Board of Building Standards

EDUCATION COMMITTEE MEETING
AGENDA (REVISED SEPTEMBER 15, 2021)

DATE: SEPTEMBER 16, 2021
TIME: 10:00 AM
LOCATION: 6606 TUSSING ROAD TRAINING ROOM 3, REYNOLDSBURG

Call to Order

Consent Agenda

Course Applications

ER-1 Fire Door Systems for Vertical Opening Separations (McKeon Door - OBOA/ODPCA Conference)
All Certifications (2 hours)
Staff Notes: Slides are chapter 3 and the appendix of the attached book. At course provider's request, reviewed again: course is based on 2018 IBC, with mentions of changes in the 2021 IBC. Recommend approval.
Committee Recommendation:

ER-2 Fire Door Systems for Elevator Lobbies (McKeon Door - OBOA/ODPCA Conference)
All Certifications (2 hours)
Staff Notes: Slides are chapters 1 and 2 and the appendix of the attached book. At course provider's request, reviewed again: course is based on 2018 IBC, with mentions of changes in the 2021 IBC. Recommend approval.
Committee Recommendation:

ER-3 2018 IBC Fire and Life Safety Principles (International Code Council)
All certifications except ESI (4 hours)
Staff Notes: Recommend approval
Committee Recommendation:

ER-4 2018 IBC Significant Changes (International Code Council)
All certifications except ESI (6 hours)
Staff Notes: Recommend approval.
Committee Recommendation:

ER-5 2018 IPC, IMC, IFGC Significant Changes (International Code Council)
All certifications except ESI (6 hours)
Staff Notes: Recommend approval.
Committee Recommendation:

ER-6 Grounding and Bonding Electrical Services (Ohio Certificate Renewal)
ESI, BO, MPE, BPE, EPE, BI, FPI, NRIUI, RBO, RPE, RBI, RIUI (4 hours)
Staff Notes: Recommend approval with usual required language.
ESIAC Recommendation: Recommend approval.
Committee Recommendation:

ER-7 NEC Round Table (Greater Cincinnati Electrical Association)
ESI, BO, EPE, RBO, RPE (4 hours)
Staff Notes: These monthly round table meetings were approved for 2020, when they focused on the 2017 NEC. They now include the 2020 NEC as well. Recommend approval with usual required language.
ESIAC Recommendation: Recommend approval.
Committee Recommendation:

ER-8 Sill Plate Anchorage Solutions for Wood-Frame Construction (Simpson Strong-Tie - OBOA-ODPCA Conference)
BI, MPE, MI, RBO, RPE, RBI (1 hour)
Staff Notes: Recommend approval
Committee Recommendation:

ER-9 Understanding the UL Fire Resistance Online Directories (National Gypsum - OBOA-ODPCA Conference)
BO, MPE, BPE, BI, FPI, MI, PI, NRIUI, RBO, RPE, RBI, EMI, RIUI (2 hours)
Staff Notes: Denied August 20 because based on Gypsum Association's GA 600 2021, whereas Ohio is on the 2015 edition. The sponsor has submitted new slides citing the 2015 edition only. Recommend approval.
Committee Recommendation:

ER-10 Voltage Drop Prevention (Ohio Certificate Renewal)
ESI, BO, MPE, BPE, EPE, BI, FPI, NRIUI, RBO, RPE, RBI, RIUI (4 hours)
Staff Notes: 2020 NEC. Recommend approval with usual required language added.
ESIAC Recommendation: Recommend approval.
Committee Recommendation:

ER-11 Ventilation Best Practices (Owens Corning)
All certifications except ESI (1 hour)
Staff Notes: Received 4:15 pm Tuesday: Recommend tabling for technical review.
Committee Recommendation:

Old Business

New Business

Adjourn

File Attachments for Item:

ER-1 Fire Door Systems for Vertical Opening Separations (McKeon Door - OBOA/ODPCA Conference)

All Certifications (2 hours)

Staff Notes: Slides are chapter 3 and the appendix of the attached book. At course provider's request, reviewed again: course is based on 2018 IBC, with mentions of changes in the 2021 IBC. Recommend approval.

