by placing complex requirements into a list format.
- Many of the changes improved readability, and those changes are not covered in this book.

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Code-Wide Revisions

Medium- and High-Voltage Requirements

Change Summary

- Many medium- and high-voltage requirements were removed from existing articles and moved to an article ending in number 5.
- For example, Article 235 now covers medium- and high-voltage services.
- New articles:
  - 235 Branch Circuits, Feeders, and Services Over 1000 Volts ac, 1500 Volts dc, Nominal
  - 245 Overcurrent Protection for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal
  - 305 General Requirements for Wiring Methods and Materials for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal

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Code-Wide Revisions

Medium- and High-Voltage Requirements (continued)

Change Summary

- 315 Medium Voltage Conductors, Cable, Cable Joints, and Cable Terminations
- 395 Outdoor Overhead Conductors over 1000 Volts
- 495 Equipment Over 1000 Volts ac, 1500 Volts dc, Nominal

- Articles 395 and 495 were relocated from 399 and 490, respectively, for consistency with the numbering scheme for medium- and high-voltage articles.

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Code-Wide Revisions

Not a Change?

Change Summary

- Prior to the 2002 *Code*, NM cable was limited to buildings of three stories or less.
- Section 334.10 permitted NM cable in buildings of Types III, IV, and V construction, but the cables had to be concealed within walls, floors, or ceilings that provided a thermal barrier of material that provided at least a 15-minute finish rating.
- Limitations in 334.12 provided some applications and occupancies where NM cable was not permitted to be used.
- *International Building Code* and *NFPA 5000* limited Type IV heavy timber construction to five stories above grade.
- The *NEC* requirements were based on these limitations for 20 years.

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Code-Wide Revisions

Not a Change? (continued)

Change Summary

- The *International Building Code* changed its definition of Class IV construction to permit a heavy timber constructed building of up to 18 stories.
- *NFPA 5000* permits a Type IV heavy timber constructed building of up to 24 stories.
- These changes resulted in a significant change to the *NEC* that was not processed through the *NEC.*
- CMP 6 did not change the language.
- Significant changes took place in other codes outside of the *NEC* but affect the *NEC*.

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90.1

NEW

Scope

Change Summary

- Article 90 now has a scope that provides the scope of Article 90, rather than the scope of the *Code*.
- The material previously found in 90.1 has been combined with 90.2, which is now titled “Use and Application.”
- This change provides consistency and clarity but does not make any technical change to the *Code*.

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90.1

NEW

Article 90 Introduction

90.1 Scope

This article covers use and application, arrangement, and enforcement of this *Code*. It also covers the expression of mandatory, permissive, and nonmandatory text, provides guidance on the examination of equipment and on wiring, planning, and specifies the use and expression of measurements.

~~90.1 Purpose.~~

~~(A) Practical Safeguarding.~~

~~The purpose of this *Code* is the practical safeguarding or persons and property from hazards arising from the user of electricity. This *Code* is not intended as a design specification or an instruction manual for untrained persons.~~

~~(B) Adequacy.~~

...

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90.2

RELOCATE REORGANIZE

Use and Application

Change Summary

- Section 90.2 has a new title: Use and Application.
- All previous text in Section 90.1 has been blended into a reorganized 90.2
- The titles of 90.2(C) and (D) have been changed to accommodate the reorganization.

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90.2

RELOCATE REORGANIZE

90.2 ~~Scope~~ Use and Application

(A) Practical Safeguarding (Formerly 90.1(A))

(B) Adequacy (Formerly 90.1(B))

(C) Installations Covered (Formerly 90.2(A))

(D) Installations Not Covered (Formerly 90.2(B))

(E) Relation to Other International Standards (Formerly 90.1(C))

(F) Special Permission (Formerly 90.1(D))

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90.4

REORGANIZE

Enforcement

Change Summary

- This section was reorganized for clarity.
- A list format is used to make this section clearer.
- A new reference was added to Informative Annex H to comply with the *NEC Style Manual*.

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90.4

REORGANIZE

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90.5(C)

REVISION

Explanatory Material

Change Summary

- If a referenced standard does not have an edition date, the latest edition can be assumed.
- Newer editions of standards could have been released after the *Code* committee considered the latest edition.
- Since references are not mandatory, there is no prohibition against using an updated edition.
- Standards references are for convenience only. Most installations can be completed without referring to the referenced standards.

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90.5(C)

REVISION

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Article 100

REORGANIZE

Article 100 Reorganization

Change Summary

- Article 100 has been consolidated into an article that is not divided into parts.
- All of the definitions from other articles have been relocated into Article 100.
- The XXX.2 sections of various articles no longer contain definitions.
- If a term had multiple uses, it has been modified to facilitate each use. In many cases, terms were modified to cover all appropriate applications.

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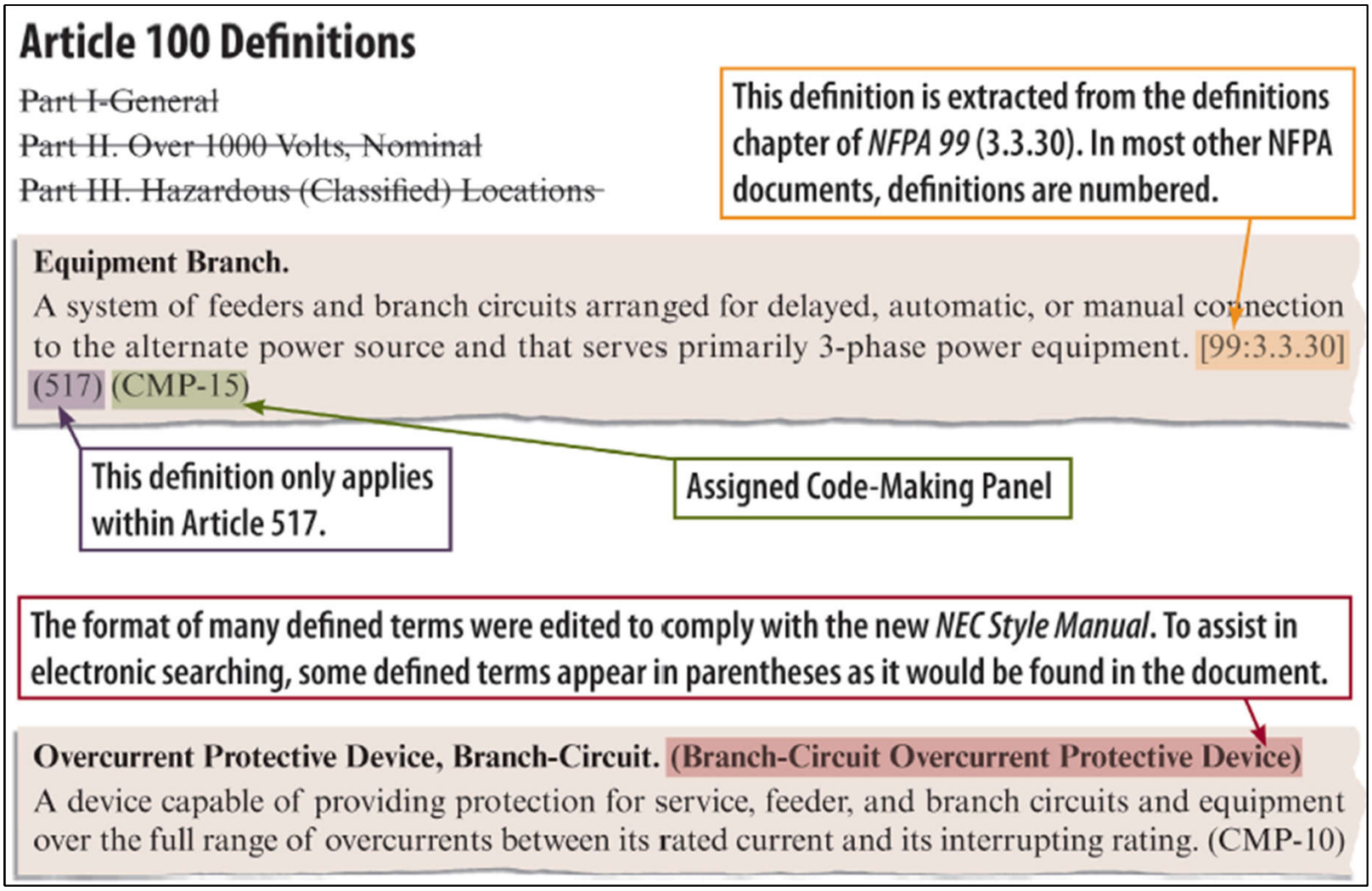
Article 100

REORGANIZE



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Article 100

REVISION

Definition of Accessible (as applied to wiring methods)

Change Summary

- For a wiring method to be considered accessible, it must not be closed in or blocked by the structure.
- Accessible wiring methods must also not be blocked by other electrical equipment.
- Coordination with other trades is often needed to ensure that accessible wiring methods are not blocked by building mechanical or plumbing systems.

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Article 100

REVISION

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Article 100

REVISION

Definition of Attachment Fitting, Weight Supporting

Change Summary

- This definition was revised to better describe the function of WSAF.
- The WSAF is a recognized component that is part of a listed luminaire or paddle fan.
- The combination of the WSAF and WSCR facilitate the modular replacement of luminaires and paddle fans in one- and two-family dwellings.
- Note also at the end of the definition the notation (CMP-18). This indicates the code-making panel that is responsible for the definition.
- NEMA WD6 recognizes WSAF configurations.

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Article 100

REVISION

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Courtesy of SKYX Platforms

Article 100

NEW

Definition of Motor Branch Circuit

Change Summary

- A new definition was added to differentiate between a branch circuit and a motor branch circuit.
- Branch circuits originate at the last overcurrent protective device supplying the circuit.
- Motor branch circuits include controllers and adjustable speed drives.

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Article 100

NEW

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Article 100

NEW

Definition of Class 4 Definitions

Change Summary

- These definitions are for terms used in new Article 726, Class 4 (CL4) Power Systems.
- Class 4 power systems will be used with equipment used in 5G Internet communications systems.
- A Class 4 Power System is a fault-managed system that relies on a continuous electronic handshake to ensure proper operation.
- Faults in Class 4 Power Systems result in immediate termination of output power.

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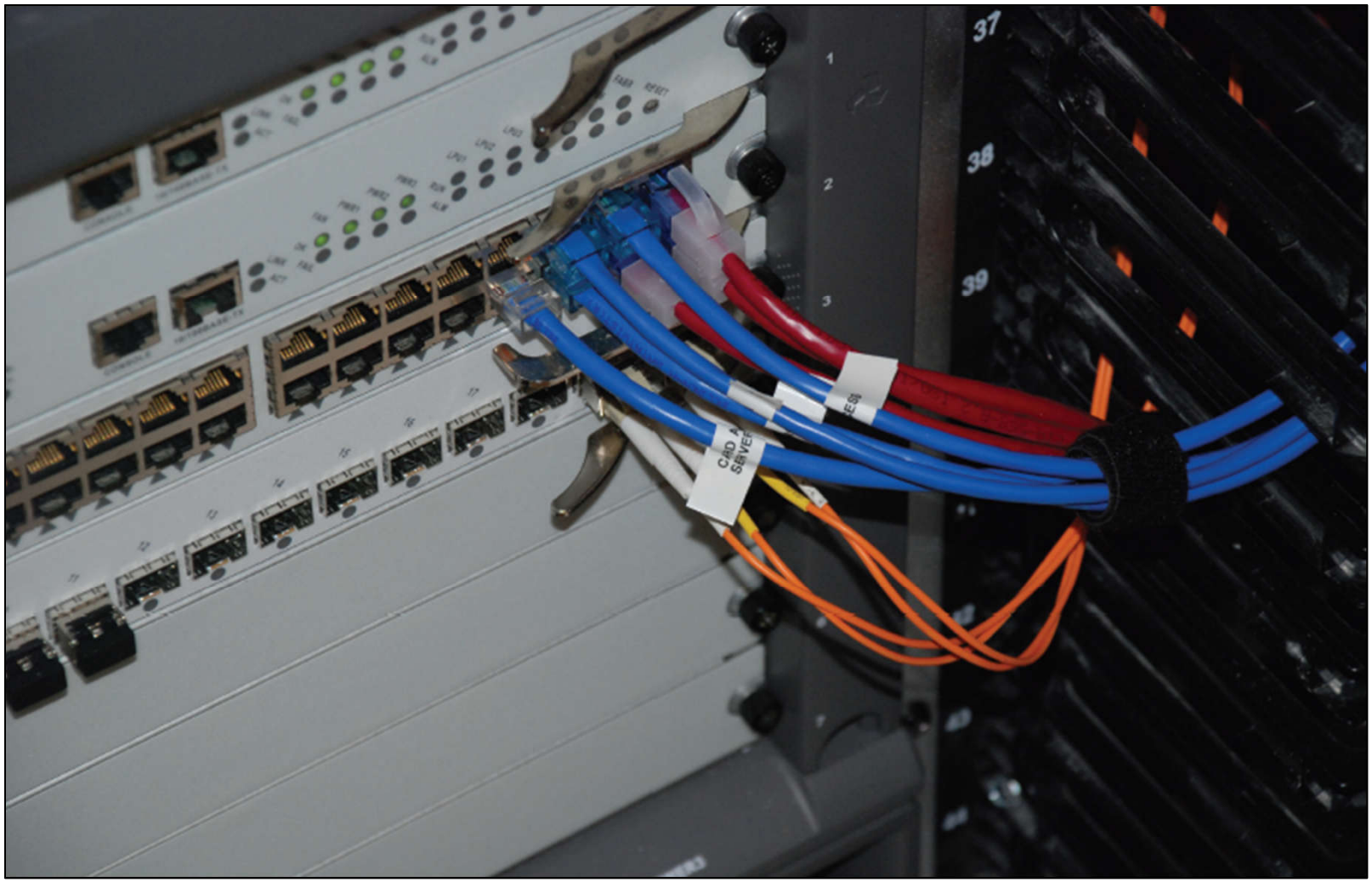
Article 100

NEW



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Courtesy of Michael J. Johnston

Article 100

NEW

Definition of Clothes Closet Storage Space

Change Summary

- A new simplified definition for clothes closet storage space has been added to Article 100.
- A clothes closet storage space is the area within a clothes closet in which combustible materials may be kept.
- The requirements for installation of luminaires remains in 410.16.

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Article 100

NEW

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Article 100

REVISION

Definition of Commissioning

Change Summary

- Revised definition to provide consistency in a commissioning process.
- Commissioning was previously covered only in Article 708, Critical Operations Power Systems.
- New commissioning requirements are found in 700.3, 701.3, and 706.7.
- Commissioning documentation should include as-built drawings and test results.

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Article 100

REVISION

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Courtesy of PDE Total Energy Solutions

Article 100

REVISION

Definition of Corrosive Environment

Change Summary

- Pool chemicals can cause corrosion of electrical equipment.
- Corrosive locations are those where pool sanitizing chemicals are present, and there is inadequate ventilation.
- Reference to *NFPA 400* was removed because it was not helpful for pool electrical equipment installers.
- The reference to the EPA website was removed, as a direct reference to the appropriate publications is more helpful.

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Article 100

REVISION

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Article 100

NEW

Definition of Counter (Countertop)

Change Summary

- A new definition was added for “counter (countertop)” to distinguish it from other work surfaces.
- An informational note reference was added for UL standards for receptacles and attachment plugs and GFCI devices.
- A second informational note references requirements for receptacles in countertops and work surfaces.

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Article 100

NEW

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Article 100

NEW

Definition of Energized, Likely to Become

Change Summary

- There is a new definition of the term *likely to become energized*.
- The term is used in 25 places in the 2020 *NEC*.
- *Likely to become energized* has been on a list of standard terms used in the *NEC Style Manual*, where it meant “failure of insulation on.” The new definition adds electrical spacing failure as an additional consideration.

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Article 100

NEW

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Courtesy of Michael J. Johnston

Article 100

REVISION

Definitions of Equipotential Plane

Change Summary

- There are now two definitions in Article 100 for Equipotential plane.
- The general definition is “Conductive elements that are connected together to minimize the voltage differences.” This definition is not limited to a single article.
- The second definition applies to natural and man-made bodies of water. This definition applies only to Article 682.

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Article 100

REVISION

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Article 100

NEW

Definition of Fault Managed Power

Change Summary

- Fault-managed power is one of the key definitions for new Article 726. Class 4 power systems are fault-managed power systems.
- Class 4 power systems provide a pulsed power output that relies on a continuous handshake to provide fault detection and ensure proper operation.
- Class 4 power systems can supply up to 450 volts dc line-to-line or 225 volts dc to ground to provide power and control of electronic equipment.

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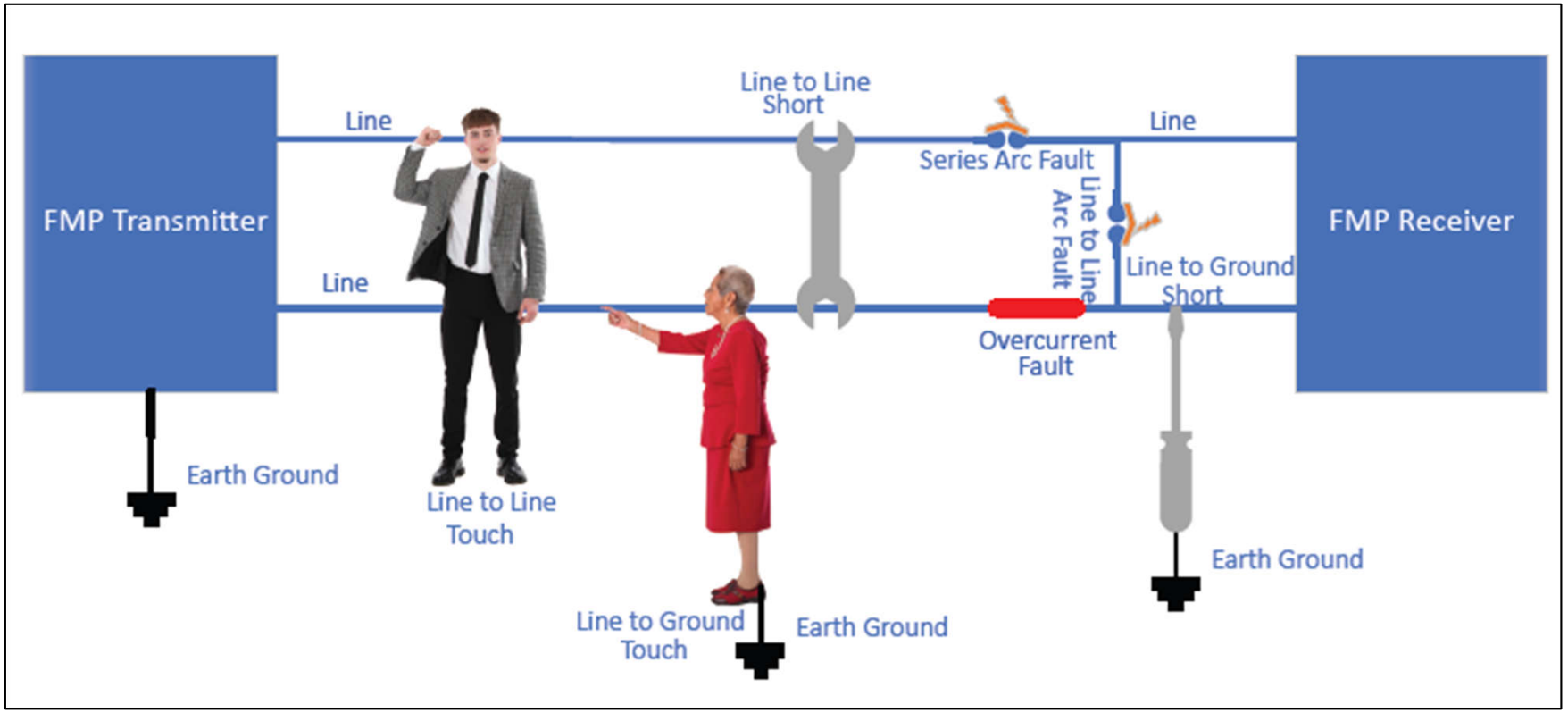
Article 100

NEW



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Courtesy of Cisco

Article 100

NEW

Definition of Fibers/Flyings, Combustible

Change Summary

- A new definition was added for combustible fibers/flyings.
- Combustible fibers/flyings consist of solid particles greater than 500 µm in size that can form an explosible mixture when suspended in air at standard atmospheric pressure and temperature.
- In contrast, combustible dusts consist of solid particles that are 500 µm or smaller that can form an explosible mixture.

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Article 100

NEW

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Article 100

NEW

Definition of GFCI, Special Purpose

Change Summary

- A new definition was added for Special Purpose Ground-Fault Circuit-Interrupter.
- SPGFCIs are used on circuits with voltage greater than 150 volts to ground.
- Traditional GFCIs are also known as Class A GFCIs. Special purpose GFCIs are either Class C, D, or E GFCIs.

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Article 100

NEW

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Article 100

NEW

Definition of Ground-Fault Detector-Interrupter

Change Summary

- GFDI protection is designed to provide ground-fault protection of photovoltaic dc circuits.
- As noted in 690.41(B), equipment that does not have ground-fault protection will often have a warning in the manual that indicates that the unit does not have a GFDI device.
- GFDIs are equipment protection, not personnel protection.

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Article 100

NEW

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Article 100

NEW

Definition of Industrial Installation, Supervised

Change Summary

- The term *Supervised Industrial Installation* is used in Articles 240 and 702, but it has been undefined until now.
- Industrial installations typically have a relaxation of some rules of the *Code*, as industrial installations are usually designed, installed, monitored, and maintained by qualified personnel.
- The definition was initially developed by CMP 10 and was revised by a task group including CMPs 1, 10, and 14; it remains limited to Article 240.

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Article 100

NEW

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Article 100

REVISION

Definition of Inverter, Multimode

Change Summary

- Multimode inverters can operate in both interactive mode and island mode.
- In the interactive mode, an inverter operates in parallel with the utility and can supply power back to the utility.
- In the island mode, it will separate from the utility to supply power to the premises through an energy storage system.

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Article 100

REVISION

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Article 100

REVISION

Definition of Location, Wet

Change Summary

- The definition of “wet location” has been rewritten into a list format.
- The previous format consisted of a sentence with commas, which made it more difficult to interpret.
- An informational note was added that gives an example of a wet location.
- The definitions of damp location and dry location were much shorter and clearer, so no changes to them were necessary.

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Article 100

REVISION

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Article 100

NEW

Definition of Locations, Hazardous (Classified)

Change Summary

- A new general definition has been added for Hazardous (Classified) Locations.
- Article 500 defines Classes I, II, and III, as well as the divisions and groups.
- Article 505 provides the classification system for gases, vapors, and liquids using the IEC Zone system.
- Article 506 provides the classification system for dusts and combustible fibers and flyings using the IEC Zone System.
- IEC uses the same zone system for dusts that is uses for fibers and flyings.

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Article 100

NEW

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Article 100

NEW

Definition of Microgrid, Health Care

Change Summary

- A health care microgrid is now permitted to be used as the normal power source.
- If a health care microgrid is used as the normal source, it is not permitted to be used as the alternate source.
- Essential electrical systems are permitted to be supplied by a health care microgrid that also supplies non-essential loads.
- Note the nomenclature at the end of the definition that indicates that the source of this definition is *NFPA 99*, the *Health Care Facilities Code.*

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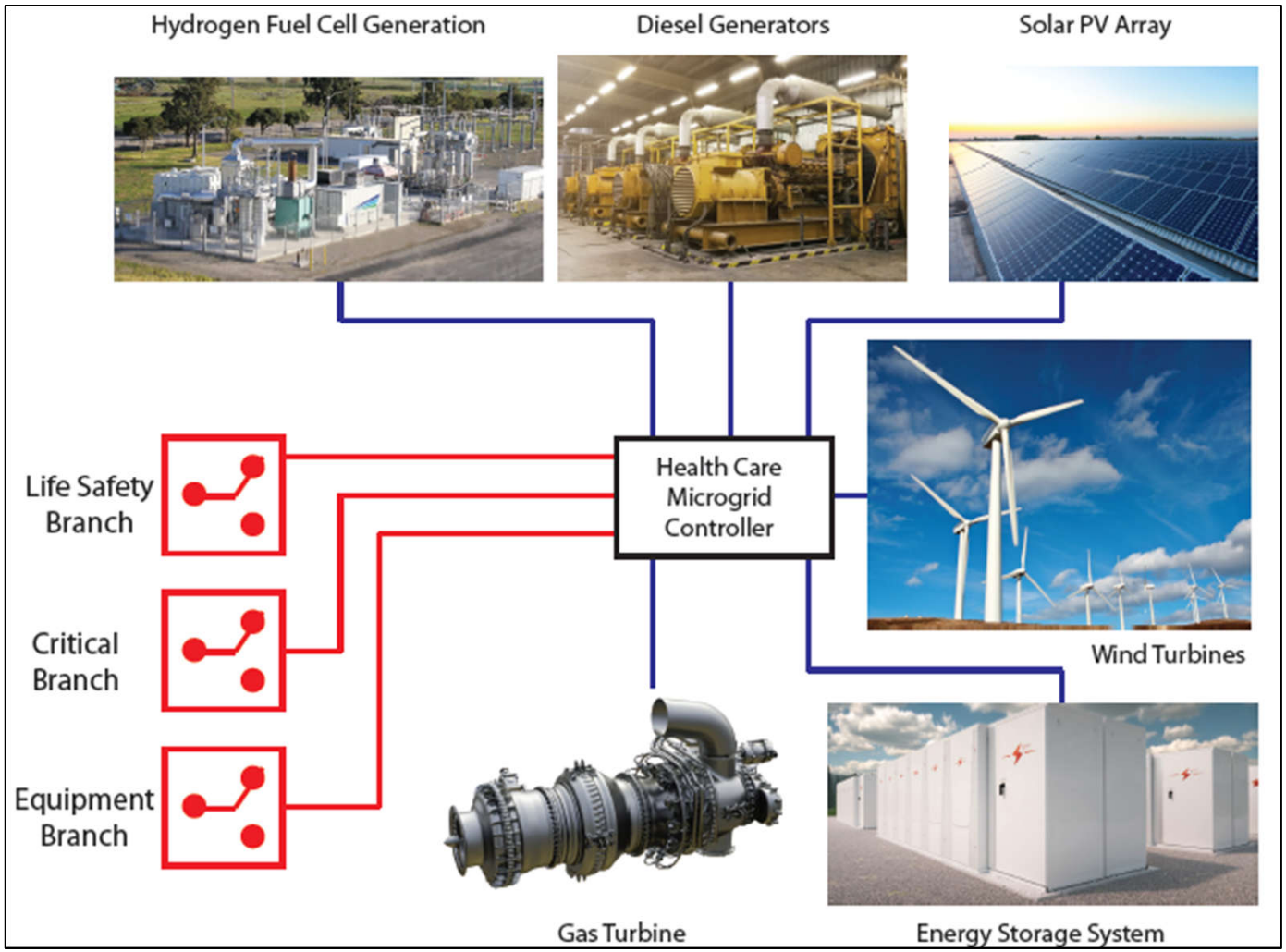
Article 100

NEW



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Article 100

NEW

Definitions of Panelboard and Panelboard, Enclosed

Change Summary

- The definition of “panelboard” was revised to recognize panelboards that are installed in an enclosure other than a cabinet or cutout box.
- A new definition was added for an “enclosed panelboard,” which is installed in a cabinet, cutout box, or enclosure suitable for a panelboard application.
- Sections 110.16(A) and 110.26(D) are among the requirements that apply to enclosed panelboards.

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Article 100

NEW

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Article 100

NEW

Definition of Receptacle, Weight-Supporting Ceiling

Change Summary

- This is a new definition of a receptacle that was introduced in the 2017 *Code*.
- Weight-supporting ceiling receptacles (WSCR) are contact devices that are designed to mate with a weight-supporting attachment fitting (WSAF) to make an electrical connection and to support the weight of luminaires or paddle fans.
- A WSCR that is listed for fan support can also support luminaires without fans, while a WSCR that is listed for luminaire support will reject a paddle fan.

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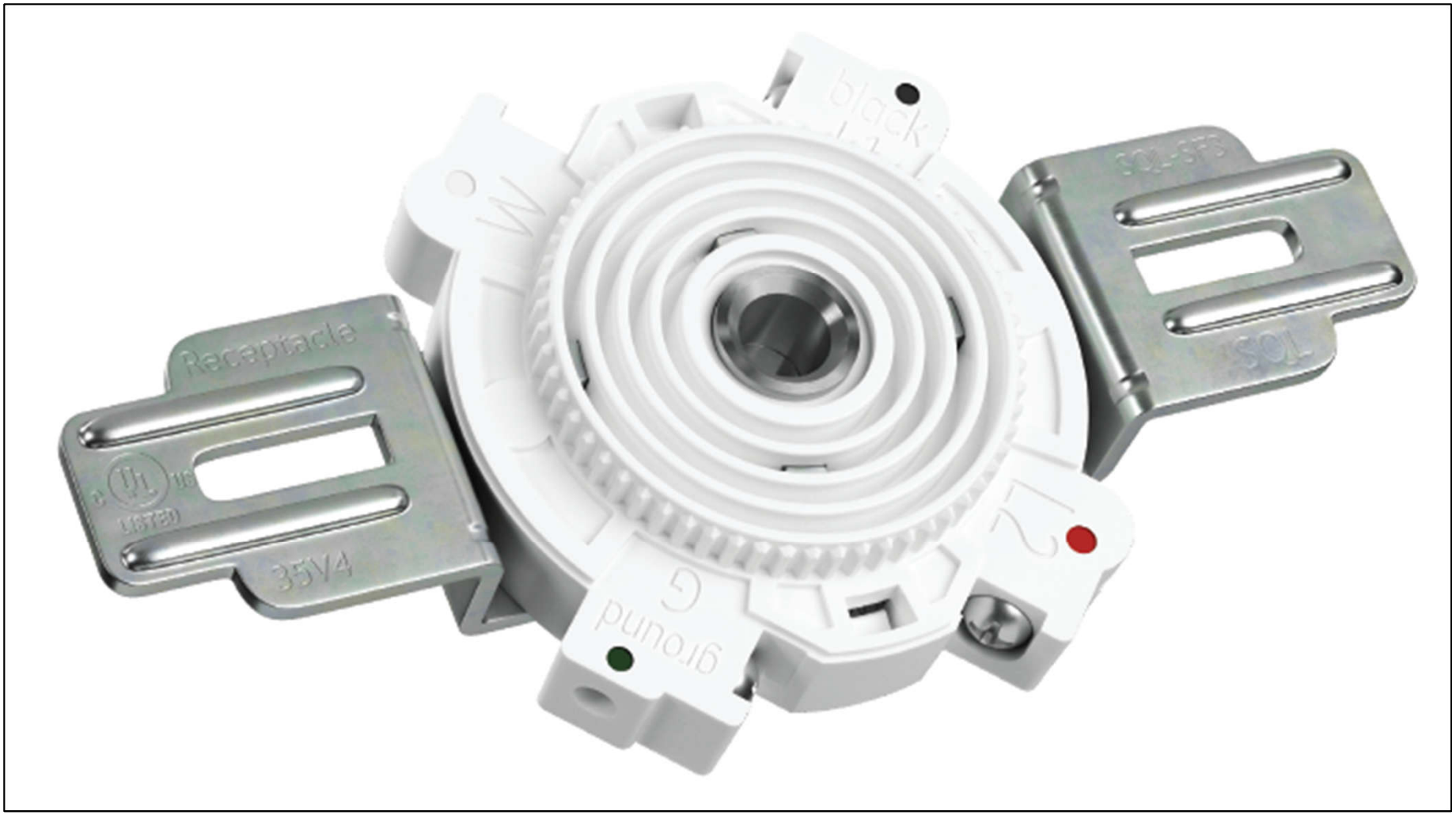
Article 100

NEW



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Courtesy of SKYX Platforms

Article 100

NEW

Definition of Servicing

Change Summary

- "Servicing" is defined as: The process of following a manufacturer's set of instructions or applicable industry standards to analyze, adjust, or perform prescribed actions upon equipment with the intention to preserve or restore the operational performance of the equipment.
- "Reconditioned" is defined as: Electromechanical systems, equipment, apparatus, or components that are restored to operating conditions. This process differs from normal servicing of equipment that remains within a facility, or replacement of listed equipment on a one-to-one basis.
- The informational note points out that servicing includes maintenance and repair.

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Article 100

NEW

Courtesy of Michael J. Johnston

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Article 100

NEW

Definition of Stranding (Compact and Compressed)

Change Summary

- New stranding definitions have been provided.
- Compact stranding: each layer is pressed together to minimize gaps between strands, reducing the overall diameter.
- Compressed stranding: conductors are pressed together, result is an overall diameter that is less than a concentric stranded conductor but greater than a compact stranded conductor.

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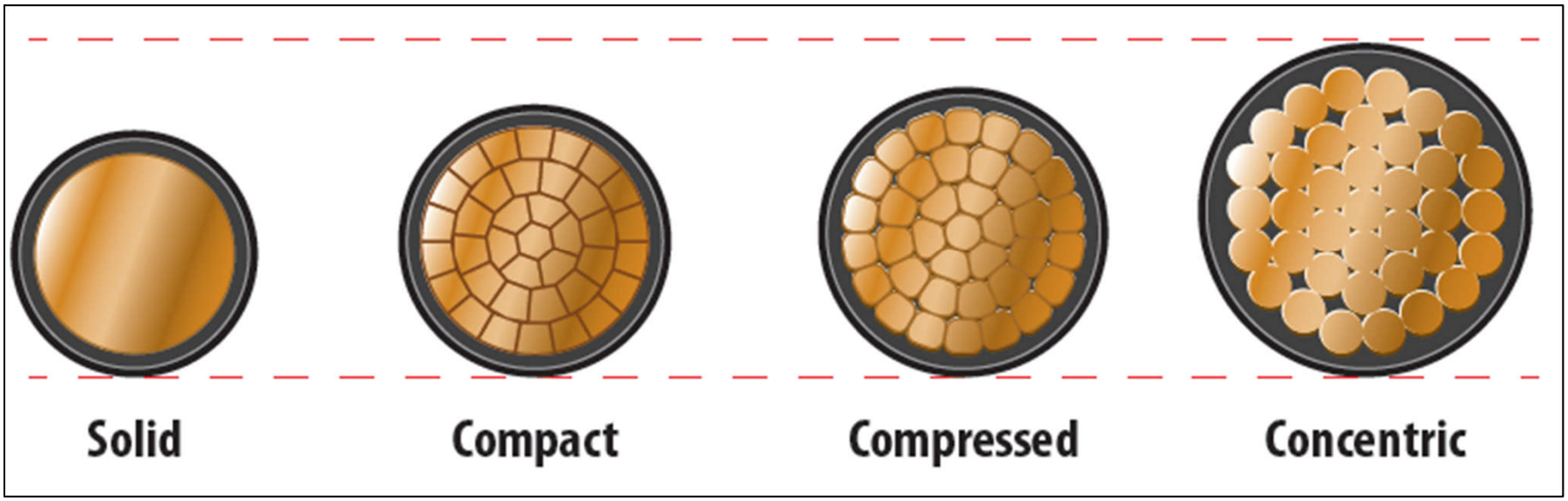
Article 100

NEW



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Article 100

REVISION

Definition of Type P Cable

Change Summary

- Type P Cable has been used on drilling rigs for four decades.
- Type P Cable is limited to industrial locations where maintenance and supervision ensure that qualified personnel monitor and service the installation.
- Type P Cable is permitted in hazardous locations, where permitted in the article covering the location.

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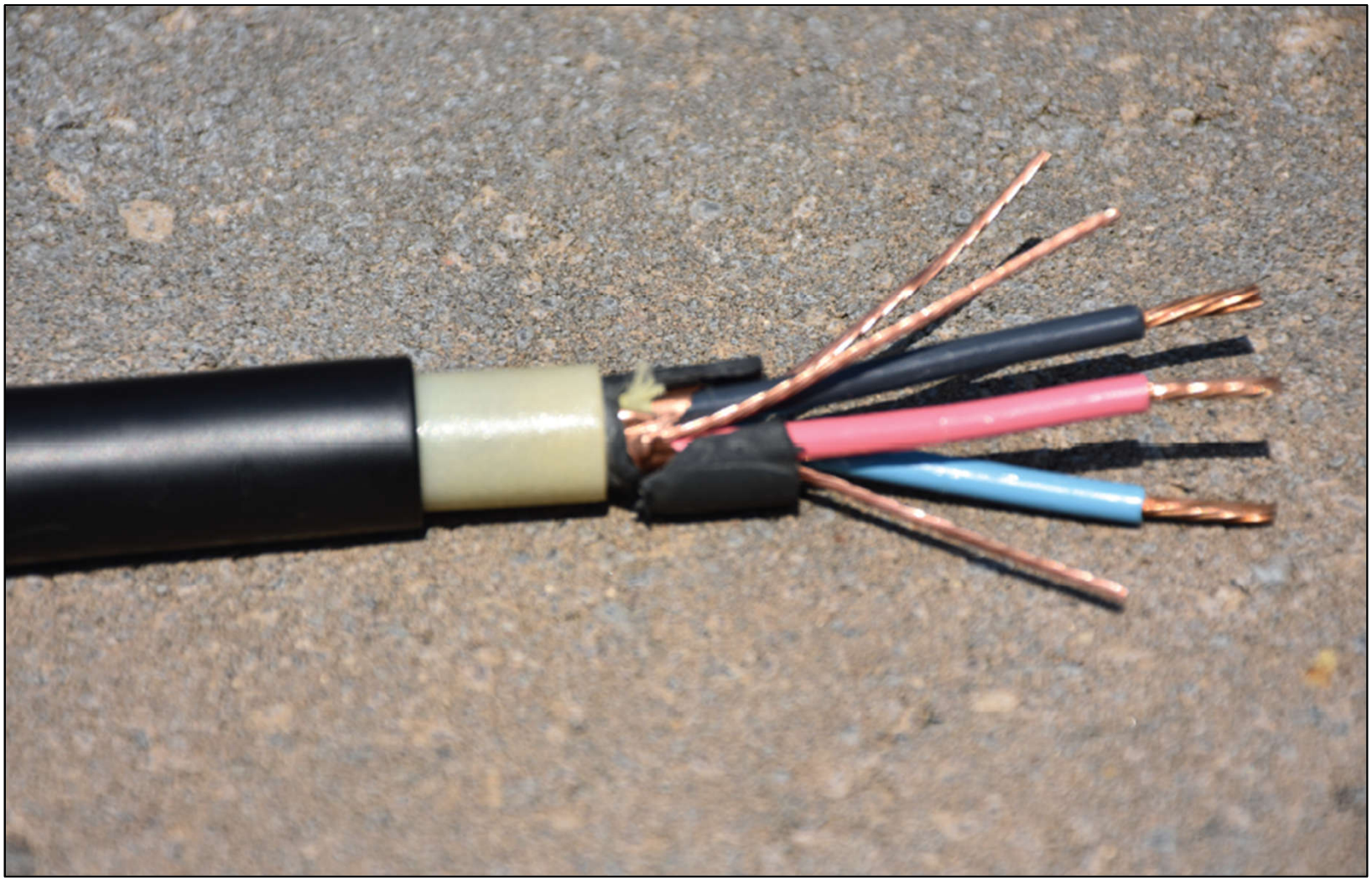
Article 100

REVISION



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110.3(A)

REVISION

Examination

Change Summary

- Cyber attacks on network connected electronic equipment are an increasing threat.
- Section 110.3(A)(8) now requires the evaluation of cyber security for network-connected life-safety equipment.
- An informational note was added that references standards for including the IEC 62443 series of standards on Industrial Automation and Control Systems and UL standards on cyber security, including UL 2900 and UL 5500.

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110.3(A)

REVISION

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110.3(B)

NEW

Installation and Use

Change Summary

- Listed or labeled equipment is required to be installed and used in accordance with any instructions included in the listing or labeling. The same now applies to equipment that is identified for a use.
- Installation instructions are often misplaced after installation. This informational note points out that QR codes on products or information on manufacturer websites can provide installation instructions.
- Online product information is often easier to access after the product is installed.

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110.3(B)

NEW

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110.8

REVISION

Wiring Methods

Change Summary

- Section 90.2(C) indicates that if the installation is covered by the *Code*, the wiring methods recognized by the *Code* are permitted to be installed in any building, occupancy, or premises wiring system.
- The definition of premises wiring in Article 100 includes interior and exterior wiring and associated hardware.
- Premises wiring does not include the internal wiring of appliances, luminaires, motor controllers, motor control centers, and similar equipment.

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110.8

REVISION

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110.12

REVISION

Mechanical Execution of Work

Change Summary

- The terms *neat* and *workmanlike* were replaced with *professional* and *skillful*.
- This editorial change uses more descriptive and gender-neutral terms.
- The informational note change is simply editorial.
- Informational Note No. 1 to 110.12(C) was deleted because this section applies to cables and conductors; it does not apply to fiber optic cables.

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110.12

REVISION

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110.14(A)

REVISION

Terminals

Change Summary

- The requirement that terminal connections be “thoroughly good” has been replaced with the term *mechanically secure* to replace vague and unenforceable terminology.
- The text was revised to clarify that terminal connections must provide a good electrical connection.
- Requirements for connection methods for certain equipment, such as receptacles (covered by CMP 18), are the responsibility of the panel that covers that equipment.

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110.14(A)

REVISION

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110.16(B)

REVISION

Service Equipment and Feeder Equipment

Change Summary

- Section 110.16(B) is expanded to apply to feeder supplied equipment, as well as service equipment.
- The requirement has been modified to make it clear that the required label is an arc flash warning label.
- The threshold for a required label has been lowered from 1,200 amperes to 1,000 amperes.
- The requirements for the content of the label have been deleted because they are included in 110.21(B).

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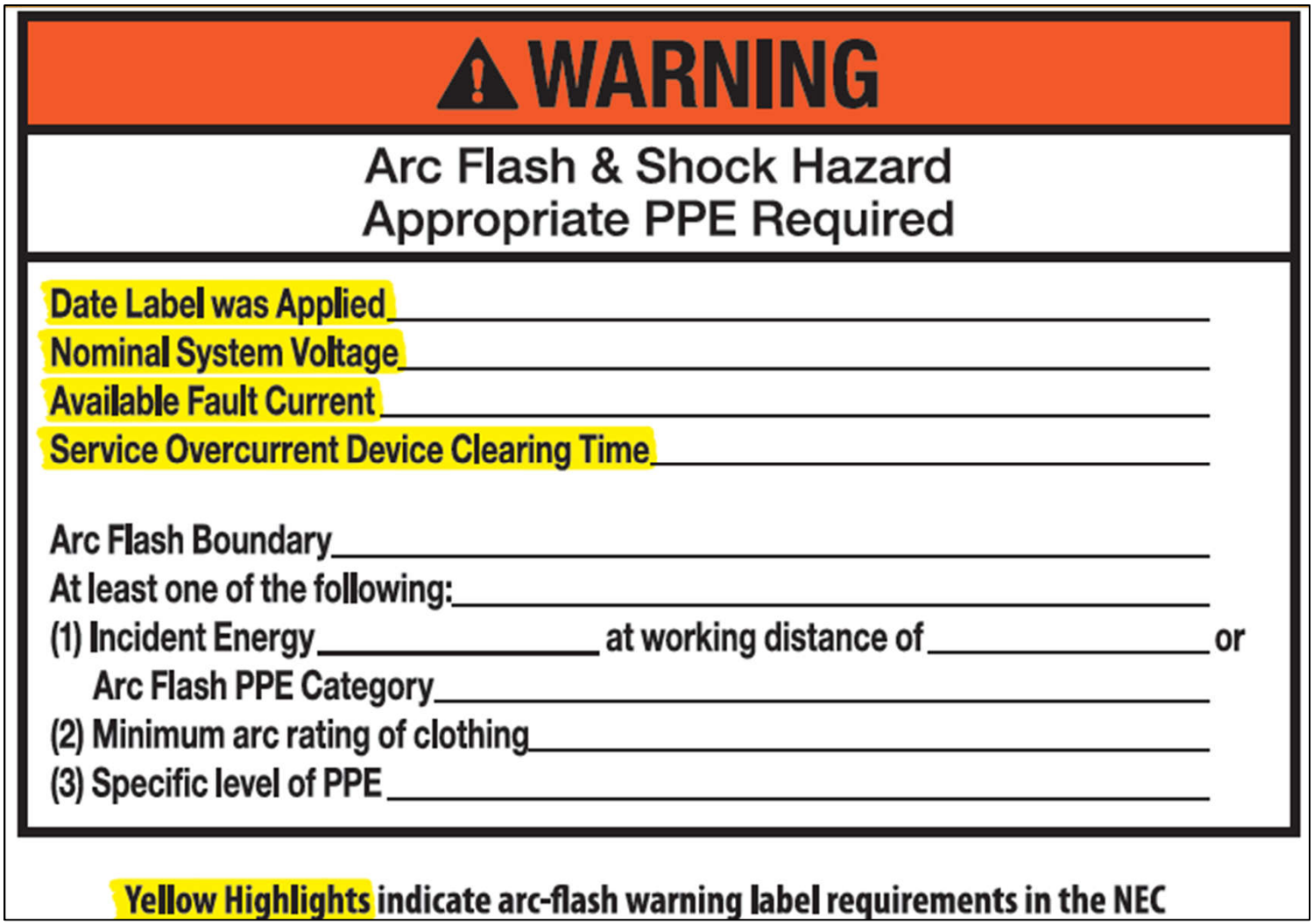
110.16(B)

REVISION



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110.17

NEW

Servicing and Maintenance of Equipment

Change Summary

- This addition is significant because in addition to requiring a *qualified person* (a defined term), the individual must be a qualified person trained in servicing and maintenance of equipment.
- Servicing and maintenance must be performed in accordance with the manufacturer's instructions and applicable industry standards or as approved by the AHJ.
- Identified replacement parts must be verified under applicable product standards.

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110.17

NEW

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Courtesy of Burlington Electrical Testing

110.20

NEW

Reconditioned Equipment

Change Summary

- Equipment is generally permitted to be reconditioned, unless prohibited elsewhere in the *Code*.
- Requirements are provided for parts and sources of information.
- If listing is required, the equipment must be listed or field-labeled as reconditioned.
- If listing is not required, it must be listed or field-labeled as reconditioned or reconditioned in accordance with the manufacturer's instructions.

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110.20

NEW

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110.21(A)

REVISION

Reconditioned Equipment, Marking Requirements

Change Summary

- The marking requirements for reconditioned equipment have been reorganized into list format.
- The original listing mark must be removed or made permanently illegible.
- The original equipment nameplate can remain, but the listing mark must be removed.
- The exception for industrial facilities still applies.

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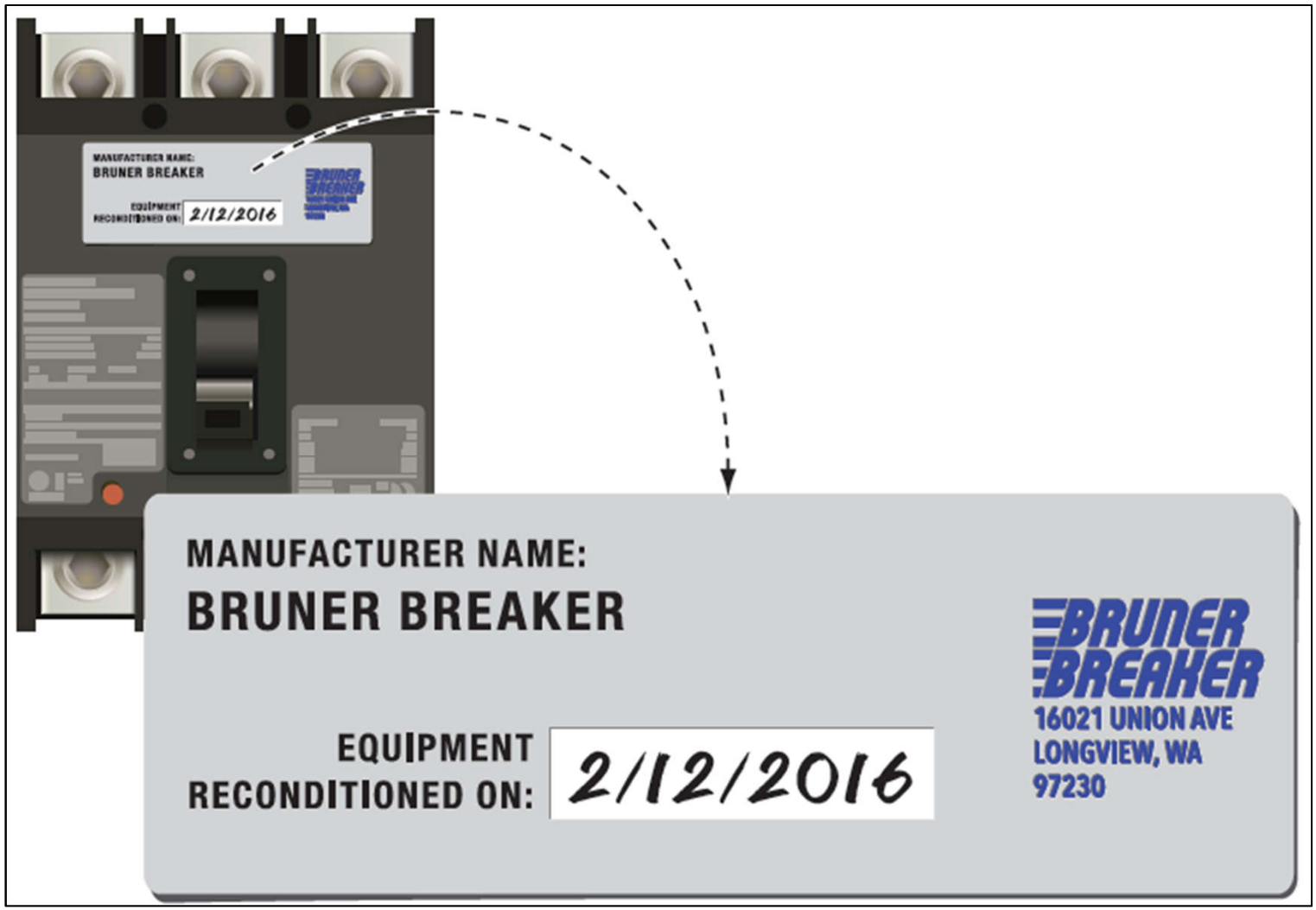
110.21(A)

REVISION



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110.22(A)

REVISION

Identification of Disconnecting Means, General

Change Summary

- Disconnecting means are required to be legibly marked to indicate their purpose, unless located and arranged to make the purpose evident.
- The marking must include the identification and location of the circuit source that supplies the disconnecting means, unless located and arranged to make the identification of the circuit source evident.
- This change is intended to make it easier for service personnel to quickly locate the power source. This is especially important in large and high-rise buildings.

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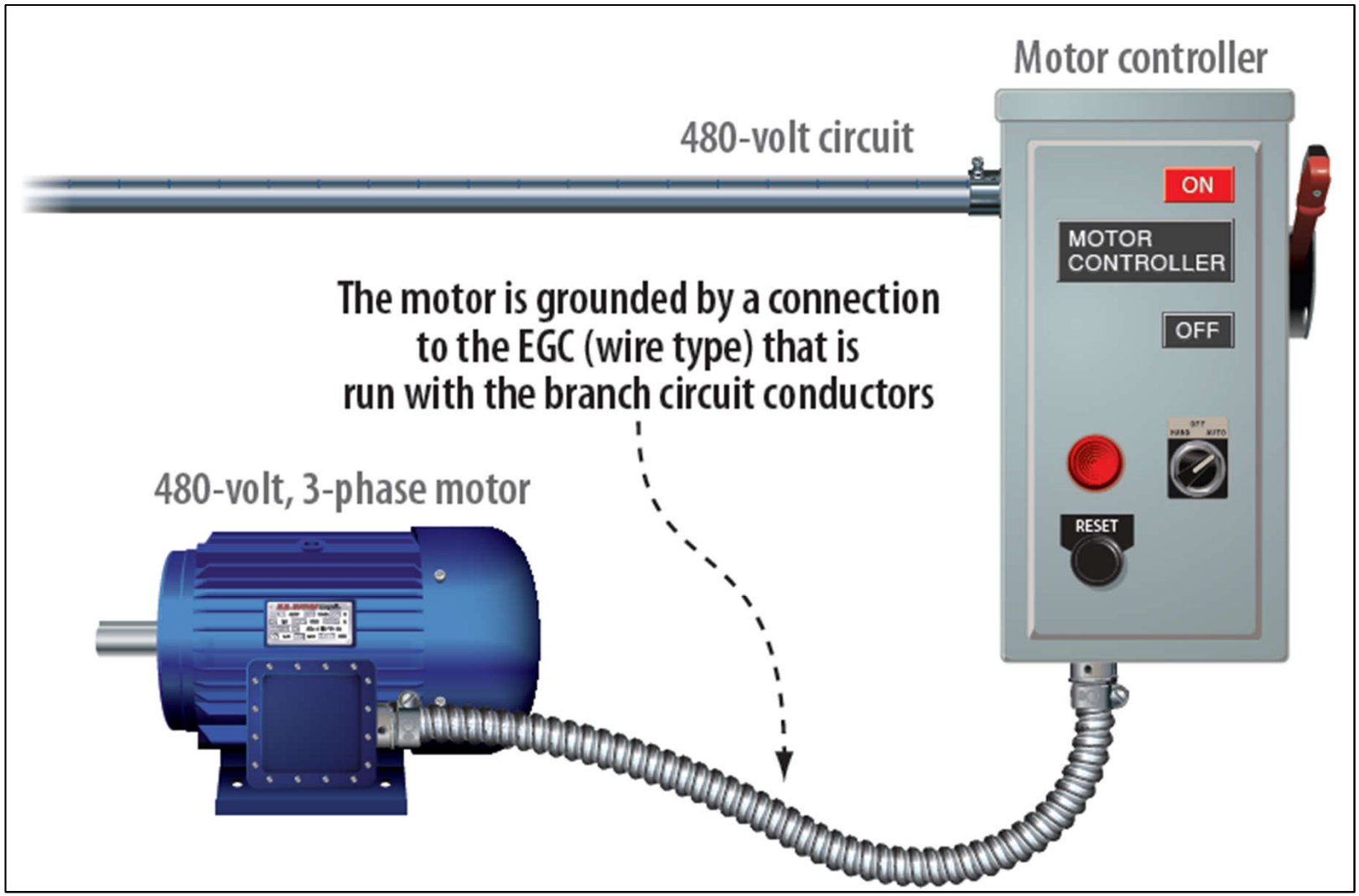
110.22(A)

REVISION



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110.26

REORGANIZE

Depth and Width of Working Space

Change Summary

- The requirement that open equipment doors must not impede entry or egress to the working space was relocated from 110.26(C)(2) to 110.26.
- Relocation of the open equipment door requirement to 110.26 means that it now applies to all equipment, not just large equipment.
- Access or egress is impeded if one or more simultaneously-opened equipment doors restricts access to less than 24 inches wide or 6 ½ feet high.