Committee Recommendation:

Vertical Opening Protection, 2 hours, *BBS 2021-XXX*, McKeon Door, David Dodge

a. *(Certifications; BI, BO, BPE, EPE, ESI, FPI, FPPE, LPE, MPE, MI, MechPE, NRIU, PI, PPE, RBI, RBO, REPE, RIUI, RMI, RPE, RPI, application for course will be submitted by McKeon to OBBS)*
b. Outline; Course will provide building code information (updated to 2018 IBC) Perhaps the most challenging aspect of building design for both the design team and the regulatory official is that of vertical spaces in structures. These include Atriums, Interior Exit Stairways, Exit Access stairways, Escalator Openings & Draft Curtains, 2-story Openings and NFPA 101 regulated Convenience Openings and Communicating Spaces. This 2-hour session will discuss the often mis-understood principles that guide their design and approval.

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

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

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

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

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

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

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

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

APPLICATION

FOR

Continuing Education Course Approval

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

Board of Building Standards
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COURSE SUBMITTER:

Course Submitter: David Dodge
(Contact Name)

Organization: McKeon Door Company
(Organization/Company)

Address: 44 Sawgrass Drive,
(Include Room Number, Suite, etc.)

City: Bellport State: NY Zip: 11713

E-Mail: ddodge@mckeondoor.com

Telephone: 801-471-7210 Fax:

Course Sponsor: McKeon Door

COURSE INFORMATION:

Course Title: Fire Door Systems for Vertical Opening Separations (Atriums &, exit stairs), and Corridor Separation for healthcare

New Course Submittal: ■ Update Course: ■ Prior Approval Number: BBS2017-138

Purpose and Objective: Provide building code information (updated to the 2018 IBC) on fire doors and their role in vertical shafts such as Atriums, Exit stairways, escalator vertical openings, and draft curtains. Provide information on fire rated doors utilized in health care corridors.

NOTE: We are simply splitting the original approved course into two 2-hour courses. Please see attached pdf workbook that each attendee will receive as party of the course materials.

The PPT slides for this course duplicate the textbook as found Chapter 3 and the Appendix pages.

Number of Instructional Contact Hours that can be obtained upon completion: (2) hour

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

Program Applicable for the Following Participants:

Building Official ■ Master Plans Examiner ■ Building Inspector ■ Fire Protection Inspector ■ Mechanical Inspector ■

Building Plans Exam. ✔
Plumbing Plans Exam. ■
Electrical Plans Exam. ■
Mechanical Plans Exam. ■
Fire Protect. Plans Exam. ✔

Plumbing Inspector ■
Non-Res IU Inspector ■

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

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

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

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

David L. Dodge, CSI, CDT

VICE PRESIDENT, BUSINESS AND CODE DEVELOPMENT

David has been involved in the construction industry since 1975. With an extensive background in project estimating and management and a bachelor's degree in business management, David soon realized a great deal of success in building product marketing and sales. Within this venue he found his passion – building code development and architectural design compliance. Since 1988, he has assisted architectural firms in understanding and implementing the provisions of the model codes as they pertain to fire and life safety. His particular focus is on the fire door industry, promoting cutting edge technology to resolve code compliance challenges.

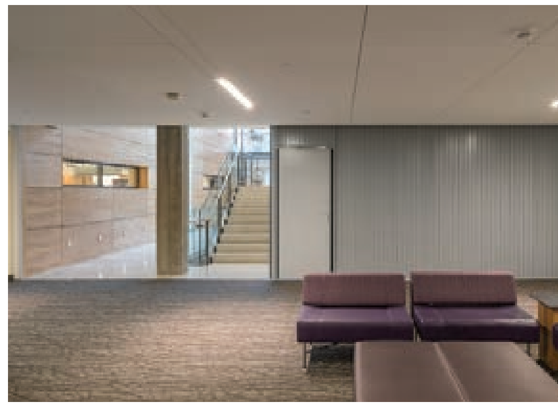
David is a corporate member of the International Code Council (ICC) and earned his Construction Document Technologist (CDT) from the Construction Specifications Institute. He has served on several ICC committees, both local, regional and national, for the adoption and implementation of the International Building Code throughout the US. He is a recognized speaker and instructor, teaching the fire and life safety provisions of the model codes to design professionals and regulatory officials. David is a certified CEU instructor under the ICC Education Provider program. As part of the McKeon Door Company team David draws on his 30-plus years of experience in the building code arena when assisting design professionals and product representatives with code and design compliance challenges.