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110.26

REORGANIZE

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110.26(A)(4)

REVISION

Limited Workspace Requirements

Change Summary

- The limited access workspace requirements were modified to provide requirements for workspaces in front of duct heaters installed above partitions.
- The workspace must be unobstructed to the floor by fixed cabinets, walls, or partitions.
- A horizontal ceiling structural member or access panel is permitted in the space if the location of weight-bearing structural members does not result in a side reach of more than 6 inches to work inside the enclosure.

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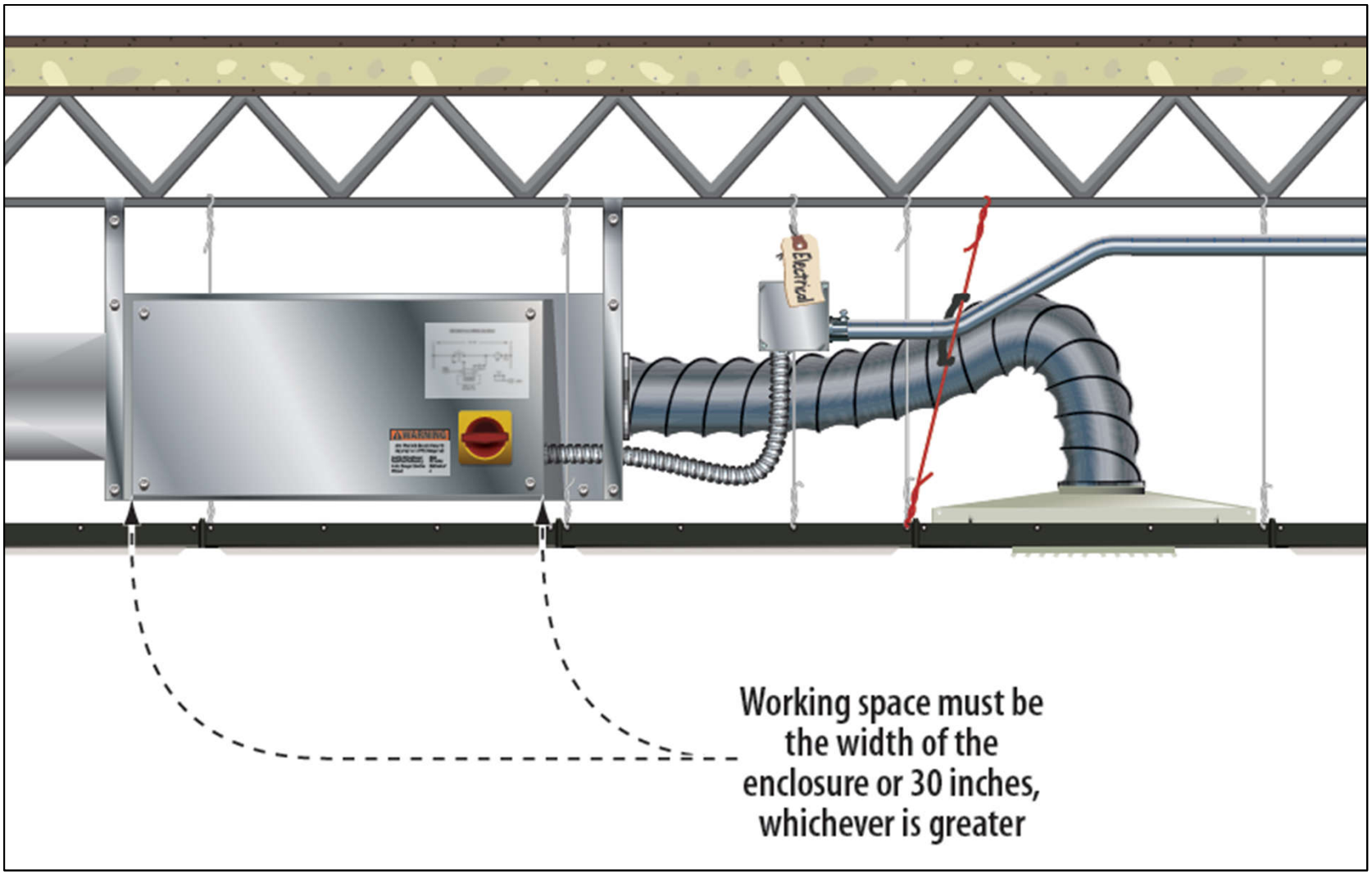
110.26(A)(4)

REVISION



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110.26(A)(6)

NEW

Grade, Floor, or Working Platform

Change Summary

- Section 110.26 requires access and workspace around all electrical equipment to permit ready and safe operation and to permit maintenance.
- The grade, floor, or platform in the workspace must be clear of obstructions and tripping hazards.
- The grade, floor, or platform in the workspace must be as level and flat as possible.
- Similar requirements have been added to 110.34(A) for equipment operating over 1,000 volts.

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110.26(A)(6)

NEW

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110.26(E)

REVISION

Dedicated Equipment Space

Change Summary

- The requirement for dedicated equipment space in 110.26(E) has been expanded to include all service equipment rated 1,000 volts or less.
- The requirement will now include service equipment for one- and two-family dwellings, including the emergency disconnects now required in 230.85
- A service rated disconnect will now have the same equipment space requirements as service rated switchgear and service rated panelboards for 1,000 volts or less.

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110.26(E)

REVISION

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Table 110.28

REVISION

Table 110.28 Enclosure Types, Informational Notes

Change Summary

- Informational Note No. 3 was revised to add a reference to 502.10(A)(2) for Class II, Division 1 locations.
- Informational Note No. 5 notes that some Type 4X enclosures are marked “for indoor use only.”
- Informational Note No. 6 notes that some Type 4, 4X, and 12 enclosures are ventilated, but still provide the required ingress protection.
- Informational Note No. 7 references the NEMA Standard for enclosure type ratings.

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Table 110.28

REVISION

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Courtesy of Michael J. Johnston

110.29

NEW

In Sight From (Within Sight From, Within Sight)

Change Summary

- A new requirement has been added that establishes that “in sight from” means that the equipment must be visible and not more than 50 feet from the other equipment.
- This requirement was created to comply with the *NEC Style Manual*.
- Definitions are not permitted to contain requirements. The establishment of limits constitutes a requirement.
- The definition with the requirement still exists.

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110.29

NEW

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110.31(A)(4)

REVISION

Locks, Personnel Doors

Change Summary

- Personnel doors for electrical vaults containing equipment rated over 1,000 volts are now required to open at least 90 degrees. These doors are required to be equipped with listed panic hardware or listed fire exit hardware.
- There is a similar requirement in 110.26(C)(3) for equipment rated 1,000 volts and less.
- An informational note was added to reference two UL Standards: UL 305, Standard for Panic Hardware; and UL 10C, Standard for Safety for Positive Pressure Fire Tests of Door Assemblies.

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110.31(A)(4)

REVISION

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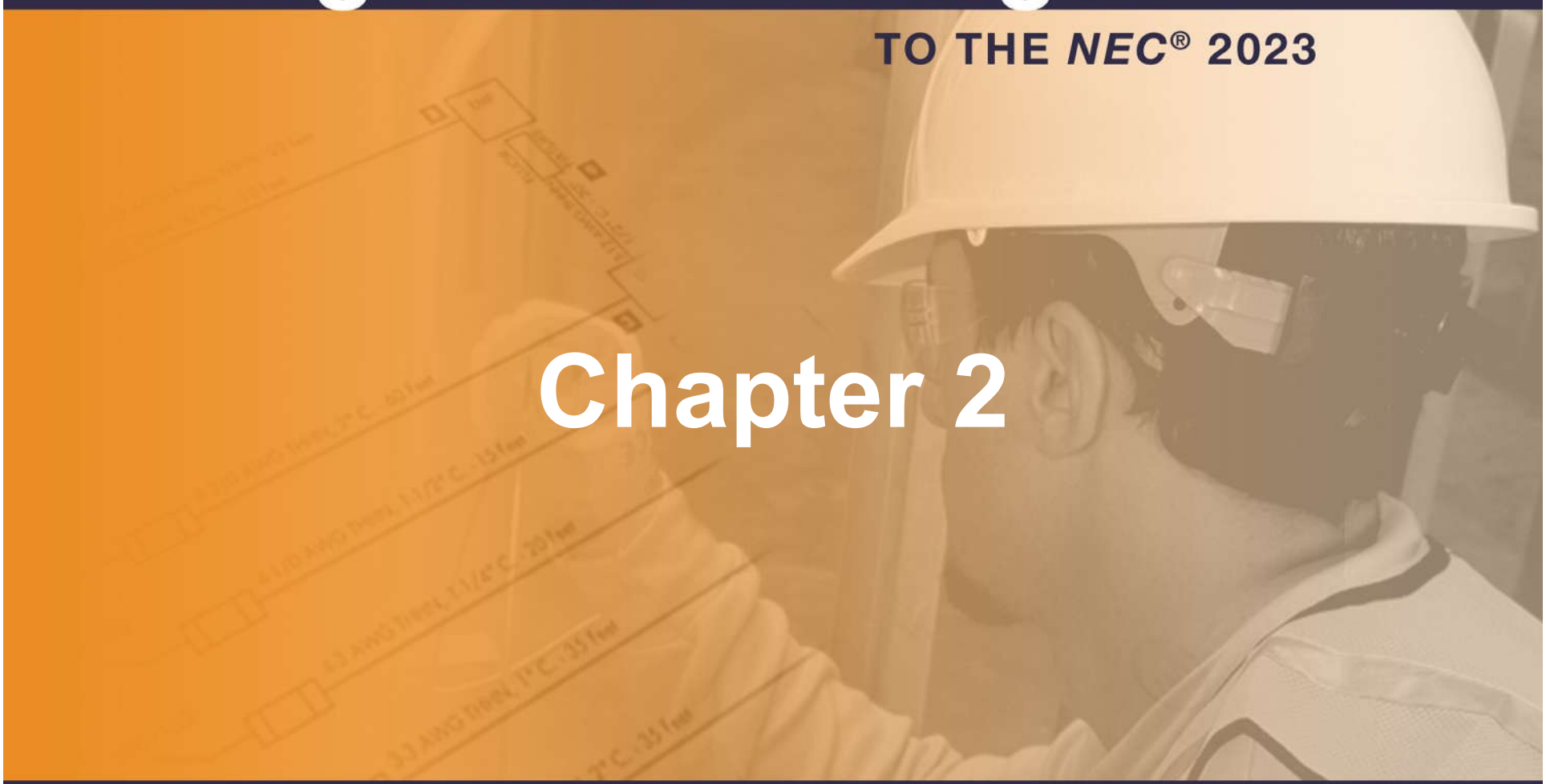
Significant Changes

TO THE *NEC*® 2023



Chapter 2

electrical training ALLIANCE IBEW - NECA IN COLLABORATION WITH NECA NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

200.2(A)

REVISION

General

Change Summary

- This section was revised to correlate with the change in 250.36.
- “High-impedance grounded systems” are now referred to as “impedance grounded systems.”
- The grounded system conductor of impedance grounded systems is now referred to as the “impedance grounded conductor.” This section does not apply to the impedance grounded conductor.
- This section was changed from paragraph to list format.

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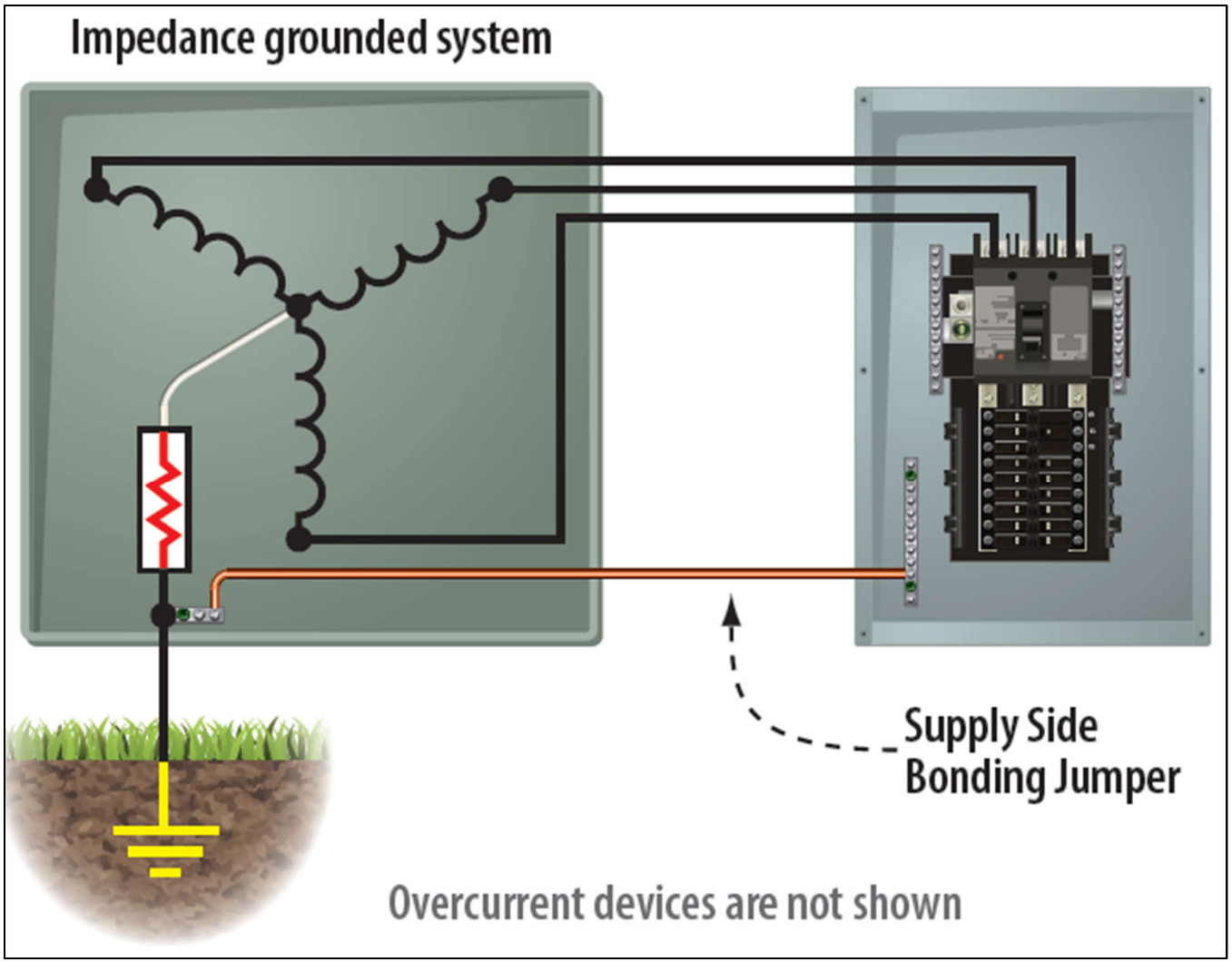
200.2(A)

REVISION



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210.6(D) & (E)

REVISION RELOCATE

Branch Circuit Voltage Limitations

Change Summary

- The voltage limit in Section 210.6(D) was increased from 600 volts between conductors to 1,000 volts between conductors for consistency with other voltage limitations across the *Code*.
- The section has also been revised to reference a limit of 1,500 volts dc between conductors.
- Section 210.6(E) has been deleted.
- A new Article 235 has been created that will contain requirements for medium and high-voltage branch circuits, feeders, and services.

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210.6(D) & (E)

REVISION / RELOCATE

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210.8

REVISION

GFCI Protection for Personnel

Change Summary

- The term *ground-fault circuit-interrupter protection for personnel* in the first sentence is replaced with the term *listed Class A GFCI*.
- Elsewhere in the section, the acronym GFCI is used to comply with the *NEC Style Manual*, which requires the use of acronyms where practical.
- The definition of “Ground-fault Circuit Interrupter (GFCI)” in Article 100 makes it clear that the term is used to describe a device that is intended to protect personnel. The informational note makes it clear that the device referred to is a Class A GFCI.

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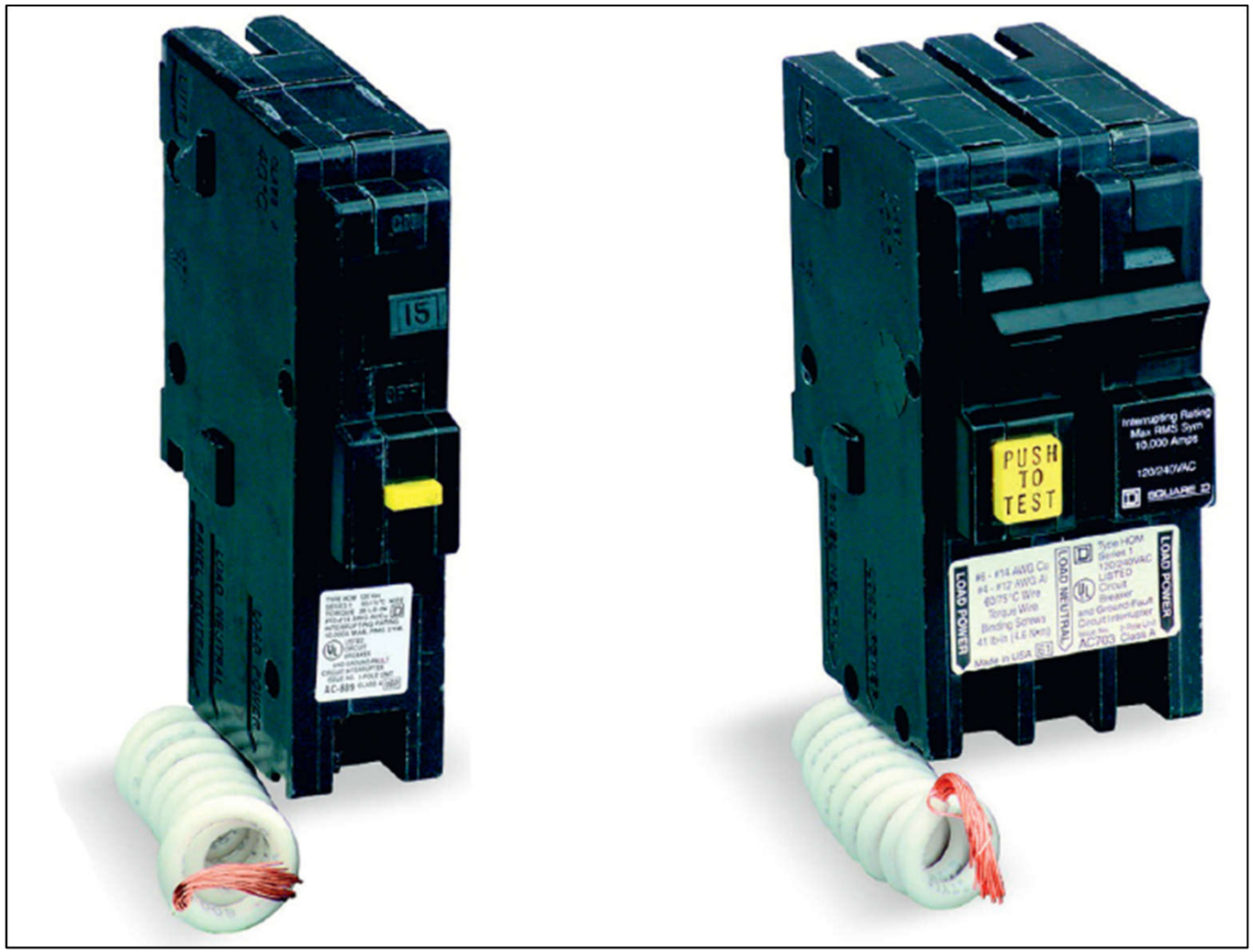
210.8

REVISION



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Courtesy of Schneider Electric

210.8(A)

REVISION

Dwelling Units

Change Summary

- The reference to fire alarm systems in an informational note to list item (5) has been deleted because it is covered in Article 760.
- GFCI requirements for kitchens now apply to all kitchen receptacles.
- GFCI requirements apply to any area of a dwelling unit with permanent provisions for food preparation, drink preparation, or cooking.
- Receptacles in bathroom exhaust fan assemblies that are not readily accessible do not require GFCI protection.

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210.8(A)

REVISION

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210.8(B)

REVISION

Other Than Dwelling Units

Change Summary

- The GFCI requirements for other than dwelling units have been revised and clarified.
- List items (3) through (5) have been revised to clarify GFCI requirement for kitchens, food and beverage preparation and food serving areas, and any other preparation or food/beverage serving area where there is also cooking.
- A new requirement for GFCI protection of cord-and plug-connected fixed or stationary appliances has been added.
- A new GFCI requirement for receptacles within 6 feet of aquariums, bait wells, and similar open aquatic vessels or containers has been added.

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210.8(B)

REVISION

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210.8(D)

REVISION

GFCI Protection for Personnel-Specific Appliances

Change Summary

- In the 2020 *Code*, the determination of which appliances required GFCI protection was assigned to CMP 17, who placed them in 422.5.
- Section 422.5(A) specified several appliances that require GFCI protection. They could be protected via a branch circuit device, or they could be protected by a device in the cord.
- This section contained convoluted cross references to 422.5(A) for the list of appliances and 422.5(B) for the protection method.
- This revision brings back the list of appliances to 210.8, and it now requires GFCI protection of the branch circuit or the outlet.

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210.8(D)

REVISION

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210.8(F)

REVISION

GFCI Protection for Personnel-Outdoor Outlets

Change Summary

- The requirements of 210.8(F) have been revised to indicate that it applies to all outdoor outlets other than those covered by 210.8(A), Exception No. 1, rated 150 volts or less to ground, and 50 amperes or less.
- A list of three locations has been added to clarify which locations are included.
- If equipment supplied by one of the specified outlets is replaced, the outlet will now be required to be GFCI protected.
- Exception No. 2 does not require GFCI protection for listed HVAC equipment installed prior to September 1, 2026.

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210.8(F)

REVISION

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210.11(C)(4)

REVISION

Garage Branch Circuits

Change Summary

- Section 210.11(C)(4) was revised to clarify that garages must be supplied by at least one 20-ampere branch circuit for receptacles with at least one receptacle for each vehicle bay. The circuits are not permitted to supply other garage receptacles.
- In a single-vehicle bay garage, the circuit is permitted to supply other outlets.
- The 20-ampere branch circuit was previously permitted to supply only readily accessible outdoor receptacle outlets. Exception No. 1 was revised to permit it to supply outdoor receptacle outlets.
- Additional branch circuits rated at least 15 amperes are permitted to supply other receptacle outlets.

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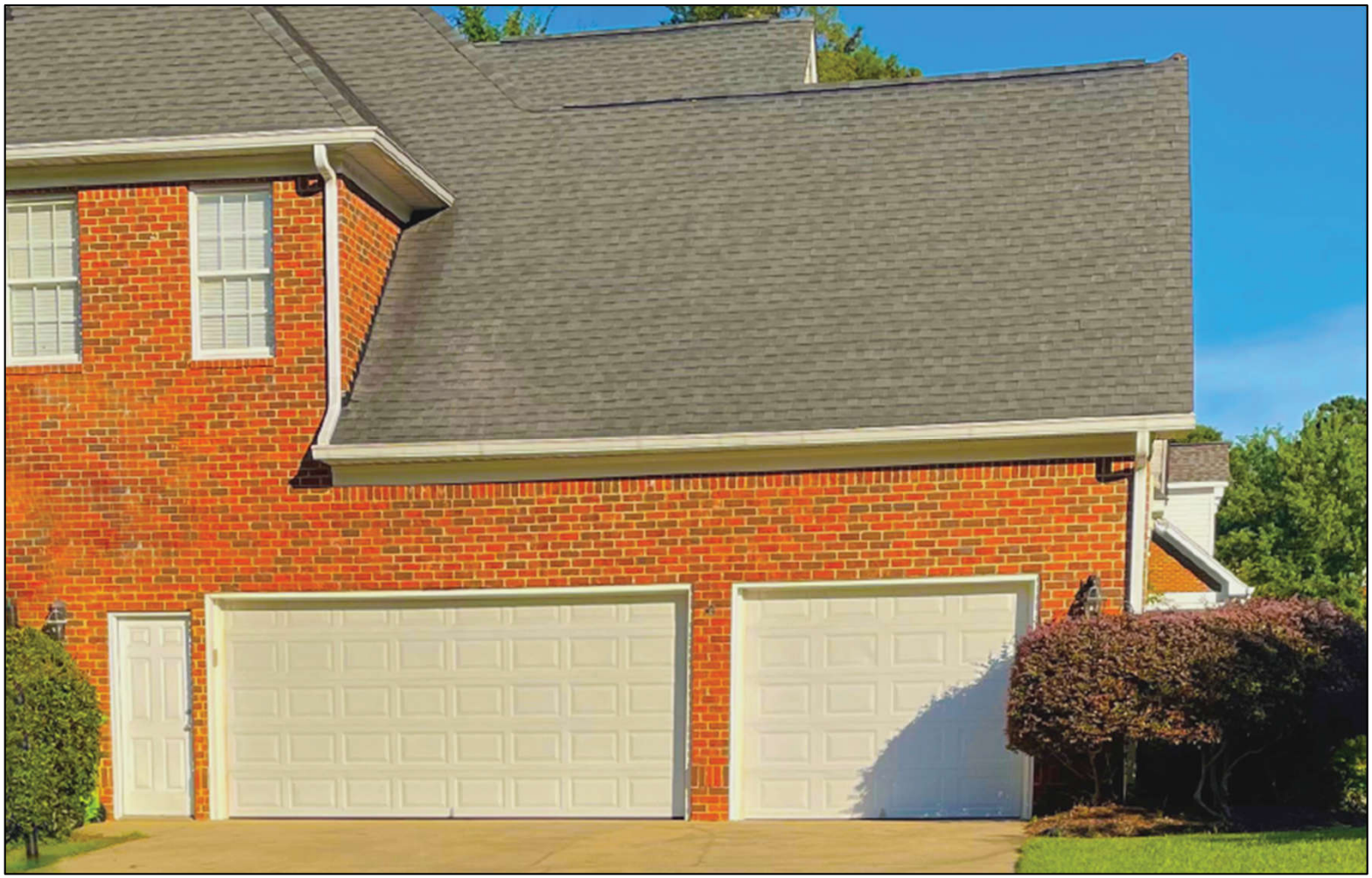
210.11(C)(4)

REVISION



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210.12

REVISION

Arc-Fault Circuit-Interrupter Protection

Change Summary

- The main rule of 210.12 was rewritten to align with changes made to the subsections of 210.12, including a new requirement that all AFCIs be listed.
- The title of 210.12(A) was changed to “means of protection.” Information regarding the specific areas of the dwelling unit requiring AFCI protection has been moved into 210.12(B).
- Section 210.12(B), (C), and (D) have been changed into lists.
- Section 210.12(D)(3) has been added to require AFCI protection of 120-volt, single-phase 15- and 20-ampere branch circuits in areas designed exclusively for sleeping in fire stations, stations for rescue squads, and police stations.

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210.12

REVISION

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210.18

REVISION

Rating

Change Summary

- Section 210.18 now recognizes 10-ampere individual branch circuits.
- Exception No. 1 has been revised to permit individual branch circuits greater than 50 amperes that supply non-lighting loads in locations with conditions of maintenance to ensure that only qualified persons service the installations. This had previously been limited to industrial locations.
- A new Exception No. 2 was added that prohibits 10-ampere branch circuits from serving receptacle outlets.

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210.18

REVISION

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210.19

REVISION RELOCATE

Conductors – Minimum Ampacity and Size

Change Summary

- New branch circuit voltage limits have been added for ac and dc circuits.
- Section 210.19 now applies to branch circuits not exceeding 1,000 volts ac and 1,500 volts dc.
- The requirements for branch circuits exceeding 1,000 volts ac and 1,500 volts dc have been removed from this section and relocated to Article 235.
- There are several minor editorial changes to comply with the *NEC Style Manual*.

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210.19

REVISION / RELOCATE

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Courtesy of Bill McGovern, City of Plano, TX

210.23

REVISION

Permissible Loads, Multiple-Outlet Branch Circuits

Change Summary

- New requirements have been added to 210.23(A) for 10-ampere branch circuits.
- This section contains an ascending list from the smallest sized branch circuit to the largest. Therefore, the 10-ampere branch circuits appear first.
- 210.23(A)(1) lists the types of loads that are permitted to be supplied by a 10-ampere branch circuit, while 210.23(A)(2) lists the loads that are not permitted to be supplied by a 10-ampere branch circuit.

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210.23

REVISION

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210.52(A)(2)

REVISION

Wall Space

Change Summary

- The criteria for what is considered wall space that requires receptacles in dwelling units has been revised.
- Since there are wall spaces where receptacle installation is impractical, Section 210.52(A)(2) spells out which spaces must be considered wall space for receptacles.
- The space behind stationary appliances has been added to 210.52(A)(2)(1) to indicate that the wall space behind stationary appliances need not be considered as wall space that requires receptacles.

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210.52(A)(2)

REVISION

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210.52(C)

REVISION

Countertops and Work Surfaces

Change Summary

- A new exception was added to 210.52(C)(1) for countertops with wall space where a receptacle cannot be installed in the required wall space to permit installation as near as practicable.
- Receptacles are no longer required in 210.52(C)(2) for island and peninsular counter tops. If not installed, provision is required for a future installation.
- Receptacles are permitted to be in or on but not below countertops.

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210.52(C)

REVISION

Courtesy of ABB Inc.

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210.70

REVISION

Lighting Outlets Required

Change Summary

- Section 210.70 has been revised to make it clear that switches of control devices are not permitted to rely only on battery power unless the lighting outlets are energized upon battery failure.
- A lighting outlet that is controlled by a listed wall-mounted control device is now required in laundry areas of dwelling units.
- A lighting outlet is required for exterior illumination of exits or entrances of dwelling units, attached garages, and detached garages with power. This does not apply to doors for vehicles.
- Dimmer control of lighting in accordance with 210.70(A)(2)(3) is not permitted, unless the listed control devices can provide dimming control that can provide maximum brightness at each location for stairway illumination.

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210.70

REVISION

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215.15

NEW

Barriers

Change Summary

- The widespread acceptance of *NFPA 70E, Electrical Safety in the Workplace*, has brought attention to the need to prevent electrical hazards that can exist while trying to establish an electrically-safe work condition.
- In the 2020 *Code*, the requirements for barriers in panelboards, switchboards, and switchgear were relocated from 408.3(A)(2) to 230.62(C), where they only applied to services.
- A similar hazard exists for panelboards, switchboards, switchgear, and motor control centers that are supplied by feeders or transformer secondary conductors.

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215.15

NEW

© 2022 *electrical training ALLIANCE*

215.18

NEW

Surge Protection

Change Summary

- During the 2020 *Code* cycle, a new surge protection requirement was added for dwelling unit services in 230.67 (expanded for 2023).
- Surge protection is now required for feeders that supply dwelling units, dormitory units, guest rooms and guest suites of hotels and motels, and patient sleeping rooms of nursing homes and limited care facilities.
- The use of sensitive electronic equipment in these newly added areas, supplied by services, is identical to its usage in dwelling units.
- A similar requirement was adopted in 225.42 for outside feeders.

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215.18

NEW

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Article 220

REORGANIZE

Article 220 Reorganization

Change Summary

- Article 220 has been rewritten to improve its usability. This change covers the reorganization only.
- Requirements that were in 220.11 and 220.10 were moved from Part II, Branch-Circuit Load Calculations, to Part I, General.
- Section 220.12 was relocated to Part III because it addresses feeder and service load calculations.
- Sections 220.14(J), (K), and (M) were relocated to 220.41, 220.43, and 220.44, respectively, because they deal with loads.

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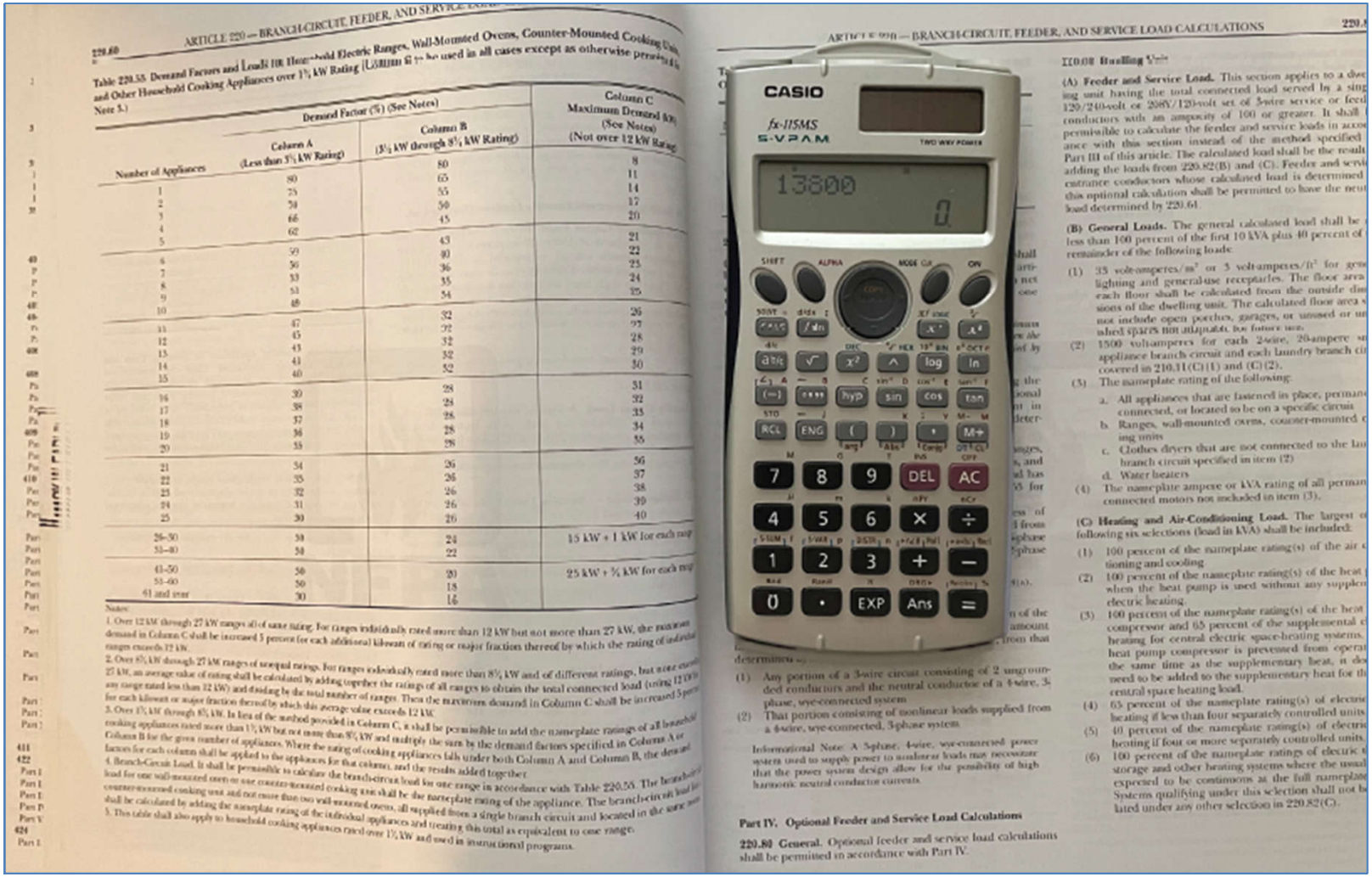
Article 220

REORGANIZE



220.60 ARTICLE 220 — BRANCH-CIRCUIT, FEEDER, AND SERVICE LOAD CALCULATIONS

Table 220.55 Demand Factors and Loads for Household Electric Ranges, Wall-Mounted Ovens, Counter-Mounted Cooking Units, and Other Household Cooking Appliances over 1¾ kW Rating (Column C to be used in all cases except as otherwise permitted in Note 3.)

Number of Appliances	Demand Factor (%) (See Notes) Column A (Less than 3½ kW Rating)	Column B (3½ kW through 8¾ kW Rating)	Column C Maximum Demand (kW) (See Notes) (Not over 12 kW Rating)
1	80	80	8
2	75	65	11
3	70	55	14
4	66	50	17
5	62	45	20
6	59	43	21
7	56	40	22
8	53	36	23
9	51	35	24
10	49	34	25
11	47	32	26
12	45	32	27
13	43	32	28
14	41	32	29
15	40	32	30
16	39	28	31
17	38	24	32
18	37	28	33
19	36	28	34
20	35	28	35
21	34	26	36
22	33	26	37
23	32	26	38
24	31	26	39
25	30	26	40
26–30	30	24	15 kW + 1 kW for each range
31–40	30	22	
41–50	30	20	25 kW + ¾ kW for each range
51–60	30	18	
61 and over	30	16	

Notes:

1. Over 12 kW through 27 kW ranges all of same rating. For ranges individually rated more than 12 kW but not more than 27 kW, the maximum demand in Column C shall be increased 5 percent (for each additional kilowatt of rating or major fraction thereof by which the rating of individual ranges exceeds 12 kW.
2. Over 8¾ kW through 27 kW ranges of unequal ratings. For ranges individually rated more than 8¾ kW and of different ratings, but none exceeding 27 kW, an average value of rating shall be calculated by adding together the ratings of all ranges to obtain the total connected load (using 12 kW for any range rated less than 12 kW) and dividing by the total number of ranges. Then the maximum demand in Column C shall be increased 5 percent for each kilowatt or major fraction thereof by which this average value exceeds 12 kW.
3. Over 1¾ kW through 8¾ kW. In lieu of the method provided in Column C, it shall be permissible to add the nameplate ratings of all household cooking appliances rated more than 1¾ kW but not more than 8¾ kW and multiply the sum by the demand factors specified in Column A or Column B for the given number of appliances. Where the rating of cooking appliances falls under both Column A and Column B, the demand factors for each column shall be applied to the appliances for that column, and the results added together.
4. Branch-Circuit Load. It shall be permissible to calculate the branch-circuit load for one range in accordance with Table 220.55. The branch-circuit load for one wall-mounted oven or one counter-mounted cooking unit shall be the nameplate rating of the appliance. The branch-circuit load for one counter-mounted cooking unit and not more than two wall-mounted ovens, all supplied from a single branch circuit and located in the same room, shall be calculated by adding the nameplate rating of the individual appliances and treating this total as equivalent to one range.
5. This table shall also apply to household cooking appliances rated over 1¾ kW and used in instructional programs.

ARTICLE 220 — BRANCH-CIRCUIT, FEEDER, AND SERVICE LOAD CALCULATIONS 220.8

II.0.0 Dwelling Unit

(A) Feeder and Service Load. This section applies to a dwelling unit having the total connected load served by a single 120/240-volt or 208Y/120-volt set of 3-wire service or feeder conductors with an ampacity of 100 or greater. It shall be permissible to calculate the feeder and service loads in accordance with this section instead of the method specified in Part III of this article. The calculated load shall be the result of adding the loads from 220.82(B) and (C). Feeder and service entrance conductors whose calculated load is determined by this optional calculation shall be permitted to have the neutral load determined by 220.61.

(B) General Loads. The general calculated load shall be not less than 100 percent of the first 10 kVA plus 40 percent of the remainder of the following loads:

(1) 33 volt-amperes/m^2 or 3 volt-amperes/ft^2 for general lighting and general-use receptacles. The floor area for each floor shall be calculated from the outside dimensions of the dwelling unit. The calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use.

(2) 1500 volt-amperes for each 2-wire, 20-ampere small-appliance branch circuit and each laundry branch circuit covered in 210.11(C)(1) and (C)(2).

(3) The nameplate rating of the following:

a. All appliances that are fastened in place, permanently connected, or located to be on a specific circuit
b. Ranges, wall-mounted ovens, counter-mounted cooking units
c. Clothes dryers that are not connected to the laundry branch circuit specified in item (2)
d. Water heaters

(4) The nameplate ampere or kVA rating of all permanently connected motors not included in item (3).

(C) Heating and Air-Conditioning Load. The largest of the following six selections (load in kVA) shall be included:

(1) 100 percent of the nameplate rating(s) of the air conditioning and cooling
(2) 100 percent of the nameplate rating(s) of the heat pump when the heat pump is used without any supplemental electric heating
(3) 100 percent of the nameplate rating(s) of the heat pump compressor and 65 percent of the supplemental electric heating for central electric space-heating systems. When the heat pump compressor is prevented from operating at the same time as the supplementary heat, it does not need to be added to the supplementary heat for the central space heating load.
(4) 65 percent of the nameplate rating(s) of electric space heating if less than four separately controlled units
(5) 40 percent of the nameplate rating(s) of electric space heating if four or more separately controlled units
(6) 100 percent of the nameplate ratings of electric thermal storage and other heating systems where the usual operation is expected to be continuous at the full nameplate rating. Systems qualifying under this selection shall not be required to be calculated under any other selection in 220.82(C).

determined by

(1) Any portion of a 3-wire circuit consisting of 2 ungrounded conductors and the neutral conductor of a 4-wire, 3-phase, wye-connected system
(2) That portion consisting of nonlinear loads supplied from a 4-wire, wye-connected, 3-phase system

Informational Note: A 3-phase, 4-wire, wye-connected power system used to supply power to nonlinear loads may necessitate that the power system design allow for the possibility of high harmonic neutral conductor currents.

Part IV. Optional Feeder and Service Load Calculations

220.80 General. Optional feeder and service load calculations shall be permitted in accordance with Part IV.

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220.5(C)

REVISION

Floor Area

Change Summary

- Section 220.11 has been relocated from Part II of Article 220 to become 220.5(C).
- Garages and unfinished spaces, as well as unused spaces, are now included in the floor area calculations.
- Open porches continue to not be included in the floor area calculation if they cannot be adapted for future use as a habitable room or occupiable space.

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220.5(C)

REVISION

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220.42

REVISION

Lighting Load for Non-Dwelling Occupancies

Change Summary

- The lighting load requirements for non-dwelling occupancies have been moved from Part II to Part III, Feeder and Service Load Calculations.
- The informational note to 200.42(A) points out that unit load conditions of the table are now based on minimum load conditions and 80% power factor, not 100%, as previously indicated. These values might not provide sufficient capacity.
- The note to the table has been revised to make it clear that no additional multiplier is required for the unit loads.

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220.42

REVISION

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220.50

REVISION

Motors and Air-Conditioning Equipment

Change Summary

- The title of Section 220.50 has been changed to “Motors and Air-Conditioning Equipment” to reflect the fact that it also provides a reference to the requirements for hermetic refrigerant motor-compressors.
- The section has been reformatted to clearly delineate the requirements for motors from those for air-conditioning equipment.
- The air-conditioning requirements now reference all of Part IV of Article 440 for sizing of the branch circuit conductors.

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220.50

REVISION

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220.53

REVISION

Appliance Load – Dwelling Units

Change Summary

- Section 220.53 permits a demand factor of 75% to be applied to the nameplate rating of four or more appliances fastened in place rated at least ¼ horsepower or 500 watts.
- Electric vehicle supply equipment has been added to the list of loads that are not permitted to have a reduced demand factor.
- Section 625.41 requires that the EVSE branch circuit be sized for continuous duty loads.

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220.53

REVISION

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220.57

NEW

Electric Vehicle Supply Equipment (EVSE) Load

Change Summary

- A new requirement has been added for sizing the load for electric vehicle supply equipment.
- The load must be sized at 7,200 volt-amperes or the nameplate rating of the equipment, whichever is larger.
- An informational note was added to reference 625.42, which provides the requirement for sizing an EVSE circuit.

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220.57

NEW

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220.60

REVISION

Noncoincident Loads

Change Summary

- This section covers requirements for calculating noncoincident loads on feeders and services. Noncoincident loads are loads that are unlikely to be used simultaneously, such as heating and air conditioning.
- The largest of the loads is permitted to be used for calculating the size of the feeder or service.
- Where a motor or air-conditioning load is part of the noncoincident load and is not the largest of the noncoincident loads, 125% of the larger of the motor load or the air-conditioning load must be used.

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220.60

REVISION

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220.70

NEW

Energy Management Systems (EMSs)

Change Summary

- Section 220.70 will allow listed energy management systems to be used to limit the load on feeders or services.
- Upon malfunction, the EMS must disconnect the loads.
- Access to the settings must be restricted to authorized personnel in accordance with 750.30(C)(3).
- There are field marking requirements indicating the maximum current setting, the date of the calculation and setting, and identification of current-limited loads and sources.

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220.70

NEW

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220.110

NEW

Receptacle Loads – Health Care Facilities

Change Summary

- Demand factors for receptacle loads in health care facilities have been added in 220.110, which is located in the new Part VI, Health Care Facilities.
- These new requirements are based on receptacle load data from health care facilities.
- Since load calculations and demand factors are found in Article 220, the demand factors are referenced in 517.22.

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220.110

NEW

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220.120

REVISION

Receptacle Loads

Change Summary

- Table 555.6 has been relocated to 220.120.
- The relocation of demand factors is consistent with the decision to place requirements for demand factors in health care facilities into 220.110.
- Note No. 2 was revised to provide a method for shore power load calculations for slips using individual kilowatt-hour submeters.
- A new note has been added to the table that notes that if a circuit feeds a boat hoist and shore power for the same boat slip, only the load with the larger demand factor must be counted in the calculation because the loads are not coincident.

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220.120

REVISION

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225.41

NEW

Emergency Disconnects

Change Summary

- One- and two-family dwelling units that are supplied by a feeder now require an emergency disconnect that is installed in an outdoor, readily accessible location.
- If more than one disconnect is required, they must be grouped.
- The disconnecting means must be marked “EMERGENCY DISCONNECT.”
- The disconnect marking is required to be on the outside front of the enclosure. The label must be red with white lettering.

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225.41

NEW

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225.42

NEW

Surge Protection

Change Summary

- During the 2020 cycle, a new surge protection requirement was added for dwelling unit services in 230.67 (expanded for 2023).
- Surge protection is now required for outside feeders that supply dwelling units, dormitory units, guest rooms and guest suites of hotels and motels, and patient sleeping rooms of nursing homes and limited care facilities.
- A similar requirement is now located in 215.18 for feeders.
- There is no exception for outside feeder equipment for remotely-located SPD protection for upstream feeder or service equipment.

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225.42

NEW

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230.7

REVISION

Other Conductors

Change Summary

- Service conductors have been prohibited from being in the same cable or raceway with branch-circuit or feeder conductors.
- Service conductors are now also prohibited from being installed in underground boxes or handhole enclosures with branch-circuit or feeder conductors.
- Intermingling service conductors with other conductors is a hazard to workers and to connected equipment.
- Grounding electrode conductors and supply-side bonding jumpers are permitted in the same raceway or enclosure as the service conductors.

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230.7

REVISION

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230.24(A)

REVISION

Above Roofs

Change Summary

- The requirement for the minimum vertical clearance of overhead conductors above a roof surface has been increased from 2.5 meters (8 ft.) to 2.6 meters (8 ft. 6 in.)
- The vertical clearance extends 3 feet in every direction from the edge of the roof.
- The minimum clearance requirement for service conductors was less than for feeder conductors. Service conductors would be a greater hazard to workers on roofs than feeder conductors.
- The metric conversion in 225.19(A) was incorrect in the last edition of the *Code*.

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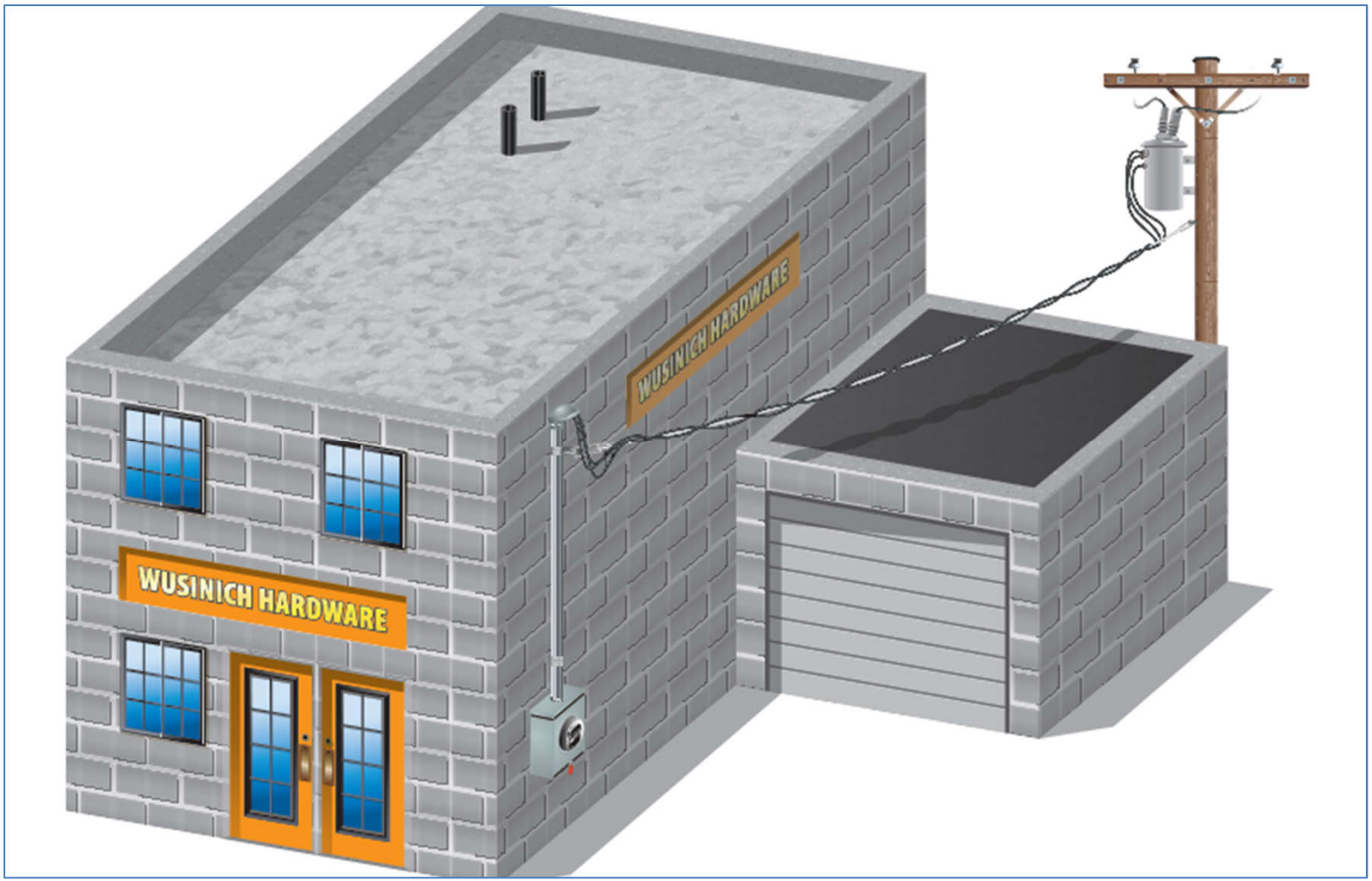
230.24(A)

REVISION



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230.43

REVISION

Wiring Methods for 1000 Volts, Nominal, or Less

Change Summary

- The list of permitted wiring methods for service entrance conductors has been revised.
- Type TC-ER cable is permitted where it is identified for use as service conductors.
- Flexible bus systems are a new wiring method that is now permitted for services.
- Article 371 provides installation requirements for flexible bus systems.

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230.43

REVISION

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230.62(C)

REVISION

Barriers

Change Summary

- Barriers are required in service equipment to minimize the likelihood of inadvertent contact with uninsulated, and ungrounded, service busbars and terminals.
- This requirement has been revised to make it clear that the requirement applies to protection from contact when the service disconnect is in the open position.
- The conductors and terminals being protected by barriers will remain energized when the service disconnect is in the open position.

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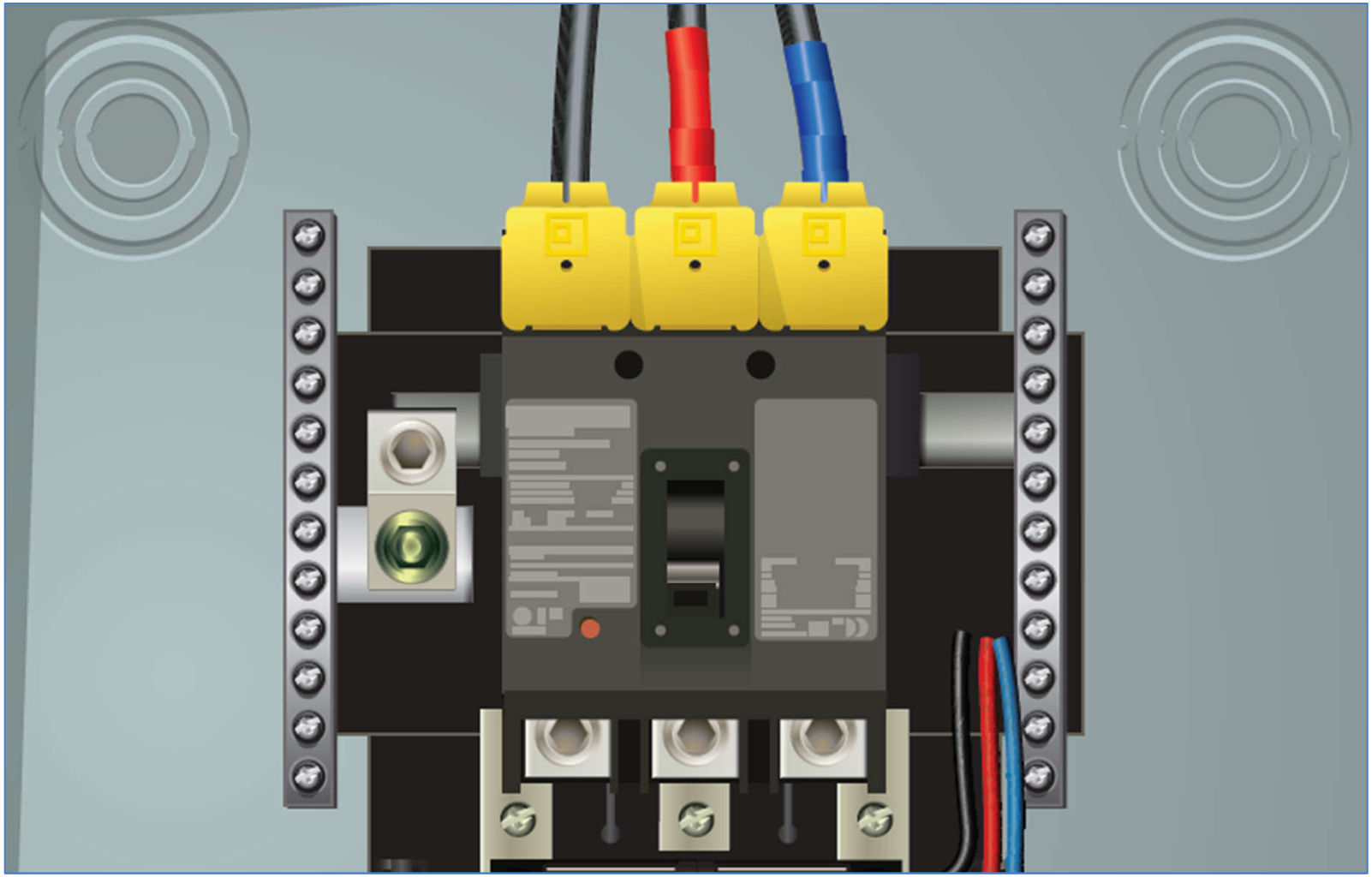
230.62(C)

REVISION



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230.67

REVISION

Surge Protection

Change Summary

- Surge protection will now be required to be provided in service equipment for dormitories, guest rooms and guest suites of hotels and motels, and sleeping areas of nursing homes and limited care facilities.
- With the expansion of the requirements, the section was reformatted into list format.
- Surge protective devices must have a nominal discharge current rating of not less than 10 kA.

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230.67

REVISION

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230.71(B)

REVISION

Two to Six Service Disconnecting Means

Change Summary

- The requirements for barriers in vertical sections of switchboards were clarified.
- Transfer switches in service equipment are now required to be in separate compartments.
- Barriers between a service disconnect for a motor control center and motor disconnects are now required.
- An exception was added that permits the addition of service disconnects (up to six) in a single enclosure in an existing installation that was installed in compliance with editions of the *Code* prior to 2020.

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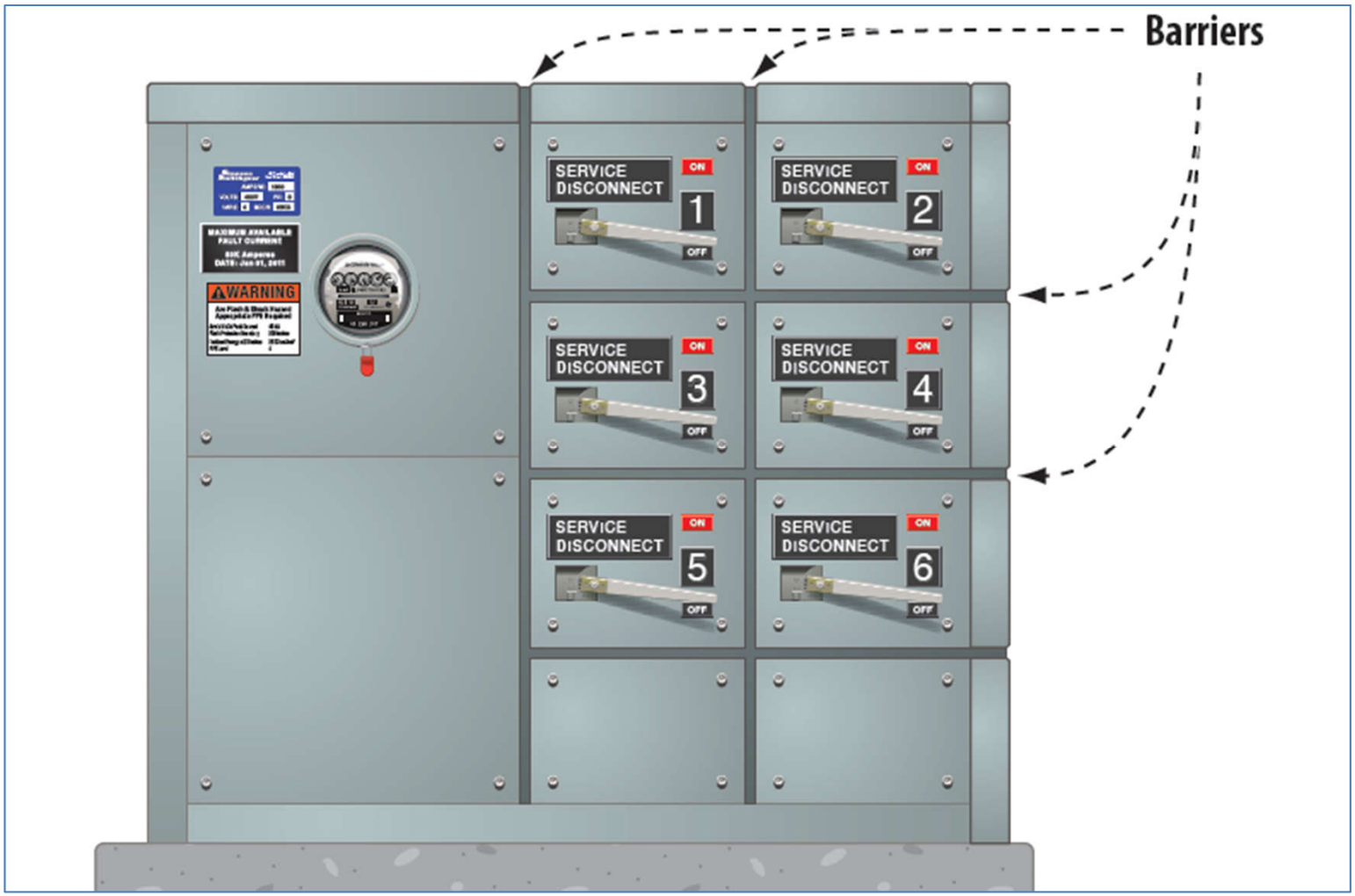
230.71(B)

REVISION



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230.85

REVISION

Emergency Disconnects

Change Summary

- Section 230.85 was rewritten into a list format and the language was clarified.
- An exception was added to not require an outdoor service disconnect to be readily accessible, where an outdoor feeder disconnect is installed in accordance with 225.41.
- If multiple disconnects are required, they must be grouped.
- If disconnects are replaced, all of the requirements of this section apply. However, the exception to (C) permits some repairs.

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230.85

REVISION

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Article 235

NEW

Branch Circuits, Feeders, and Services Over 1000 Vac…

Change Summary

- A new Article 235 has been created that covers requirements for branch circuits, feeders, and services over 1,000 volts ac or over 1,500 volts dc.
- This change is intended to locate the medium-voltage requirements to improve usability and clarity.
- Corresponding requirements have been deleted from Articles 210, 215, and 230.

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Article 235

NEW

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240.2

NEW

Reconditioned Equipment

Change Summary

- Section 240.2 has been created to indicate which equipment is permitted to be reconditioned.
- Equipment not permitted to be reconditioned includes GFPE, GFCI, low-voltage fuseholders, low-voltage nonrenewable fuses, molded-case circuit breakers, and low-voltage circuit breaker electronic trip units.
- Equipment permitted to be reconditioned includes low-voltage power circuit breakers, electromechanical relays, and current transformers.
- Reconditioned equipment covered by Article 240 must be listed.

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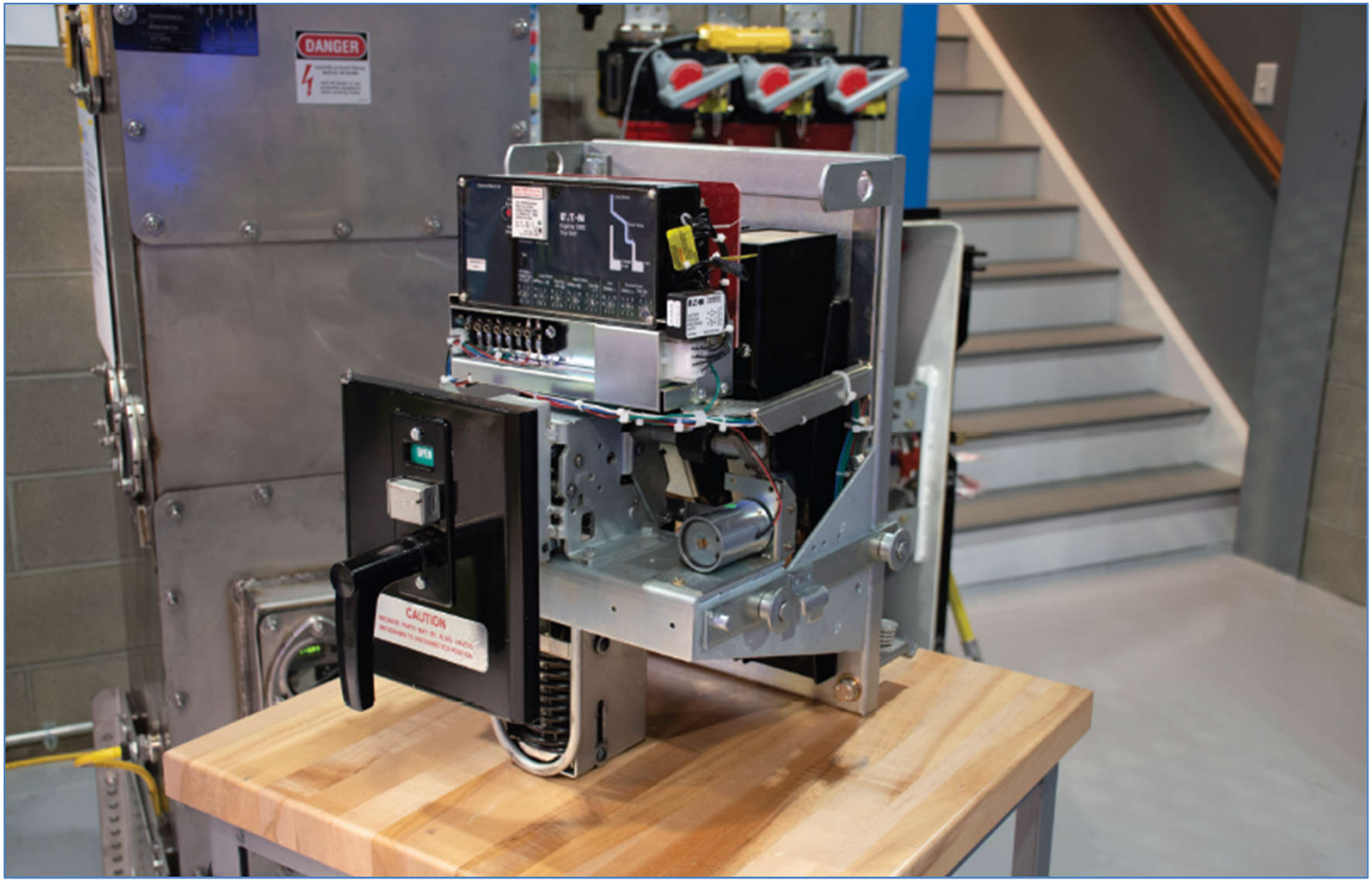
240.2

NEW



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Courtesy of Eaton

240.4(B)

REVISION

Overcurrent Devices Rated 800 Amperes or Less

Change Summary

- Conductors must be protected from overcurrent in accordance with their ampacity. Where the ampacity does not equal a standard OCPD rating, the next standard size (not to exceed 800 amperes) is permitted to be used in accordance with 240.4(B).
- An adjustable trip OCPD is permitted to be used as long as the setting does not exceed the next standard rating size above the conductor ampacity.
- The means to adjust the setting of the adjustable trip mechanism must have restricted access in accordance with 240.6(C).

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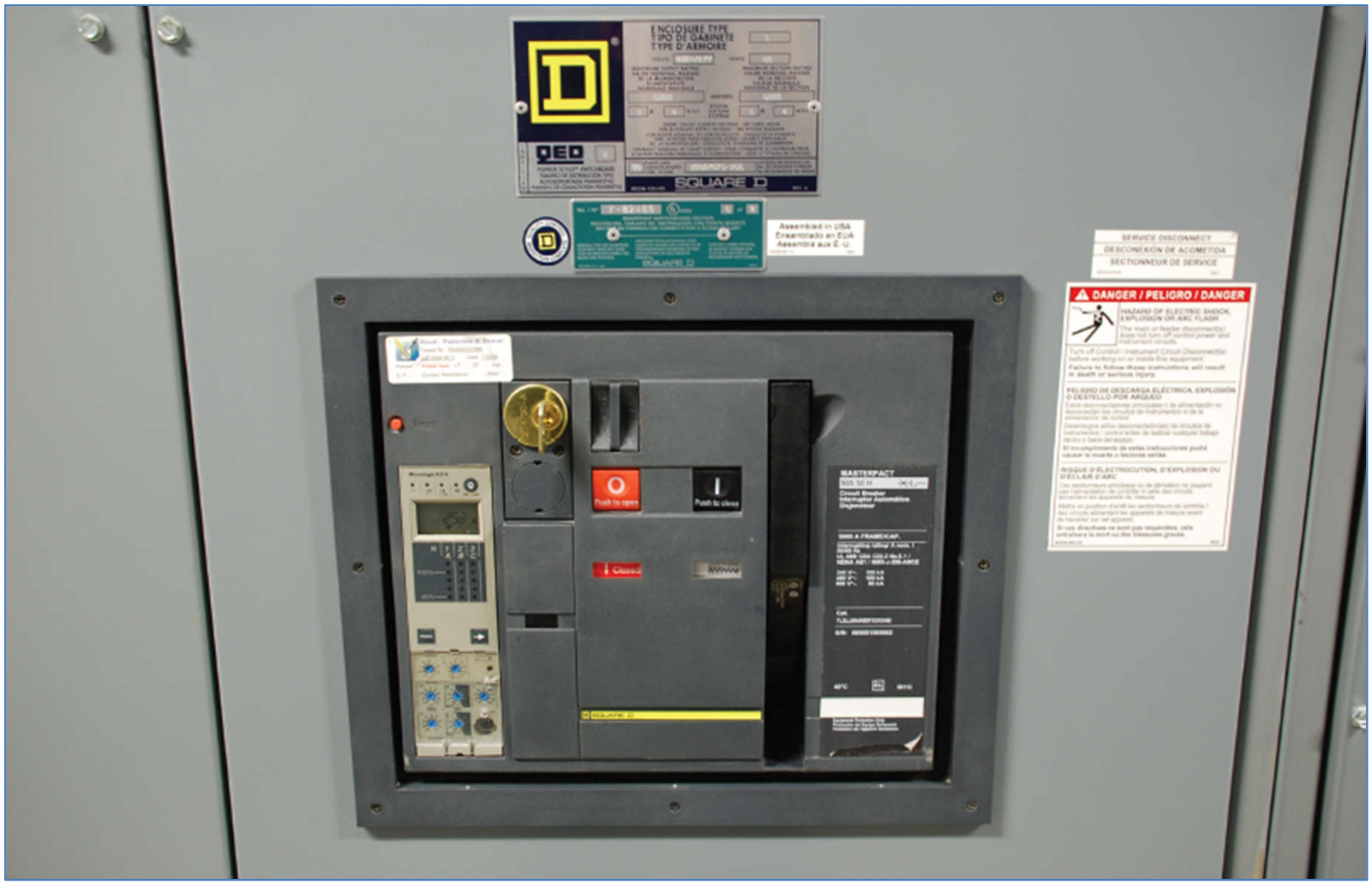
240.4(B)

REVISION



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240.6(D)

NEW

Remotely Adjustable Trip Circuit Breakers

Change Summary

- Remotely adjustable circuit breakers are permitted to have an ampere rating that is equal to the adjusted current setting (long-time pickup setting).
- Access can be achieved directly through a local nonnetworked interface or through a networked interface where the circuit breaker and software are identified as being evaluated for cybersecurity or the network has had a documented cybersecurity assessment.
- Two informational notes were added that reference cybersecurity standards and recognized methods of commissioning to identify cyber threats.
- A third informational note points out that continuous vigilance is necessary.

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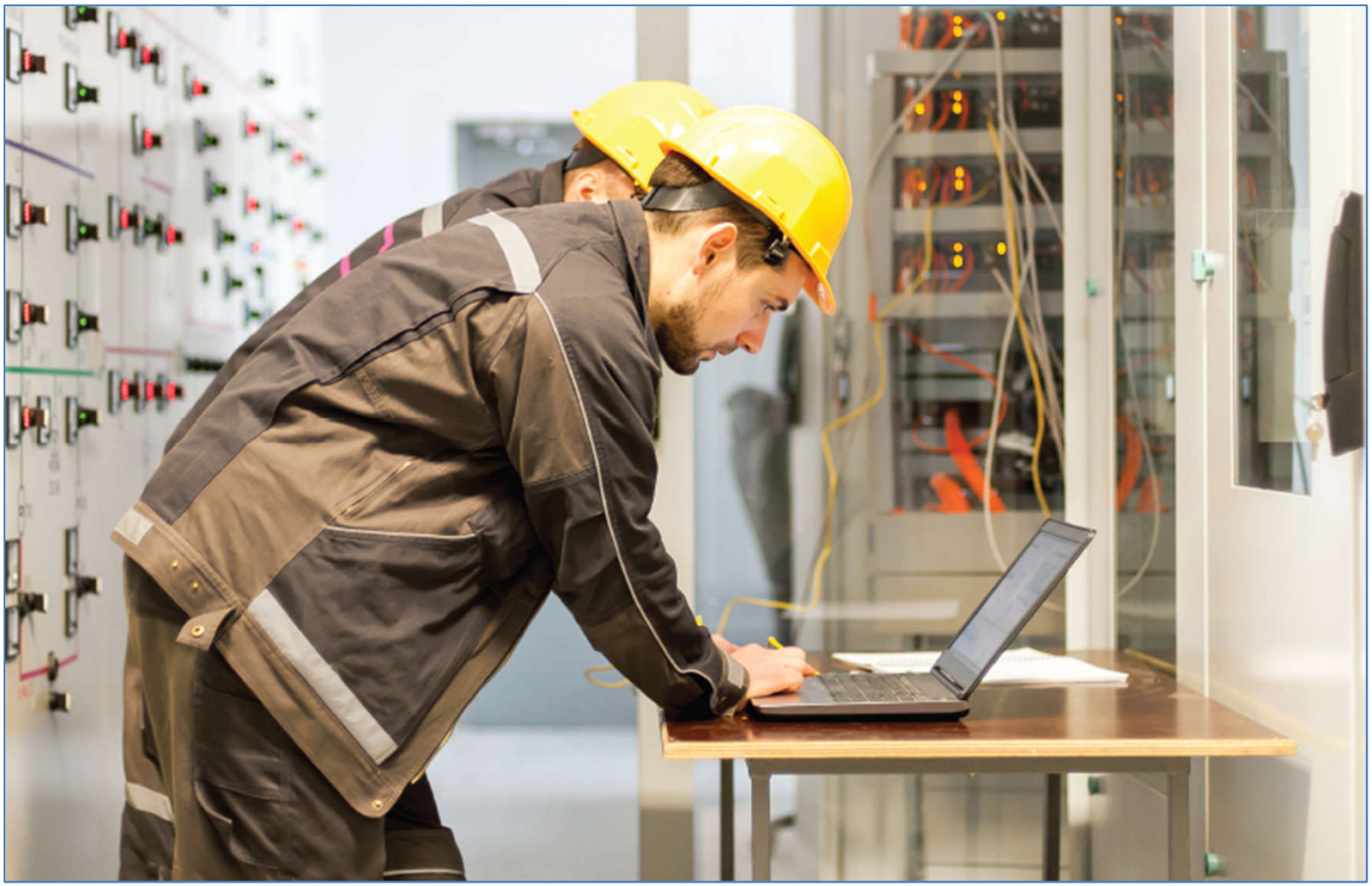
240.6(D)

NEW



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240.7

NEW

Listing Requirements

Change Summary

- Branch-circuit overcurrent protective devices are now required to be listed.
- The listing standards include *UL 489 Standard for Safety: Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures*, and *UL 1066 Standard for Safety: Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures.*
- Products that are not listed must be evaluated for safety in accordance with 110.3(A) as the basis for approval by the AHJ. Jurisdictions do not have the facilities to properly evaluate circuit breakers.

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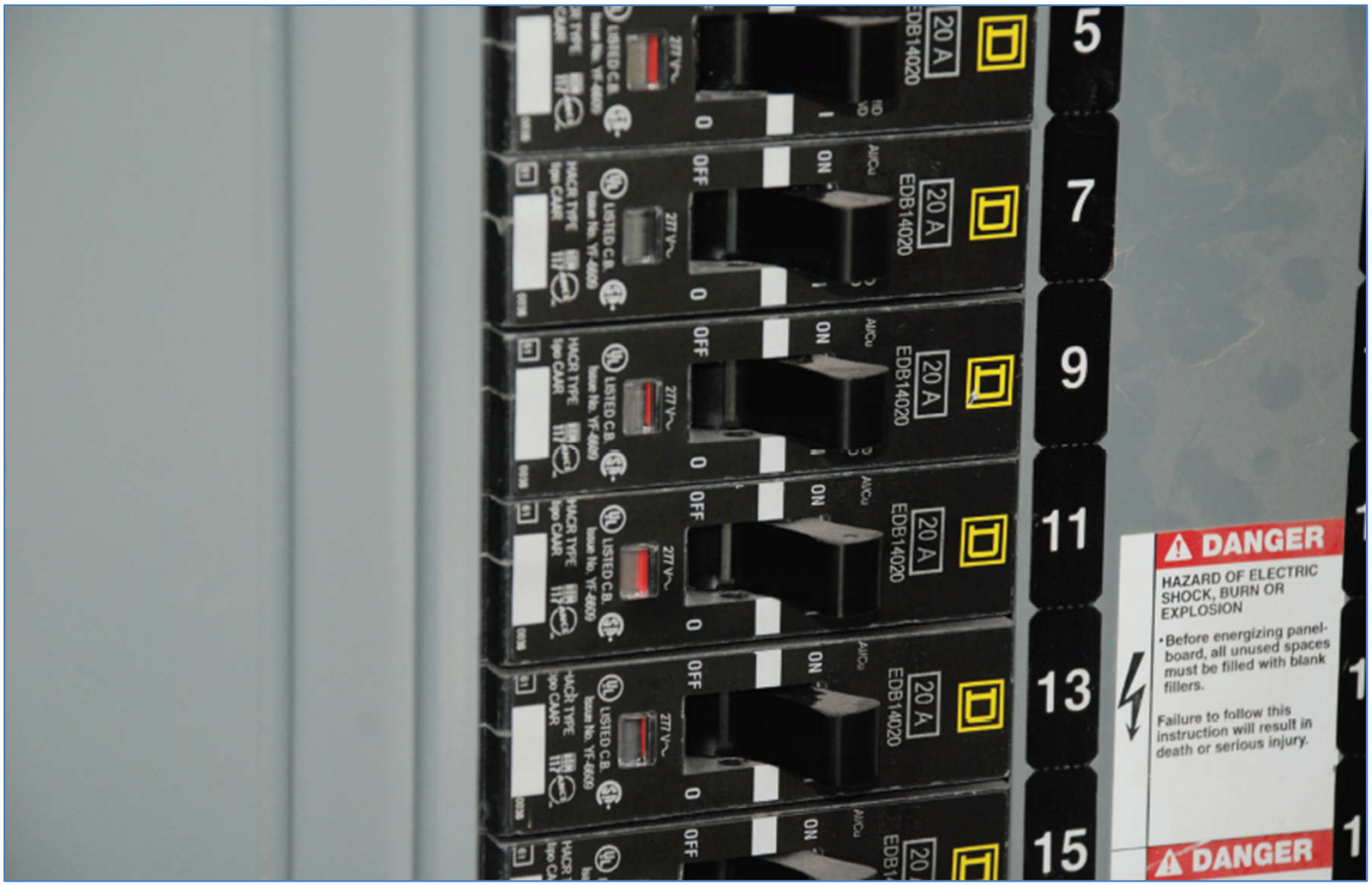
240.7

NEW



Courtesy of Michael J. Johnston

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240.11

NEW

Selective Coordination

Change Summary

- Selective coordination of overcurrent protective devices limits the extent of an outage without opening the service.
- If there are feeders connected to the service that have loads that are not required to be coordinated, the uncoordinated loads could be capable of opening the service OCPD.
- The 2023 *Code* requires that when feeders are connected to a service that has loads that are required to be selectively coordinated, the feeders are also required to be selectively coordinated.

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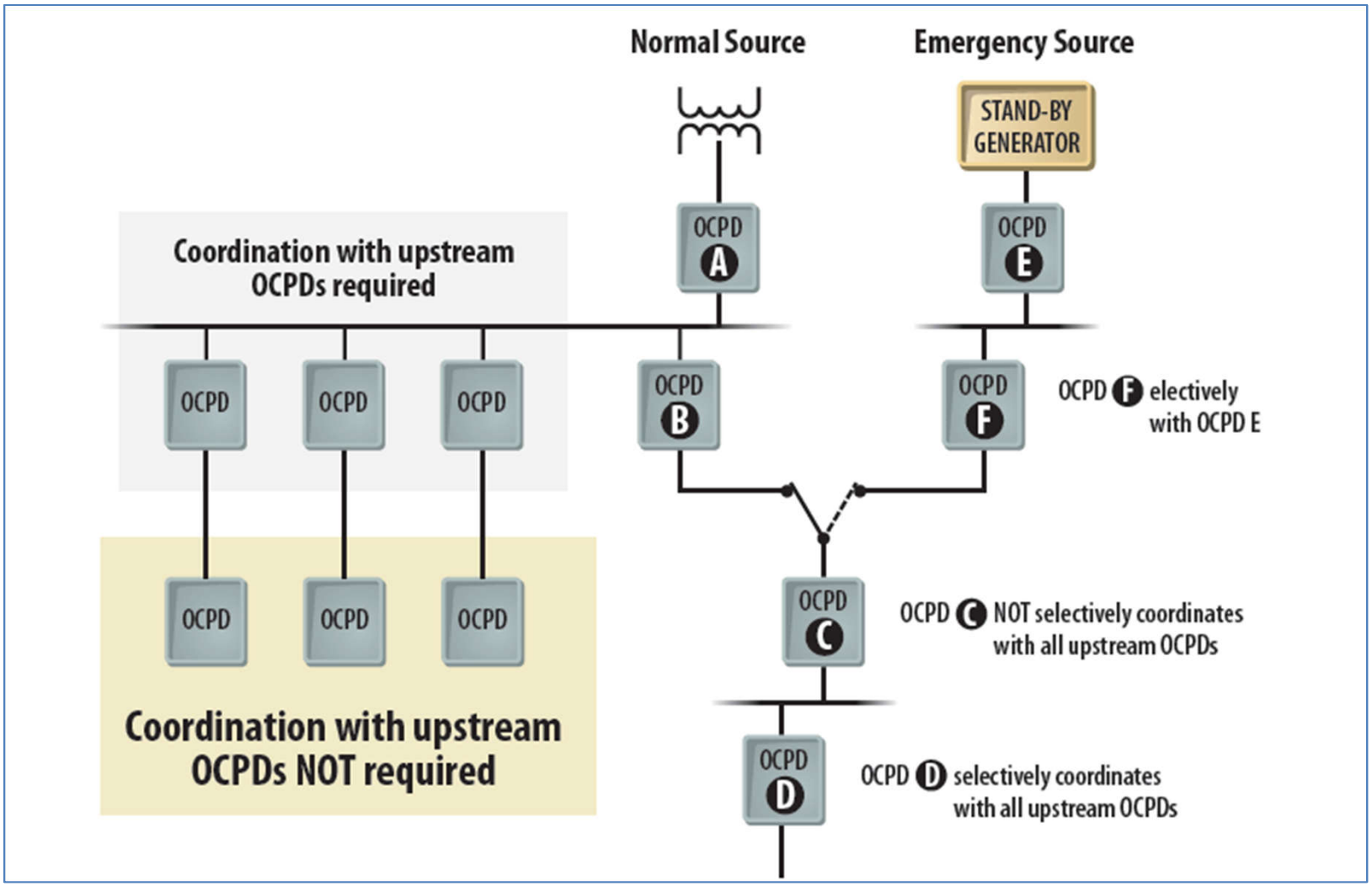
240.11

NEW



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240.24

REVISION

Location in or on Premises

Change Summary

- The use of a tool to access overcurrent protective devices will be permitted in enclosures designed for hazardous (classified) locations and for enclosures to protect against environmental conditions.
- Branch-circuit overcurrent protective devices will not have to be accessible to all residents in sleeping rooms in dormitory units.
- The prohibition against locating overcurrent protection in bathrooms of dwelling units, dormitory units, and guest rooms and guest suites has been expanded to include all bathrooms, showering facilities, and locker rooms with showering facilities.

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240.24

REVISION

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240.89

NEW

Replacement Trip Units

Change Summary

- Replacement trip units for circuit breakers must be listed for use in the specific circuit breaker type.
- The trip unit may be identical to the original, or it could provide additional features.
- Listing ensures that the new trip unit will not compromise the operation of the circuit breaker.
- This action correlates with the action taken during the 2020 cycle in 490.21(A)(5) for circuit breakers rated over 1,000 volts (245.21(A)(5) in this edition).

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240.89

NEW

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242.9

NEW

Indicating

Change Summary

- Surge protective devices are required to provide an indication that they are operating properly.
- A surge protective device can be damaged by a high-level surge, even if it has protected the equipment.
- Previously, the occupant may not have known that the SPD operation may have damaged it, precluding future protection.

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242.9

NEW

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242.42

REVISION

Surge Arrester Rating

Change Summary

- Previously, the rating of a surge arrester was required to be equal to or greater than the maximum continuous operating voltage at the point of application.
- The duty cycle is now required to be not less than 125% of the maximum continuous operating voltage available at the point of application.
- The reference to silicon-carbon type surge arresters was deleted because they are no longer manufactured.

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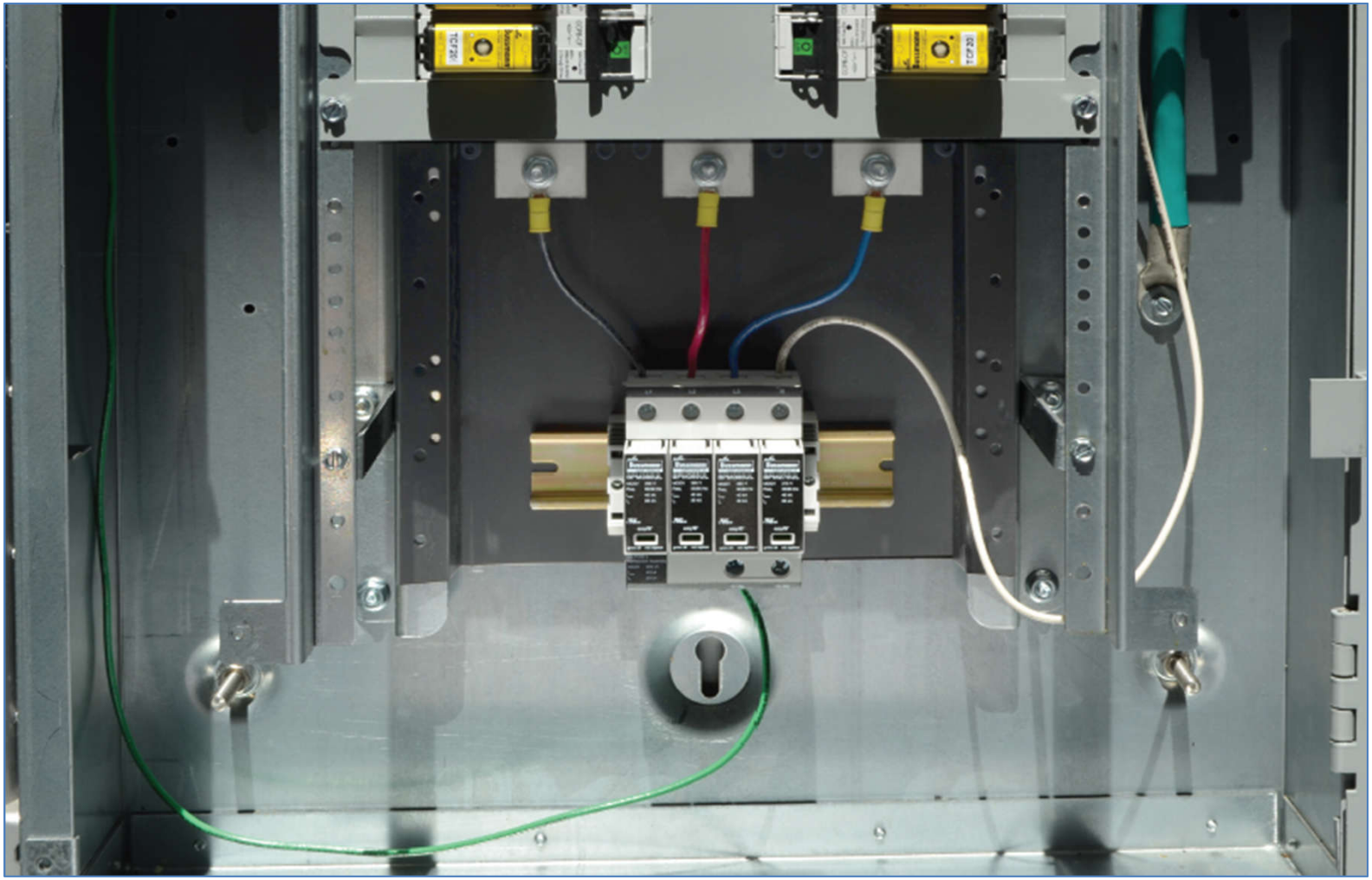
242.42

REVISION



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Article 245

NEW

Overcurrent Prot. Sys. Rated Over 1000 Vac, 1500 Vdc

Change Summary

- A new Article 245 has been created on overcurrent protection for systems rated over 1,000 volts ac and 1,500 volts dc.
- This new article will replace previous requirements for systems over 1,000 volts, which were located in Articles 240 and 490.
- This is one of several new articles that are intended to enhance the *NEC*'s coverage of medium- and high-voltage applications.

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Article 245

NEW

Courtesy of Michael J. Johnston

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245.2

REVISION

Reconditioned Equipment

Change Summary

- This section was revised, placed into list format, and relocated to become 245.2.
- Medium- and high-voltage circuit breakers are now permitted to be reconditioned.
- Electromechanical protective relays and current transformers are now permitted to be reconditioned.
- Medium-voltage fuseholders and medium-voltage nonrenewable fuseholders are not permitted to be reconditioned.

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245.2

REVISION

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250.6

REVISION

Objectionable Current

Change Summary

- This section was revised to recognize that bonding of various parts of electrical systems and equipment can also cause objectionable currents.
- 250.6(B) now provides remedies to objectionable currents resulting from bonding.
- 250.6(C) was revised to recognize that currents resulting from abnormal conditions may not be temporary and could also exist due to required grounding and bonding connections.

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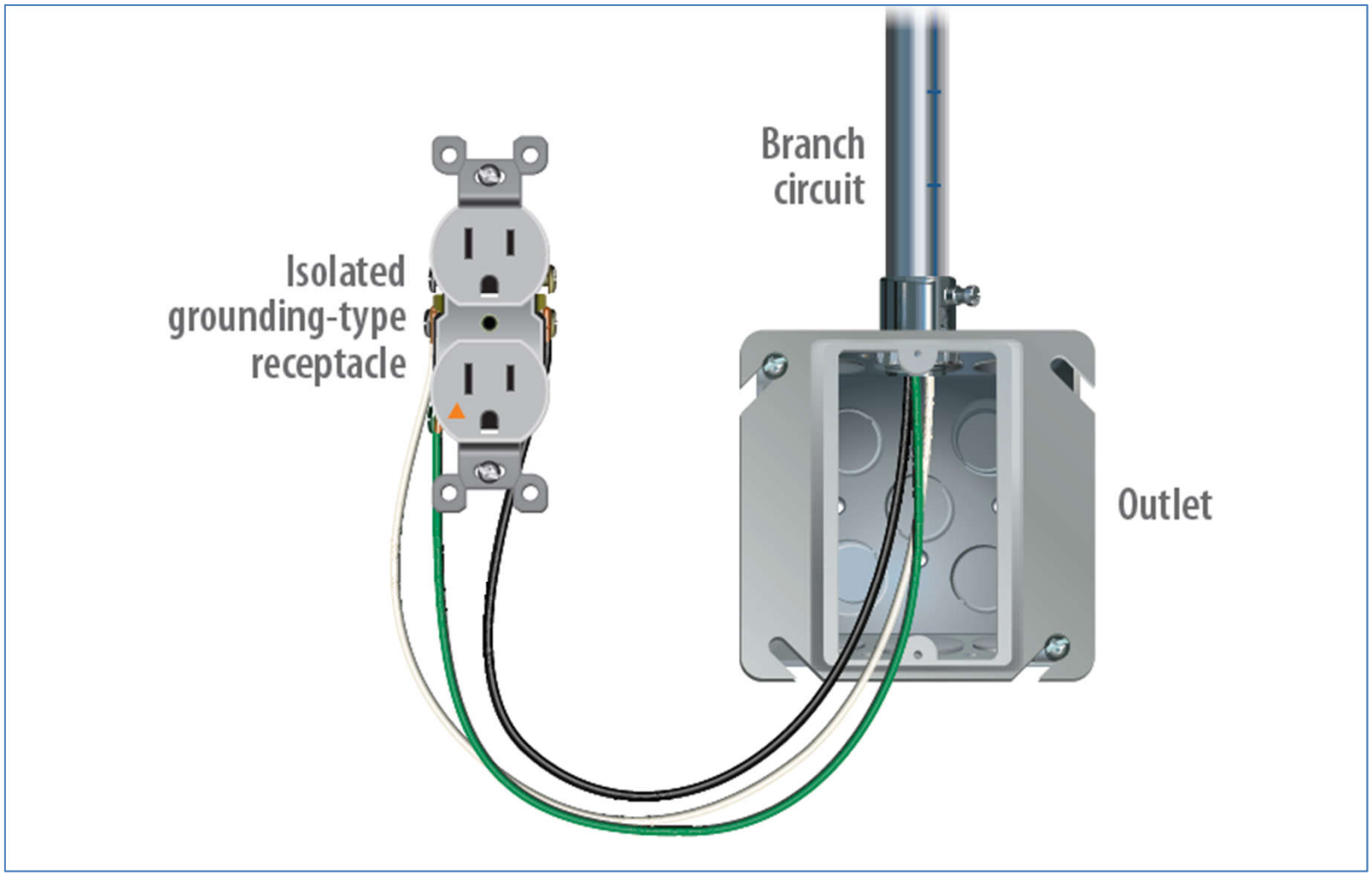
250.6

REVISION



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250.20

REVISION

Alternating-Current Systems to Be Grounded

Change Summary

- Alternating current systems are now required to be grounded in accordance with 250.20, unless prohibited elsewhere in the *Code.*
- A new informational note has been added to point to specific examples of applications where grounding is prohibited. In addition, 250.22 was deleted because it was a reference to some of these requirements elsewhere in the *Code*.
- 250.20(D) was revised to recognize that impedance grounded systems do not have a neutral conductor.

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250.20

REVISION

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250.24

REVISION

Grounding of Service-Supplied AC Systems

Change Summary

- The term *high impedance grounded system* is now changed to *impedance grounded system.*
- The conductor that connects to the neutral point through an impedance is not a grounded conductor – it is an impedance grounded conductor. Correlating changes were made in 250.36.
- Parallel grounded service conductors in two or more parallel raceways are required to be connected in parallel. The grounded conductor in each raceway is to be sized based on the conductor in the raceway.

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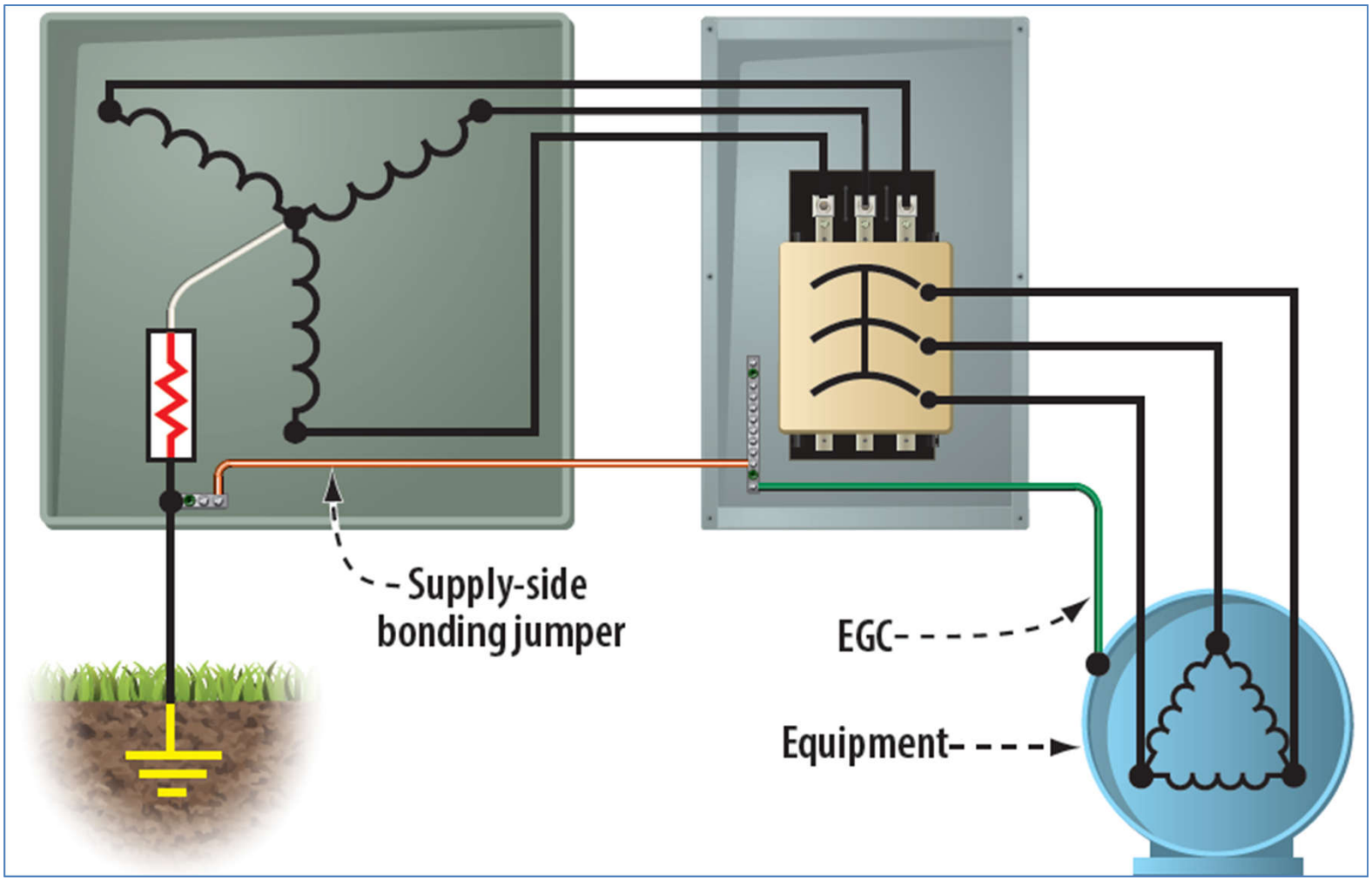
250.24

REVISION



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250.36

REVISION

Impedance Grounded Systems – 480 V to 1000 V

Change Summary

- The term *high impedance grounded neutral system* is now changed to *impedance grounded system.*
- The conductor that connects to the neutral point through an impedance is not a grounded conductor – it is an impedance grounded conductor.
- The conductor is also not a neutral conductor.

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250.36

REVISION

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250.64

REVISION

Grounding Electrode Conductor Installation

Change Summary

- Section 250.64(B) has been updated to include copper-clad aluminum conductors in the requirements for securing and supporting.
- Section 250.64(D)(2)(2) has been revised to recognize that some buildings are supplied by branch circuits, rather than by feeders or services. This removes a conflict with 250.24(A)(1).
- A new 250.64(G) was added to prohibit grounding electrode conductors from being run through the ventilation openings of equipment.
- There were several minor editorial corrections in this section.

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250.64

REVISION

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Courtesy of Copperweld Bimetallics LLC

250.68(C)

REVISION

Grounding Electrode Conductor Connections

Change Summary

- Interior metal piping that is electrically continuous with a metal underground water pipe electrode that is not more than 5 feet from the point of entrance is permitted to extend the grounding electrode.
- The measurement has been clarified in three places to make it clear that the measurement is along the water piping.
- In 250.68(C)(2) and (C)(3), there were references to “the usual steel tie wires” without explanation. The phrase “the usual” was deleted.

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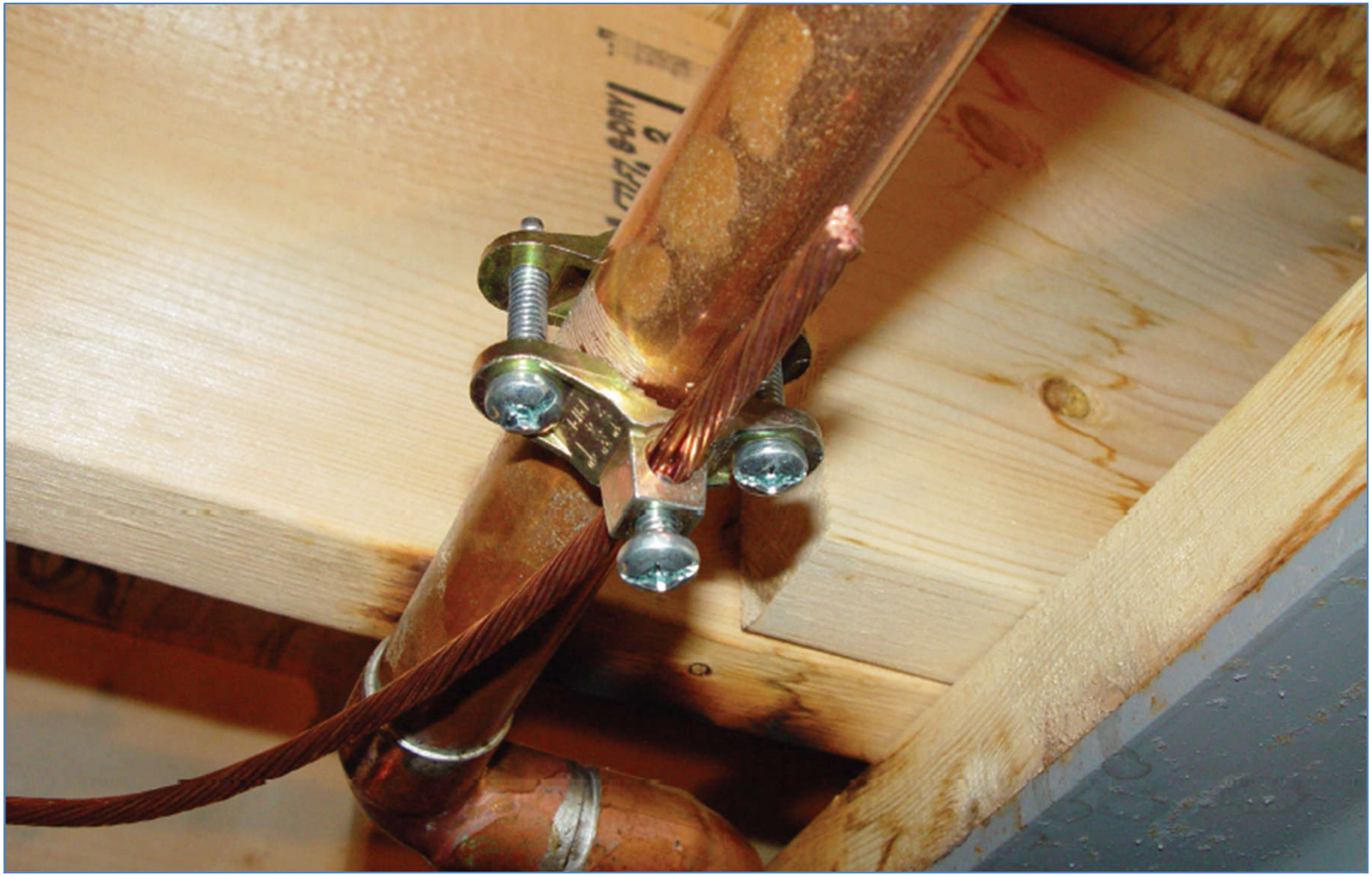
250.68(C)

REVISION



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250.94(B)

REVISION

Bonding for Communications Systems-Other Means

Change Summary

- Section 250.94(B) was revised to clarify the requirement for the connection to a busbar, which is connected to the grounding electrode conductor. The conductor must be the larger of one of the following:
  - A conductor that is sized at least as large as the largest conductor connected to the busbar.
  - A 6 AWG conductor in accordance with 250.94(A)(4)

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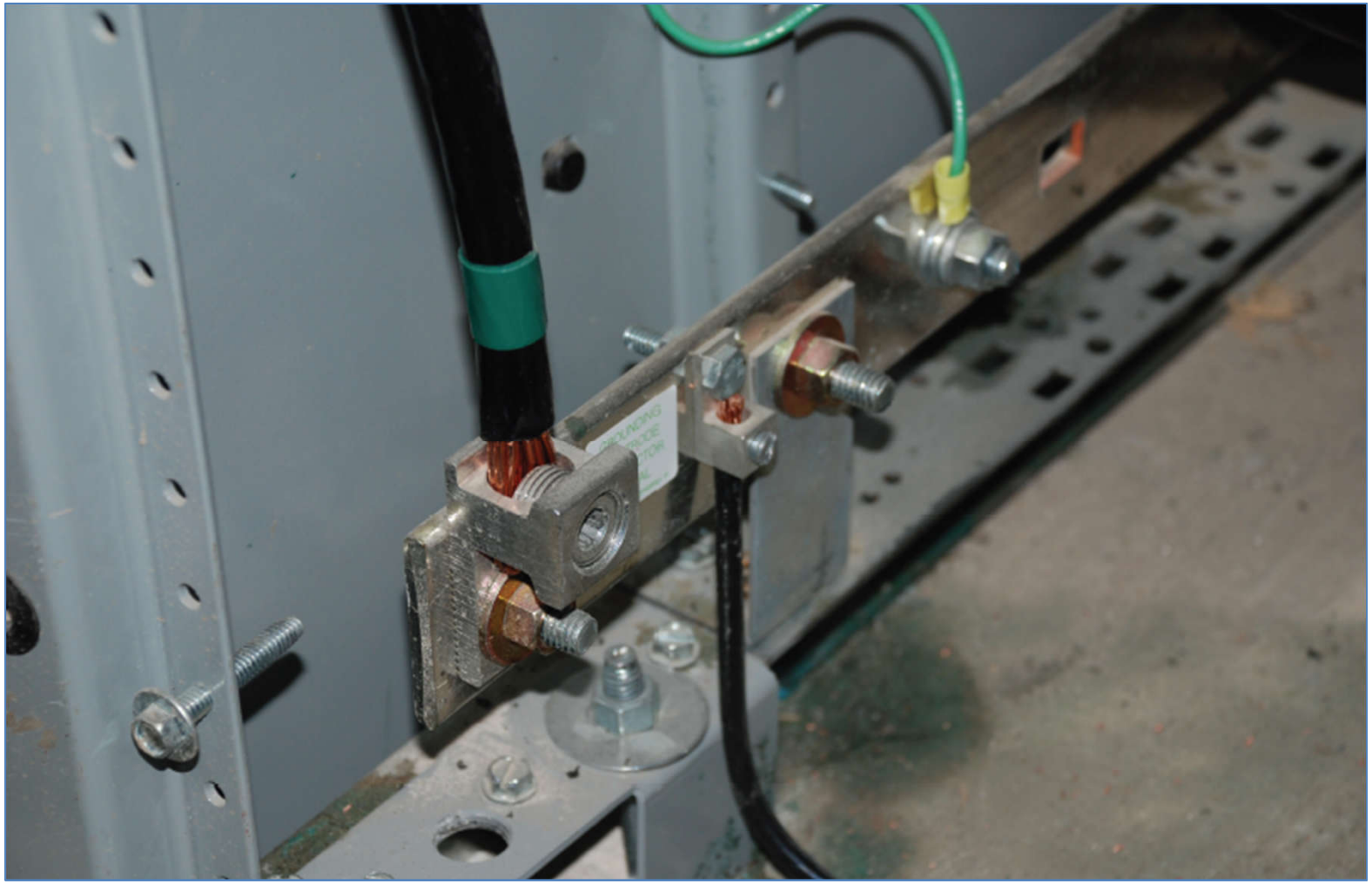
250.94(B)

REVISION



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250.104(C) & (D)

REVISION

Bonding of Piping Systems and Exposed Struct. Metal

Change Summary

- Changes were made in 250.104(C) to replace the vague language about conductors of “sufficient size” with a reference to Table 250.102(C)(1) to specify the size.
- Changes were made in 250.104(D)(3) to make it clear that the piping being referred to is metal water piping.
- Changes were also made to recognize that connections to grounding electrodes in the earth may be extended through portions of the pipe or structural electrodes that are above ground, provided the installation complies with 250.68(C).

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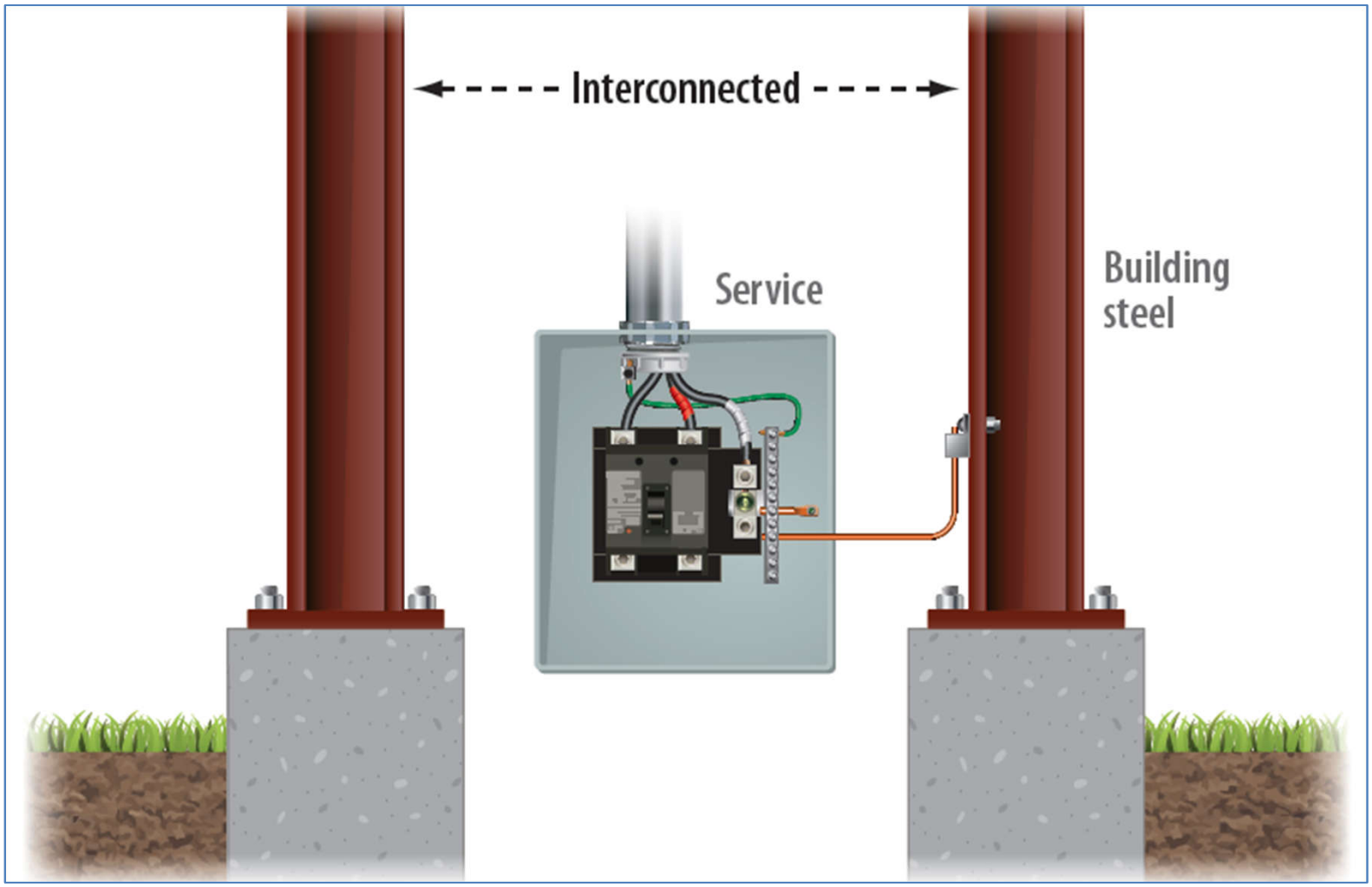
250.104(C) & (D)

REVISION



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250.118

REVISION

Types of Equipment Grounding Conductors

Change Summary

- Section 250.118, Types of Equipment Grounding Conductors, was reformatted into two subdivisions: (A) Permitted, and (B) Not Permitted.
- Section 250.118(A)(5)(f) and (A)(6)(f) were added for locations where there is a need for high resistance to corrosion. A stainless-steel core has a higher electrical resistance than other metals used in the construction of liquidtight flexible metal conduit. The bonding jumper can be internal or external to the liquidtight flexible metal conduit.
- A requirement for a bonding jumper was also added to 250.118(A)(5)(e).