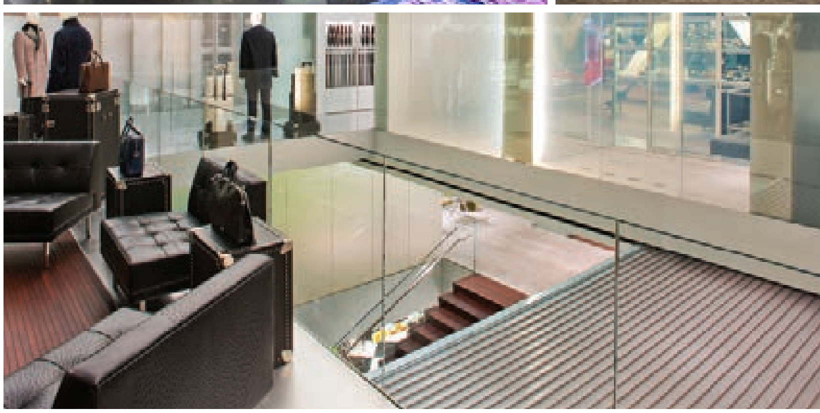
REV. 6/19

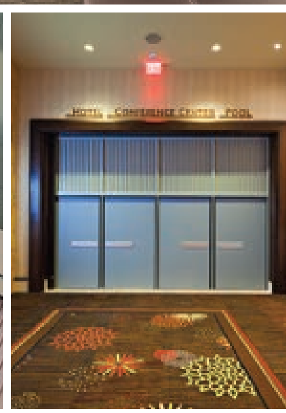
Updated! Based on the 2018 Edition of the IBC

Fire Door Systems

A Guide to Code Compliance







Fire Door Systems

A Guide to Code Compliance

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info@mckeondoor.com • www.mckeondoor.com

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12th Edition - June 2019

Introduction

THIS EDITION of *Fire Door Systems, A Guide to Code Compliance* is based on the 2018 IBC with inserts from the "Group A" portion of the 2021 IBC code development cycle. The insertions reflect code changes that have been approved by the voting membership in both the general sessions and the subsequent on-line voting forum, and will be published in the next printing of the IBC.

THE INTERNATIONAL BUILDING CODE has been widely accepted in the United States and is recognized as a uniform code addressing the design and installation of building systems with performance-based requirements. The current International Building Code has been developed over the last two decades through the extensive work and efforts of code enforcement personnel organized at both local and national levels under the direction of the International Code Council. A vital part of the development of the building code is the involvement of industry and nationally recognized organizations with interests in building product development and the protection of public health, safety and welfare.

McKEON develops and manufactures numerous fire and smoke rated assemblies that function as wide-span opening protectives. These building products enter the marketplace specifically to assist design professionals and code enforcement personnel in satisfying open design without compromising fire and life safety requirements. This document is formatted to present the building code as it pertains to the use of opening protectives; first, recite specific prescriptive code requirements, second, performance-based language in laymen's terms for common sense understanding, and third, illustrate product case studies presented as design solutions to frequently approached complex code application challenges. The building code interpretations found herein represent the opinion and experience of the preparer, intended only to assist the reader in recognizing and understanding the potential use and application of McKEON fire and smoke rated opening protective assembly products.

1 Elevator Separation

Elevator Lobbies & Hoistway Protection

Elevator Smoke & Draft

Elevator Lobbies & Hoistway Protection

Section 3006

Hoistway protection is designed to isolate fire, smoke, heat and toxic gases or fumes from migrating floor to floor through vertical hoistways in multi-story structures. There are two fundamental methods prescribed in this code section – elevator lobbies or protection at the point of access to the elevator car.

Fire & Life Safety Concerns

Elevator shafts are the most common inter-connecting vertical shafts in multi-story buildings. These shafts become conduits for fire, heat, smoke and other toxins between the fire floor(s) and additional floors.

Code Requirements

3006.1 General. Elevator hoistway openings and enclosed elevator lobbies shall be provided with the following:

1. Where hoistway opening protection is required by Section 3006.2, such protection shall be in accordance with Section 3006.3.
2. Where enclosed elevator lobbies are required for underground buildings, such lobbies shall comply with Section 405.4.3.
3. Where an area of refuge is required and an enclosed elevator lobby is provided to serve as an area of refuge, the enclosed elevator lobby shall comply with Section 1009.6.
4. Where fire service access elevators are provided, enclosed elevator lobbies shall comply with Section 3007.6.
5. Where occupant evacuation elevators are provided, enclosed elevator lobbies shall comply with Section 3008.6.

3006.2 Hoistway opening protection required. Elevator hoistway door openings shall be protected in accordance with Section 3006.3 where an elevator hoistway connects more than three stories, is required to be enclosed within a shaft enclosure in accordance with Section 712.1.1 and any of the following conditions apply:

ELEVATOR SEPARATION

1. The building is not protected throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. The building contains a Group I-1 Condition 2 occupancy.
3. The building contains a Group I-2 occupancy.
4. The building contains a Group I-3 occupancy.
5. The building is a high rise and the elevator hoistway is more than 75 feet (22 860 mm) in height. The height of the hoistway shall be measured from the lowest floor to the highest floor of the floors served by the hoistway.

Exceptions:

1. Protection of elevator hoistway door openings is not required where the elevator serves only open parking garages in accordance with Section 406.5.
2. Protection of elevator hoistway door openings is not required at the level(s) of exit discharge, provided the level(s) of exit discharge is equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. Enclosed elevator lobbies and protection of elevator hoistway door openings are not required on levels where the elevator hoistway opens to the exterior.

3006.2.1 Rated Corridors. Where corridors are required to be fire-resistance rated in accordance with Section 1020.1, elevator hoistway openings shall be protected in accordance with Section 3006.3.

3006.3 Hoistway opening protection. Where Section 3006.2 requires protection of the elevator hoistway door opening, the protection shall be provided by one of the following:

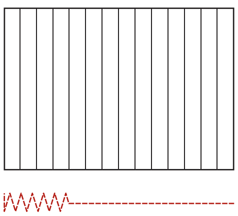
1. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway shaft enclosure doors from each floor by fire partitions in accordance with Section 708. In addition, doors protecting openings in the elevator lobby enclosure walls shall comply with Section 716.5.3 as required for corridor walls. Penetrations of the enclosed elevator lobby by ducts and air transfer openings shall be protected as required for corridors in accordance with Section 717.5.4.1.
2. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway shaft enclosure doors from each floor by smoke partitions in accordance with Section 710 where the building is equipped with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2. In addition, doors protecting openings in the smoke partitions shall comply with Sections 710.5.2.2, 710.5.2.3 and 716.5.9. Penetrations of the enclosed elevator lobby by ducts and air transfer openings shall be protected as required for corridors in accordance with Section 717.5.4.1. Note: Smoke partitions as defined in Section 710.3 are not required to be fire rated. The doors located in smoke partition walls referenced in Section 710.5.2.2 are required to be UL 1784 labeled as smoke & draft control assemblies.
3. Additional doors shall be provided at each elevator hoistway door opening in accordance with Section 3002.6. Such door shall comply with the smoke and draft control door assembly requirements in Section 716.5.3.1 when tested in accordance with UL 1784 without an artificial bottom seal.
4. The elevator hoistway shall be pressurized in accordance with Section 909.21.

3006.4 Means of egress. Elevator lobbies shall be provided with at least one means of egress complying with Chapter 10 and other provisions in this code. Egress through an elevator lobby shall be permitted in accordance with Item 1 of Section 1016.2.