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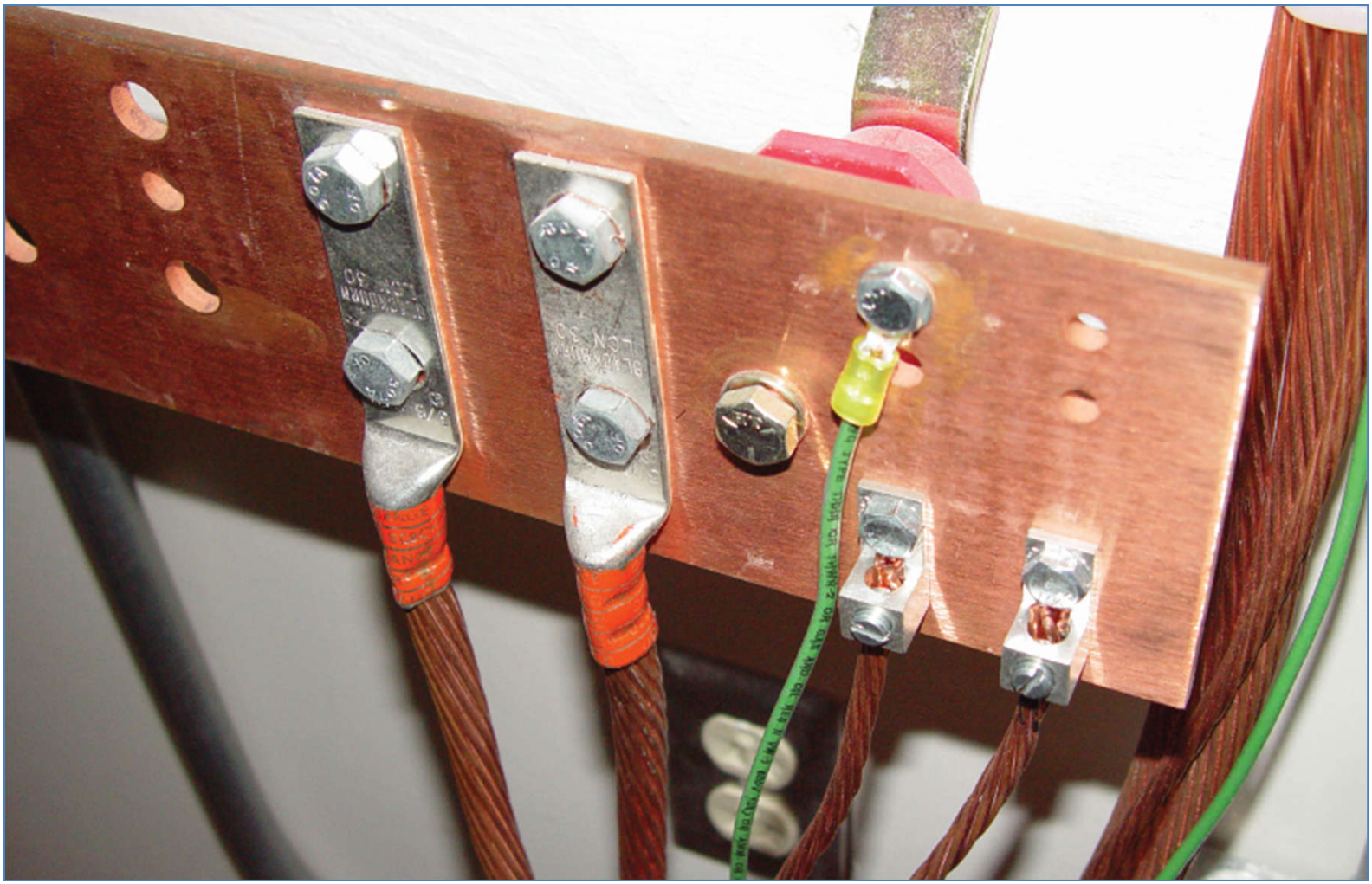
250.118

REVISION



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Significant Changes

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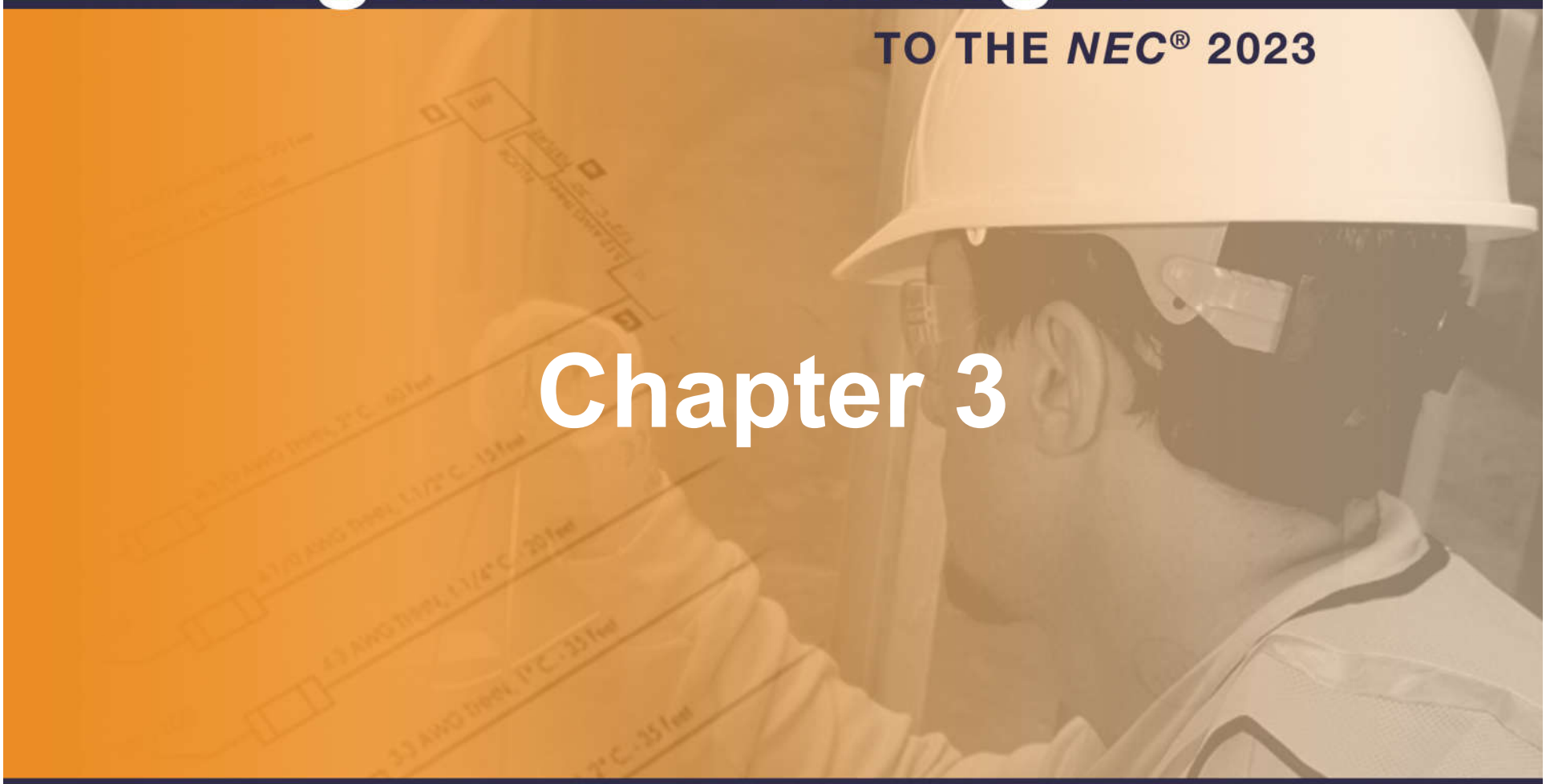

Chapter 3

electrical training ALLIANCE IBEW - NECA IN COLLABORATION WITH NECA NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

Article 300

REORGANIZE NEW

Limitations

Change Summary

- Article 300 was reorganized to limit it to systems rated 1,000 volts ac, nominal, or less and 1,500 volts dc, nominal, or less.
- Medium- and high-voltage requirements have been moved to the new Article 305.
- This is the first cycle that 1,500 volts dc has been established as a limit.

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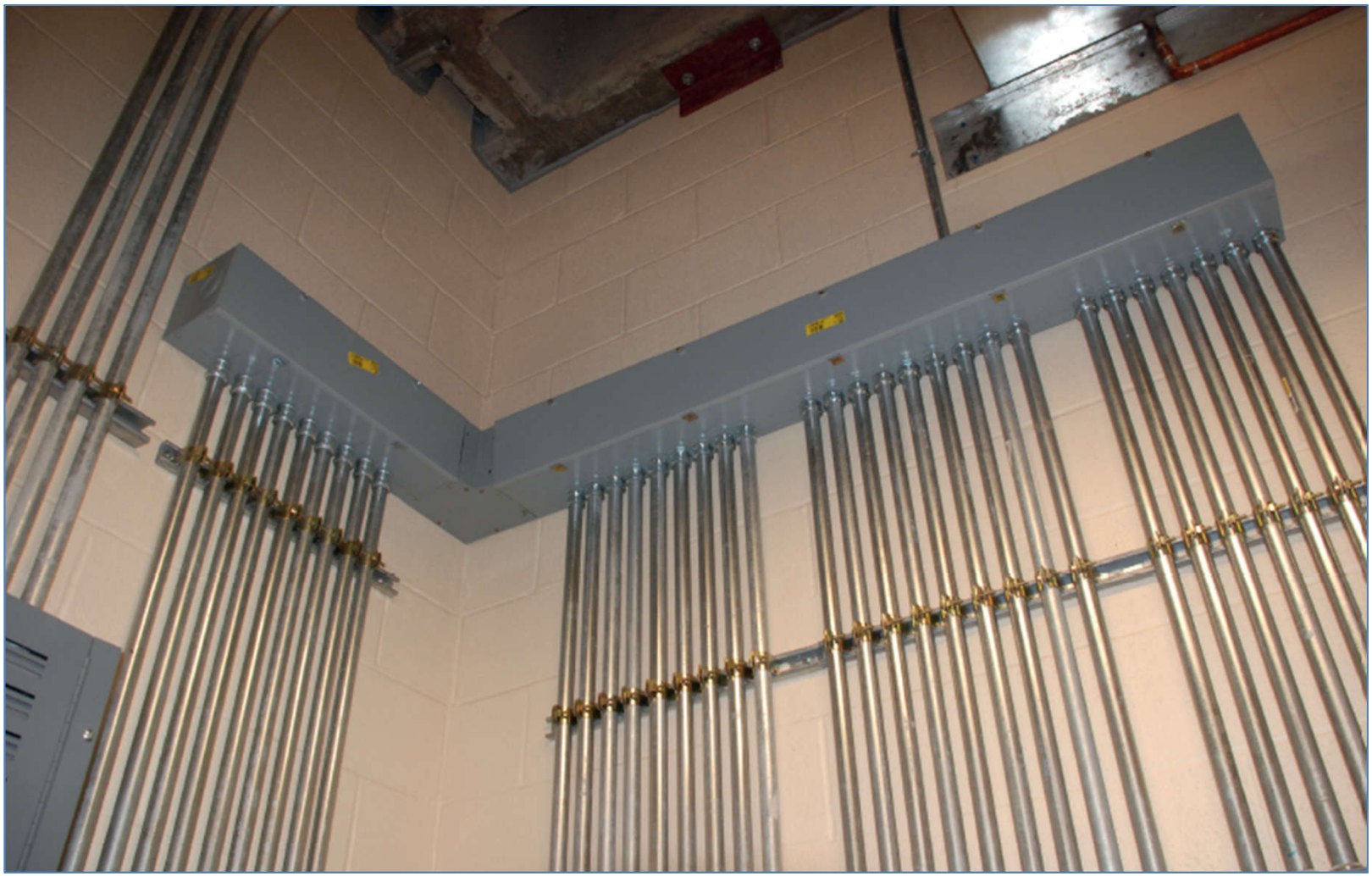
Article 300

REORGANIZE NEW



Courtesy of Bill McGovern, City of Plano, TX

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300.2 & 300.3

REVISION

Limitations

Change Summary

- Section 300.2 has added a voltage limitation for dc systems that are covered by Article 300.
- Chapter 3 wiring methods apply to systems operating at 1,000 volts ac or less or 1,500 volts dc or less.
- Chapter 3 wiring methods are only permitted on systems operating over 1,000 volts ac and 1,500 volts dc if specifically permitted elsewhere in the *Code*.
- The scope of Article 305 states that it applies to installations exceeding 1,000 volts ac or exceeding 1,500 volts dc.

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300.2 & 300.3

REVISION

Courtesy of PDE Total Energy Solutions

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300.4(E)

REVISION

Cables, Raceways, or Boxes Under Metal Decking

Change Summary

- Section 300.4(E) will now only apply to installations beneath metal-corrugated roof decking.
- Exception No. 1 was revised to recognize that listed steel or malleable metal fittings and boxes provide protection from nail penetration.
- A new exception was added for corrugated roof decks that have a minimum 2-inch slab installed over the corrugated metal roof deck.

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300.4(E)

REVISION

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300.7(B)

NEW

Expansion, Expansion-Deflection, Deflection Fittings

Change Summary

- Section 300.7(B) requires raceways to be provided with expansion-deflection or deflection fittings where necessary to compensate for expansion, deflection, and contraction.
- Failure to provide these fittings can result in damage to the installation.
- Informational Note No. 1 provides references to tables that provide expansion information. It also provides information on the rate of expansion.
- A new informational note was added that references NEMA FB 2.40, *Installation Guidelines for Expansion and Expansion/Deflection Fittings.*

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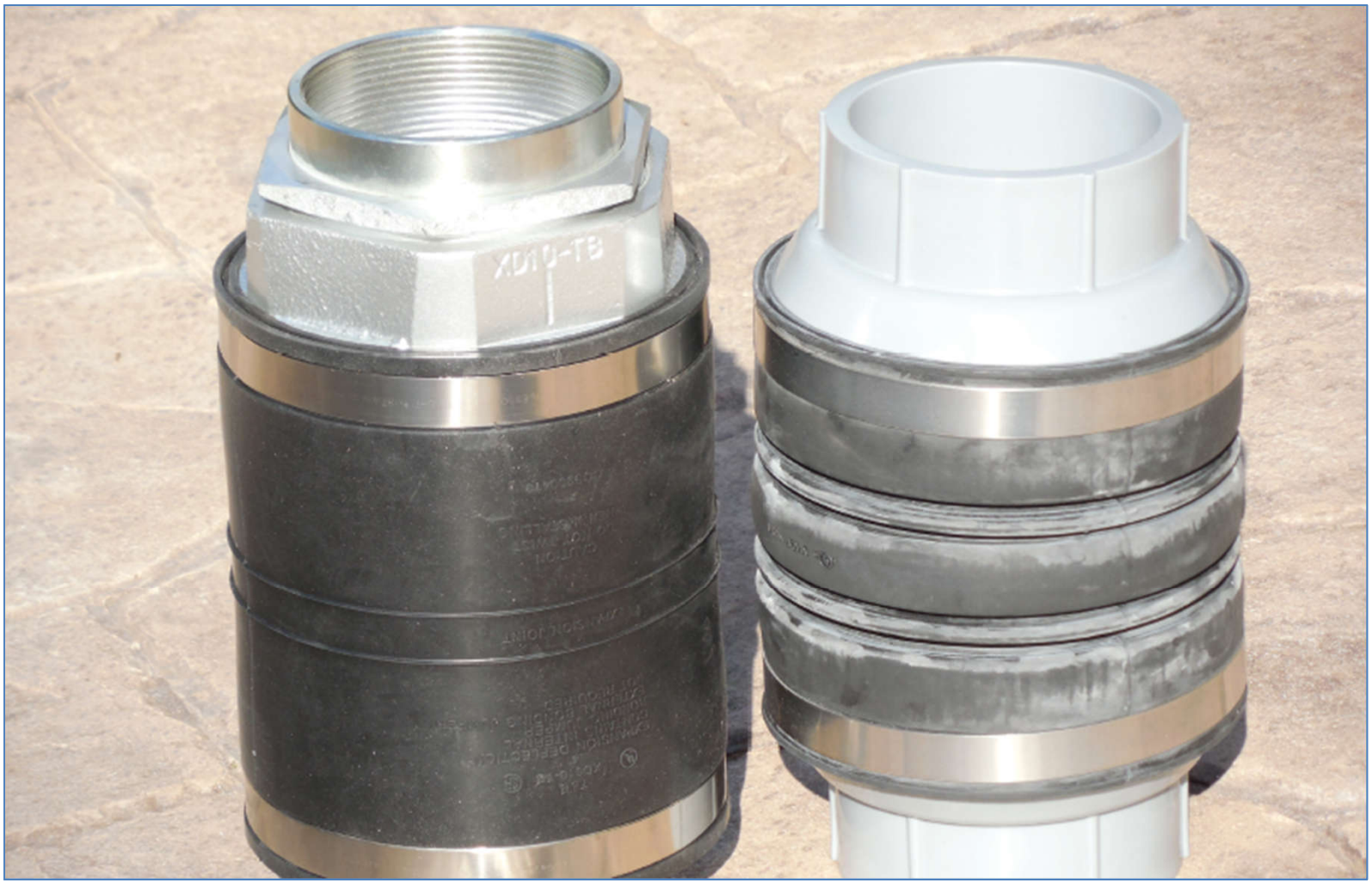
300.7(B)

NEW



Courtesy of ABB Inc.

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300.15

REVISION

Boxes, Conduit Bodies, or Fittings – Where Required

Change Summary

- Section 300.15 was clarified to indicate that a box or conduit body is required at conductor splice, termination, junction, and pull points.
- Wording was added to indicate that boxes or conduit bodies are required at “wiring method transition points,” which indicates a change in wiring method.
- Section 300.15(G) was revised to clarify that it also applies to direct-buried cables in addition to direct-buried conductors.

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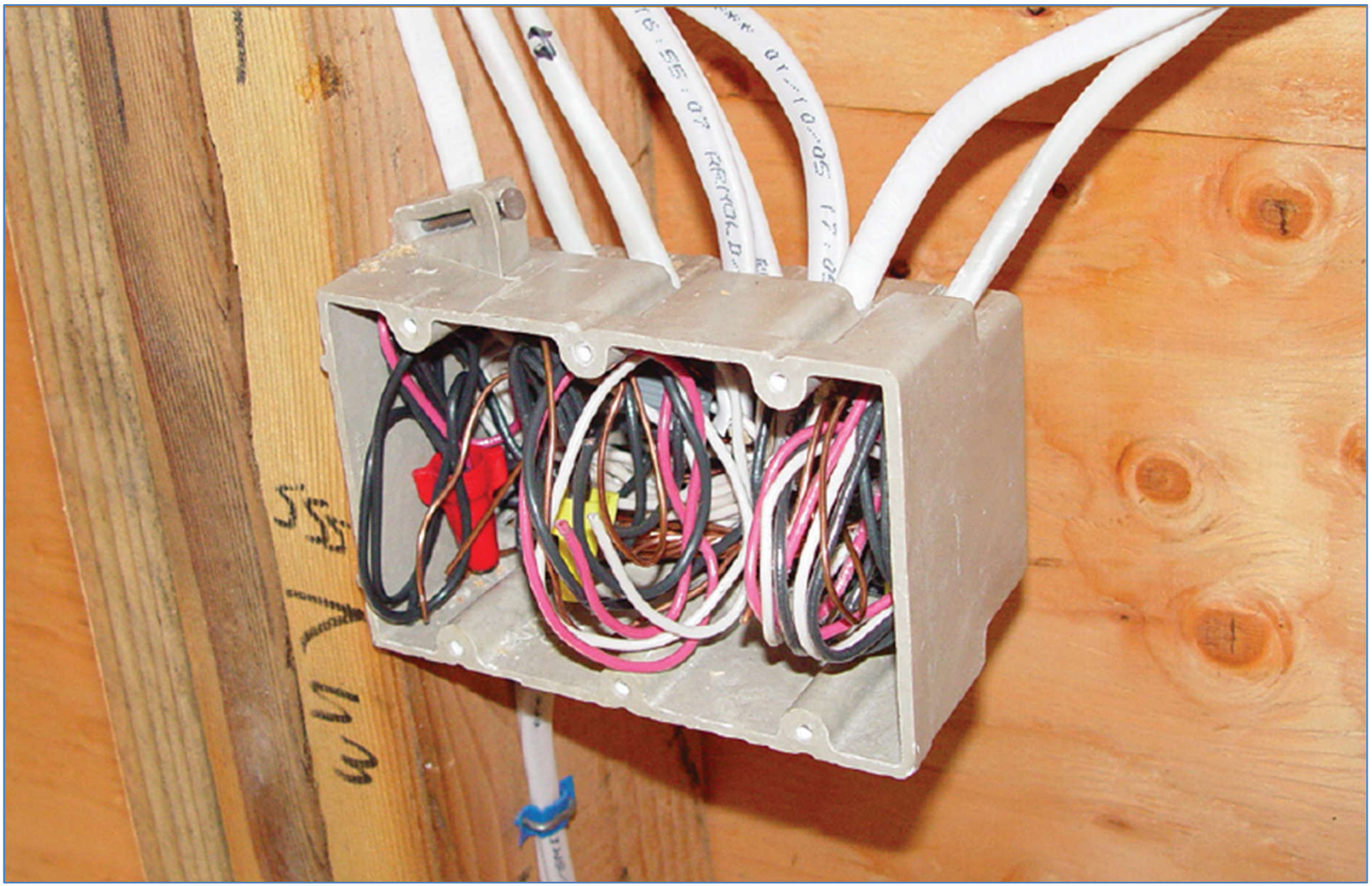
300.15

REVISION



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300.25 & Exception

REVISION

Exit Enclosures (Stair Towers)

Change Summary

- Many buildings have exit enclosures (stair towers) to protect personnel who need to exit during a fire. These are often supported independently of the building.
- Exit enclosures that are required to have a fire rating must be served only by wiring methods serving equipment that is permitted by the AHJ to be in the stair tower.
- Luminaires for the exterior lighting of exit doors of exit enclosures are permitted to be supplied by a circuit that supplies the inside of the exit enclosure.

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300.25 & Exception

REVISION

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300.26

NEW

Remote-Control and Signaling Circuits Classification

Change Summary

- The scope of Article 725 has been changed, requiring this clarification.
- Class 2 and 3 power-limited remote-control and signaling circuits remain in Article 725.
- Class 1 power-limited remote-control and signaling circuits were relocated to the new Article 724.
- Non–power-limited remote-control and signaling circuits are governed by the requirements of Chapters 1 through 4 of the *Code*.

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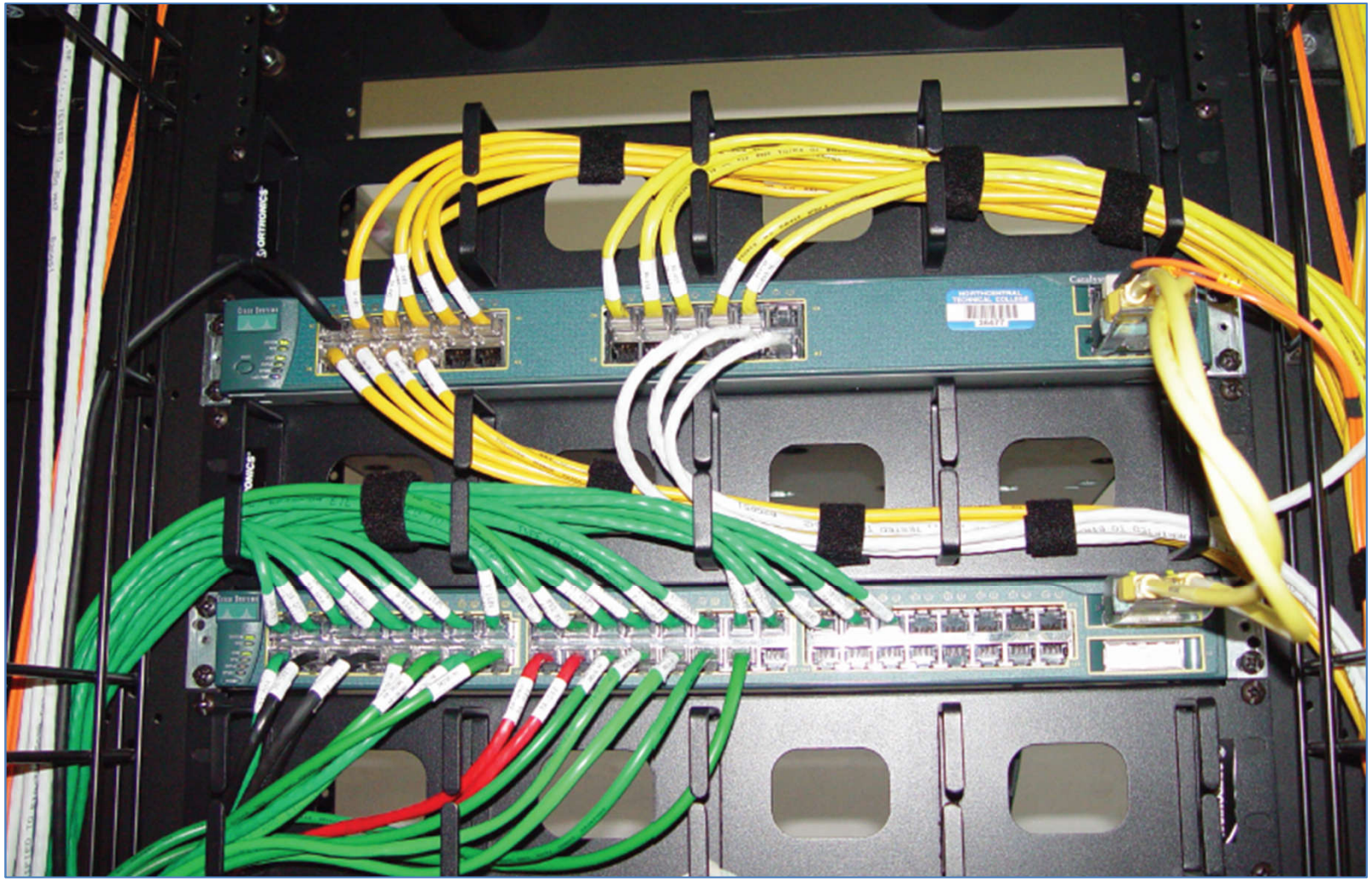
300.26

NEW



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Article 305

NEW

Systems Rated Over 1000 V ac, 1500 V dc, Nominal

Change Summary

- Article 305 has been created to separate the requirements for medium-voltage systems from the requirements of systems rated 1,000 volts ac or less and 1,500 volts dc or less.
- The bulk of Article 305 came from Part II of Article 300.
- Section 305.3 references the wiring methods permitted to be used over 1,000 volts ac and 1,500 volts dc.
- Requirements for services, feeders, and branch circuits for systems rated over 1,000 volts ac and over 1,500 volts dc are found in Article 235.

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Article 305

NEW

Courtesy of Michael J. Johnston

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312.8

NEW

Splices, Taps, and Feed-Through Conductors

Change Summary

- A new 312.8(A)(3) has been added to recognize the additional bending space needed for conductors 4 AWG and larger.
- Where splices or where angle or U pulls are made with insulated conductors, 314.28(A)(2) requires the distance between the raceway and the opposite wall to be at least six times the largest trade size in a row.
- The six times rule also applies to straight-through conduit entries if the conductors are spliced.

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312.8

NEW

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Courtesy of Tom Garvey

312.10

NEW

Screws or Other Fasteners

Change Summary

- Screws and other fasteners installed in the field that enter the wiring space are required to be those provided by or specified by the manufacturer.
- If not supplied or specified by the manufacturer, this section provides three criteria that can be used, where applicable.
- An exception allows screws that enter to extend into the enclosure not more than 7/16 inch if located within 3/8 inch of an enclosure wall.
- A similar requirement was added for screws and fasteners in 314.5.

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312.10

NEW

Courtesy of Michael J. Johnston

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314.5

NEW

Screws or Other Fasteners

Change Summary

- New requirements for screws and other fasteners have been added to 314.5. Screws and other fasteners are required to have blunt ends.
- Specific requirements are provided for the permitted length, based on where in the box the screw or fastener is used.
- Longer screws are permitted where protected with an approved means.

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314.5

NEW

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314.16(B)

REVISION

Box Fill Calculations

Change Summary

- The second paragraph of 314.16(B)(2) was deleted because the product line that it was intended for is not being produced.
- Equipment bonding jumpers were removed for the conductor fill calculation requirements in 314.16(B)(5). The panel concluded that if equipment bonding jumpers are run within raceways, they are considered an expansion of the equipment grounding conductor.
- 314.16(B)(6) was added to require a single volume allowance for a terminal block assembly based on the largest conductor terminated to the assembly.

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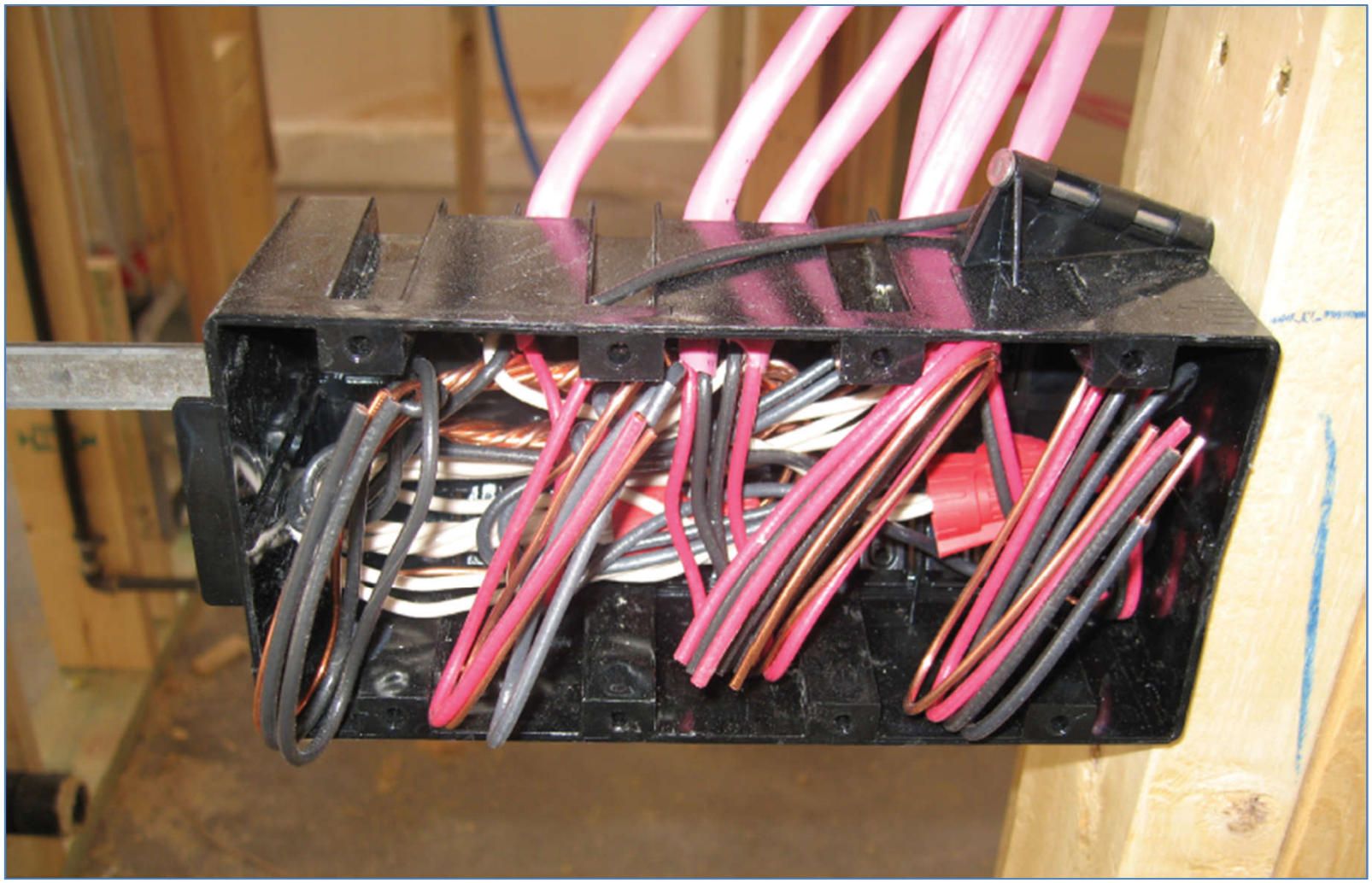
314.16(B)

REVISION



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314.24

REVISION

Dimensions of Boxes

Change Summary

- The title of 314.24 has been changed from “depth of boxes” to “dimensions of boxes” to recognize that this section deals with more than depth.
- The rearward projection of devices or equipment must not be greater than the center line of a knockout used for a side wiring entrance or a ½-inch clearance must be maintained between the device and the sidewall of the box.
- Where wiring enters the center portion of the rear of a box opposite the equipment, the minimum clearance must be increased to ½ inch.

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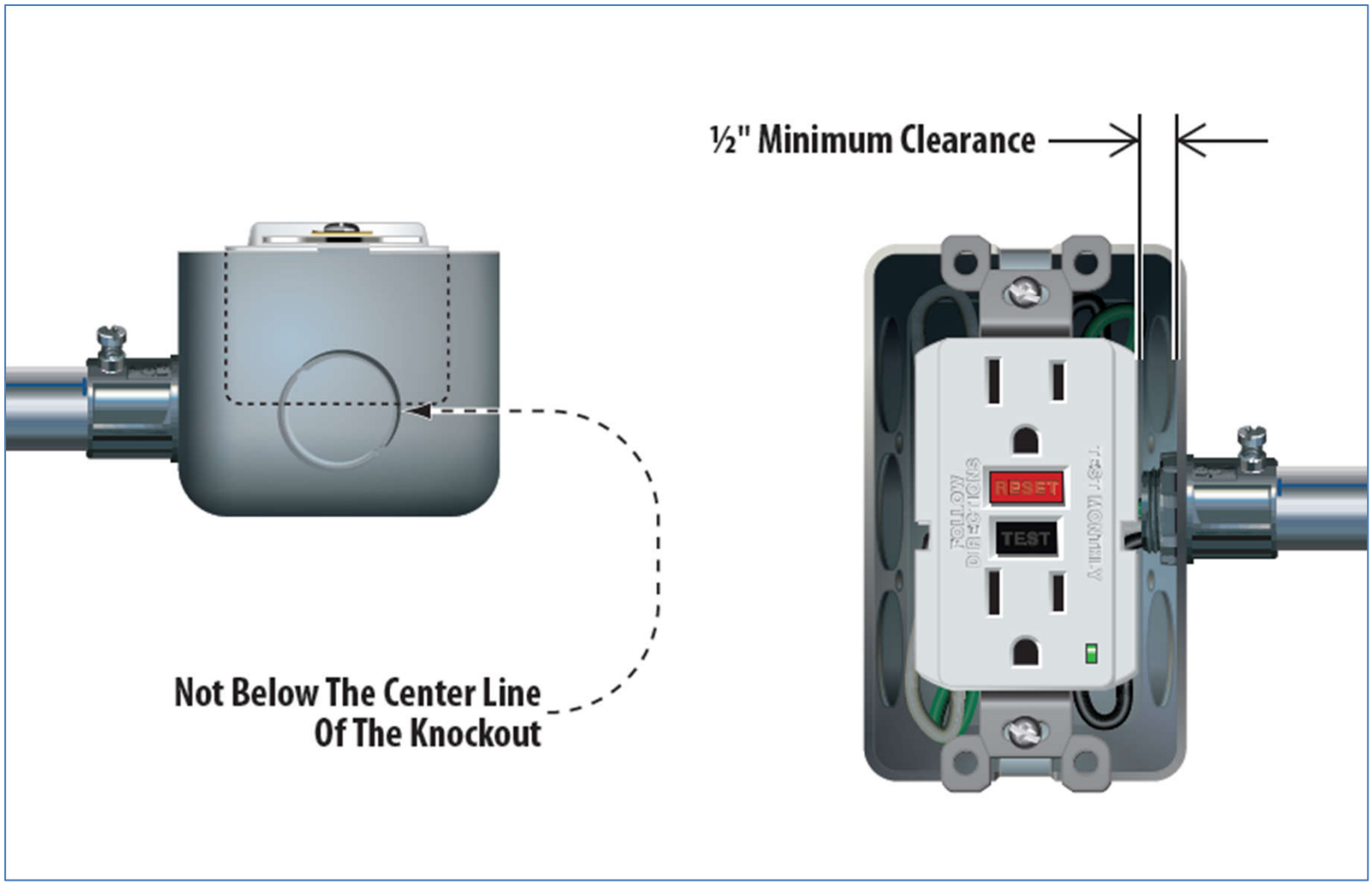
314.24

REVISION



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314.25

REVISION

Covers and Canopies

Change Summary

- Section 314.25 was revised to clarify that conduit body enclosures must be enclosed by a cover, a lampholder, or a device.
- Like boxes, conduit bodies can contain splices, terminations, and devices. Therefore, conduit bodies should also be covered.
- The language in 314.25(A) and the informational note were revised to clarify that they apply to equipment grounding conductors.

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314.25

REVISION

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314.27(C) & (E)

REVISION

Outlet Boxes, Ceiling-Suspended (Paddle Fans)

Change Summary

- Outlet boxes used as the sole support of ceiling-suspended (paddle) fans are now required to be marked on the inside of the box so that the marking can be seen during a rough-in inspection.
- 314.27(C)(2) was simplified to recognize boxes that provide direct access through the box to structural framing capable of supporting a paddle fan, without the need to remove the box.
- The locking support and locking receptacle and the compatible attachment fitting have been renamed as “weight-supporting ceiling receptacle” and “weight-supporting attachment fitting.”

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314.27(C) & (E)

REVISION

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Article 315

REVISION RELOCATE

Medium Voltage Conductors and Cables

Change Summary

- Article 311 has been relocated to become Article 315, consistent with the numbering scheme for medium-voltage articles.
- The title and scope of Article 315 have been expanded to include cable joints and cable terminations.
- The scope of this article for dc cables is limited to cables rated 2,001 through 2,500 volts.

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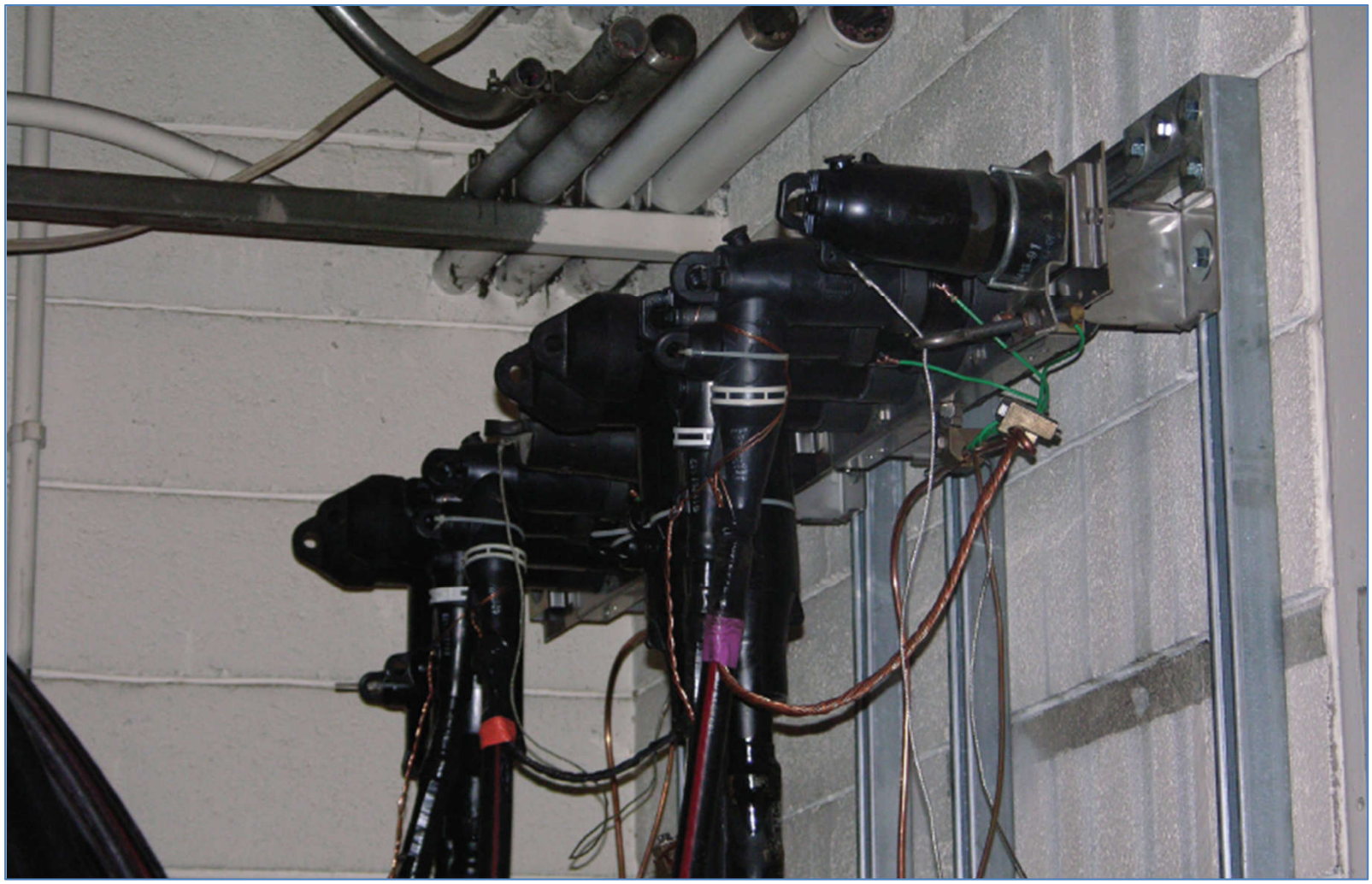
Article 315

REVISION RELOCATE



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342.24

REVISION REORGANIZE

Bends

Change Summary

- Sections 342.24 and 342.26 have been combined into a 342.24, Bends.
- This now clarifies the total degrees of bends between pull points.
- Since Chapter 3 articles follow the same format, the same change was made in Article 344, 348, 350, 352, 353, 354, 355, 356, 358, 360, and 362.

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342.24

REVISION REORGANIZE

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342.30(A)

NEW

Securing and Supporting

Change Summary

- Section 342.30(A) requires intermediate metal conduit (IMC) to be securely fastened.
- A new exception permits IMC in concealed work to be fished in finished buildings or in prefinished wall panels where secure fastening is impractical.
- This exception only applies to unbroken lengths of IMC without couplings in the concealed space.

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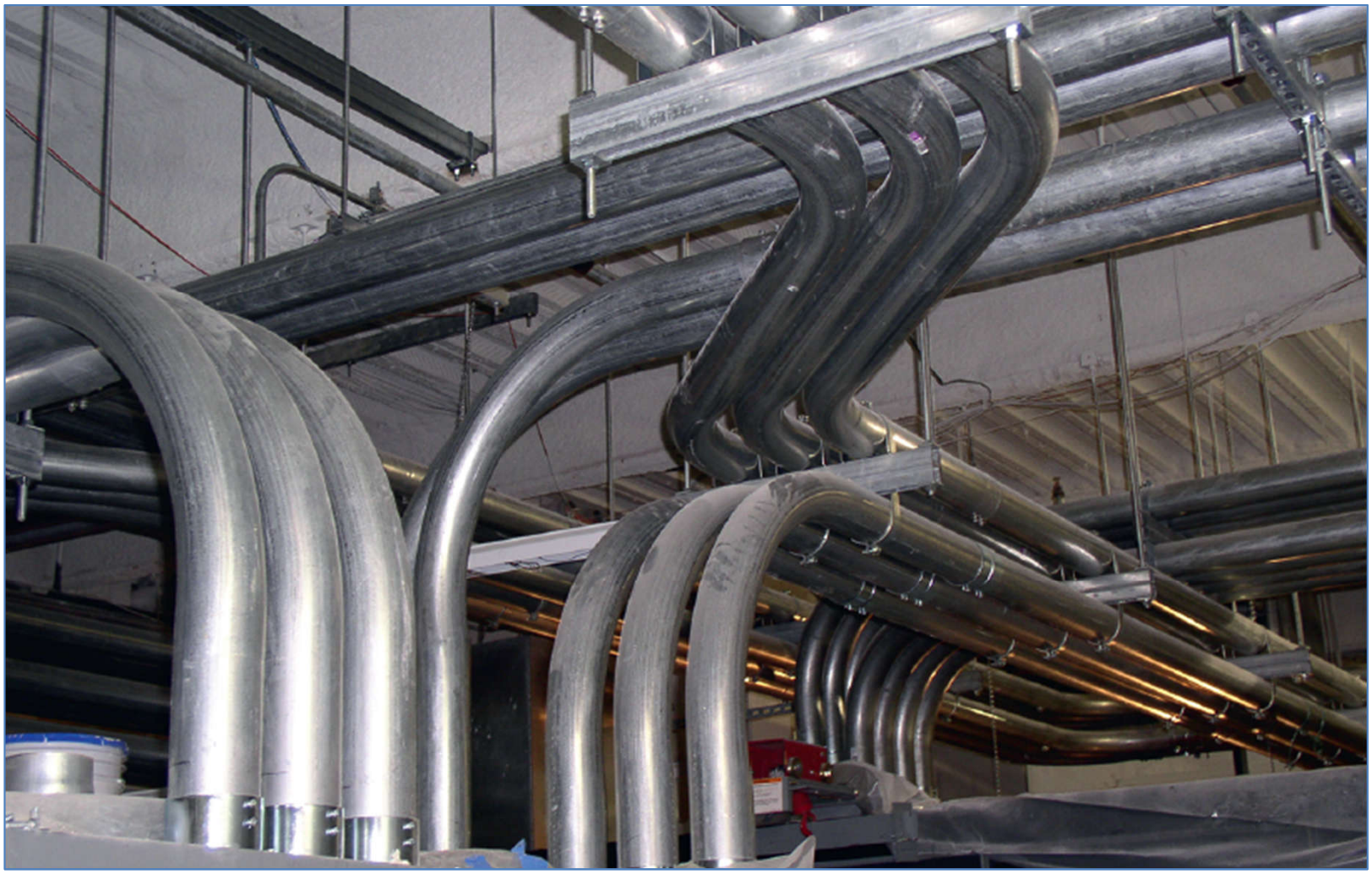
342.30(A)

NEW



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344.28

REVISION

Reaming and Threading

Change Summary

- PVC-coated RMC is often used in areas subject to corrosion.
- New text was added to this section to require that the manufacturer's instructions be followed when threading PVC-coated RMC to prevent damage to the exterior coating.
- A new informational note was added that references NECA 101, *Standard for Installing Steel Conduits (RMC, IMC, EMT)*, which provides information on threading PVC-coated RMC.

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344.28

REVISION

Courtesy of Corrosion College

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352.10

REVISION REORGANIZE

Insert Uses Permitted

Change Summary

- The uses permitted for PVC conduit have been clarified.
- PVC conduit is permitted to be embedded in concrete.
- Exposure to physical damage requirements have been removed from 352.10(G) and moved to the new 352.10(K), Physical Damage.
- Where subject to physical damage, Schedule 80 PVC conduit, along with listed Schedule 80 PVC conduit fittings, must be used.

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352.10

REVISION REORGANIZE

Courtesy of Michael J. Johnston and Tom Garvey

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358.10

REVISION

Uses Permitted

Change Summary

- Section 358.10 was revised to recognize two new permitted uses for EMT.
- EMT is permitted in direct burial applications where it is used with fittings that are identified for direct burial.
- EMT is recognized for manufactured wiring systems as permitted in 604.100(A)(2).

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358.10

REVISION

Courtesy of Michel J. Johnston

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362.10

REVISION

Uses Permitted

Change Summary

- Section 362.10(2) was revised to clarify that ENT is permitted to be installed in combustible or noncombustible buildings where the walls, floors, and ceilings meet the finish rating.
- The mandatory reference to *NFPA 13* was changed to an informational note reference.
- Section 362.10(6) was split into two sections to separate requirement for installations in poured concrete floors, ceilings, walls, and slabs from those where the ENT is embedded in concrete slabs.

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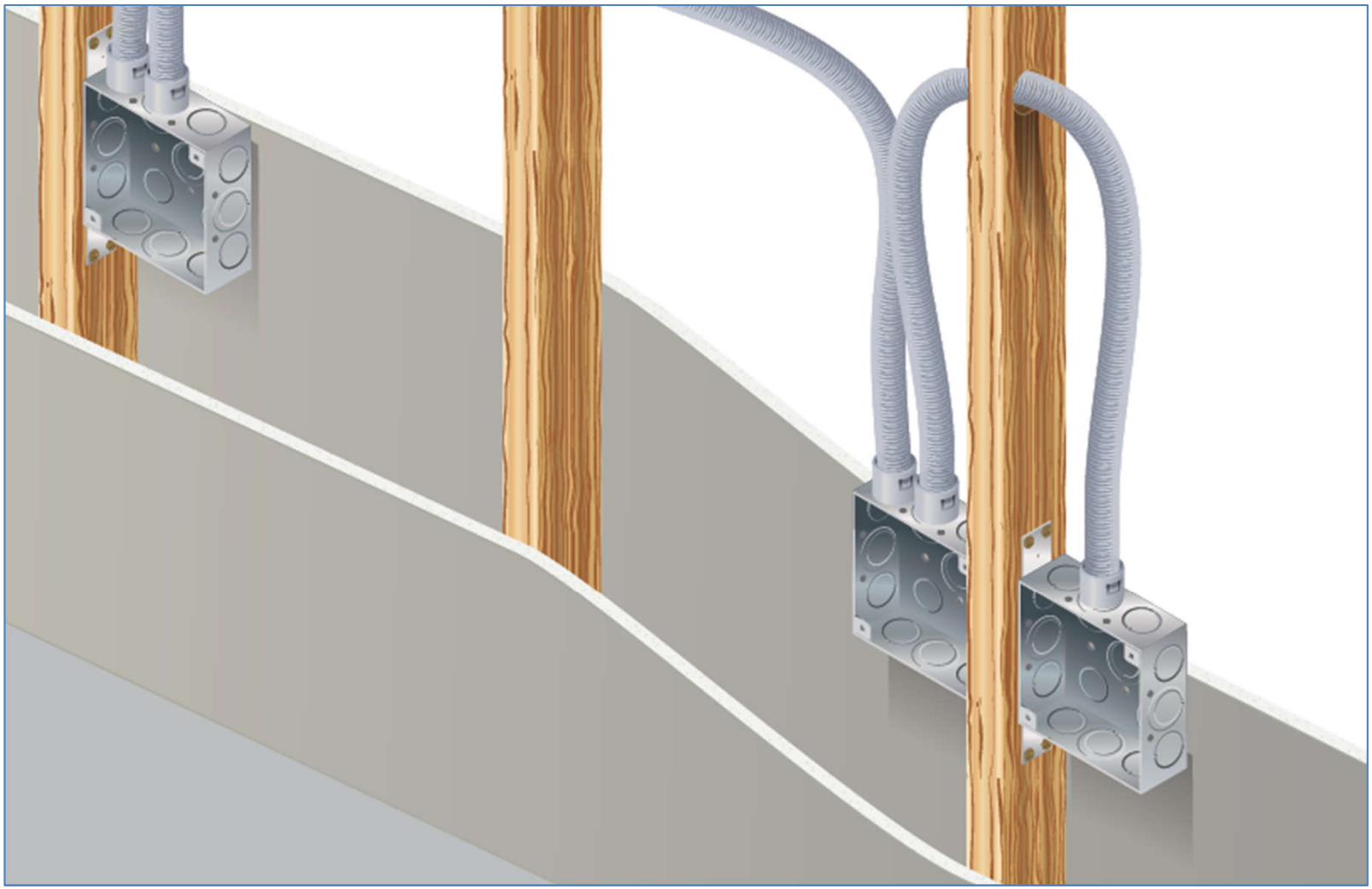
362.10

REVISION



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Article 369

NEW

Insulated Bus Pipe (IBP)/Tubular Covered Conductors

Change Summary

- The new Article 369 covers Insulated Bus Pipe (Type IBP).
- IBP is a cylindrical solid or hollow conductor with a solid insulation system having conductive grading layers and a grounding layer embedded in the insulation that is provided with an overall insulation or metallic material. It is permitted for up to 35 kV.
- IBP is required to be listed.
- IBP is permitted to be used in wet or damp locations when listed for wet or damp locations.
- IBP must not be accessible to unqualified persons.