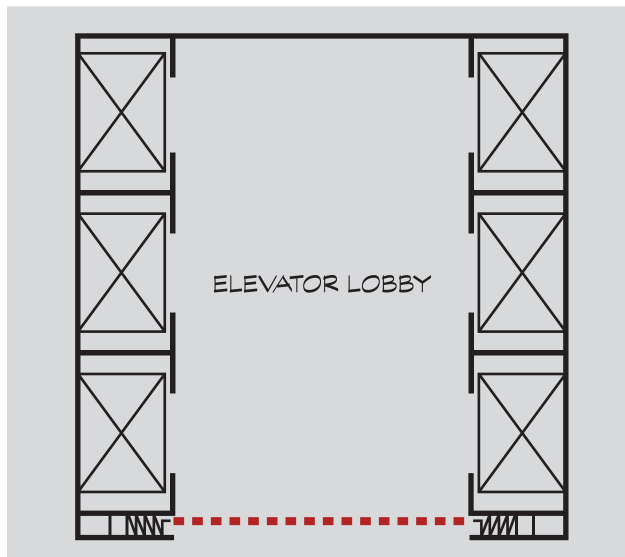
Design Solutions

A diverse line-up of McKEON door assemblies can easily accommodate wide-span openings, radius applications, and egress.

CASE 1: Side Acting Accordion with Power-assisted Egress

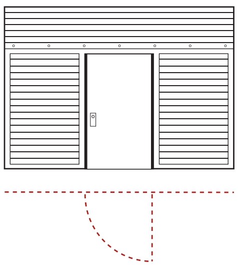


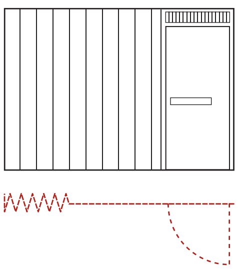
In the first case study, there is no headroom and side stacking space is limited. The McKEON bi-parting accordion fire door technology stepped up to meet the demand of hi-end design without compromising specific code requirements including conforming side acting accordion fire door egress acceptance.