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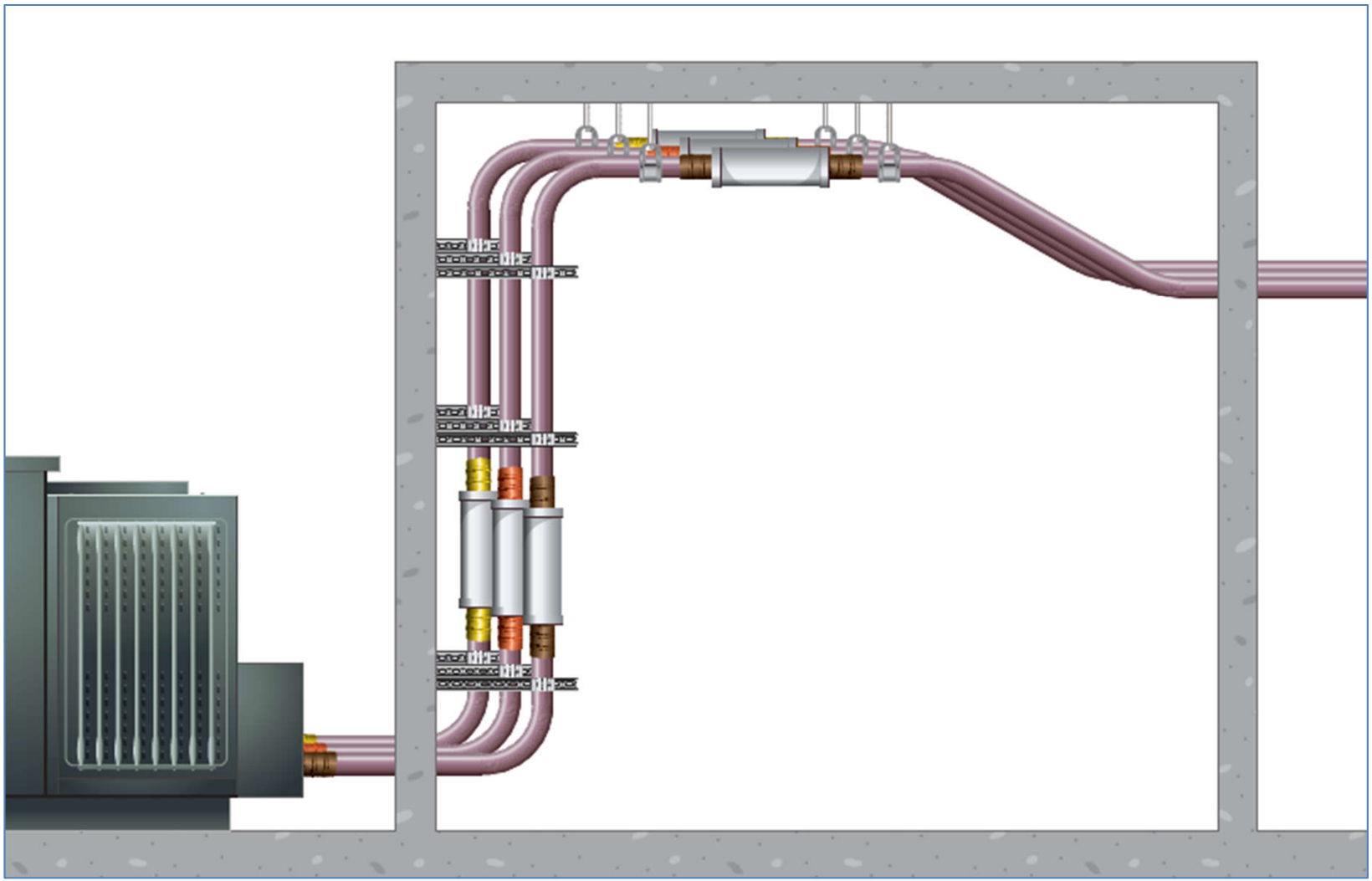
Article 369

NEW



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370.18

REVISION

Cablebus Installation

Change Summary

- Cablebus installation requirements have been simplified.
- Cablebus is permitted to be run through fire walls in accordance with 300.21.
- Since cablebus is a support system, similar to cable trays, the firestop requirements now refer to 300.21.
- The previous requirement for curbs where cablebus penetrates floors has been removed because cablebus is permitted in wet locations.

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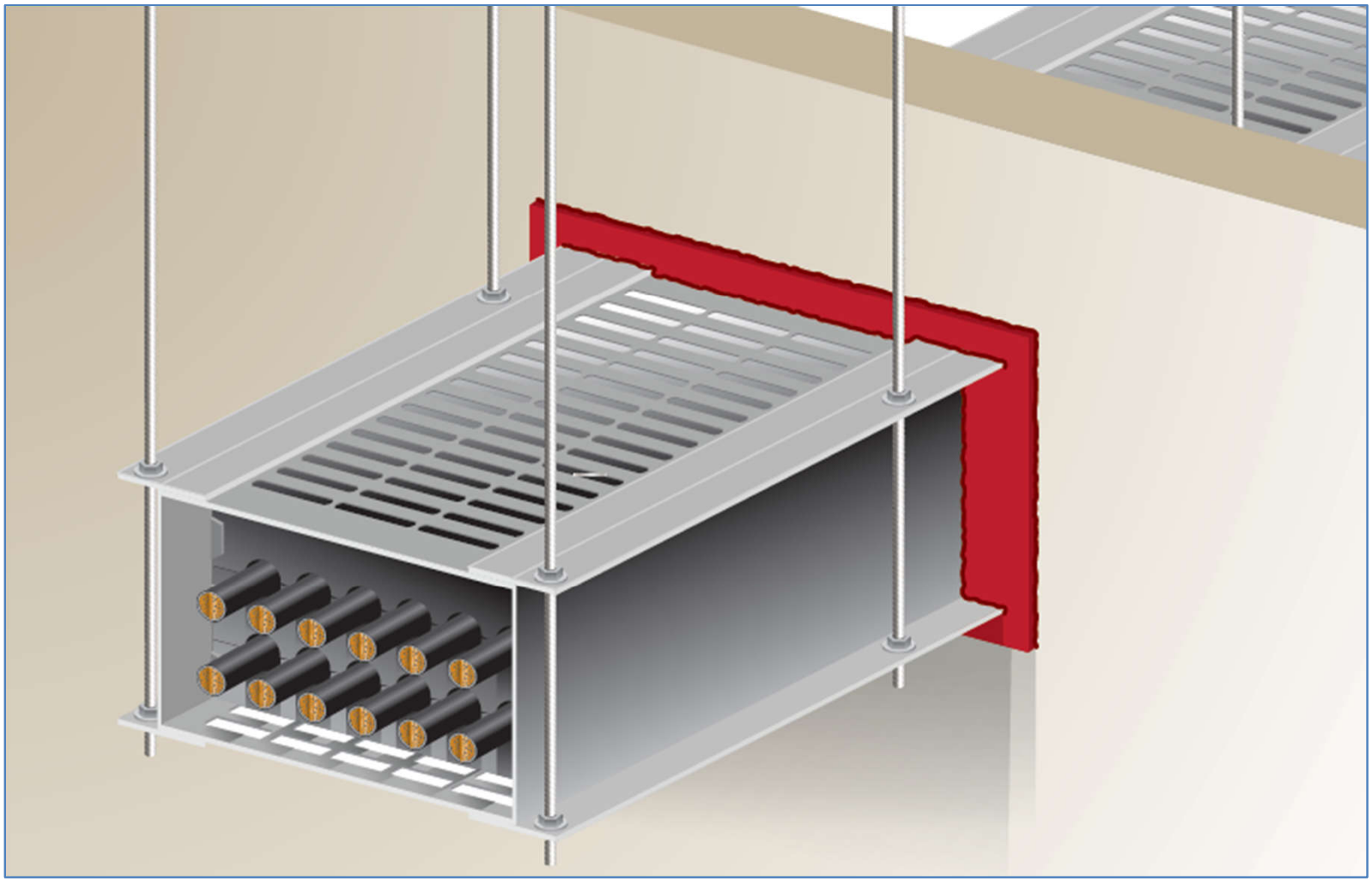
370.18

REVISION



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370.120

REVISION

Marking

Change Summary

- Section 370.120 was revised to clarify cablebus marking requirements and to harmonize with requirements in Canada.
- Nameplates are required at each terminating end of the system, identifying the manufacturer as well as the ratings.
- Nameplates are required to be visible after installation.
- Each section and fitting of a cablebus system is required to be identified with a marking that corresponds with the installation instruction.

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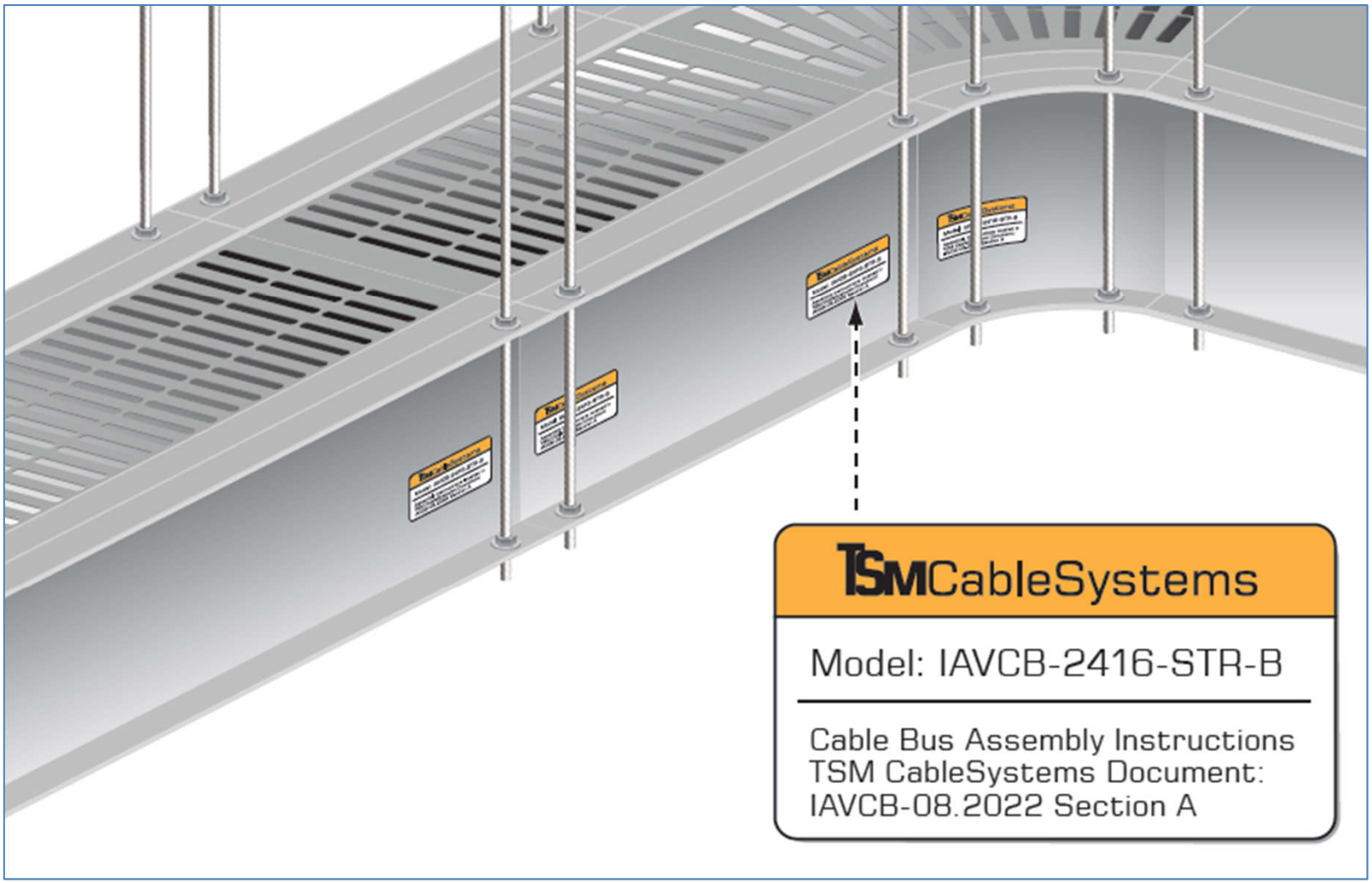
370.120

REVISION



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Article 371

NEW

Flexible Bus Systems

Change Summary

- A new Article 371 was created for flexible bus systems, which are assemblies of flexible bus with associated fittings to secure, support, and terminate the bus.
- Flexible bus is permitted for services, feeders, and branch circuits.
- Flexible bus is permitted indoors, or outdoors if identified for outdoor use.
- Flexible bus is permitted to be used exposed or behind access panels as long as the space behind the access panels is not used for air handling.

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Article 371

NEW

Courtesy of Ward Judson, nVent

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Significant Changes

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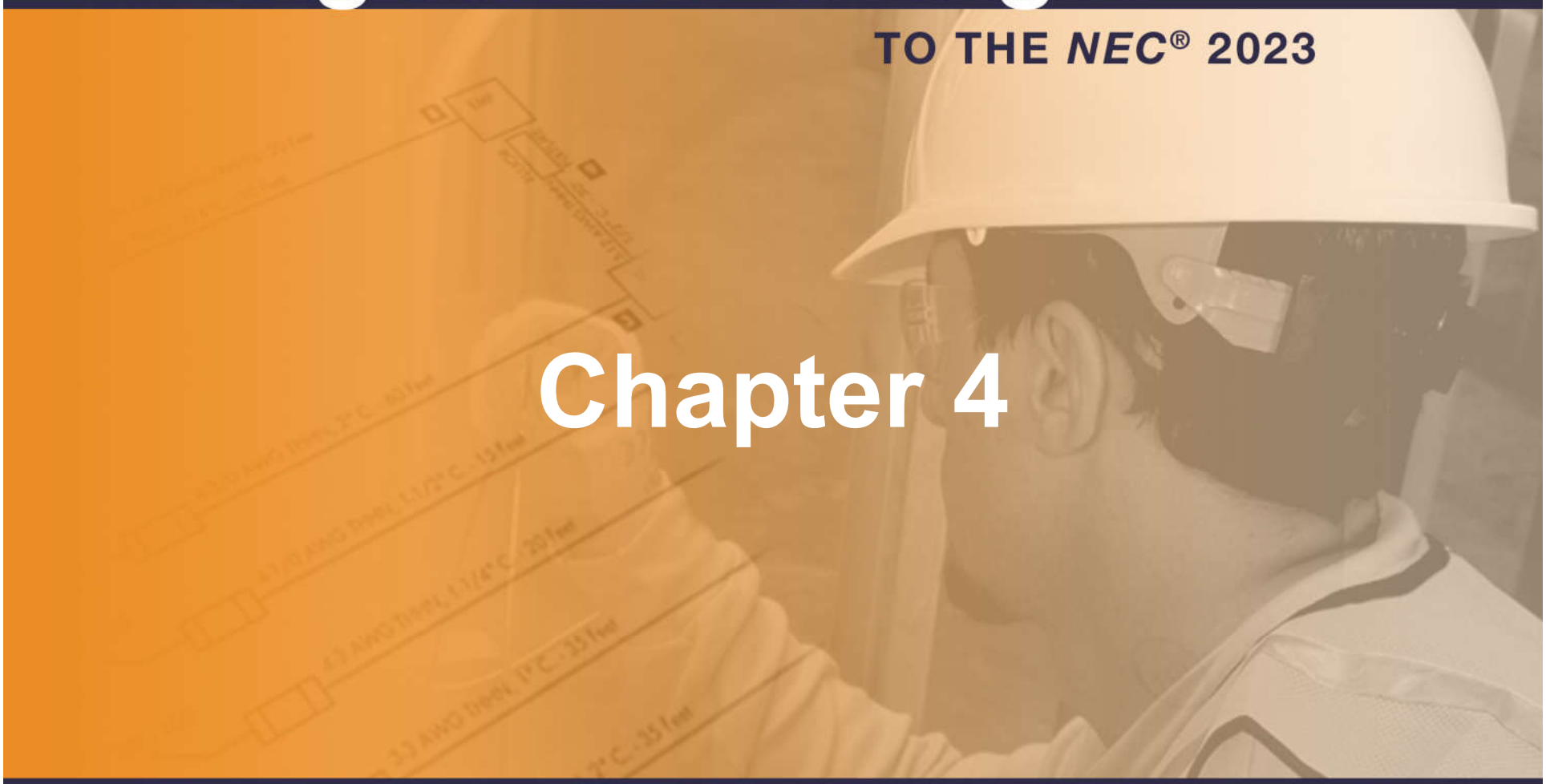

Chapter 4

electrical training ALLIANCE IBEW - NECA IN COLLABORATION WITH NECA NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

400.40 through 400.52

NEW REVISION

Portable Power Feeder Cables Over 2000 V, Nominal

Change Summary

- Article 400, Part III has a title change. It now covers portable cables of over 600 volts up to 2,000 volts.
- A new Part IV was added on portable power feeder cables over 2,000 volts, nominal.
- Portable power feeder cables can be used for connection of portable equipment and machinery or for wiring of cranes and hoists. Portable power feeder cables can also be used for temporary services and other temporary installations.

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400.40 through 400.52

NEW REVISION

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404.1

REVISION

Scope

Change Summary

- Article 404 applies to all switches, switching devices, and circuit breakers used as switches.
- Article 404 typically applies to switches operating at 1,000 volts or less but can apply to switches operating at higher voltages as specifically referenced elsewhere in the *Code*.
- There is a new generation of wireless control switches that are battery operated. These wireless switches are not covered by Article 404.
- An informational note was added that points to 210.70, which now has requirements that apply to wireless switches.

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404.1

REVISION

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404.14 & 404.14(D)

NEW REVISION

Snap Switch Terminations

Change Summary

- Section 404.14 has been revised to require that switches be listed and marked with their ratings.
- New 404.14(D) was added to provide requirements for conductors used on the terminals of switches based on the markings of the switches.
- Section 404.14(D)(3) also addresses the limited use of push-in terminals, which are restricted to 14 AWG copper conductors only.

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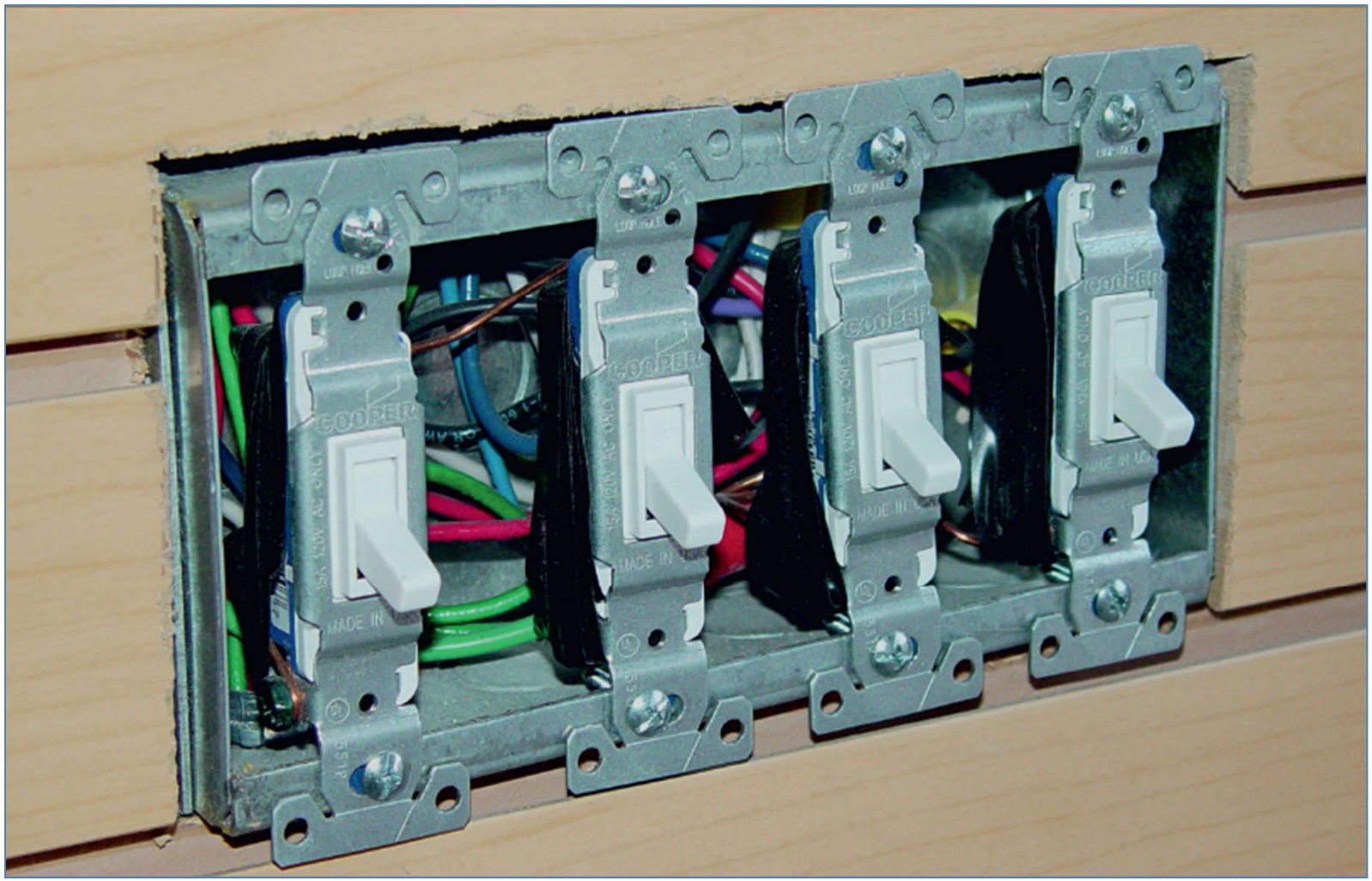
404.14 & 404.14(D)

NEW | REVISION



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404.16

NEW

Reconditioned Equipment

Change Summary

- Lighting, dimmer, and electronic control switches are not permitted to be reconditioned.
- Snap switches are an inexpensive and easily-replaceable item. Therefore, they are not permitted to be reconditioned.
- Knife switches, switches with butt contacts, and bolted pressure switches are permitted to be reconditioned.

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404.16

NEW

Courtesy of Leviton

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404.30

NEW

Switch Enclosures with Doors

Change Summary

- Doors of enclosures for switches that provide access to live parts when opened must be constructed so that either a tool or other approved means is necessary to open the door if the switch is in the closed position.
- A similar change was made in 690.13(A) and 690.15(A) during the 2020 cycle.
- This does not prohibit the use of a lock to prevent access.
- These changes are intended to restrict access by unqualified persons. The primary intent is to protect children.

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404.30

NEW

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Courtesy of Michael J. Johnston

406.3

REVISION

Receptacle Rating and Type

Change Summary

- The title of 406.3(C) has been changed to CO/ALR Receptacles.
- Section 406.3(D) has been added to cover requirements for termination of conductors to receptacles.
- Push-in terminals are only listed for 14 AWG copper conductors and can only be used to connect receptacles on 15-ampere branch circuits.

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406.3

REVISION

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406.4

REVISION

General Installation Requirements

Change Summary

- Section 406.4(D)(3) now requires replacement GFCI-type receptacles to be listed.
- Section 406.4(D)(5) provides requirements for replacement tamper-resistant receptacles. A tamper-resistant receptacle is not required if a non–grounding-type receptacle is replaced with another non–grounding-type receptacle. A tamper-resistant receptacle is also not required if a CO/ALR receptacle is replaced with another CO/ALR receptacle.
- Replacement receptacles must be provided with GFPE if required elsewhere in the *Code*.
- Floor receptacles must be protected in accordance with 406.4(G).

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406.4

REVISION

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406.9

REVISION

Receptacles in Damp or Wet Locations

Change Summary

- Hinged covers of outlet box hoods in damp locations must be able to open at least 90° from the open to the closed position.
- If not designed to open 90°, it must be able to open fully.
- All receptacles in wet locations must be listed and identified as weather resistant.
- Other receptacles in wet locations that are attended while in use must be weatherproof with the attachment plug removed.
- The bathtub and shower space zones have been revised.

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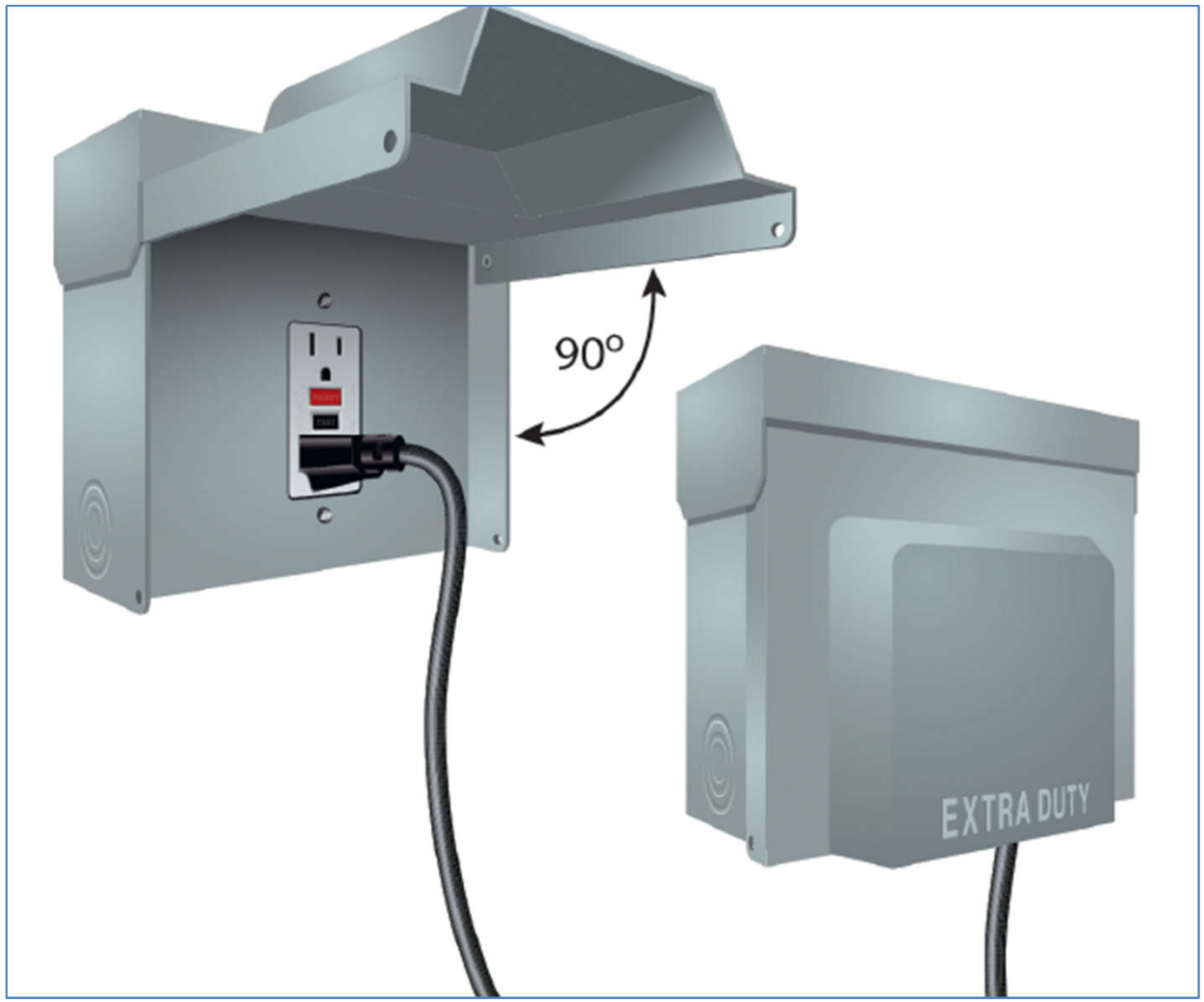
406.9

REVISION



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406.12

REVISION

Tamper-Resistant Receptacles

Change Summary

- Tamper-resistant receptacle requirements now include all dwelling units, boathouses, mobile homes, and manufactured homes, including their attached and detached garages.
- Requirements for tamper-resistant receptacles in medical facilities and other types of residential facilities have been revised and clarified.
- The exception has been clarified so that a tamper-resistant receptacle is not required for single receptacles that supply one appliance or duplex receptacles that are not readily accessible. The exception only applies if the receptacle is in the space designated for a specific appliance.

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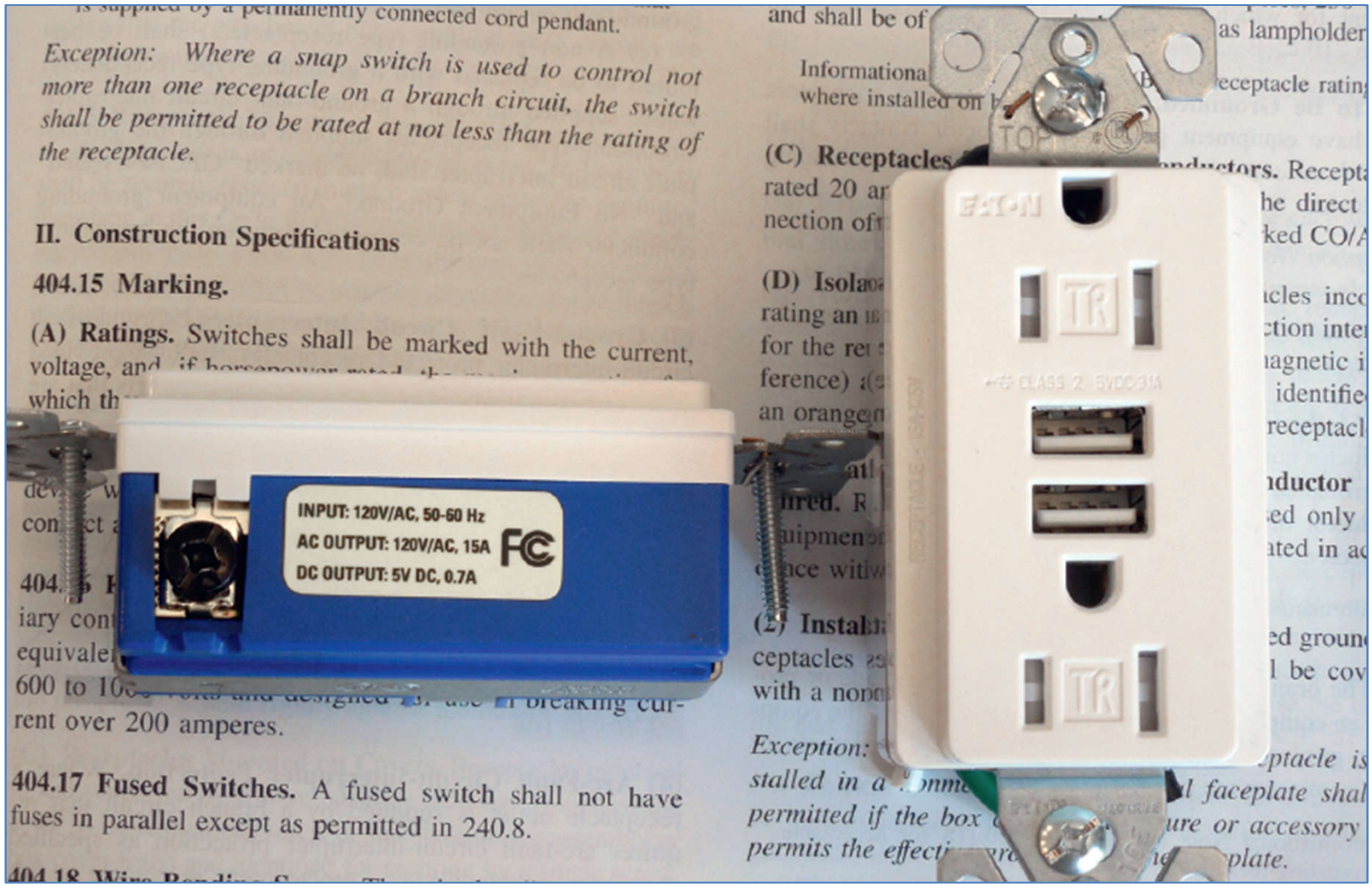
406.12

REVISION



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Courtesy of Eaton Corporation

408.4

REVISION

Descriptions Required

Change Summary

- The title of 408.4 has been changed from “Field Identification” to “Descriptions Required.”
- Every circuit and circuit modification is required to be legibly and permanently described with its clear, evident, and specific purpose or use.
- All switchboards, switchgear, and panelboards supplied by a feeder in other than one- and two-family dwellings must be marked to indicate the location of the power source.

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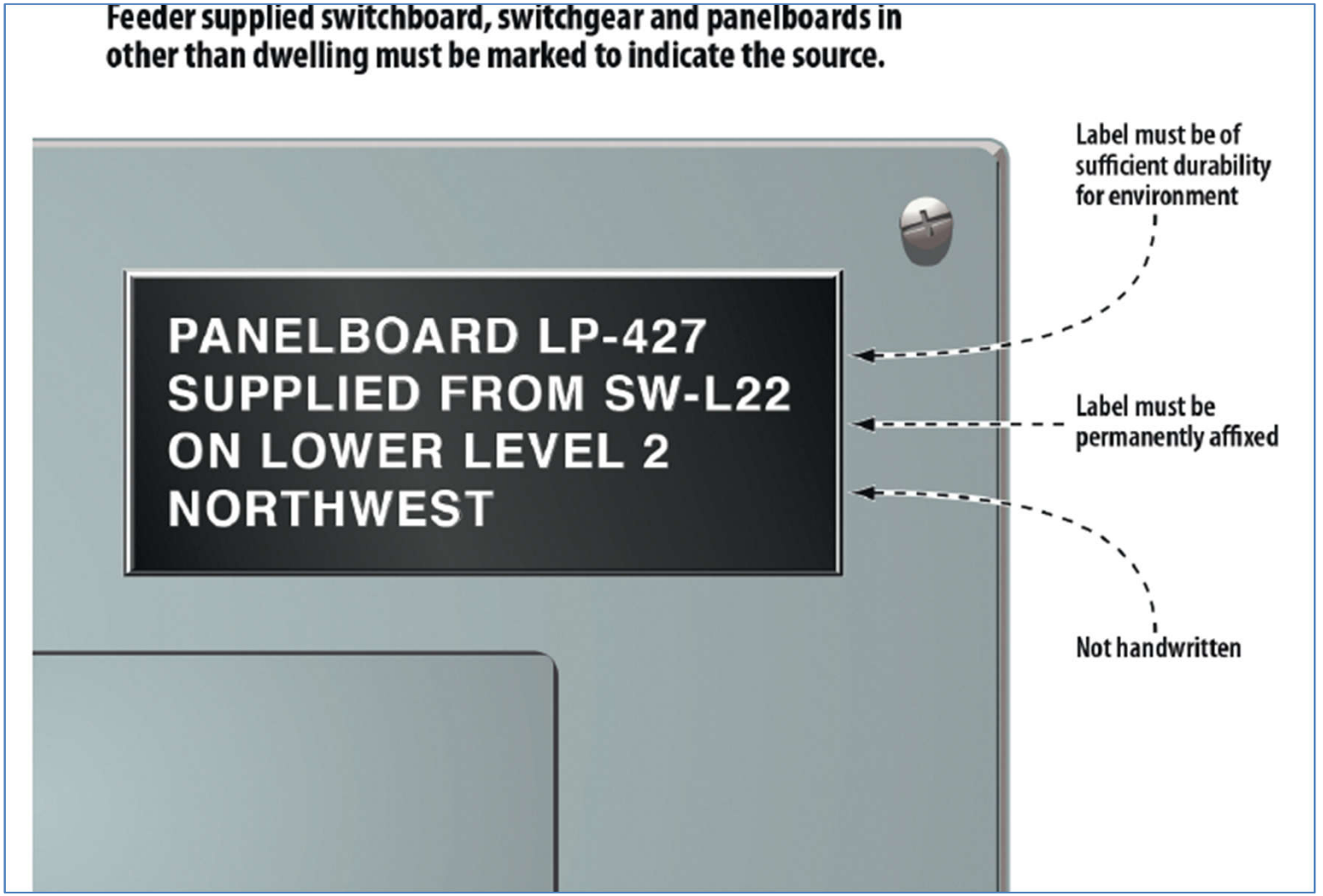
408.4

REVISION



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408.9

NEW

Replacement Panelboards

Change Summary

- A new 408.9 has been added to provide requirements for replacement panelboards.
- Panelboards listed for the specific enclosure are permitted to maintain their short-circuit current rating.
- Panelboards not listed for the specific enclosure with fault current over 10,000 amperes require field labeling. If fault current is less than 10,000 amperes, any previous listing marks must be removed.

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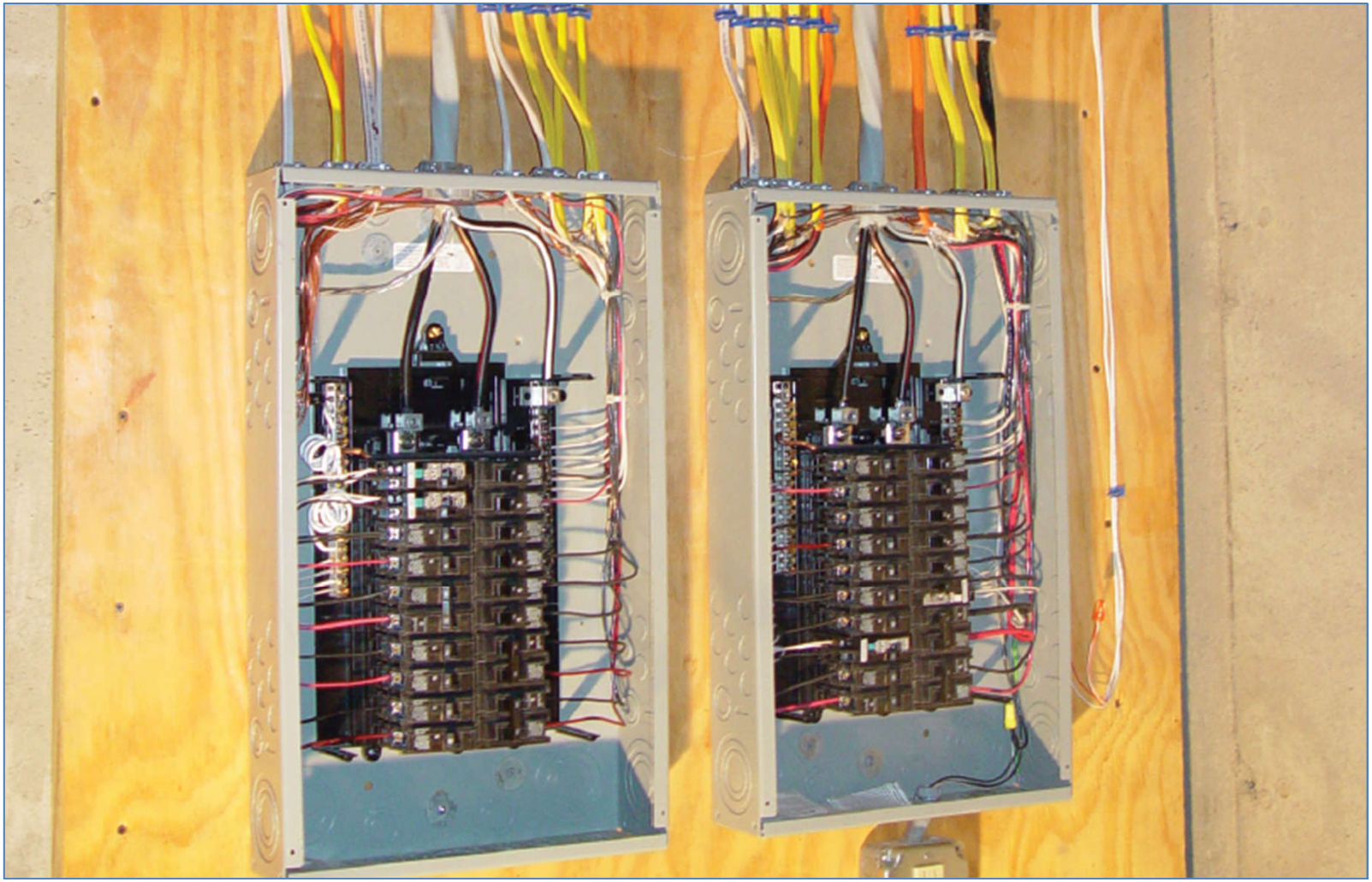
408.9

NEW



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Courtesy of Michael J. Johnston

408.43

REVISION

Panelboard Orientation

Change Summary

- The 2020 *Code* prohibited panelboards from being installed in the face-up position because it created an unsafe working position and increased the likelihood that debris could accumulate in the panelboard.
- The requirement has also been modified for the 2023 *Code* to prohibit installation in the face-down position.
- Installation in a face-down position introduces working space concerns. Working on the panelboard would be awkward, increasing the likelihood of injury during an arc flash or arc blast incident.

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408.43

REVISION

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Courtesy of Michael J. Johnston

409.60

REVISION

Bonding

Change Summary

- Section 409.60 has been retitled “Bonding” and has been reorganized into list format for clarity.
- Section 409.60(A), “Grounding,” requires an EGC sized in accordance with 250.122 to be connected to an equipment grounding bus or equipment grounding termination point provided in a single-section industrial control panel.
- Section 409.60(B) requires multisection industrial control panels to be bonded together using a bonding jumper sized in accordance with 250.102(D).

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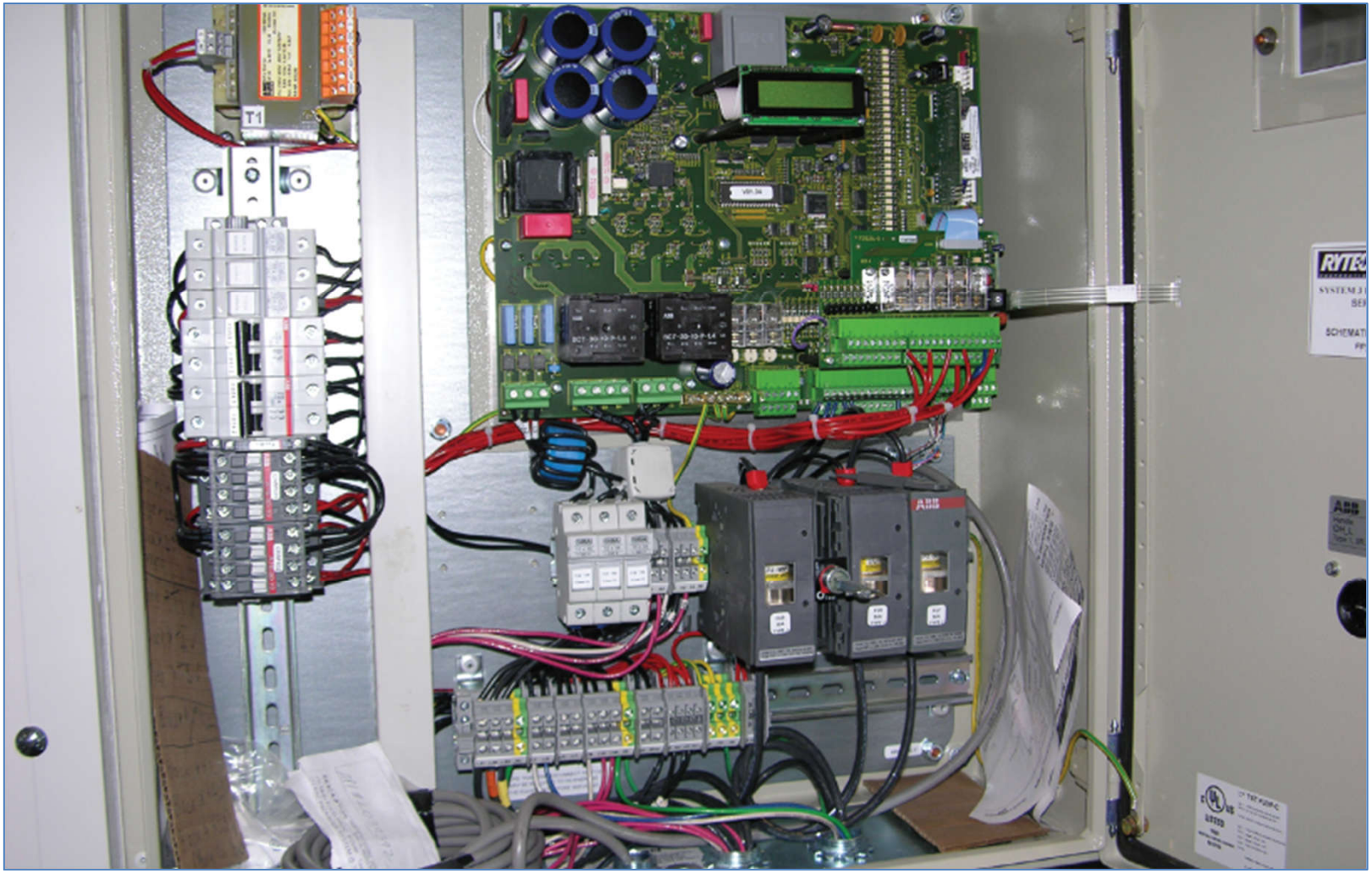
409.60

REVISION



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409.70

NEW

Surge Protection

Change Summary

- A new Section 409.70 has been added to require surge protection for safety circuits for personnel protection.
- A survey of facility managers in 2013 and 2014 by the Fire Protection Research Foundation found that 26% of safety circuits that were intended to protect personnel had surge damage.
- It was also found that 40% of the surges in industrial facilities were from causes within the plant rather than lightning-caused surges.

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409.70

NEW

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409.110

REVISION

Marking

Change Summary

- The marking requirements for industrial control panels have been clarified.
- The voltage, number of phases, and full-load current are required to be marked on the exterior of the enclosure for each supply circuit.
- If the industrial control panel is supplied by multiple sources of supply with multiple disconnecting means, the location of all sources exceeding 50 volts is required to be marked on the exterior.
- The other required markings must be inside or outside of the enclosure.

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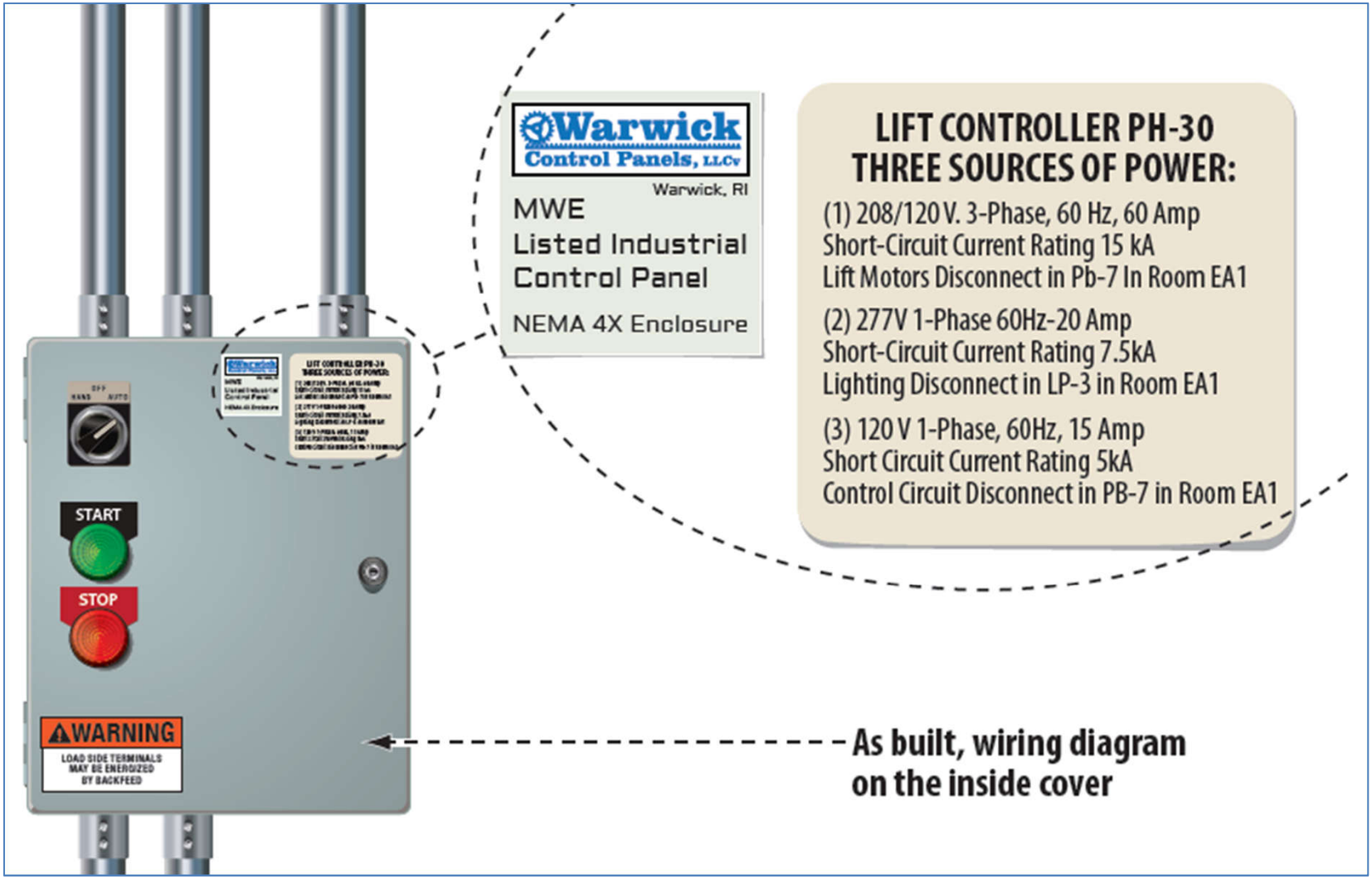
409.110

REVISION



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410.42

REORGANIZE

Luminaires with Exposed Conductive Surfaces

Change Summary

- Section 410.42 was reorganized into a main rule that requires exposed conductive surfaces of a luminaire to be connected to an equipment grounding conductor.
- An exception covers parts that do not require an EGC connection, including:
  - Surfaces that are separated by a listed system of double insulation.
  - Small, isolated parts such as screws, clips, and bands that are separated by at least 1 ½ inches from terminals.
  - Portable luminaires with polarized attachment plugs.

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410.42

REORGANIZE

Courtesy of Michael J. Johnston

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410.71

REVISION RELOCATE

Disconnecting Means-Fluorescent or LED Luminaires

Change Summary

- Section 410.130(G)(1) was moved into a new 410.71.
- The requirement has been expanded to include LED luminaire drivers that utilize double-ended lamps.
- LED luminaires are more energy-efficient but can still pose the same shock and electrocution hazards to workers.

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410.71

REVISION | RELOCATE

Courtesy of Tom Garvey and Michael J. Johnston

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410.190 through 197

NEW

Provisions for Germicidal Irradiation Luminaires

Change Summary

- A new Part XVII on germicidal radiation luminaires has been added to Article 410.
- Luminaires intended to emit germicidal radiation are required to be listed.
- Germicidal radiation luminaires must be installed in accordance with the manufacturer's instructions.
- Germicidal luminaires are not permitted in dwellings, unless listed and identified for dwellings.

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410.190 through 197

NEW

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Article 422

DELETION REORGANIZE

Appliances

Change Summary

- Several sections in Article 422 were deleted because they were unnecessary for field applications.
- Section 422.6 requires that all appliances be listed. This eliminated the need for Sections 422.3 and 422.4.
- Sections 422.15 and 422.46 were deleted because they do not address unique field installation problems.
- Section 422.23 was deleted because it provides a redundant reference to the special permission requirement in 90.3.
- The flexible cord requirements in 422.43 were consolidated with other flexible cord requirements in 422.16(A).

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Article 422

DELETION REORGANIZE

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422.18

REVISION

Ceiling-Suspended (Paddle) Fans

Change Summary

- 422.18(A)(1) was revised to clarify that listed outlet boxes or outlet box systems must be identified for fan support.
- 422.18(A)(2) was revised to use the new terms for weight-supporting ceiling receptacle and weight-supporting attachment fitting.
- 422.18(B) was added to prohibit metal parts of paddle fans from being located within three feet horizontally and eight feet vertically from the top of a bathtub rim or shower threshold.

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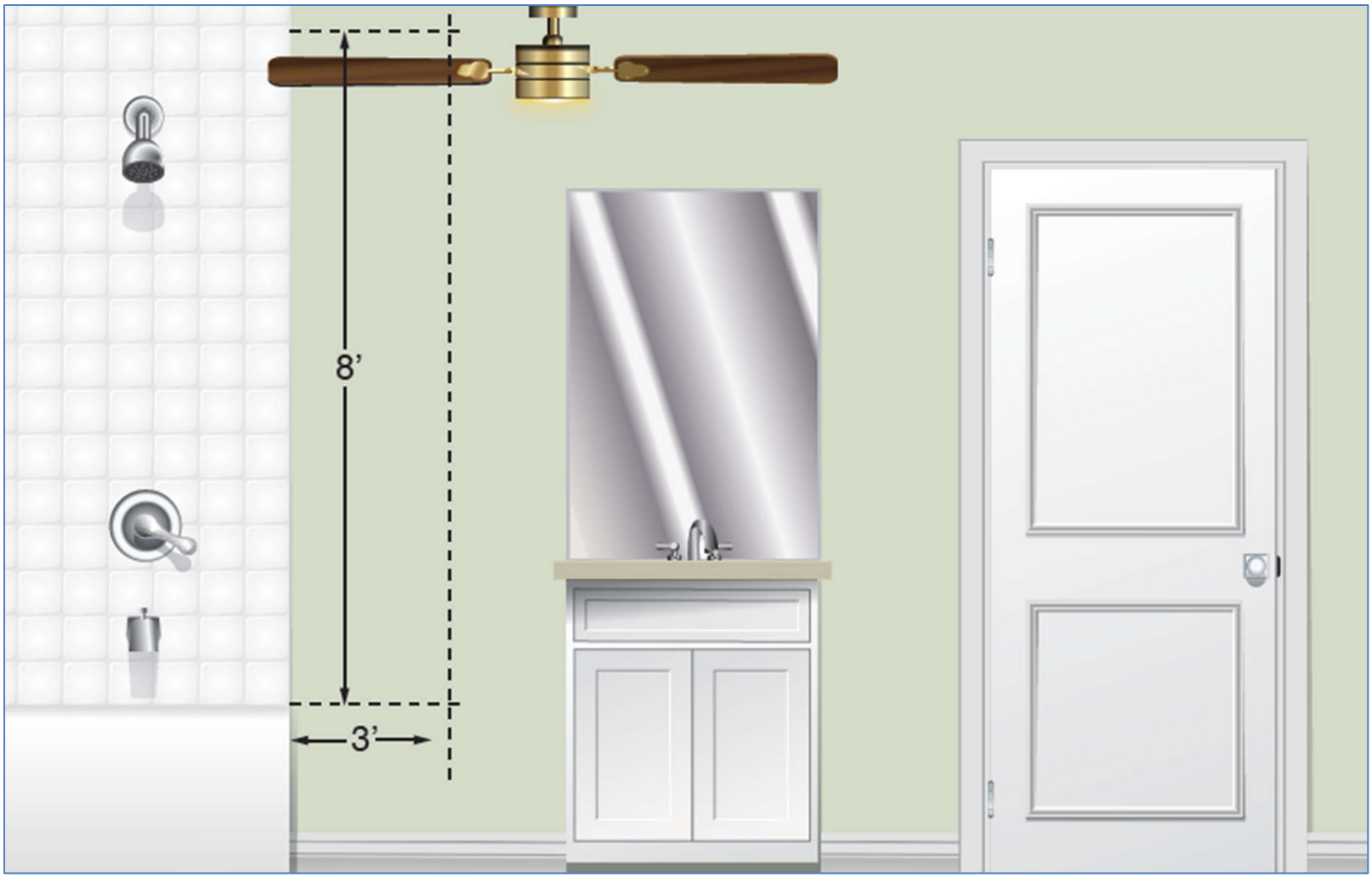
422.18

REVISION



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424.48

NEW

Installation of Cables in Walls

Change Summary

- Section 424.48 recognizes a new heating system that consists of heating cable sets or heating panel sets that can be installed in, on, or behind walls.
- Heating cables and cable sets are required to be GFCI and AFCI protected.
- Heating cables and cable sets are not permitted more than four feet above the floor.

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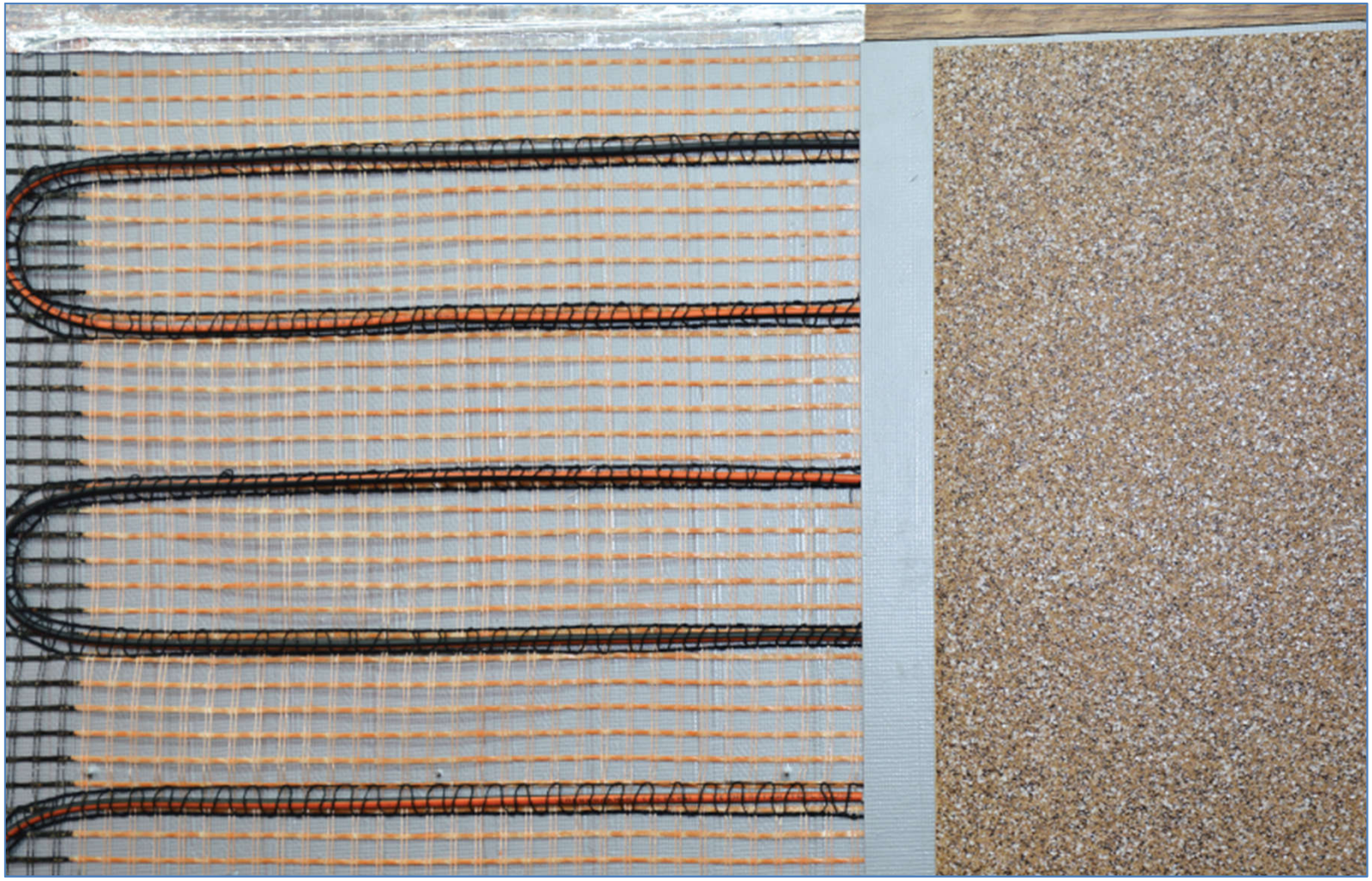
424.48

NEW



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430.1

REVISION

Scope

Change Summary

- Informational Note Figure 430.1 was revised to make it more useful. The table above the figure remains unchanged.
- For consistency, section numbers were removed from the figure.
- Blocks were added to the diagram indicating feeder overcurrent protection, motor controller disconnecting means, motor branch-circuit conductors, local motor branch-circuit disconnecting means (moved),and grounding.

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430.1

REVISION

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Courtesy of Michael J. Johnston

430.6

REVISION

Conductor Ampacity and Motor Rating Determination

Change Summary

- For most general applications, the current values used for determining the ampacity of conductors, the ampere rating of switches, and the ampere rating of branch-circuit short-circuit and ground-fault protection are based on table values from Article 430, Part IV.
- New 430.6(A)(2)(3) was added to permit the use of nameplate current ratings for motors that exceed the motor sizes in Part XIV.
- Section 430.6 was changed into list format to make it easier to use.

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430.6

REVISION

Courtesy of Michael J. Johnston

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430.52(C)

REVISION

Rating or Setting

Change Summary

- Section 430.52(C)(3) was revised to recognize the higher available inrush current that is available for Design B premium efficiency motors that are protected by an instantaneous-trip circuit breaker.
- Section 430.52(C)(6) was revised to recognize the higher inrush current for Design B premium efficiency motors supplied by a self-protected combination motor controller.
- Design B premium efficiency motors have been mandated in new federal energy efficiency regulations. Design B and Design B premium efficiency motors have high inrush currents because they are low-impedance equipment.

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430.52(C)

REVISION

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Courtesy of Michael J. Johnston

430.83(F)

NEW

Ratings

Change Summary

- The new 430.83(F) prohibits installing a motor controller on a circuit where the motor controller's short-circuit current rating is exceeded.
- Section 430.8 generally requires motor controllers to be marked with their short-circuit current ratings.
- Section 110.20 requires the equipment short-circuit current ratings and other characteristics of the circuit to be selected and coordinated to permit the circuit protective devices to clear faults without extensive damage to the electrical equipment.

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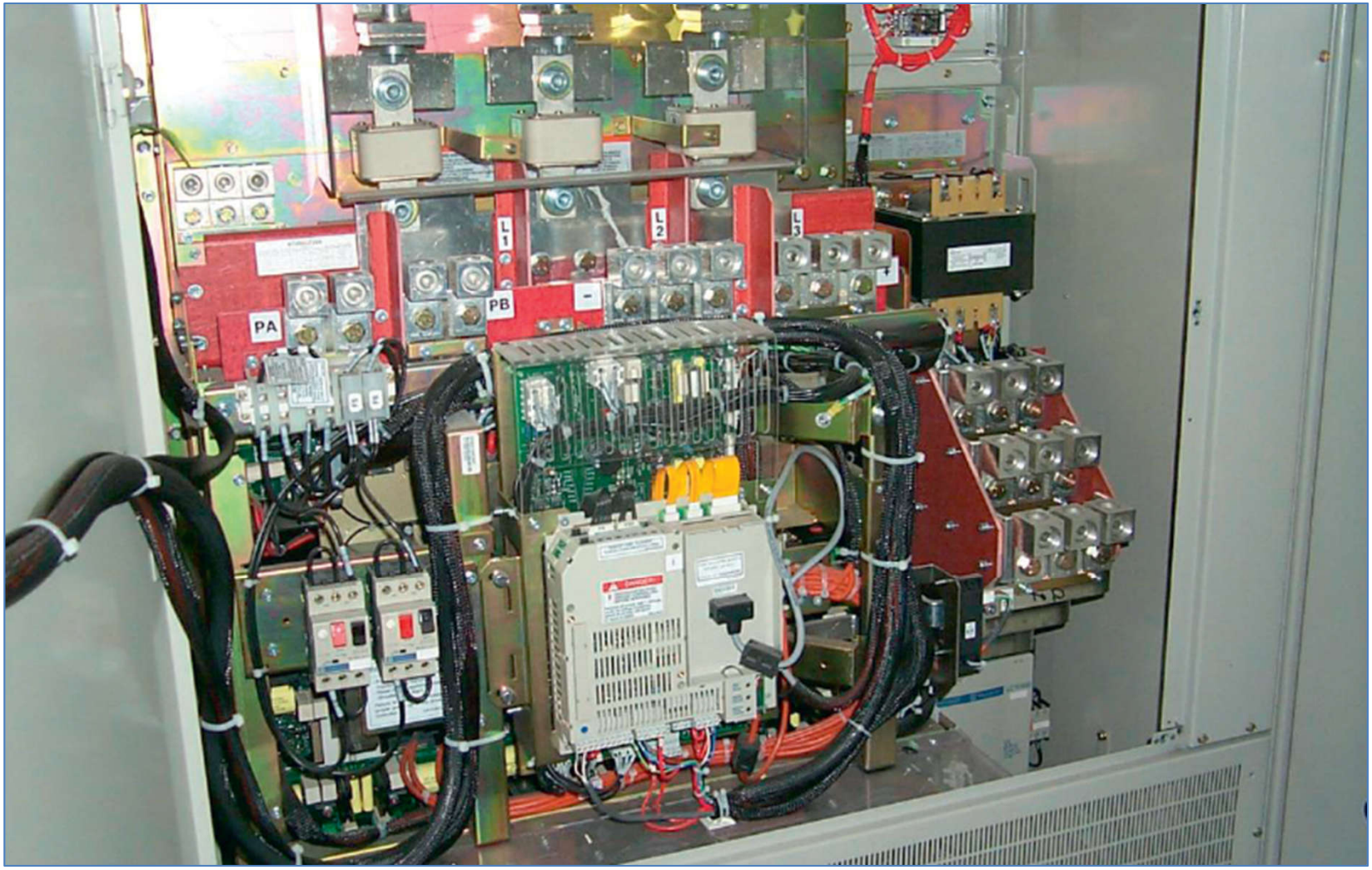
430.83(F)

NEW



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440.8

REVISION

Single Machine and Location

Change Summary

- Air-conditioning and refrigeration equipment is prohibited from being installed within three feet horizontally and eight feet vertically above a bathtub rim or shower threshold, including the space directly above the shower or tub.
- This requirement primarily affects the installation of mini-split air-conditioning system evaporators.
- Bathrooms are typically very small rooms. A change in bathroom configuration may be necessary to accommodate the equipment of this type of system.

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440.8

REVISION

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440.22(A)

REVISION

Rating or Setting for Individual Motor-Compressor

Change Summary

- Section 440.22(A) was revised by splitting the last sentence and creating two new exceptions. The existing exception became Exception No. 3.
- The first exception addresses installations where the determined value of branch-circuit short-circuit and ground-fault protection does not correspond with the standard sizes of OCPDs.
- The second exception permits the value of an OCPD to be increased in size to as much as 225% if the motor will not start.

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440.22(A)

REVISION

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445.6

REVISION

Listing

Change Summary

- Previously, stationary generators rated 600 volts or less were required to be listed.
- This section now requires all generators to be listed. However, one-of-a-kind custom manufactured generators are permitted to be field labeled.
- UL 2200, Stationary Generator Assemblies, now also covers medium-voltage generators.

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445.6

REVISION

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445.11

REVISION

Marking

Change Summary

- The generator marking requirements were clarified.
- This criterion is needed to ascertain the performance characteristics of the generator and to establish the overcurrent protective device settings.
- A new requirement was added that prohibits mounting equipment on the generator assembly that conceals or obscures the generator nameplate.

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445.11

REVISION

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445.18 & 445.19

NEW REVISION

Disconnecting Means

Change Summary

- Section 445.18 was divided into two sections. Section 445.18 addresses disconnecting means, and new Section 445.19 addresses emergency shutdown of the prime mover.
- Section 445.18(B) was revised to clarify the need for the ability to isolate the generator output terminals from the paralleling system bus.
- A labeling requirement was added to identify the generator emergency shutdown.

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445.18 & 445.19

NEW REVISION

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450.43(C)

REVISION

Accessibility

Change Summary

- The title of 450.43(C) was changed from “Locks” to “Accessibility.”
- Transformer vault doors are required to open in the direction of egress. This has been modified to require that the door be capable of opening at least 90°.
- Similar changes for a 90° opening of egress doors have been implemented in 110.26(C), 110.33(A)(3), and 480.10(E).

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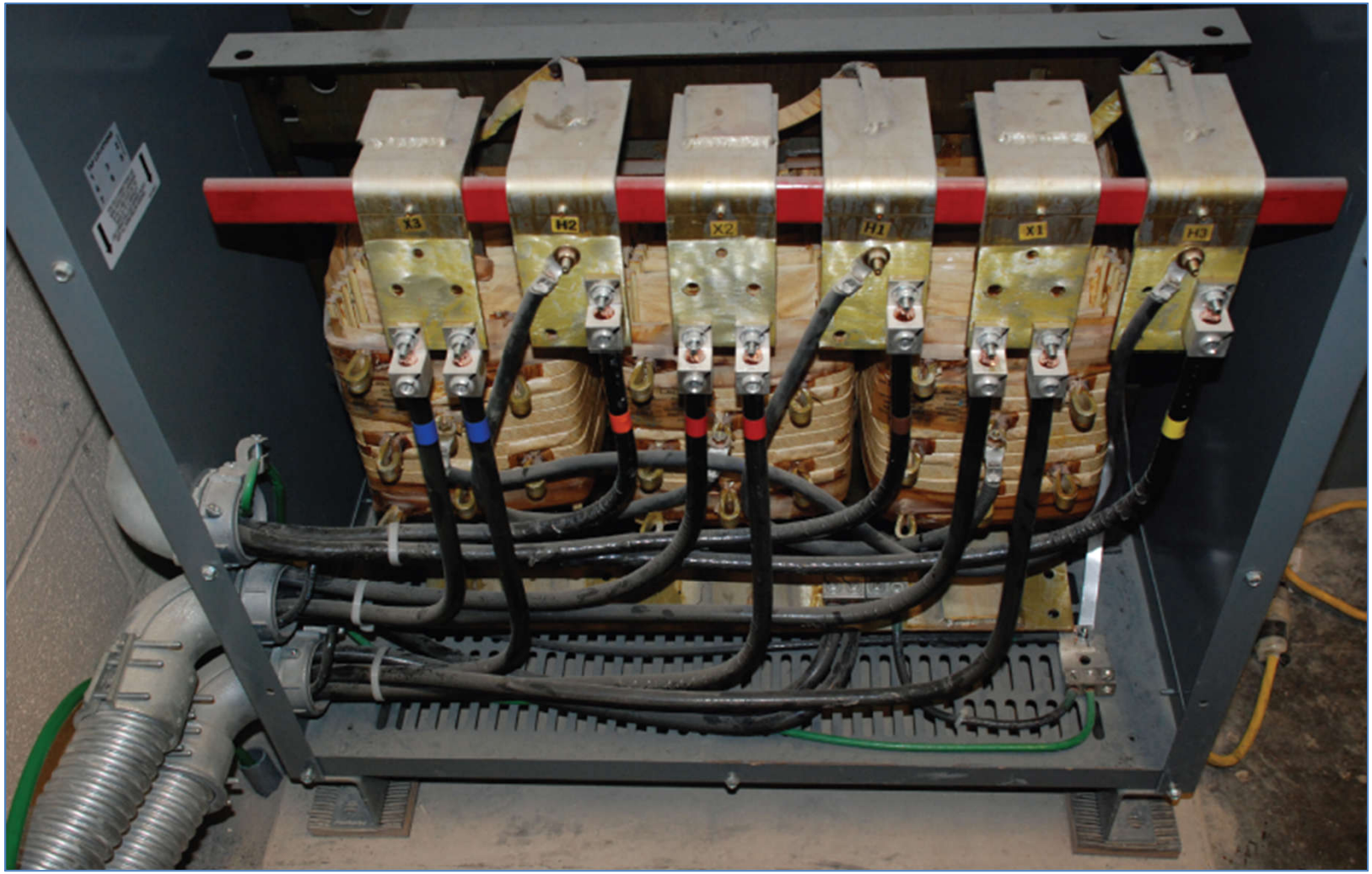
450.43(C)

REVISION



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460.24(A)

REVISION

Load Current

Change Summary

- Switches used to switch capacitive loads on circuits over 1,000 volts, nominal, shall be specifically rated for the switching of capacitive loads.
- Switches are often evaluated for switching inductive loads, but not capacitive loads.
- Capacitive loads can generate recovery voltages of two to three times the rated system voltage, which can cause external equipment flashovers, rupture of capacitors, and damage to surge protective devices.

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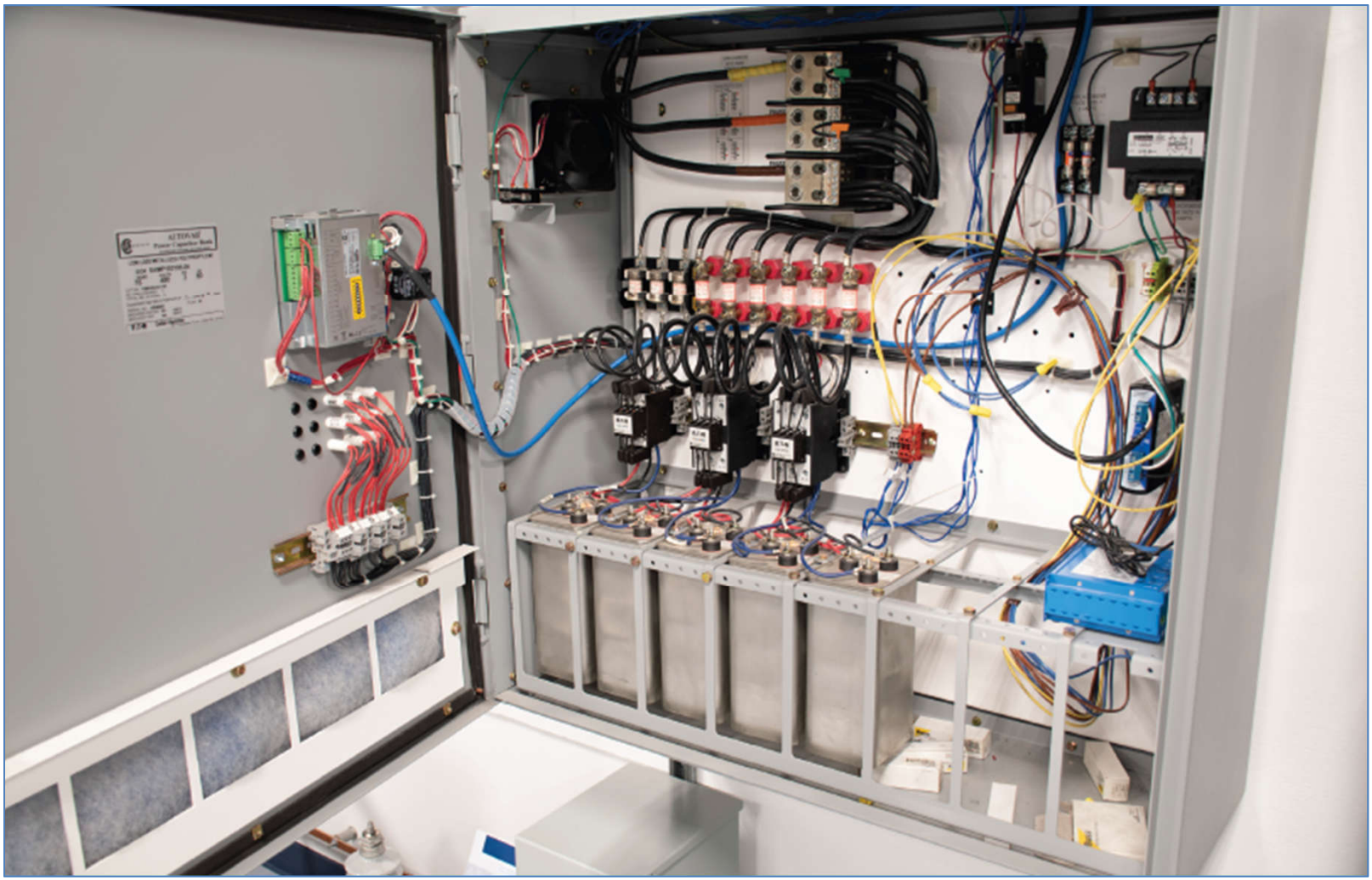
460.24(A)

REVISION



Courtesy of Eaton

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Article 480

REVISION

Stationary Standby Batteries

Change Summary

- The title of Article 480 has been changed from “Storage Batteries” to “Stationary Standby Batteries.”
- The scope of Article 480 has been revised to limit it to stationary batteries exceeding one kilowatt-hour.
- A new Informational Note No. 1 points to Article 706 for batteries that do not meet the definition of stationary storage batteries.
- A reference was added in Informational Note No. 2 to point to *NFPA 855*, which is a fire protection standard for energy storage systems.
- *NFPA 111: Stored Energy Systems* also covers battery installations.

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Article 480

REVISION

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Article 495

REVISION / RELOCATE

Equipment Over 1000 Volts ac, 1500 Volts dc, Nominal

Change Summary

- Article 490 has been relocated to become Article 495. The scope now covers equipment operating at more than 1,000 volts ac or 1,500 volts dc, nominal.
- Requirements for motors, capacitors, resistors, and reactors remain in Articles 430, 460, and 470, respectively.
- Requirements for transformers remain in Article 450. Moving those requirements may be warranted in the future.

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Article 495

REVISION / RELOCATE

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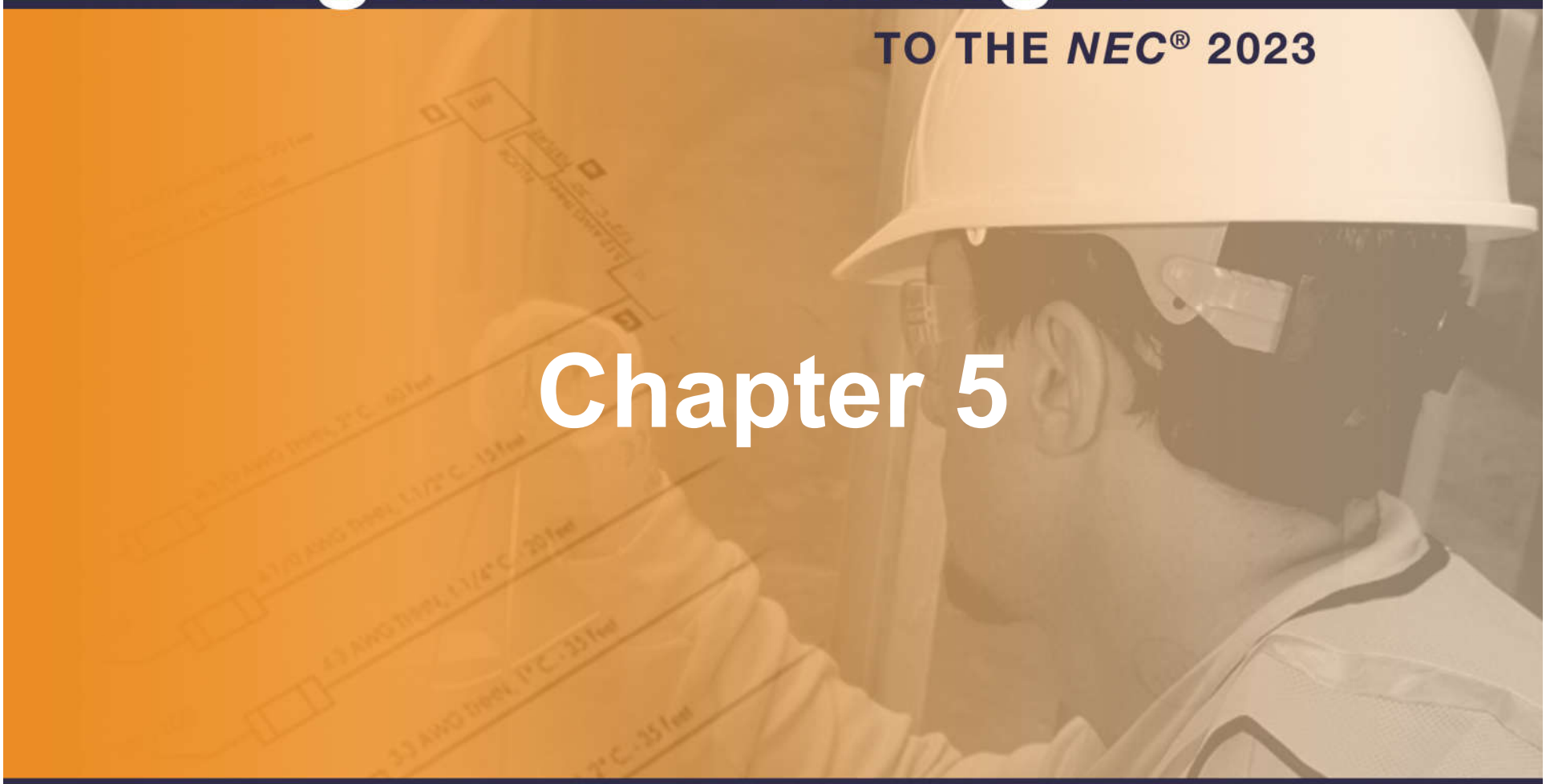
Courtesy of Michael J. Johnston

Significant Changes

TO THE *NEC*® 2023



Chapter 5

electrical training ALLIANCE IBEW - NECA IN COLLABORATION WITH NECA NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

500.1

REVISION

Scope

Change Summary

- The scope of Article 500 was revised. As previously written, it provided a scope for Articles 500 through 504.
- The new scope only covers what is in Article 500.
- Article 500 now only covers the traditional Class I, II, and III locations.
- The zone classification systems are covered in Article 505 for Zones 0, 1, and 2, and Article 506 for Zones 20, 21, and 22.

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500.1

REVISION

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500.4

REVISION

Documentation

Change Summary

- The documentation required by 500.4 now includes areas that have been determined to be unclassified.
- The documentation of the hazardous location must also be available to the authority having jurisdiction.
- The edition dates have been deleted for many of the referenced standards.
- It is important to remember that referenced standards are for information only.

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500.4

REVISION

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500.5(D)

REVISION

Class III Locations

Change Summary

- The definitions of Class III locations have been rewritten.
- The new definitions now align with the definitions of Class II locations.
- A Class III, Division 1 location is one in which combustible fibers/flyings can be present in the air under normal conditions in quantities to produce explosive or ignitible mixtures. Previously, combustible fibers/flyings were considered fast burning fire hazards, rather than explosion hazards.
- A Class III, Division 2 location is one in which nonmetal combustible fibers/flyings can be released through the abnormal operation of equipment and will not interfere with equipment operation.

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500.5(D)

REVISION

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500.6(C) & (D)

NEW

Class III Combustible and Ignitible Fibers/Flyings

Change Summary

- New 500.6(C) and (D) were added to correlate with *NFPA 499: Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.*
- Combustible fibers/flyings are materials with any dimension that is greater than 500 µm in nominal size that can form an explosible mixture when suspended in air at standard atmospheric pressure and temperature.
- Ignitible fibers/flyings are larger than 500 µm in nominal size, which are not likely to be in suspension in quantities to produce an explosible mixture but could produce an ignitable layer fire hazard.

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500.6(C) & (D)

NEW

2021

NFPA 499

Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

Origins

Committee Personnel

> Chapter 1 – Administration

> Chapter 2 – Referenced Publications

> Chapter 3 – Definitions

> Chapter 4 – Combustible Dusts

> Chapter 5 – National Electrical Code (NEC) Criteria

> Chapter 6 – Classification of Combustible Dust Locations

> Annex A – Explanatory Material

Annex B – Informational References

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500.7

REVISION

Protection Techniques

Change Summary

- A reference was added for the new Chapter 9, Table 13 on protection techniques.
- Section 500.7(E) was revised to delete references to entire articles.
- New protection techniques were added to this section, including electrical resistance trace heating, impedance heating, enclosed break, non-sparking, sealed, and other techniques that are identified for use in hazardous (classified) locations.

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500.7

REVISION

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500.8(E)(3)

REVISION

Unused Openings

Change Summary

- Unused openings must be closed with blanking elements or close-up plugs that are listed for the location.
- If the equipment has threaded entries of NPT-threaded conduit or fittings, the NPT-threaded entries must be made up with at least five threads fully engaged.
- For listed explosionproof equipment, joints with factory-threaded entries must be made up with at least 4 ½ threads fully engaged.
- For metric threaded entries, either the entry must be listed as being metric or listed adapters must be used.

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500.8(E)(3)

REVISION

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501.10

REVISION

Wiring Methods, Class I

Change Summary

- The previous Exception to 501.10(A)(1)(1) was converted into positive text and now appears as (A)(1)(2).
- The wiring methods in (A)(4), (5), (7), and (8) are for restricted industrial establishments.
- Requirements for cable tray applications have been added to 501.10(A)(1)(4), (A)(1)(7) and (A)(1)(8) which now reference 392.22.
- The reference to 337.10 has been corrected to Article 337, Part II.

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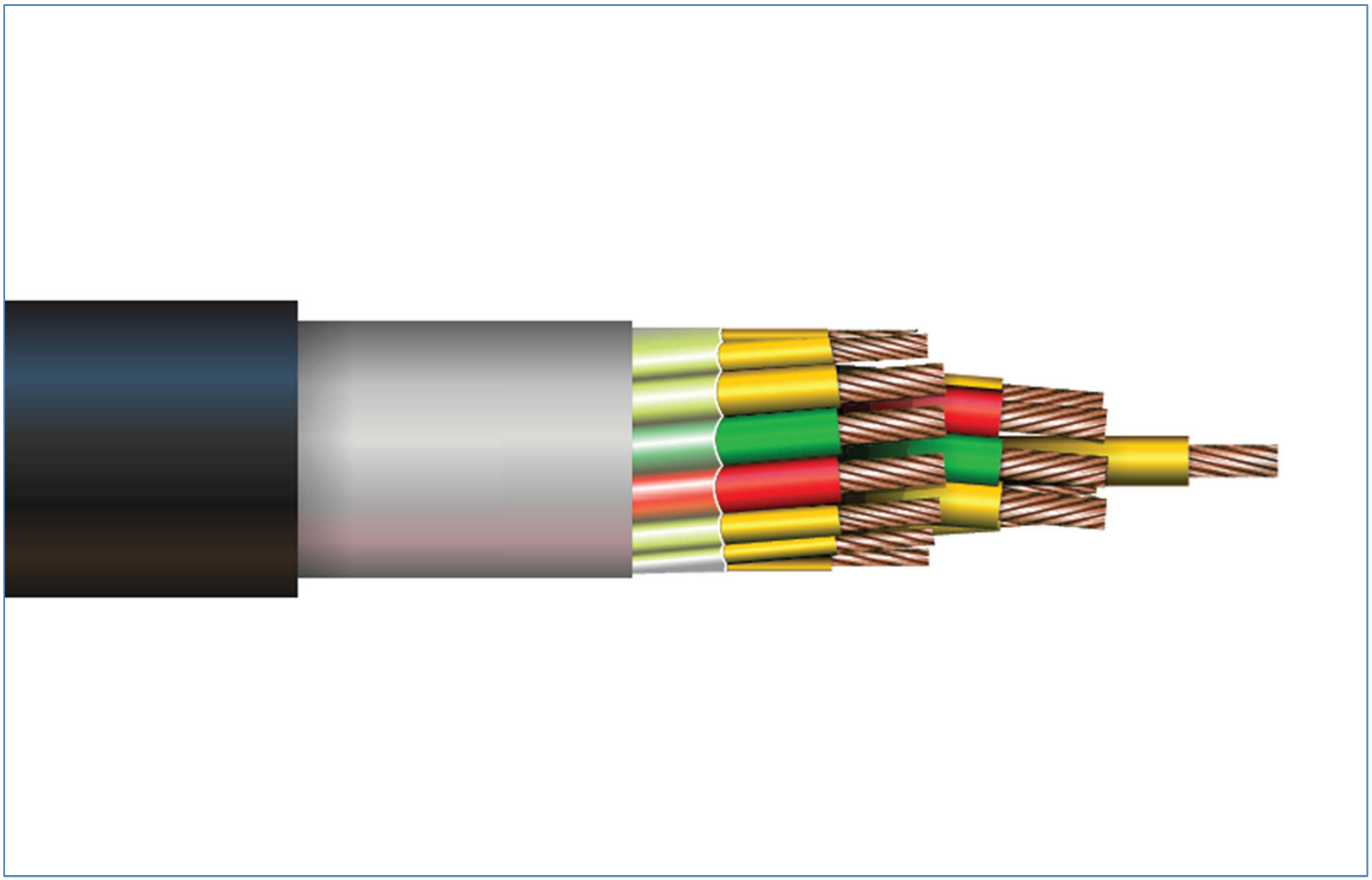
501.10

REVISION



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501.15

REVISION

Sealing and Drainage

Change Summary

- The boundary seal requirement for seals in Division 2 locations has been relocated to 501.15(A)(4). This requires Division 1 wiring methods up to the seal fitting in the Division 2 location.
- A revision to 501.15(B)(2) permits Type RTRC to be used from the boundary conduit seal to the point where it exits the Division 2 location.
- Types TC-ER-HL and Type P cable were inadvertently omitted from the cable seal requirements in 501.15(D)(1) in the 2020 *Code*.

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501.15

REVISION

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Courtesy of Michael J. Johnston

501.141

NEW

Flexible Cables, Class I, Division 2

Change Summary

- A new Section 501.141 was added to provide requirements for flexible cables in Class I, Division 2 locations.
- This new section is primarily focused on permitting the use of Type P cable.
- The means of terminating the cables requires the use of cable connectors that are listed for Class I, Division 2 locations.
- A new definition of “cable connector [as applied to hazardous (classified) locations]” has been added to Article 100.

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501.141

NEW

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501.145

REVISION

Receptacles and Attachment Plugs, Class I Locations

Change Summary

- Section 501.145 now requires receptacles and attachment plugs to be listed for the location, except as permitted by 501.105(B)(6) for meters, instruments, and relays.
- Listing for Class I, Division 2 is not required if the circuit only involves nonincendive wiring.
- Listing is not required in restricted industrial establishments complying with 501.105(B)(6), Exception No. 2, which also requires compliance with 501.6(B)(6)(2) through (4).

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501.145

REVISION

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Courtesy of Michael J. Johnston

502.10

REVISION

Wiring Methods Class II Locations

Change Summary

- PVC-coated metal conduit is permitted in Class II, Division 2 locations, even where there is not an increased level of corrosion.
- EMT with compression-type fittings or connectors is now permitted in Class II, Division 2 Locations.
- Type RTRC-XW conduit is permitted in industrial establishments with restricted public access where conditions of maintenance and supervision ensure that only qualified persons service the installation.

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502.10

REVISION

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502.15

REVISION

Sealing, Class II, Divisions 1 and 2

Change Summary

- The informational note was changed to become 502.15(5). It indicates that electrical sealing putty is a recognized means to prevent the entrance of dust into a dust-ignition-proof enclosure.
- Informational notes cannot be used to provide permissions or recommendations.
- Seal fittings are required to be accessible, but they are not required to be explosionproof.

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502.15

REVISION

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502.30

REVISION

Grounding and Bonding

Change Summary

- References to Article 250 were changed to refer to Article 250, Part VI for grounding and Part V for bonding.
- Cable trays were added to 502.30(B)(1), which addresses specific bonding means, to make it clear that cable trays must be bonded in the same manner as raceways.
- Requirements were added for bonding of metal struts, angles, or channels if used with Types TC-ER, PLTC-ER, or ITC-ER.
- Section 502.30(B)(2)(3) was changed from “not a power utilization load” to “part of a meter, instrument, or relay circuit.”

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502.30

REVISION

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503.10

REVISION

Wiring Methods

Change Summary

- Type P cable is now permitted in Class III, Division 1 locations in restricted industrial establishments.
- Criteria is established for the installation of Type P cable in cable trays.
- Wiring in Class III, Division 2 locations must comply with the Division 1 requirements.
- In sections, compartments, or areas that do not contain machinery and are used solely for storage, open wiring on insulators is permitted.

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503.10

REVISION

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503.30

REVISION

Grounding and Bonding

Change Summary

- References to Article 250 were changed to refer to the general requirements in Part I of Article 250, as well as to Part VI for grounding and Part V for bonding.
- Cable trays were added to 503.30(B)(1), on specific bonding means, to make it clear that cable trays must be bonded in the same manner as raceways.
- Requirements were added for bonding of metal struts, angles, or channels if used with Types TC-ER, PLTC-ER, or ITC-ER.

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503.30

REVISION

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504.30

REVISION

Separation of Intrinsically Safe Conductors

Change Summary

- Section 504.30(A)(1), installations in raceways, cable trays, and cables, had a simple rule, four exceptions, and three informational notes. It has been converted into more usable positive text.
- Section 504.30(A)(2), installations within enclosures, had three informational notes that were incorporated into enforceable *Code* text.
- Section 504.30(A)(3), other installations, contained an exception that was converted into positive text and incorporated into the existing text.

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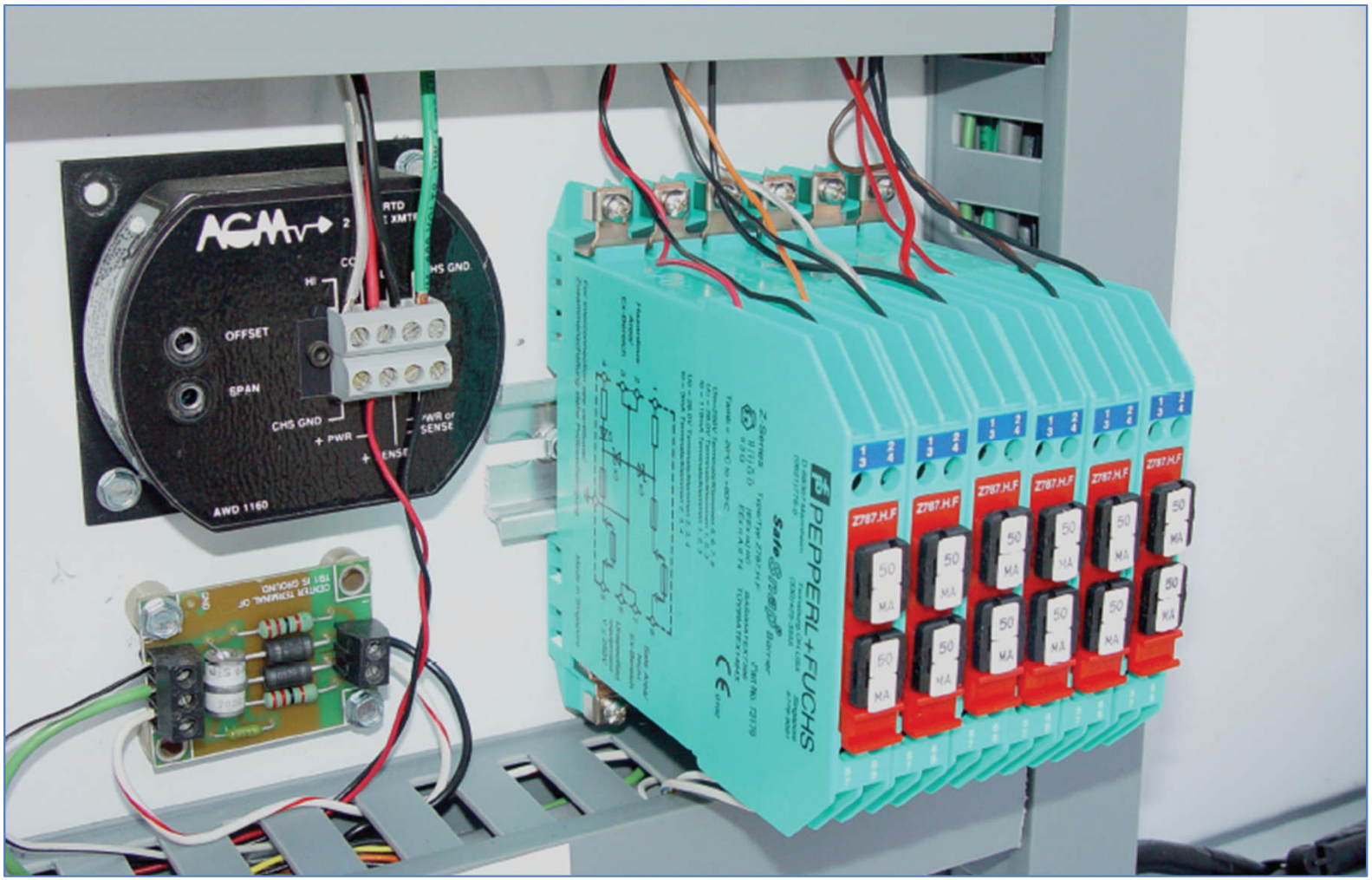
504.30

REVISION



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Article 505

DELETION REVISION

Zone 0, 1, and 2 Locations

Change Summary

- 505.1 was revised to make it clear that this article does not cover the class/division classification system and that it does not cover explosives, pyrotechnics, or blasting agents.
- Section 505.3 was deleted because 90.3 makes it unnecessary.
- Section 505.4 on documentation was revised for consistency with the requirements for documentation in other articles in Chapter 5.
- Section 505.5(A) was revised for consistency with 500.5(A).

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Article 505

DELETION REVISION

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505.8

NEW

Protection Techniques

Change Summary

- Section 505.8 has been revised to recognize new protection techniques.
- Impedance heating is a protection technique that is now recognized. Its design is based on IEEE 844.3.
- A pressurized room “p” is a protection technique that is recognized for Zone 1 or 2 locations.
- Special protection “s” is a protection technique that is recognized for Zones 0, 1, and 2.

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505.8

NEW

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505.16

REVISION

Sealing and Drainage

Change Summary

- Section 505.16(B)(3) has been expanded to include pressurized rooms. An informational note was added to reference the IEC Standard for pressurized rooms.
- Section 505.16(C)(1) was rewritten into list format, and the exceptions were rewritten into positive language.
- New requirements were added to provide sealing requirements for cables that enter breathing-type enclosures “nR.”

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505.16

REVISION

2021

NFPA 496

Standard for Purged and Pressurized Enclosures for Electrical Equipment

Committee Personnel

> Chapter 1 – Administration

> Chapter 2 – Referenced Publications

> Chapter 3 – Definitions

> Chapter 4 – General Requirements for Pressurized Enclosures

> Chapter 5 – Pressurized Enclosures for Class I, or Zone 1, or Zone 2

> Chapter 6 – Pressurized Enclosures for Class II

> Chapter 7 – Pressurized Control Rooms

> Chapter 8 – Pressurized Enclosures Having an Internal Source of Flammable Gas or Vapor

> Chapter 9 – Pressurized Analyzer Rooms Containing a Source of Flammable Gas, Vapor, or Liquid

Annex A – Explanatory Material

Annex B – Informational References

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505.20(C), Exc. Nos. 5 & 6

NEW

Equipment Requirements, Zone 2

Change Summary

- Two new exceptions were added to 505.20(C) to make the requirements for Zone 2 locations consistent with the requirements for Class I, Division 2 locations.
- Exception No. 5 permits the use of certain space heaters in Zone 2 locations where the space heaters are used to reduce condensation during shutdown periods.
- Exception No. 6 permits the use of sliding contact shaft bonding devices that are used on certain motors where the potential discharge is determined to be nonincendive.

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505.20(C), Exc. Nos. 5 & 6

NEW

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Article 506

REVISION

Zone 20, 21, and 22 Locations

Change Summary

- 506.1 was revised to clarify that this article does not cover the class/division classification system and that it does not cover explosives, pyrotechnics, or blasting agents.
- 506.3 was deleted because 90.3 makes it unnecessary.
- 506.4, on documentation, was revised for consistency with similar requirements in other articles in Chapter 5.
- Table 506.9(C)(2)(3) has been deleted. The information is now located in Chapter 9, Table 13.

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Article 506

REVISION

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506.6

REVISION

Material Groups

Change Summary

- The definition of the material groups has been updated for consistency with *NFPA 499: Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*.
- Group IIIC consists of combustible metal dusts and combustible metal fibers/flyings.
- Group IIIB includes combustible dusts other than combustible metal dust.
- Group IIIA, includes combustible fibers/flyings or ignitible fibers/flyings.

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506.6

REVISION

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511.2

NEW

Other Articles

Change Summary

- A new Section 511.2 was created with a table that points to requirements in Articles 500, 501, and 505.
- The table is intended to simplify the use of either the traditional class/division classification system or the zone classification system.
- Articles 511 through 516 provide occupancy-specific requirements that are predicated on the use of Articles 500 and 501, or Article 505.
- Similar tables have been added to 512.2, 513.2, 514.2, 515.2, and 516.2.

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511.2

NEW

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511.7(A)

REVISION

Fixed Wiring Above Hazardous (Classified) Locations

Change Summary

- Section 511.7(A)(1) was converted into list format to make it easier to navigate.
- “Rigid Nonmetallic Conduit” was changed to “PVC Conduit.”
- Reinforced thermosetting resin conduit, RTRC, was added as a permitted fixed wiring method.
- The same changes were made in 514.7 for Wiring Above Hazardous (Classified) locations in Motor Fuel Dispensing Facilities.

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511.7(A)

REVISION

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511.8

REVISION

Underground Wiring Below Hazardous Locations

Change Summary

- The title of this section was changed to “Underground Wiring Below Hazardous (Classified) Locations.”
- The language permitting intermediated metal conduit has been revised to clarify that it must be threaded.
- The exception has been rewritten into positive language.

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511.8

REVISION

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Article 512

NEW

Cannabis Oil Equipment and Cannabis Oil Systems

Change Summary

- A new Article 512 has been created on cannabis oil equipment and cannabis oil systems using flammable materials.
- Flammable materials are used to extract cannabis oil, including butane, ethanol, hexane, pentane, propane, and LPG.
- Article 512 provides detailed classification diagrams to help to evaluate hazardous areas.

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Article 512

NEW

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516.7(A)

REVISION

Wiring & Equipment Not Within Hazardous Locations

Change Summary

- Section 516.7(A) was converted into a list format to make it easier to navigate.
- “Rigid Nonmetallic Conduit” was changed to “PVC Conduit.”
- Reinforced thermosetting resin conduit, RTRC, was added as a permitted fixed wiring method.
- Similar changes were made in 511.7(A) and 514.7(A).

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516.7(A)

REVISION

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517.6

NEW

Patient Care-Related Electrical Equipment

Change Summary

- A new requirement has been added that indicates that patient care-related equipment is not subject to the reconditioning requirements in the *Code*.
- Patient care-related equipment is subject to a recertification process after it is reconditioned.
- Patient care-related equipment is also subject to recommissioning or recertification when it is relocated.

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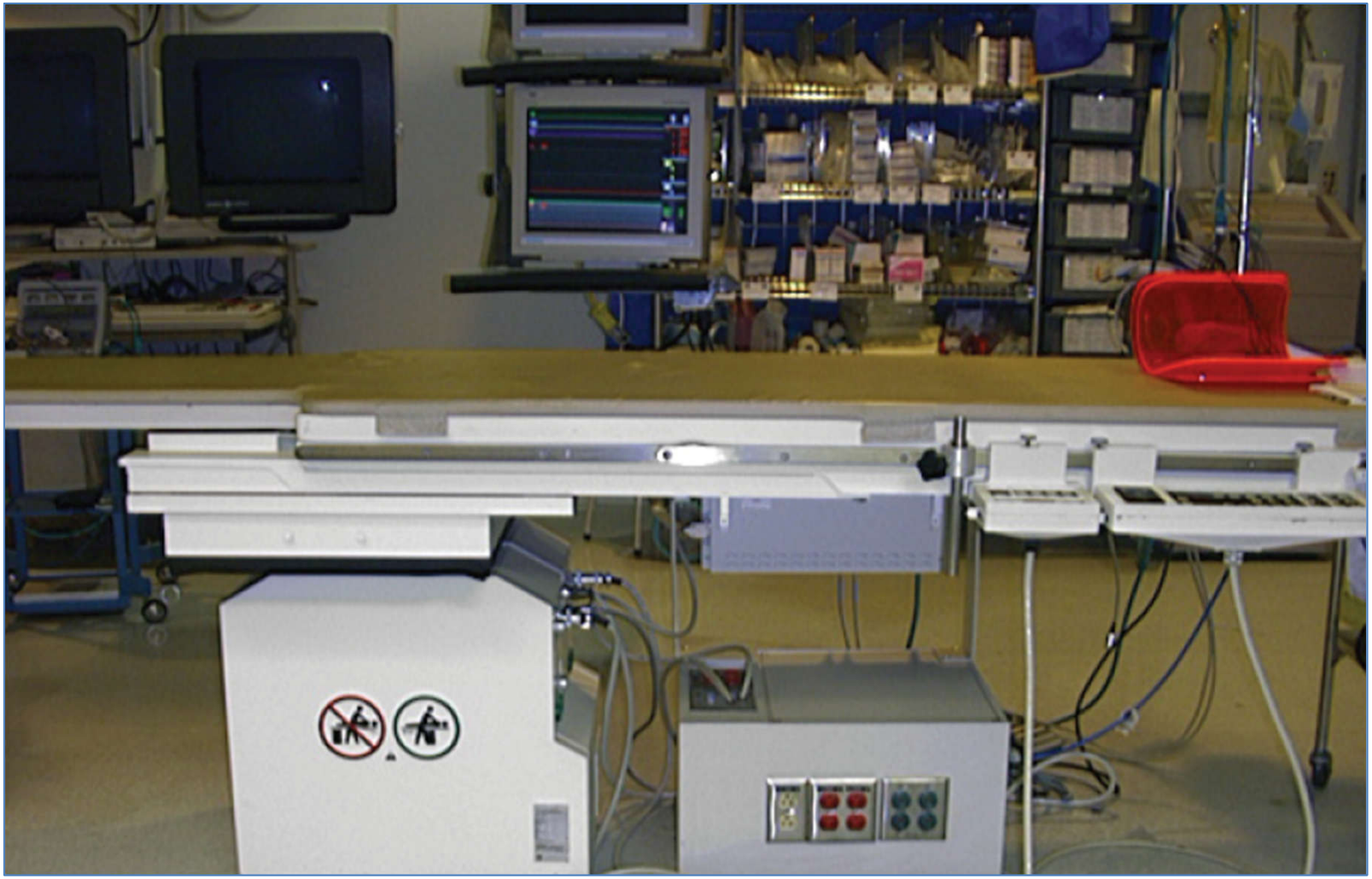
517.6

NEW



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517.10(B)

REVISION

Not Covered

Change Summary

- Informational Note No. 1 was added to point to certain receptacles in health care business offices that are required to be tamper-resistant.
- Informational Note No. 2 was added to point to requirements for AFCI protection for branch-circuit outlets in patient sleeping rooms that are required to be AFCI protected.
- A new list item (3) was added to exempt pharmacy services not contiguous to health care facilities from the requirements of Article 517.

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517.10(B)

REVISION

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517.13

REVISION

Equipment Grounding Conductor

Change Summary

- 517.13(B)(1), Exception No. 2 was relocated to 517.13 following the main rule.
- The requirement for grounding and bonding of metal faceplates was relocated from 517.13(B)(1)(3) to 517.13(B)(1), Exception No. 2. Faceplates are normally grounded through the attachment screws that connect them to the yoke of the switch or receptacle.
- All branch-circuit wiring for a patient care space must comply with 517.13, including wiring that originates outside of the patient care space.

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517.13

REVISION

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517.14

REVISION

Panelboard Bonding

Change Summary

- An exception was added to 517.14 on panelboard bonding to permit an insulated copper conductor not smaller than 10 AWG to be terminated on listed connections to an aluminum or copper busbar.
- The busbar must be at least ¼ inch thick by two inches wide and of sufficient length to accommodate the number of terminations necessary for the bonding of the panelboards.
- The busbar must be securely fastened and installed in an accessible location.

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517.14

REVISION

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517.20(A)

REVISION

Wet Procedure Locations

Change Summary

- Wet procedure locations are required to be provided with protection against electric shock.
- 517.20(A)(1) was clarified to indicate that it applies to isolated power systems that remain in operation in the event of a single line-to-ground fault.
- The informational note was revised to clarify that isolated power systems can eliminate the danger of electric shock.

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517.20(A)

REVISION

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517.22

NEW

Demand Factors

Change Summary

- New demand factors have been added for general-use receptacles and individual branch circuits not exceeding 150 volts to ground.
- This information is based on hospital load studies and a study by the Fire Protection Research Foundation.
- For cord-connected equipment, the table provides two sets of demand factors. One set applies to Category 1 and 2 spaces. The second applies to Category 3 and 4 spaces.
- For receptacle loads, the first 5 kVA is calculated at 100%, the next 5–10 kVA is calculated at 50%, and the remainder is calculated at 25%.

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517.22

NEW

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517.30

REVISION

Sources of Power

Change Summary

- 517.30 requires that essential electrical systems (EES) have two or more independent sources or sets of sources.
- At least one source or set of sources must be entirely onsite and it must be capable of serving the entire EES load.
- 517.30(B) now provides a list of power sources for the EES, which includes utility supply power, generating units, fuel cell systems, energy storage systems, and health care microgrids.

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517.30

REVISION

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517.41

REVISION

Required Power Sources

Change Summary

- Section 517.41 requires that the essential electrical system (EES) have two or more independent sources or sets of sources, one of which must be onsite and capable of supplying the entire EES load.
- At least one source or one set of sources must be entirely onsite.
- EES components are required so that they are not exposed to interruptions from storms, floods, earthquakes, or hazards from adjoining structures or nearby activities.

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517.41

REVISION

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Article 517, Part V.

REVISION

Diagnostic Imaging and Treatment Equipment

Change Summary

- The title of Part V has been changed to “Diagnostic Imaging and Treatment Equipment.”
- A new Informational Note No. 3 has been added that provides examples of 12 types of diagnostic imaging equipment covered by Part V.
- A new Informational Note No. 4 was added that provides examples of five types of treatment equipment covered by Part V.

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Article 517, Part V.

REVISION

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517.80

REVISION

Patient Care Spaces

Change Summary

- Section 517.80 was revised to recognize that Class 2 circuits that transmit power and data to a powered device do not need to comply with the grounding requirements in 517.13.
- Power over Ethernet (PoE) is an example of a Class 2 circuit that can transmit power for applications, such as wireless access points and lighting, while also transmitting data.
- A new informational note was added to reference a NEMA standard on PoE lighting.

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517.80

REVISION

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518.2(A)

REVISION

Examples

Change Summary

- Casinos and gaming facilities have been added to the list of examples of assembly occupancies that are covered by Article 518.
- Casinos can have transient crowds of people hovering over machines and table games that can grow larger than in traditional places of assembly.
- Many casinos also have entertainment to retain customers at the machines.

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518.2(A)

REVISION

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518.4

REVISION

Wiring Methods-General

Change Summary

- Section 518.4 was reformatted into list format.
- Section 518.4(B)(4) was added to recognize power over Ethernet (PoE) supplying lighting.
- A new informational note was added to 518.4(B)(4) that references a NEMA standard for the installation of PoE lighting.
- The wiring methods for buildings or portions of buildings of non-fire rated construction were expanded to include the permitted Chapter 3 wiring methods.

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518.4

REVISION

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520.53(C)

REVISION

Construction

Change Summary

- A new sentence was added to the main rule to clarify that the requirements of 408.18(C) do not apply to portable stage switchboards.
- In the 2020 *Code*, single-pole separable connectors were relocated into 406.13.
- This section has been revised to point to 406.13. Since the general requirements would continue to apply to this section, there is no reason to repeat the requirements here.
- Section 520.53(C) now only covers those requirements that are unique to occupancies that are covered by Article 520.

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520.53(C)

REVISION

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520.68(D)

NEW

Special-Purpose Multi-Circuit Cable Systems

Change Summary

- A new 520.68(D) was created to provide requirements for multi-circuit cable systems.
- These circuits are limited to not more than 20 amperes and not more than 150 volts to ground.
- Trunk cables, breakout assemblies, and multi-circuit enclosures are required to be listed.
- Installation and operation of special-purpose multi-circuit cable systems requires qualified persons.

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520.68(D)

NEW

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Article 530

REVISION

Motion Picture and TV Studios and Remote Locations

Change Summary

- Article 530 has been rewritten and updated.
- Several technologies have disappeared or are being phased out, including carbon arc luminaires, tungsten luminaires, fused extension cables, video tape, and film.
- Several newer technologies are being used, including the use of generators, AC enclosed arc luminaires, and digital cameras.

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Article 530

REVISION

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545.22

REVISION

Power Supply

Change Summary

- This section was revised to clarify that relocatable structures must be supplied by a feeder.
- This correlates with Article 550, which does not allow service equipment on a structure without a permanent foundation.
- Two or more relocatable structures joined into a single unit are permitted to use a chassis bonding conductor as the tap conductor.

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545.22

REVISION

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547.26

REVISION

Physical Protection

Change Summary

- Section 547.26 has been revised to prohibit nonmetallic sheathed cable from being concealed within walls and above ceilings of buildings or portions thereof which are contiguous with or physically adjoined with livestock areas.
- Rodents and other pests frequently chew through cables.
- The requirement also provides examples of areas where this commonly happens, including within walls and ceilings of offices, lunchrooms, and ancillary areas adjoining animal confinement areas.

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547.26

REVISION

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547.44(B)

REVISION

Bonding of Equipotential Planes

Change Summary

- The bonding requirements in agricultural buildings have been clarified.
- Equipotential planes must be bonded to the grounding electrode system or an equipment grounding terminal in any panelboard associated with the equipotential plane.
- The bonding conductor must be an insulated, covered, or bare solid copper conductor that is not smaller than 8 AWG.

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547.44(B)

REVISION

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550.10(I)

REVISION

Mast Weatherhead or Raceway

Change Summary

- The reference to Article 230 has been clarified to indicate that Part II applies.
- This section previously permitted metal raceways. It has been clarified to indicate that the permitted metal raceways are rigid metal conduit or intermediate metal conduit.
- Previously, this section permitted rigid nonmetallic conduit. It now recognizes rigid polyvinyl conduit or other raceways suitable for the location.

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550.10(I)

REVISION

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550.16(C)(1)

REVISION

Exposed Non-Current-Carrying Metal Parts

Change Summary

- Mobile homes often consist of multiple units that are joined together.
- Multiple sections of a mobile home are now required to be bonded with a solid copper conductor that is at least 8 AWG. It can be insulated or bare.
- Bonding conductor terminations must be in accordance with 250.8 and 250.12.

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550.16(C)(1)

REVISION

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550.32(A)

REVISION

Mobile Home Service Equipment

Change Summary

- Section 550.32(A) was revised to make it clear that mobile home service equipment is not permitted to be mounted in or on the mobile home.
- The service equipment must be mounted in a readily accessible outdoor location, and it must be visible from the mobile home it serves.
- The mobile home service disconnect is permitted to serve as the emergency disconnect specified in 230.85.

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550.32(A)

REVISION

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550.33(A)

NEW

Feeder Equipment

Change Summary

- A new 550.33(A) has been added. The previous 550.33(A) has become 550.33(B).
- Service equipment is not permitted to be mounted in or on a mobile home.
- The feeder assembly is not permitted to be mounted in or on the mobile home.
- Manufactured home feeder disconnecting means are permitted to be installed in or on the manufactured home in accordance with 550.32(B).

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550.33(A)

NEW

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551.3

NEW

Electrical Datum Plane Distances

Change Summary

- Electrical datum plane requirements were added to Article 551 because RV parks often border bodies of water.
- In areas subject to tidal fluctuations, the datum plane is two feet above the highest high-tide level under normal conditions.
- In areas not subject to tidal fluctuation, the plane is two feet above the normal high-water level.

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551.3

NEW

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551.40(D)

NEW DELETION

Loss of Ground Device

Change Summary

- The previous 551.40(D), titled “Reverse Polarity Device,” was deleted.
- The reverse polarity device may only indicate that the pedestal is mis-wired but may not interrupt power.
- A new 551.40(D) was added to require a listed grounding monitor interrupter to be installed between the feeder assembly connection to the vehicle and before either a transfer switch (if installed) or the panelboard.

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551.40(D)

NEW DELETION

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551.72

REVISION

Distribution System

Change Summary

- Section 551.72(A) was revised to recognize 208Y/120 three-phase distribution systems in RV parks.
- The prohibition against reducing the size of the neutral conductor was moved from 551.72(C) to (D).
- An informational note was added indicating that RV loads are line-to-neutral and non-permanently connected loads.
- The prohibition of the use of cord- and plug-connected autotransformers used on RV park distribution systems has been deleted.

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551.72

REVISION

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552.4

REVISION

General Requirements

Change Summary

- Park trailers are designed for seasonal use. They are not permitted as permanent dwelling units.
- Section 552.4 makes it clear that trailers used as banks, clinics, offices, or similar applications are considered relocatable structures and are covered in Part II of Article 545.
- This change correlates with the action of CMP 7 to create a new Part II in Article 545 on relocatable structures.

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552.4

REVISION

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555.4

REVISION

Location of Service Equipment

Change Summary

- Service equipment for a floating building, dock, or marina must be no closer than five feet horizontally from and adjacent to the structure.
- Service equipment must also be located a minimum of 12 inches above the datum plane.
- An electrical datum plane is a specified vertical distance above the normal high-water level at which electrical equipment can be installed and connections can be made.

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555.4

REVISION

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555.14

NEW

Equipotential Planes and Bonding of the Planes

Change Summary

- Articles 555 and 682 have overlaps in coverage. This change is intended to improve correlation between the articles.
- A new 555.14 has been added to correlate requirements for equipotential planes and bonding of equipotential planes with Article 682.
- This section is intended to reduce step and touch potentials. It is also intended to reduce the hazards that have resulted in electric shock drownings.

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555.14

NEW

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555.15

NEW

Replacement of Equipment

Change Summary

- A new requirement has been added titled “replacement of equipment,” which addresses modification of equipment as well as repairs.
- This new requirement recognizes the harsh environment that exists at marinas. The intent is to ensure that the installation remains in compliance.
- *NFPA 303* requires annual inspections of marinas. Periodic inspections are outside the scope of the *NEC*.

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555.15

NEW

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555.30

REVISION

Electrical Equipment and Connections

Change Summary

- The term *pier* has been replaced with the term *structure* to apply to all fixed and floating structures.
- The separate section on fixed piers has been deleted as the requirements apply to both fixed and floating piers.
- Electrical components within electrical equipment and connections that are not intended for use while submerged are required to be located at least 12 inches above the deck of the structure.

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555.30

REVISION

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555.35

REVISION

GFPE and GFCI

Change Summary

- The requirements for GFPE of feeder-supplied installations have been rewritten. Coordination with downstream GFPE is permitted.
- Requirements for GFCI protection of boat hoist receptacles have been relocated from 555.9 to 555.35(C).
- The requirements for GFCI protection have been expanded to include all docking facilities, not just those at dwelling unit docks.
- A new requirement was added in 555.35(B)(2) for GFCI protection of outlets for other than shore power not exceeding 150 volts and 60 amperes and 100 amperes or less, three-phase.

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555.35

REVISION

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555.36(C)

NEW

Disconnecting Means for Shore Power Connection(s)

Change Summary

- A new requirement has been added for an emergency disconnect for each power outlet or enclosure that provides shore power to boats.
- The emergency disconnect must be a listed emergency shutoff device or disconnect that is clearly marked “emergency shutoff.”
- The emergency shutoff must be located within sight of the marina power outlet or other device that provides shore power.

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555.36(C)

NEW

© 2022 *electrical training ALLIANCE*

555.37

REVISION

Equipment Grounding Conductor

Change Summary

- Section 555.37(B) and (C) were consolidated to require that the EGCs be insulated wire-type EGCs, sized in accordance with 250.122, but not smaller than 12 AWG.
- Section 555.37(E) has been added to provide requirements for EGCs for equipment that is not double-insulated.
- An exception was added to (E) that permits the EGC to be uninsulated if it is part of a listed cable assembly that is identified for the environment.

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555.37

REVISION

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555.38

NEW

Luminaires

Change Summary

- New requirements have been added for luminaires in marinas, boatyards, and docking facilities.
- Luminaires and retrofit kits are required to be listed and identified for use in the environment.
- Luminaires and their supply connectors must be secured to the structural elements of the marina in a manner that limits damage from watercraft impacts and from marine life.

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555.38

NEW

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590.8

REVISION

Overcurrent Protective Devices

Change Summary

- A new requirement has been added for wye-connected temporary service installations of more than 150 volts to ground, but not more than 1,000 volts phase-to-phase.
- If the available fault current exceeds 10,000 amperes, the overcurrent protection is required to be current-limiting.
- Where available fault current is less than 10 kA, conventional OCPDs will operate quickly enough to clear a fault before damage occurs.

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590.8

REVISION

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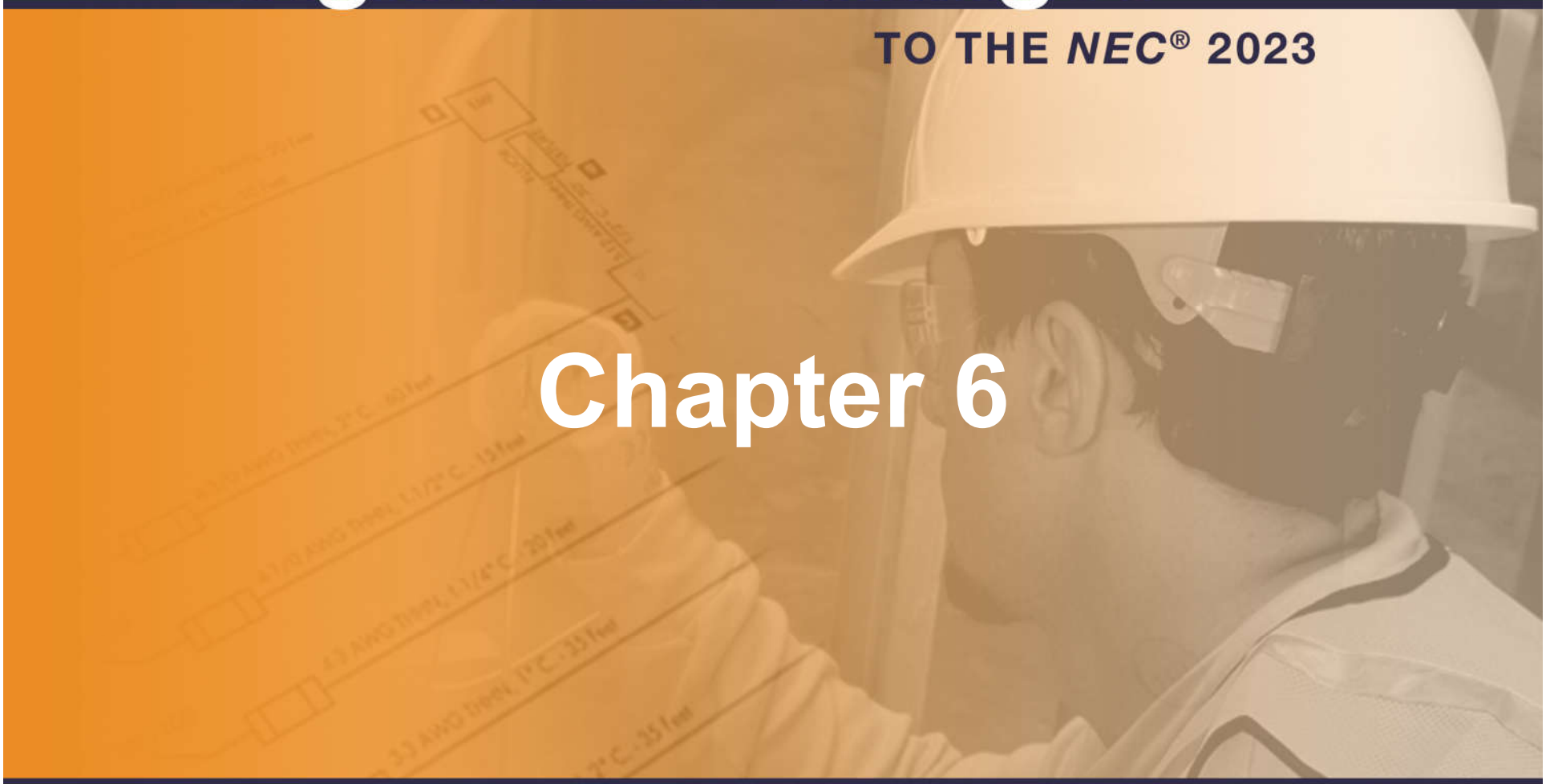
Significant Changes

TO THE *NEC*® 2023



Chapter 6

electrical training ALLIANCE IBEW - NECA IN COLLABORATION WITH NECA NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

600.5

REVISION

Branch Circuits

Change Summary

- The last sentence of 600.5(A) was converted into an exception that exempts some entrances, corridors, and hallways.
- A second exception was added that permits the branch circuit to supply other loads that are directly related to the control of the sign.
- Section 600.5(D)(2) now permits electrical enclosures integral to the sign that are listed and labeled as electrical enclosures to be used as pull or junction boxes for up to 600 volts.

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600.5

REVISION

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600.6

REVISION

Disconnects

Change Summary

- The general requirements of Chapters 1 through 4 of the *Code* apply, including the requirements of 404.7, requiring disconnects to indicate whether they are open or closed.
- The disconnecting means is required to be accessible and located at the point of entry to the sign, within sight of the sign, or within sight of the controller.
- If the disconnecting means is remote from the sign, it must be mounted at an accessible location that is available to first responders and service personnel.

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600.6

REVISION

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620.12(A)

REVISION

Traveling Cables

Change Summary

- A new 620.12(A)(2) has been added to recognize Class 2 and communications cables used on Class 2 circuits, including power over Ethernet, in traveling cables.
- The minimum size of Class 2 and communications circuit conductors is 24 AWG.
- New requirements were added to require parallel conductors of traveling cables to be not smaller than 20 AWG.

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620.12(A)

REVISION

© 2022 *electrical training ALLIANCE*

620.22

REVISION

Branch Circuits for Car Lighting, Receptacles, HVAC

Change Summary

- Section 620.22(A) permits car lighting branch circuits to supply additional loads.
- The lighting circuit is now permitted to supply emergency responder radio coverage circuits, car ventilation purification systems, car emergency signaling, and communications devices, including charging circuits.
- The permitted location of the OCPD for the circuit for the air conditioning and heating source has been revised to correlate with the OCPD locations permitted for other branch circuits in 620.22(A).

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620.22

REVISION

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NECA Photo – © 2010 Rob Colgan

620.23

REVISION

Branch Circuits for Machine Room, Control Room…

Change Summary

- The title of 620.23 was revised to include truss interior lighting.
- Truss interiors are the structure of moving walkways and escalators.
- At least one 125-volt, single-phase, 15- or 20-ampere duplex receptacle is now required for truss interiors.

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620.23

REVISION

Courtesy of Tom Garvey

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625.1 Info. Notes

NEW

Scope

Change Summary

- Two new informational notes were added to 625.1 to provide additional information for installation of electric vehicle infrastructure.
- UL 2750 provides information that was developed by UL when they were investigating wireless power transfer equipment.
- NECA 413 provides information on installation and maintenance of AC Level 1 and 2 and fast-charging dc EVSE.

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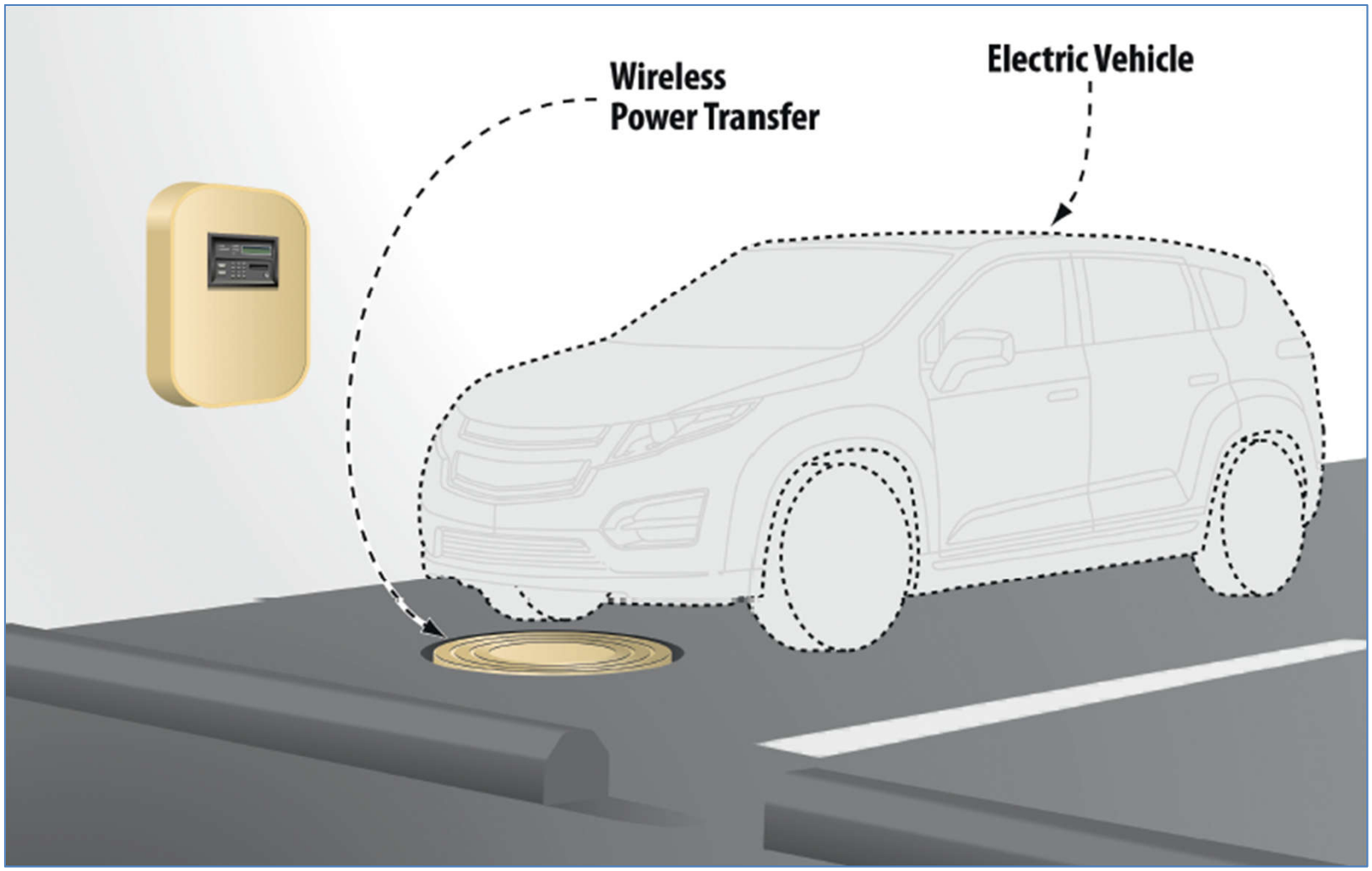
625.1 Info. Notes

NEW



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625.17

REVISION

Cords and Cables

Change Summary

- “Stationary equipment” was changed to “fastened-in-place equipment” for consistency with 625.44(B).
- The overall cord and cable length is not permitted to exceed 25 feet unless equipped with a cable management system.
- Section 625.17(C) has been revised to indicate how the power supply cords for the output cable is measured.

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625.17

REVISION

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625.40

REVISION

Electric Vehicle Circuit

Change Summary

- Section 625.40 requires each outlet installed for supplying EVSE to be supplied by an individual branch circuit.
- The requirement for an individual branch circuit applies to outlets greater than 16 amperes or 120 volts.
- A new exception has been added that permits branch circuits to supply multiple EVSEs in accordance with 625.42(A) or (B).

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625.40

REVISION

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625.42

REVISION

Rating

Change Summary

- Section 624.42 was split into two subsections to clearly provide separate requirements for load management systems and EVSE with adjustable settings.
- Energy management systems are permitted to be integral to one piece of equipment or to a listed system. If integral load management is provided, the system must be marked to indicate that control is provided.
- EVSE with adjustable settings is permitted if access to the settings is restricted.

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625.42

REVISION

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625.43

REVISION

Disconnecting Means

Change Summary

- Section 625.43 was revised so that it applies to EVSE and WPTE rather than to all equipment.
- The disconnect must be installed in a readily accessible location.
- If the disconnect is in a remote location, a plaque must be installed on the equipment indicating the location of the disconnecting means.

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625.43

REVISION

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625.49

NEW

Island Mode

Change Summary

- EVPE and EVSE with a power export function is now permitted to be part of an interconnected power system that operates in island mode.
- Some electric vehicle installations can function as optional standby power systems.
- The rest of the connected system must be capable of operating in island mode.

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625.49

NEW

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625.102

REVISION

Installation

Change Summary

- Changes were made to 625.102 to better integrate wireless power transfer into the *Code*.
- The title of 625.102(B) was changed to “Control Box.” The term *charger power converter* is no longer used.
- The title of 625.102(D) has been changed from “Protection of Cables” to “Protection of Cords and Cables to the Primary Pad.”
- If there is not a control box, the cord or cable supplying power to the primary pad must be secured in place to restrict movement and prevent strain at the connection points.

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625.102

REVISION

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630.8

NEW

Ground-Fault Circuit-Interrupter Protection

Change Summary

- All 125-volt, single-phase, 15- and 20-ampere receptacles installed in work areas where welders are operated are required to be GFCI protected.
- This requirement is to protect workers who are using electric hand tools or portable lighting equipment.
- The work area is not defined in this requirement.

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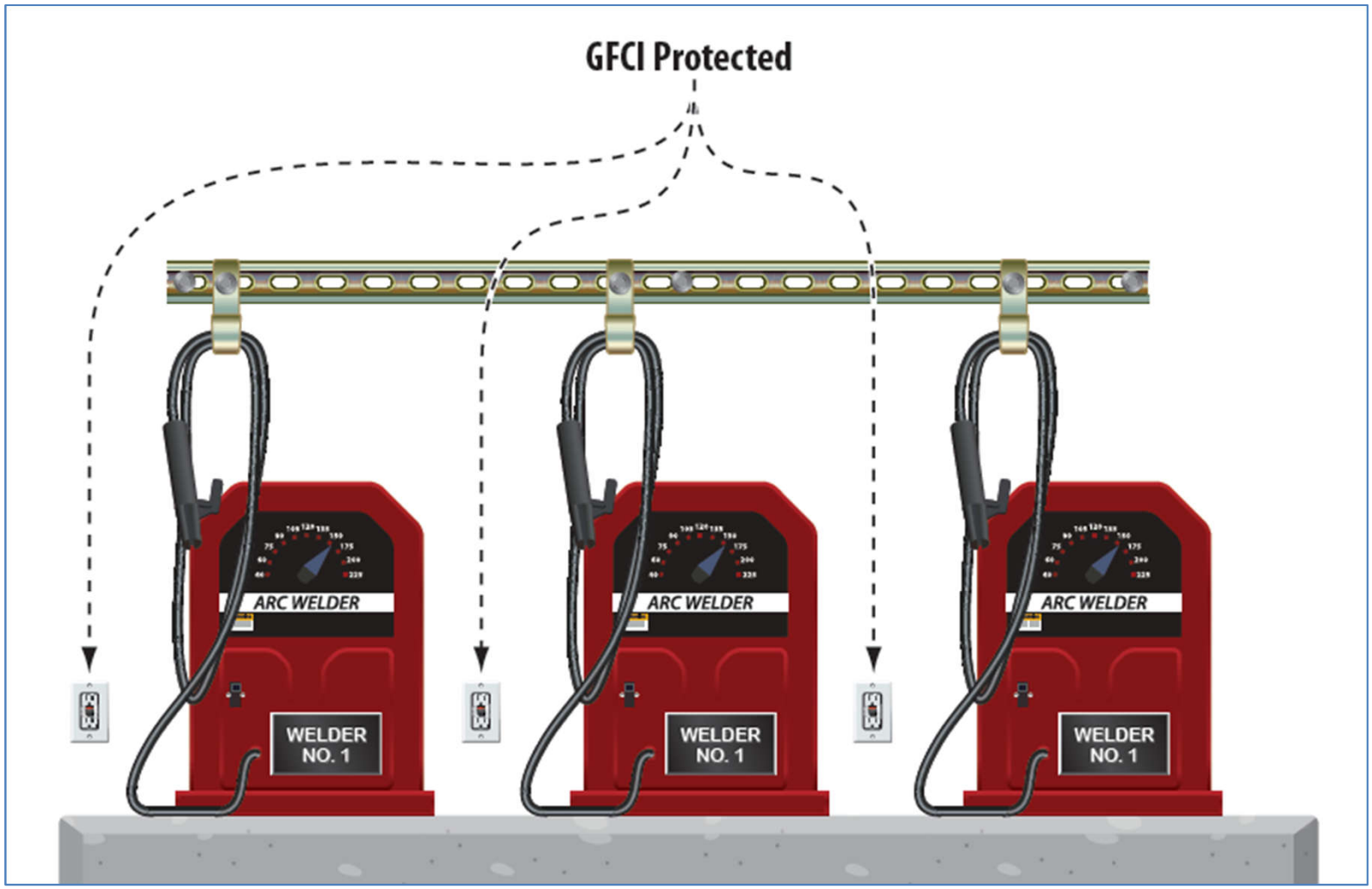
630.8

NEW



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645.5

REVISION

Supply Circuits and Interconnecting Cables

Change Summary

- New 645.5(B)(3) was added to ensure that the plugs and receptacles that connect power supply cords are listed and have properly-mated components.
- Sections 645.5(D), (E), and (F) were modified to use properly descriptive terminology.
- Section 645.5(H) was rearranged into list format to improve clarity.

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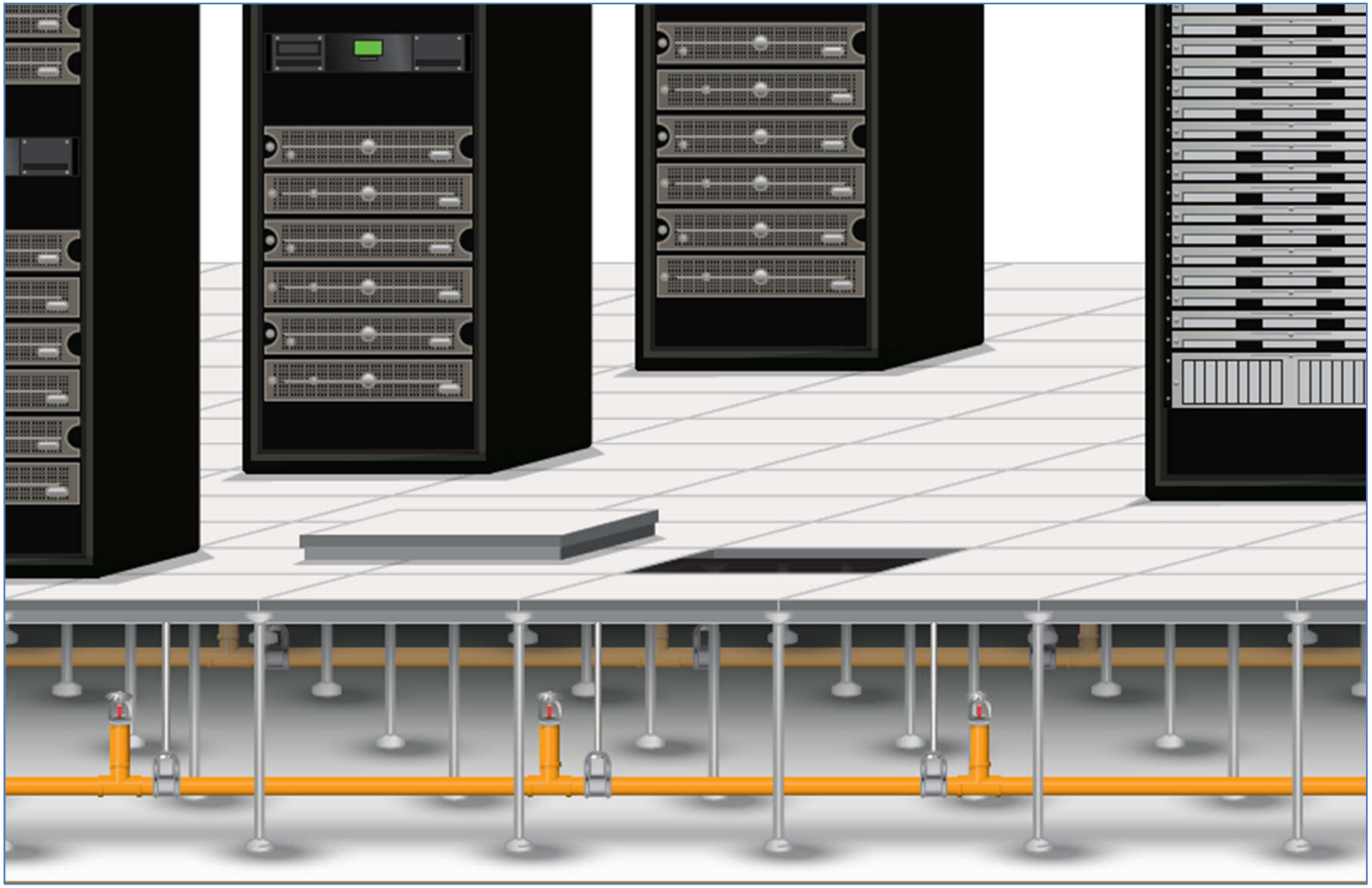
645.5

REVISION



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670.3(A)

REVISION

Permanent Nameplate

Change Summary

- The requirements for nameplates on industrial machinery were revised for consistency with *NFPA 79* regarding industrial machinery.
- The nameplate must be attached to the outside of the control equipment enclosure or on the machine immediately adjacent to the main control equipment enclosure so that it is visible after installation.
- The requirement previously required that the nameplate be “plainly visible,” which was unenforceable.

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670.3(A)

REVISION

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680.5

REVISION

GFCI and SPGFCI Protection

Change Summary

- The first sentence of 680.8 was deleted because it described the types of devices used for GFCI protection, which was not needed.
- Some GFCI requirements from other parts of Article 680 were consolidated into 680.5.
- The informational note to 680.5(B) points out that the high leg of a 120/240-volt, 4-wire, delta-connected system exceeds the limits for Class A GFCIs.
- A new 680.5(C) has been added to address ground-fault protection of receptacles and outlets on single- and 3-phase circuits exceeding 150 volts to ground.

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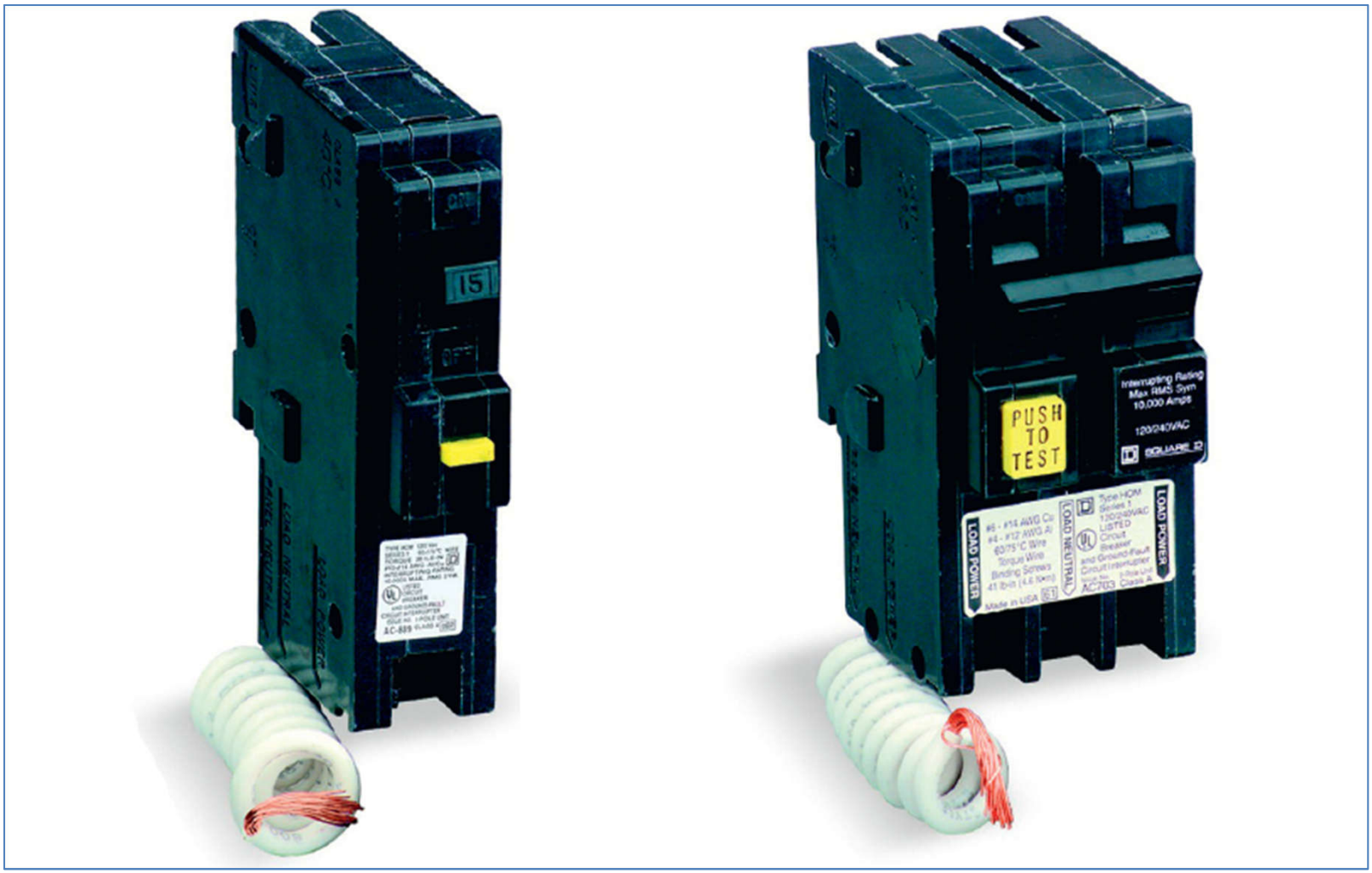
680.5

REVISION



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Courtesy of Schneider Electric

680.6 & 680.7

DELETION REVISION

Grounding and Bonding

Change Summary

- Section 680.6, Bonding and Equipment Grounding, was deleted as it was redundant with requirements in Article 250.
- Section 680.7 was retitled “Grounding and Bonding.” The previously existing text was revised and relocated to 680.7(C).
- The requirements for cord- and plug-connected equipment were relocated to 680.7(B) from 680.21(A)(3) and 680.8(B).
- Requirements for feeders and branch circuits were relocated into 680.7(A) from 680.21(A)(3) and 680.8(B).

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680.6 & 680.7

DELETION **REVISION**

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680.10

REVISION

Electric Pool Water Heater

Change Summary

- The title of 680.10 has been changed to indicate that it applies to heaters incorporating resistive heating elements and electrically-powered swimming pool heat pumps and chillers.
- Section 680.10(A) only applies to heaters incorporating the traditional resistive heating elements.
- Section 680.10(B) recognizes the newer technology of electric heat pumps and chillers to heat or cool the pool water. They may do both.

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680.10

REVISION

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680.12

REVISION

Equipment Rooms, Vaults, and Pits

Change Summary

- The title of the section and 680.12(A) have been revised so that the requirements also apply to equipment in vaults.
- Equipment in rooms or vaults that do not have drainage that prevents water accumulation must be identified for submersion.
- A new 680.12(B) has been added to require at least one GFCI-protected, 125-volt, 15- or 20-ampere receptacle in the equipment room or vault.
- All other receptacles rated 150 volts or less to ground must be GFCI protected.

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680.12

REVISION

Courtesy of Mark Ode

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680.14

REVISION

Corrosive Environments

Change Summary

- Section 680.14 now covers wiring methods and other equipment in corrosive environments.
- Liquidtight flexible nonmetallic conduit is now permitted to be used in corrosive environments.
- Aluminum conduit and tubing are not permitted for use in corrosive environments.
- Other equipment in corrosive environments must be installed in identified corrosion-resistant enclosures.
- Equipment listed for spa and pool use is suitable.

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680.14

REVISION

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680.21

REVISION

Motors

Change Summary

- The requirements for corrosive environments were removed from this section because they are covered by 680.14.
- The title of 680.21(C) has been changed to “Ground-Fault Protection,” which now refers to 680.5(B) or (C).
- Section 680.21(D) has been revised to require that pool pump motors that are replaced or repaired be provided with ground-fault protection in accordance with 680.5.

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680.21

REVISION

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680.41

REVISION

Location of Other Equipment

Change Summary

- This section was retitled “Location of Other Equipment.”
- The emergency switch for spas and hot tubs has been relocated to 680.41(A). It will not apply to installations in one- and two-family dwellings.
- A new 680.41(B) was added to provide requirements for equipment exceeding the low-voltage contact limit.

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680.41

REVISION

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680.43(A)

REVISION

Ground-Fault Protection for Receptacles

Change Summary

- The requirements for ground-fault protection for receptacles have been revised.
- All receptacles rated 125 through 250 volts, 60 amperes or less, that are located within 10 feet of the inside walls of a spa or hot tub must have ground-fault protection complying with 680.5(B) or (C).
- Receptacles that provide power for spas and hot tubs are not permitted to exceed 150 volts to ground.

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680.43(A)

REVISION

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680.44

REVISION

GFCI and SPGFCI Protection

Change Summary

- The first sentence of this section has been relocated to become 680.44(A), and has been revised so that it requires the outlet that supplies a self-contained spa or hot tub, a packaged spa or hot tub equipment assembly, or a field-assembled spa or hot tub to have ground-fault protection in accordance with 680.5(B) or (C), as applicable.
- Section 680.44(C), “Other Units,” has been deleted because the reference to 680.5(C) covers ground-fault protection for 3-phase units.
- The new 680.44(C) provides requirements for gas-fired water heaters operating above the low-voltage contact limit.

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680.44

REVISION

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680.54

REVISION

Bonding

Change Summary

- Section 680.54(B) was revised to require that a conductor used for bonding be a minimum 8 AWG solid copper conductor.
- Section 680.54(B)(6) was revised by replacing *devices and controls* with the more general term *equipment*.
- A new first-level subdivision 680.54(C) was added to require equipotential bonding of splash pads.

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680.54

REVISION

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680.58

REVISION

GFCI and SPGFCI Protection for Receptacles

Change Summary

- The requirements for ground-fault protection for adjacent receptacle outlets have been expanded to apply to all receptacles rated 125 through 250 volts, 60 amperes or less.
- The requirements apply to single-phase and 3-phase receptacles within 20 feet of the edge of the fountain.
- The protection will be GFCI or SPGFCI protection, in accordance with 680.5(B) or (C), as applicable.

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680.58

REVISION

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680.59

REVISION

Ground-Fault Protection for Nonsubmersible Pumps

Change Summary

- The title of 680.59 has been revised to recognize that it applies to GFCI and SPGFCI protection for permanently installed nonsubmersible pumps.
- If the voltage to ground is 150 volts or less, GFCI protection is required.
- If the voltage to ground exceeds 150 volts, SPGFCI protection is required.
- An exception was added for listed low-voltage motors not requiring grounding that do not exceed the low-voltage contact limit, if the motor is supplied by listed transformers or power supplies that comply with 680.23(A)(2).

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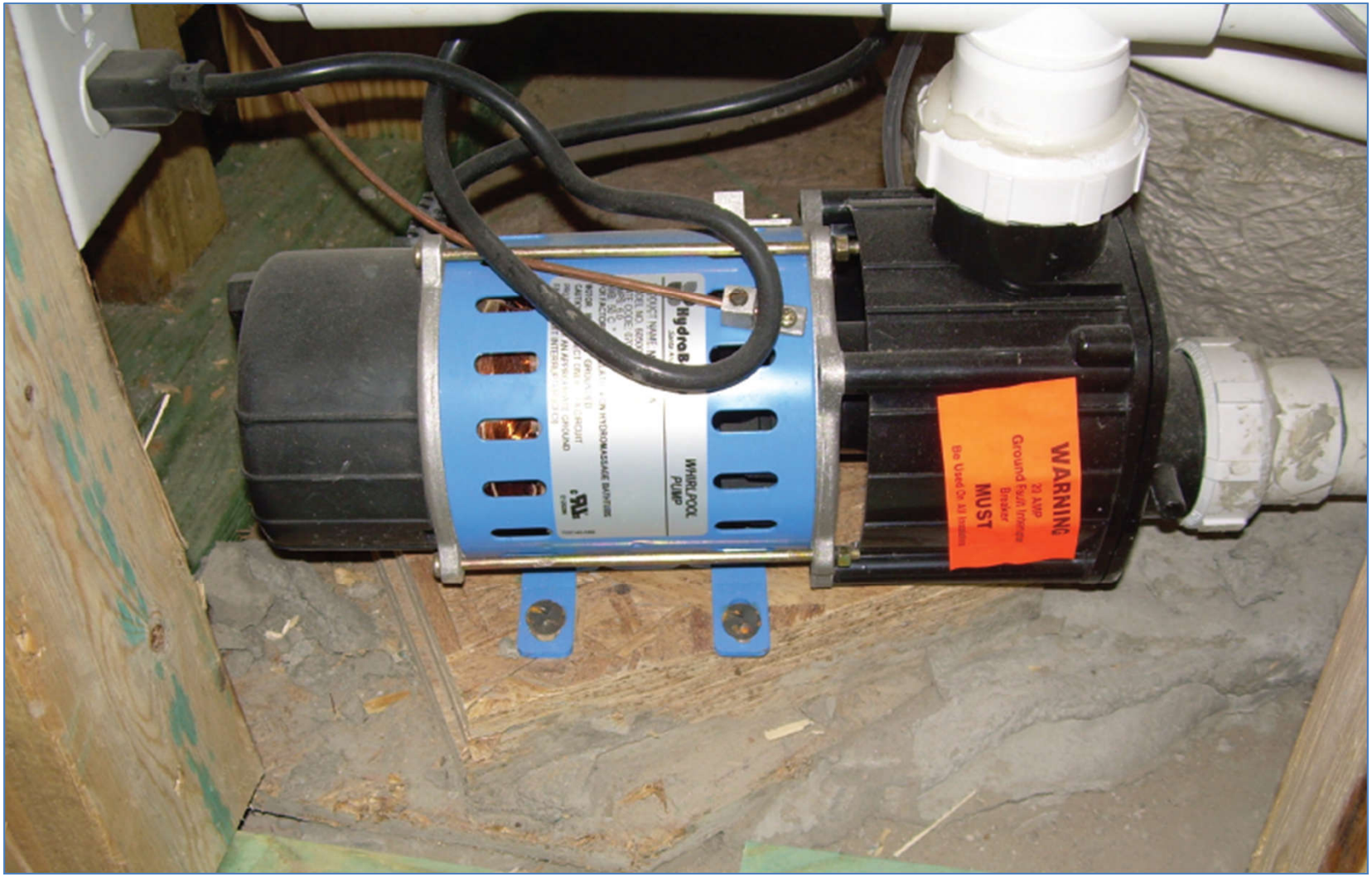
680.59

REVISION



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680.83

REVISION

Equipotential Bonding

Change Summary

- Equipotential bonding of pool lift equipment must use solid copper conductors that are not smaller than 8 AWG and may be covered, insulated, or bare.
- Connection to bonded parts must comply with 250.8.
- The bonding jumpers in the pool area are not required to be extended to remote panelboards, service equipment, or electrodes.

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680.83

REVISION

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682.11

REVISION

Location of Electrical Distribution Equipment

Change Summary

- Section 682.11 has been revised to apply to electrical distribution equipment. It previously applied only to service equipment. It now provides two options for the location of the installation.
- Electrical distribution equipment can be located at least five feet horizontally from the shoreline where live parts of the equipment are located at least 12 inches above the datum plane.
- Electrical equipment can be located no closer than the shoreline where live parts of equipment are located at least 10 feet above the datum plane.

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682.11

REVISION

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682.12

REVISION

Electrical Connections

Change Summary

- Section 682.12, Electrical Connections, was divided into two subsections.
- Conductor splices located above the waterline but below the datum plane must be in junction boxes identified for wet locations, using sealed wire connector systems listed and identified for submersion.
- Replacement electrical connections that are located below the electrical datum plane and above the waterline must be listed and identified for submersion.

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682.12

REVISION

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Article 690

REVISION

Solar Photovoltaic (PV) Systems

Change Summary

- The informational note figures in 690.1 have been redrawn.
- Requirements for stand-alone systems were deleted from 690.10. Article 710 covers stand-alone systems.
- Parts VI and VIII were deleted. Part VII, Connection to Other Sources, became Part VI, Source Connections. Part VIII, Energy Storage Systems, was deleted because that is covered in Article 706.

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Article 690

REVISION

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690.4

REVISION

General Requirements

Change Summary

- There is a new definition of “electronic power converter” in Article 100, which includes inverters and dc-to-dc converters. Electronic power converters were added to the list of equipment in 690.4(B) to replace inverters and dc-to-dc converters. PV hazard control equipment and PV hazard control systems were also added.
- Acronyms were added for rapid shutdown (PVRSE), hazard control system (PVHCS), and hazard control equipment (PVHCE).
- New requirements were added for PV equipment floating on or attached to structures floating on bodies of water.

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690.4

REVISION

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690.7

REVISION

Maximum Voltage

Change Summary

- Section 690.7 was revised for clarity and to remove requirements for systems over 1,000 volts.
- Section 690.7(A) through (D) were revised to eliminate the terminology *source and output* and to add the defined term *PV string circuit* in 690.7(B).
- Section 690.7(B) was also updated by deleting “source and output” from the term *dc-to-dc converter circuits*.
- The marking requirements for dc PV circuits were relocated to 690.7(D) from 690.53.

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690.7

REVISION

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690.8

REVISION

Circuit Sizing and Current

Change Summary

- An informational note was added to 690.8(A)(1) noting that some modules can produce electricity when exposed to light on multiple surfaces.
- Section 690.8(B) requires a minimum conductor size without adjustment and correction factors based on an ampacity not less than the current calculated in 690.8(A) multiplied by 125%.
- Section 680.8(D) was updated to use the term *PV string circuits*, which describes how some PV circuits are arranged.

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690.8

REVISION

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690.9(D)

REVISION

Transformers

Change Summary

- The requirements for protection of transformers are now covered in 705.30(C).
- The requirements in 450.3 are based on the primary being one side at a time.
- Section 705.30(F) is based on interconnected power production sources. It is applicable to installations where there can be multiple sources.

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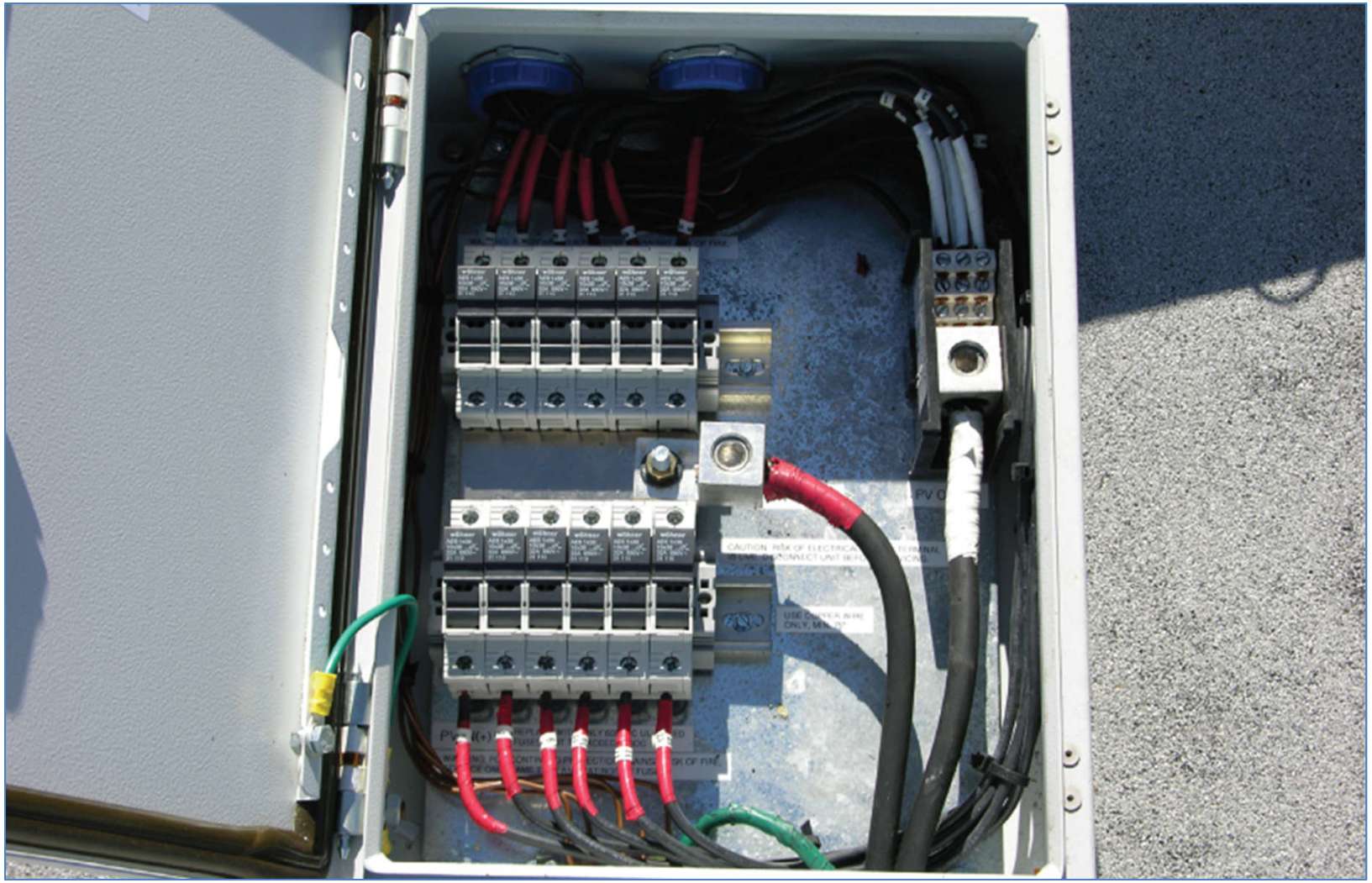
690.9(D)

REVISION



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690.12, Exception

REVISION

Rapid Shutdown of PV Systems on Buildings

Change Summary

- Section 690.12 establishes requirements for rapid shutdown of PV systems on buildings.
- A new exception was added to exempt non-enclosed detached structures, such as those that provide parking shade, carports, solar trellises, and similar structures.
- The exception aligns with requirements for firefighter rooftop access in the building and fire codes.

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690.12, Exception

REVISION

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690.15

REVISION

Disconnecting Means for Isolating PV Equipment

Change Summary

- 690.15(D), Type of Disconnecting Means, has been relocated to 690.15(A). Revised wording clarifies that disconnecting means complying with 690.15(C) are permitted in any circuit, regardless of current rating.
- 690.15(A)(2) was revised to permit an isolating device that is part of listed equipment where an interlock prevents opening the isolating switch under load.
- 690.15(D) was rewritten to remove the distances and to replace them with the terms *readily accessible* and *in sight from*.

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690.15

REVISION

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690.31

REVISION

Wiring Methods

Change Summary

- Section 690.31(A)(2) has been expanded to cover all PV dc circuits, and it has been clarified to indicate the conditions to which it applies.
- Section 690.31(B)(1) has been rewritten into list format and clarified regarding which conductors can be intermingled.
- Requirements have been added that provide more detail on cable tray installations.

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690.31

REVISION

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691.1 & 691.4

REVISION

Large-Scale Photovoltaic (PV) Electric Supply Stations

Change Summary

- Large-scale PV systems are those that have an inverter generating capacity of 5,000 kW or larger that are not under exclusive utility control.
- The 5,000 kW lower limit was moved from the scope to 691.4(7).
- Section 691.4(6) now requires large-scale PV systems to be monitored from a central command center.

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691.1 & 691.4

REVISION

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Article 692

REVISION

Fuel Cell Systems

Change Summary

- Section 692.4(B) now points to the requirement of a plaque or directory in 705.10.
- Part V, Grounding, was deleted because it did not modify the general rules of Article 250.
- Part VI, Marking, became Part V, Marking.
- Sections 692.60 through 692.65 were deleted in order to remove sections that did not modify the requirements of Chapters 1 through 4. In addition, requirements that are addressed during product listing were also deleted.

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Article 692

REVISION

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694.50 & 694.68

DELETION

Interactive System Point of Interconnection

Change Summary

- The marking requirement for interactive points of interconnection with other sources that was in Section 694.50 was deleted. The new requirement is located in 705.14, which is a more general requirement for labeling an interactive point of connection to other sources.
- The requirement for points of connection was deleted from 694.68. The intent is that all sources combined with other sources must comply with Article 705.
- Requirements for identification of power sources in 694.54 requires a plaque or directory installed in accordance with 705.10.

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694.50 & 694.68

DELETION

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695.1(B)

NEW

Not Covered

Change Summary

- The small water pumps that may be installed in one- and two-family dwellings for fire suppression are not the fire pumps covered by Article 695.
- These water pumps would have to comply with Article 430 rather than Article 695.
- Larger homes may have a sprinkler system in accordance with *NFPA 13* or *NFPA 13R*, which could require a fire pump in accordance with *NFPA 20* and Article 695.

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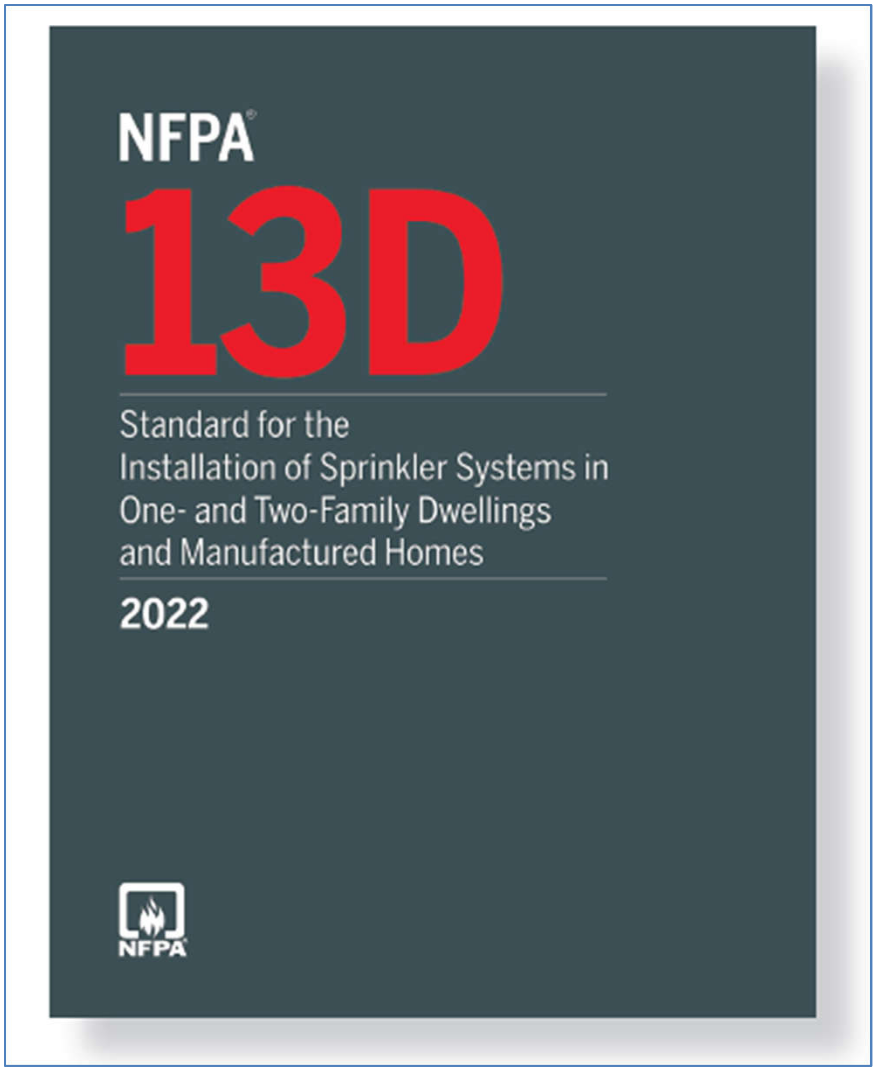
695.1(B)

NEW



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695.7

NEW

Voltage Drop

Change Summary

- The exception to 695.7(A) which permits the voltage to drop more than 15% below normal is now 695.7(B), Emergency Run.
- A new 695.7(C) has been added to recognize bypass mode.
- Both emergency run mode and bypass mode are permitted to exceed 15% voltage drop, provided the pump can still be started while supplied by a generator.

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695.7

NEW

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Significant Changes

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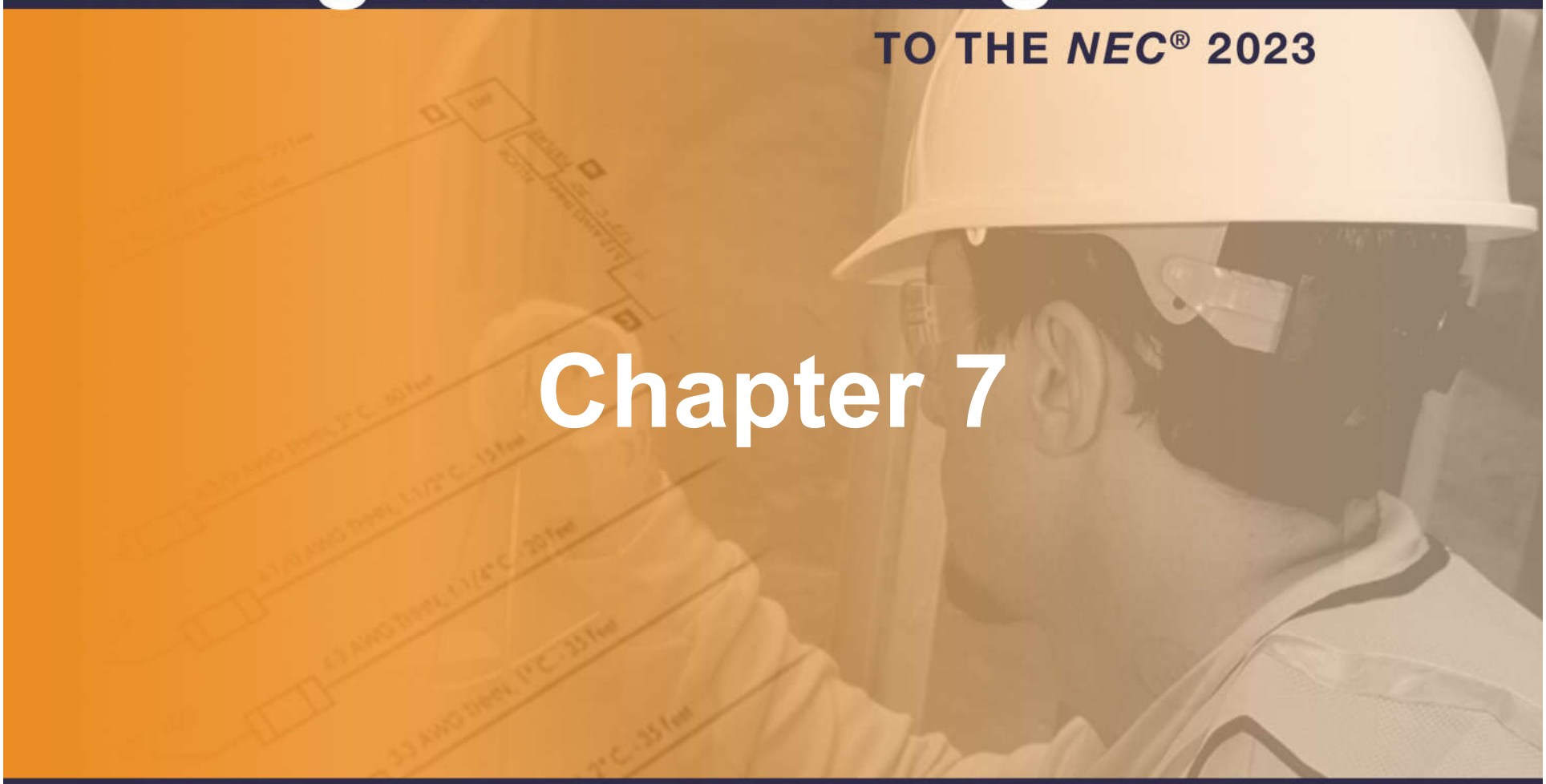

Chapter 7

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700.3

REVISION

Tests and Maintenance

Change Summary

- The permanent connection point for the temporary generator must be located outdoors. Cables must not be run through exterior windows, doors, or similar openings.
- The switching means, including the interlocks, are required to be listed to prevent inadvertent interconnection of power sources.
- A permanent label must be field-applied at the permanent connection point that indicates the system voltage, maximum load, and short-circuit current rating of the load-side equipment.

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700.3

REVISION

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700.4

REVISION

Capacity and Rating

Change Summary

- Section 700.4(A) was deleted because this is a general requirement covered by 110.9 and 110.10.
- Emergency systems are now required to have sufficient capacity for rapid load changes and transient energy requirements associated with expected loads.
- Peak load shaving requirements are now covered in 700.4(C), Parallel Operations.
- A new 700.4(C) addresses requirements for the two types of parallel operations. Section 700.4(C)(1) covers parallel operation of normal and emergency sources, while 700.4(C)(2) covers emergency sources that operate in parallel.

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700.4

REVISION

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700.5

REVISION

Transfer Equipment

Change Summary

- The requirement in 700.5(A) for approval by the AHJ of transfer equipment was deleted.
- The prohibition of reconditioning emergency transfer switches has been relocated to 700.2.
- A new 700.5(D), Redundant Transfer Equipment, has been added to require emergency loads that are supplied by a single feeder to have a redundant transfer switch or a bypass isolation switch.
- Where the redundant transfer switch or bypass isolation switch is manual or not automatic, it must be supervised when the primary is out of service.

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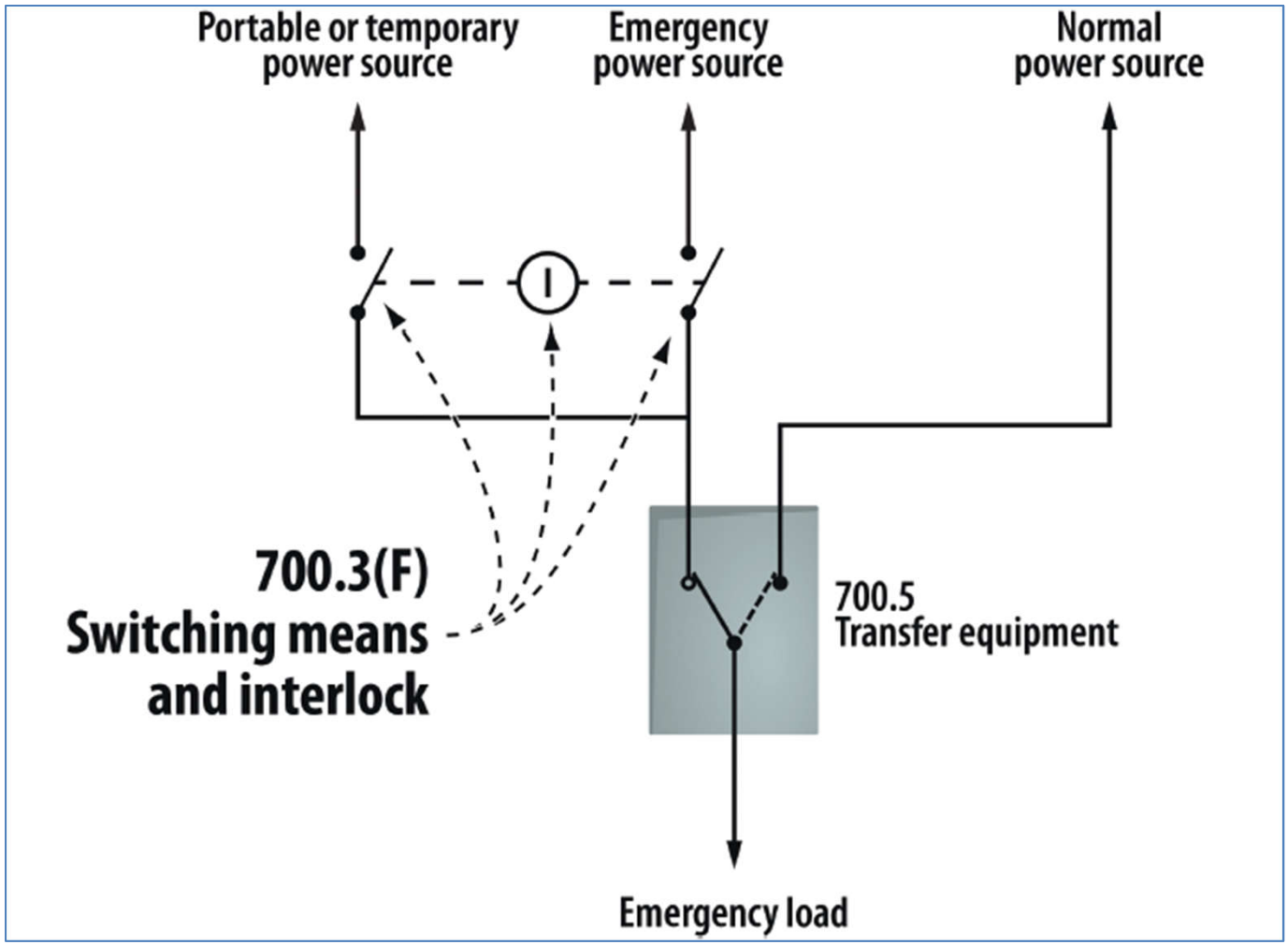
700.5

REVISION



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700.11

NEW

Wiring, Class-2-Powered Emergency Lighting Systems

Change Summary

- New Section 700.11 recognizes Class 2 emergency lighting systems that could use power over ethernet technology or low-power LED luminaires.
- These are directly-controlled luminaires and must comply with 700.24.
- In addition to other separation requirements, Class 2 emergency circuits must be separated from nonemergency Class 2 circuit conductors. If bundled, they must be bundled separately.
- Wiring must comply with 300.4 and be installed in a raceway, armored or metal-clad cable, or cable tray.

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700.11

NEW

Courtesy of Electronic Theatre Controls Incorporated

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700.12

REVISION

General Requirements

Change Summary

- Section 700.12(B) was revised to correlate with the occupancy requirements in 700.10(D)(1).
- The title of 700.12(C) has been changed from “storage battery” to “supply duration” to cover the duration of all supplies. Battery and UPS durations are covered under 700.10(C)(4).
- The exception to 700.12(C)(3) recognizes that where the AHJ approves a public gas system to supply an emergency source, an onsite fuel supply is not required.

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700.12

REVISION

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Courtesy of Eaton

700.24

REVISION

Directly Controlled Emergency Luminaires

Change Summary

- Directly controlled luminaires can be energized in two different ways.
- An active control signal can be sent from a listed external control system. This requires the controller and the luminaire to be listed for use in emergency systems.
- Systems that are activated by disconnection of the control input by a listed control device, such as an automatic load control relay, would not require the luminaire to be listed for use in emergency systems.

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700.24

REVISION

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700.32

NEW

Selective Coordination

Change Summary

- Selective coordination of emergency systems is required to ensure that overcurrent protective device operation does not affect other loads supplied by the emergency systems.
- The text has been revised by adding “load-side” to ensure that coordination applies upstream and downstream.
- New text states that if OCPDs are replaced, modified, deleted, or added, coordination must be reevaluated.

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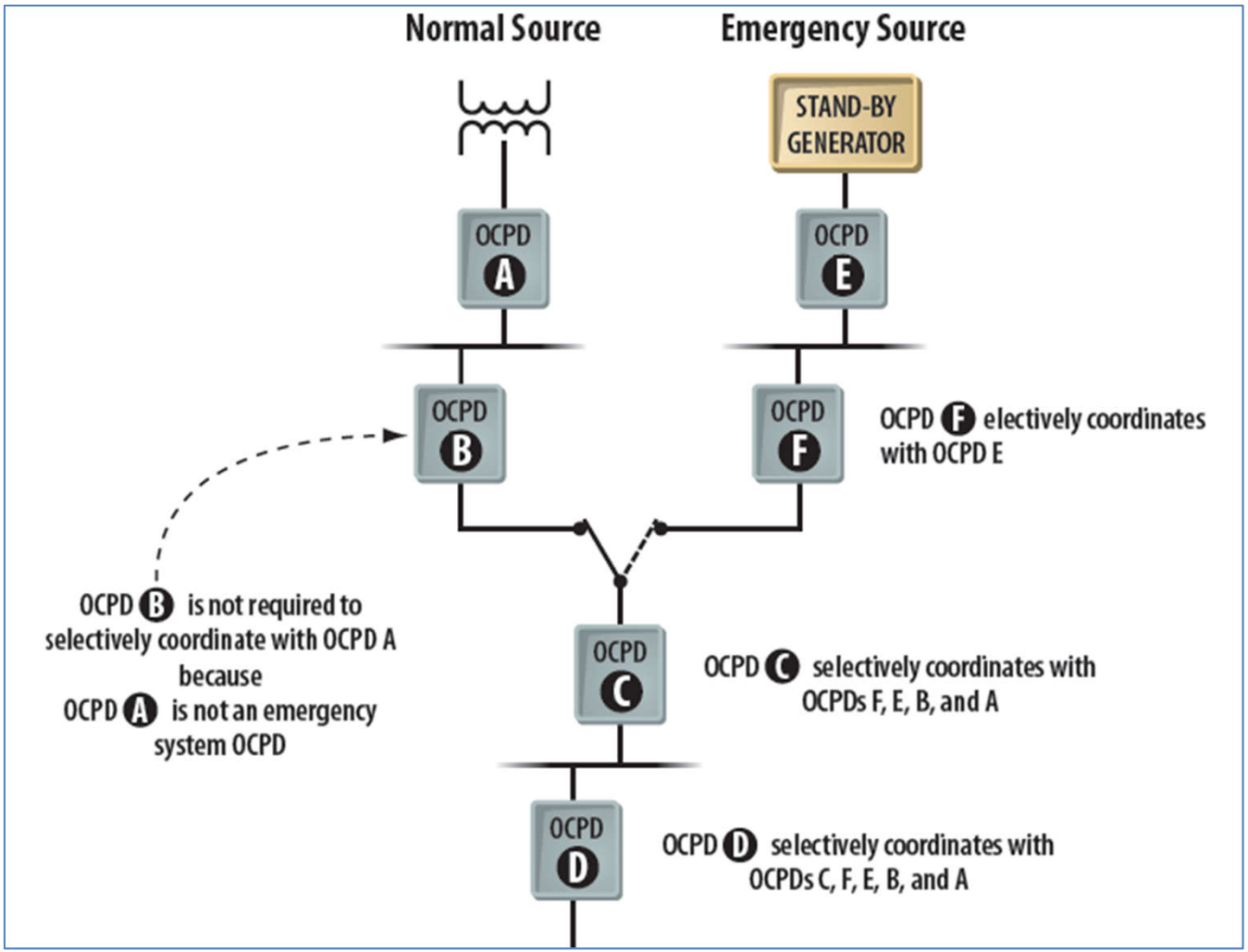
700.32

NEW



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705.5

REVISION

Parallel Operation

Change Summary

- Section 705.14 has been relocated to become 705.5.
- The title was changed from “Output Characteristics” to “Parallel Operation.”
- The previous first sentence of 705.14 has become 705.5(A).
- The marking requirements from 705.14 were deleted because listed equipment is required, which addresses the marking requirements.
- The last sentence of 705.14 has become 705.5(B).

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705.5

REVISION

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705.10

NEW

Identification of Power Sources

Change Summary

- The identification requirements have been reorganized into list format.
- The plaques, labels, or directories are now required to indicate the emergency telephone numbers of off-site entities that service the installation.
- A reference was added to *NFPA 1: Fire Prevention Code*, which provides installer information.

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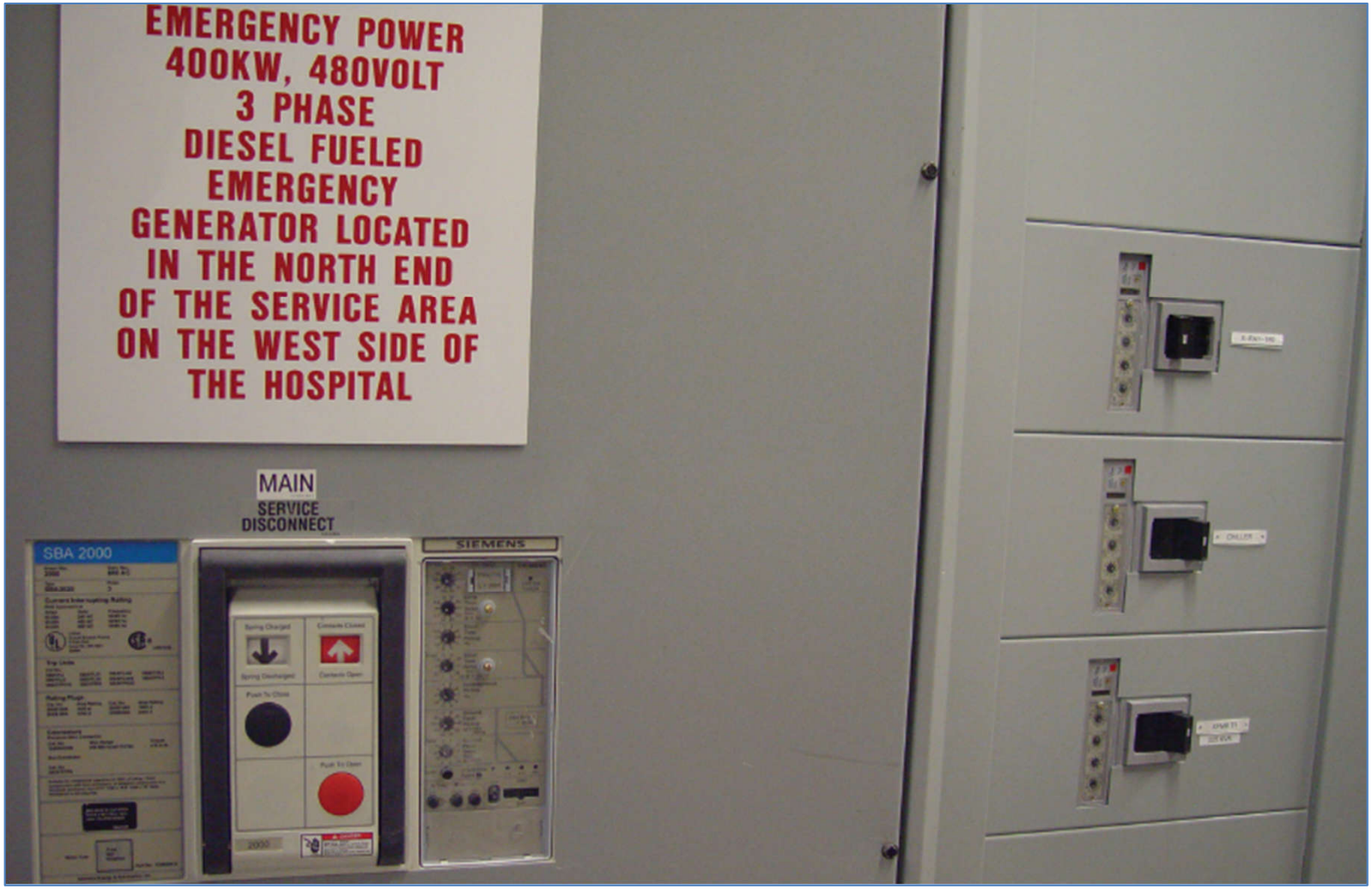
705.10

NEW



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Courtesy of Michael J. Johnston

705.11

REVISION

Source Connections to a Service

Change Summary

- The title of 705.11 was revised to make it clear that it refers to any connection of an interconnected source to a service.
- The requirements for service conductors were moved to 705.11(B).
- The former 705.11(D) was relocated to (C) and was completely rewritten.
- The new 705.11(E) was added to provide requirements for bonding and grounding.

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705.11

REVISION

Courtesy of the National Renewable Energy Laboratory

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705.12

REVISION

Load-Side Source Connections

Change Summary

- The first paragraph was revised for clarity by deleting unnecessary words.
- 705.12(A) was deleted because disconnecting requirements are covered in 705.20 and overcurrent protection is covered in 705.30.
- Requirements were revised for ampere ratings of busbars for connection to distribution equipment with no specific listing and instructions for combining multiple loads.

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705.12

REVISION

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705.20

NEW

Source Disconnecting Means

Change Summary

- Section 705.20 provides requirements for disconnecting means for interconnected electric power production sources.
- Most articles that cover power sources also include disconnecting means requirements.
- If an installation complies with 705.20, a single disconnecting means is permitted to disconnect multiple sources.

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705.20

NEW

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705.80 through 705.82

NEW

Interconnected Systems Operating in Island Mode

Change Summary

- A new Part III has been added to provide requirements for operating an interconnected electric power production source in island mode.
- The three categories of operation are automatic load management, manual load management, and no-load management.
- Operation in island mode requires voltage and frequency to be controlled within limits.

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705.80 through 705.82

NEW

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706.1 & 706.8

REVISION

Scope

Change Summary

- Informational Note No. 1 points out that Article 480 covers installation of stationary-standby batteries.
- Other battery applications that are not stationary standby batteries are covered by Article 706.
- *NFPA 1* and *NFPA 855* were added to the list of reference standards because some battery chemistries require special fire protection precautions.

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706.1 & 706.8

REVISION

Courtesy of Tesla Energy

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706.7

REVISION

Commissioning and Maintenance

Change Summary

- Section 706.7 has been expanded to require that energy storage systems be commissioned before being placed into service.
- This does not apply to ESS installations in one- and two-family dwellings.
- An informational note was added to point to *NFPA 855* for information on commissioning of energy storage systems.

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706.7

REVISION

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Courtesy of Michael J. Johnston

706.15

REVISION

Disconnecting Means

Change Summary

- Requirements for disconnecting means for energy storage systems have been expanded.
- For one- and two-family dwellings, an emergency shutdown function must cease export of power from the ESS to the premises wiring of other systems.
- New requirements have been added for disconnecting means for batteries where the battery is separate from the ESS electronics and is subject to field servicing.

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706.15

REVISION

Courtesy of Tesla Energy

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Article 722

NEW

Cables for Power-Limited Circuits

Change Summary

- A new Article 722 has been created to cover cable requirements for Class 2 and 3 power-limited circuits, power-limited fire alarm circuits, and Class 4 fault-managed power systems.
- Many of the installation requirements for these types of cables were repeated in Articles 725 and 760.
- Part I provides general requirements for power-limited circuit conductors and cables.
- Part II covers listing requirements for conductors and cables.
- The requirements for Class 4 circuits are new for this cycle.

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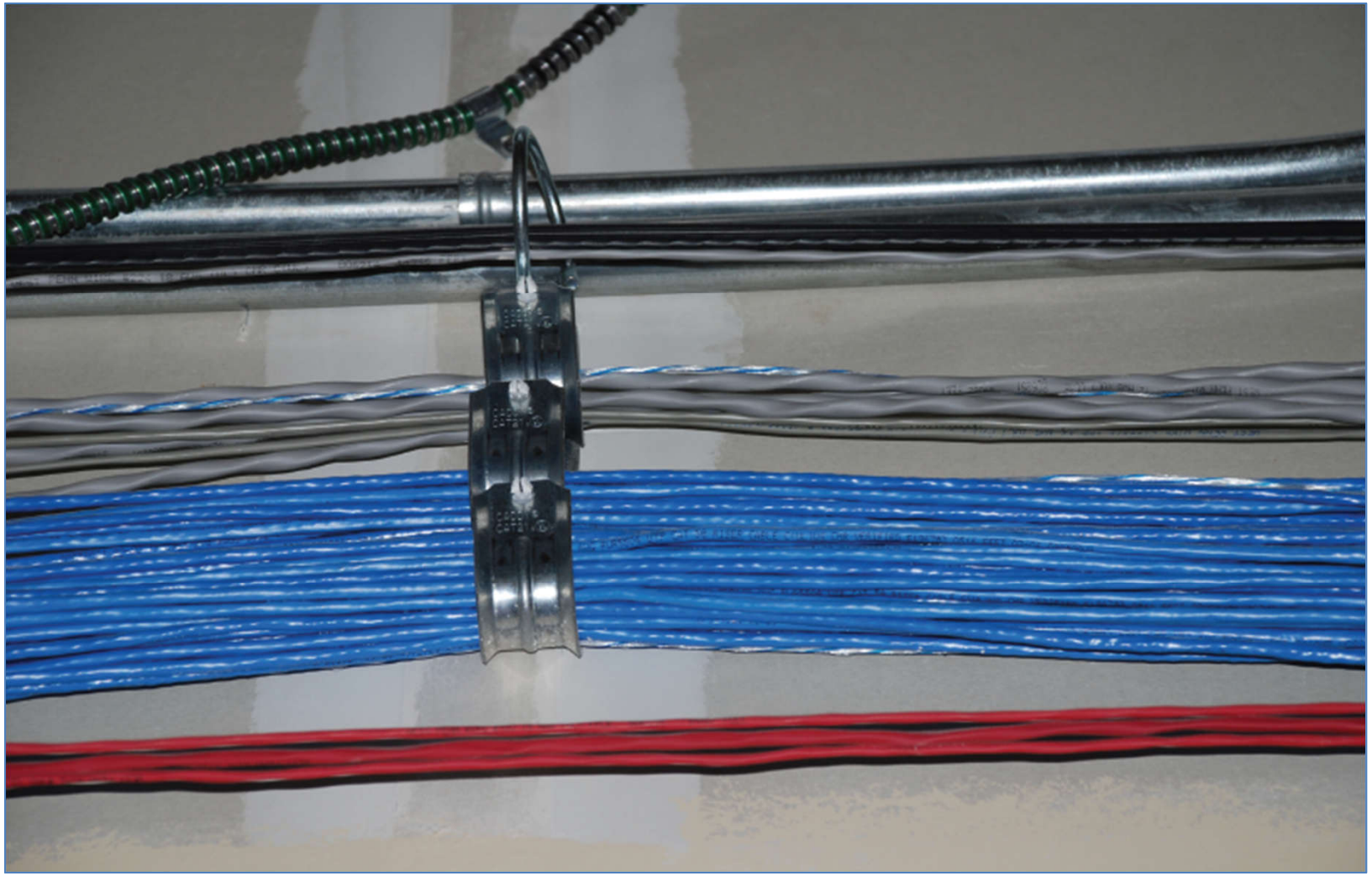
Article 722

NEW



Courtesy of Michael J. Johnston

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722.10

NEW

Hazardous (Classified) Locations

Change Summary

- Class 4 cables are permitted in hazardous (classified) locations where specifically permitted in the applicable article elsewhere in the *Code*.
- Similar language permitting wiring and applicable equipment has also been added to 725.10, 726.10, and 760.10 to provide a consistent approach in each of these articles.
- All of these sections have been rewritten into positive language by the *NEC* Correlating Committee.

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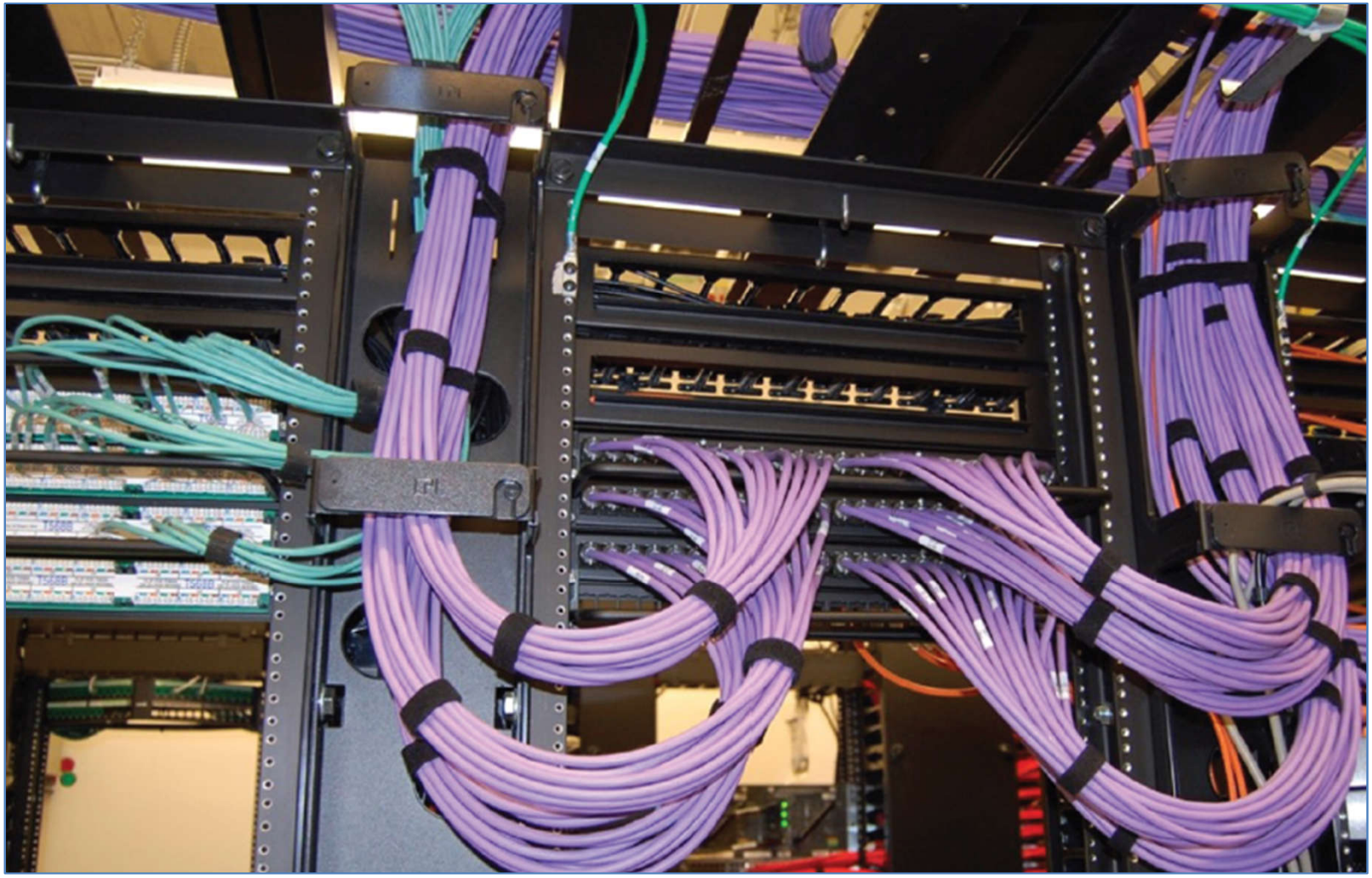
722.10

NEW



Courtesy of Cisco

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Article 724

NEW

Class 1 Power-Limited Circuits

Change Summary

- Class 1 circuit requirements have been moved from Article 725 to the new Article 724.
- Class 1 circuits are now limited to not more than 30 volts and 1,000 volt-amperes.
- The remote control and signaling circuits that are not power-limited are no longer considered to be Class 1 circuits. They are now covered by the first four chapters of the *Code*.

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Article 724

NEW

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Article 725

NEW

Class 2 and 3 Power-Limited Circuits

Change Summary

- Requirements for Class 1 circuits have been removed from Article 725, which now only applies to Class 2 and 3 power-limited remote control and signaling circuits.
- General requirements for wiring of Class 2 and 3 circuits have been relocated to new Article 722, Cables for Power-Limited Circuits.
- The relocated material includes substitution tables, abandoned cables, mechanical execution of work, and other requirements that are common to Articles 725, 760, and 770.

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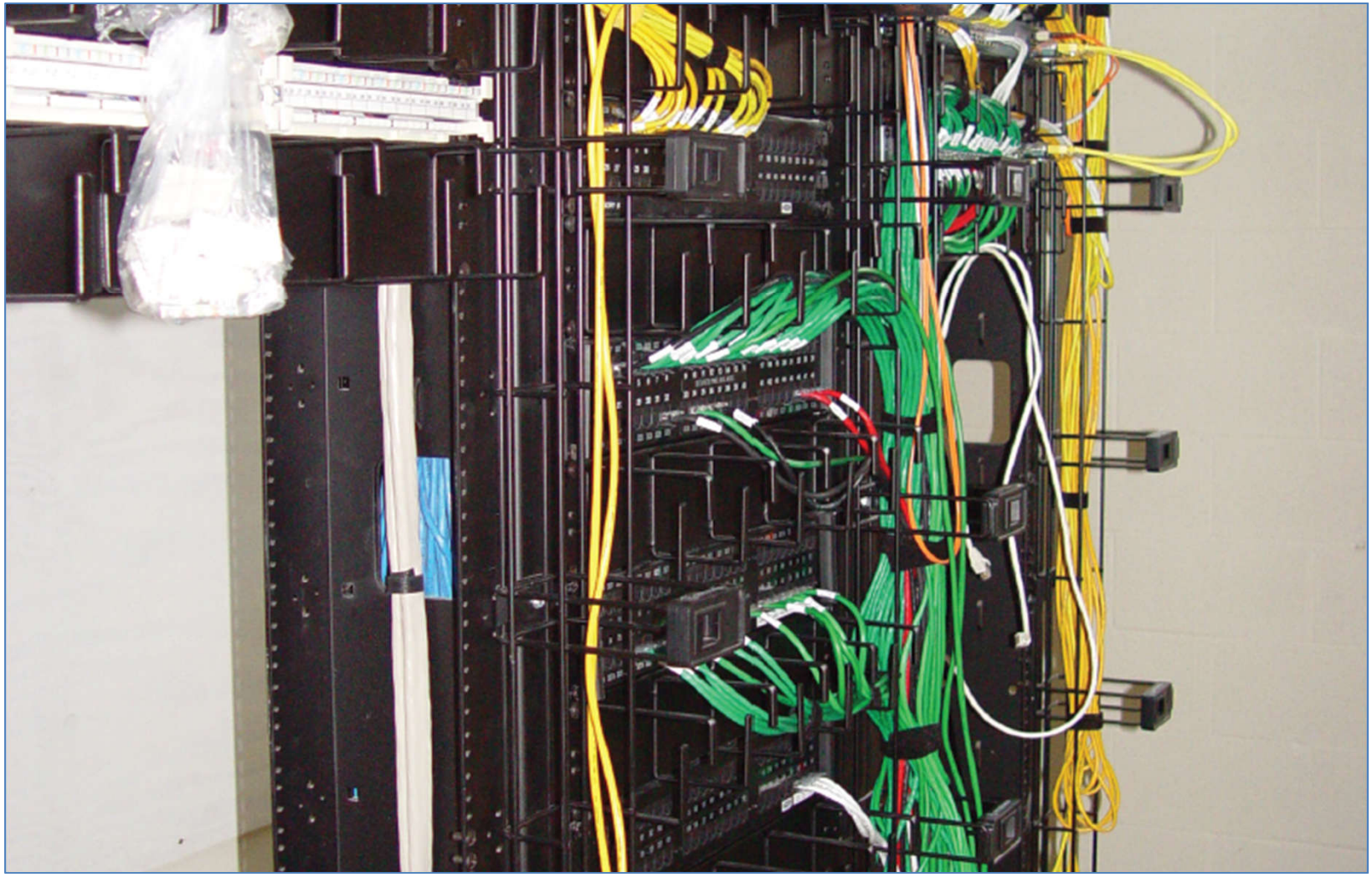
Article 725

NEW



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725.31

REVISION

Safety-Control Equipment

Change Summary

- If damage to Class 2 and 3 power-limited safety-control equipment can result in a direct fire or life safety hazard, the power-limited circuit must be installed in accordance with 724.31.
- Such circuits are no longer permitted to be reclassified as Class 1, but are required to be installed using Class 1 wiring methods.
- Reclassifying the wiring as Class 1 would require recertification of the source and load equipment as Class 1 equipment.

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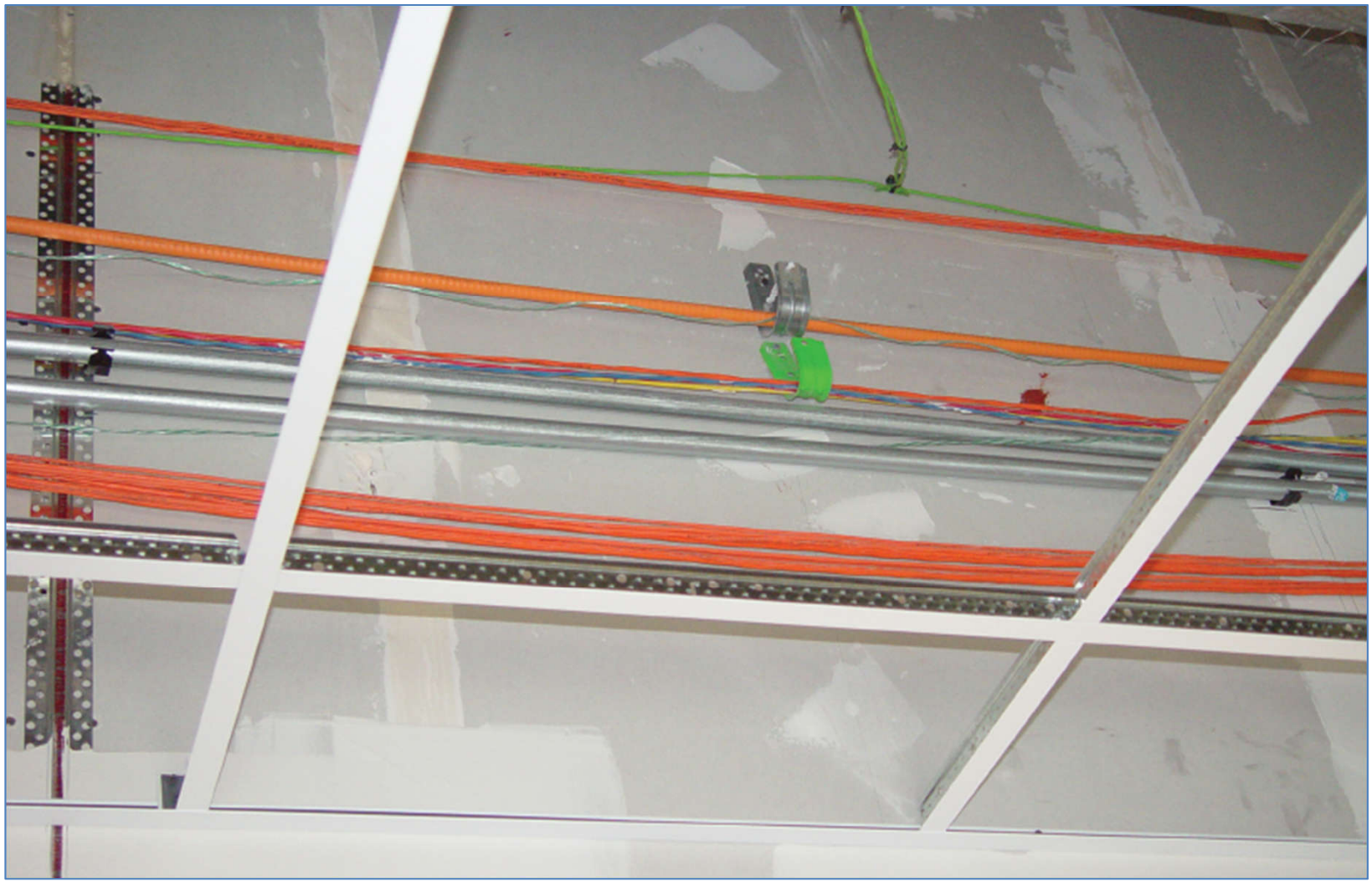
725.31

REVISION



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Article 726

NEW

Class 4 Power Systems

Change Summary

- A new Article 726, Class 4 Power-Limited Circuits, has been created to provide requirements for fault-managed power systems.
- Fault-managed power systems monitor the circuit for faults and control power delivery to ensure that fault energy is limited.
- Class 4 circuits can have a peak output voltage of 450 volts dc line-to-line or 225 volts line-to-ground.

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Article 726

NEW

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Courtesy of Michael J. Johnston

Article 750

REVISION

Energy Management Systems

Change Summary

- Energy management systems are required to be listed.
- Three options are provided for listing, including a complete listed system, a field installation kit, or listed components assembled as a system.
- 750.30(C) was expanded to provide requirements for current set point, system malfunction, settings, and marking requirements.

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Article 750

REVISION

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760.24

REVISION

Mechanical Execution of Work

Change Summary

- Fire alarm circuit cables and conductors must be supported by hardware, including straps, hangers, and cable ties, that are listed and identified for securement and support.
- This correlates with requirements in 320.30, 330.30, 334.30, and 337.30, which all require mounting hardware that is listed for securement and support.
- A similar requirement in 722.24 covers Class 2, 3, and 4 wiring.

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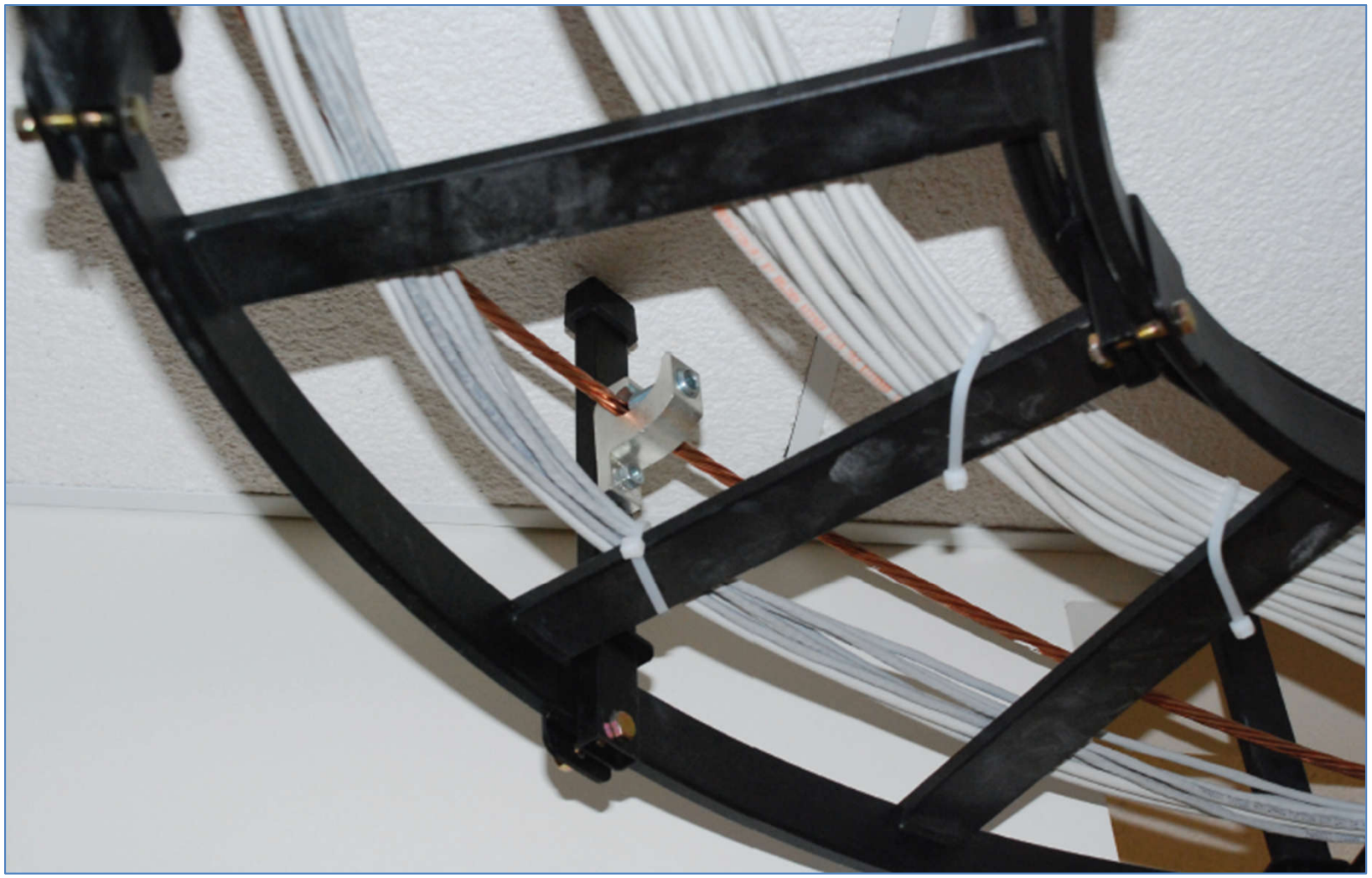
760.24

REVISION



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Significant Changes

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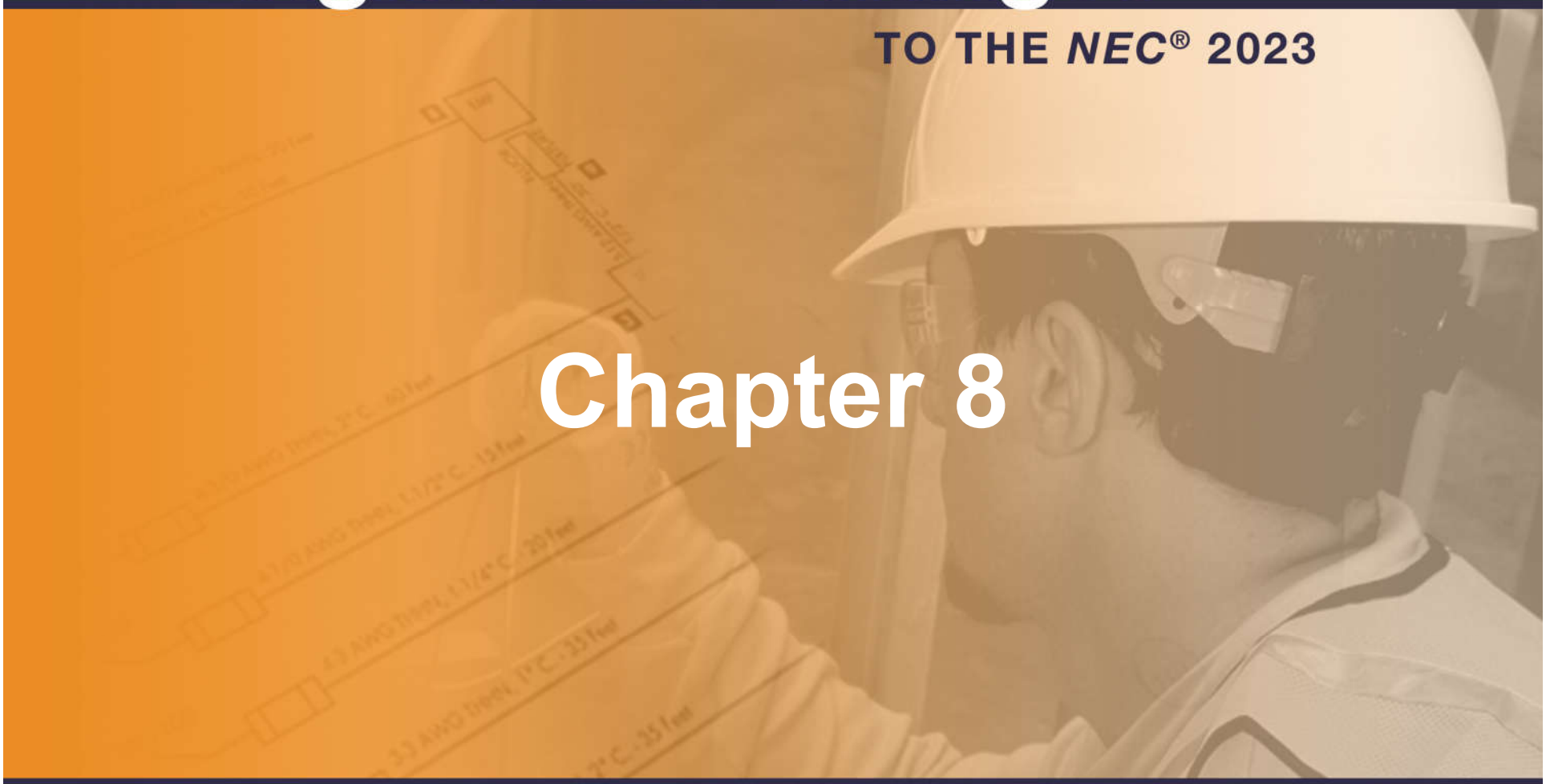

Chapter 8

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Article 800

REVISION

General Requirements for Communications Systems

Change Summary

- During the 2020 cycle, communications circuit requirements were moved from Article 800 to Article 805.
- A new Article 800, General Requirements for Communications Circuits, was created as a location for the Chapter 8 articles.
- The task was incomplete in the 2020 cycle. This cycle, several additional sections have been moved into Article 800.

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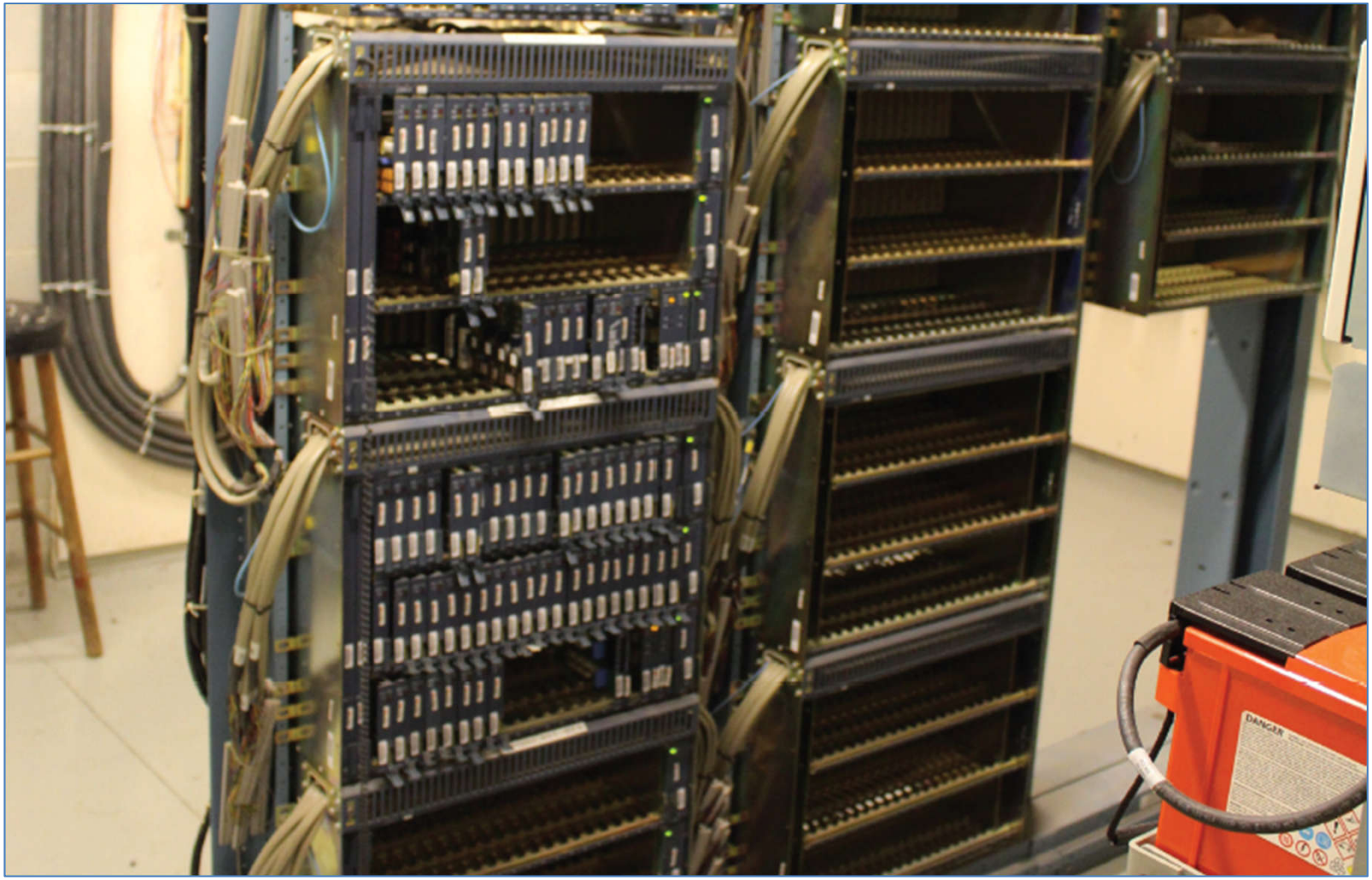
Article 800

REVISION



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Article 810

REVISION

Antenna Systems

Change Summary

- The title of Article 810 has been changed from “Radio and Television Equipment” to “Antenna Systems.”
- Most radio receiving equipment covered by Article 810 is cord- and plug connected to branch-circuit wiring.
- This article covers all radio receiving equipment.
- The only radio transmitting equipment covered by Article 810 is transmitters used for amateur radio and citizens band radio.

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Article 810

REVISION

Courtesy of David Nelson, WV1H

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