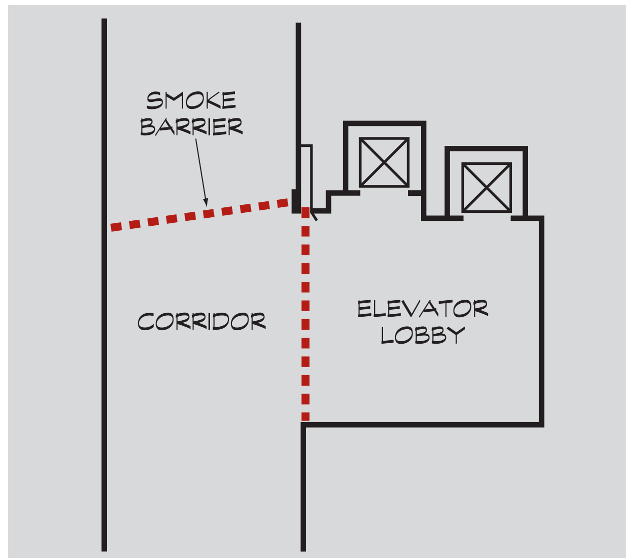
ELEVATOR SEPARATION

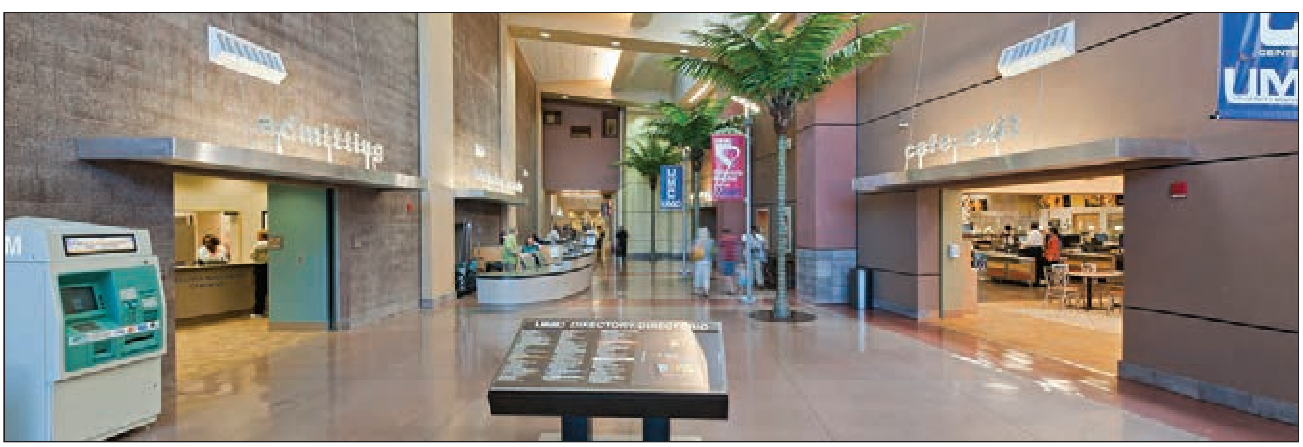
CASE 2: Side Acting Accordion with Complying Swing Egress Door & Vertical Acting with Complying Swing Egress Door(s)



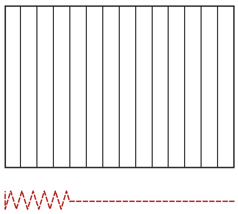


This case study includes both a side acting accordion with conventional egress elevator lobby separation and a vertical acting with conventional egress smoke barrier opening protective.

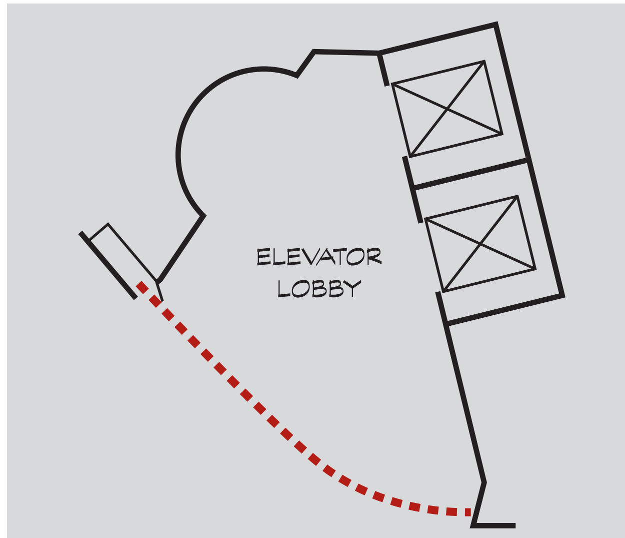


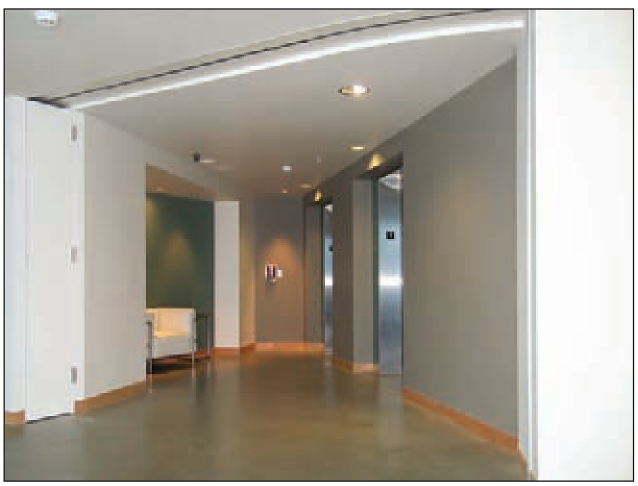


CASE 3: Side Acting Accordion with Power-assisted Egress



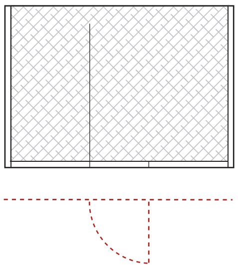
The side acting accordion technology will accommodate custom radius applications as well as serve as the primary means of egress from the space.



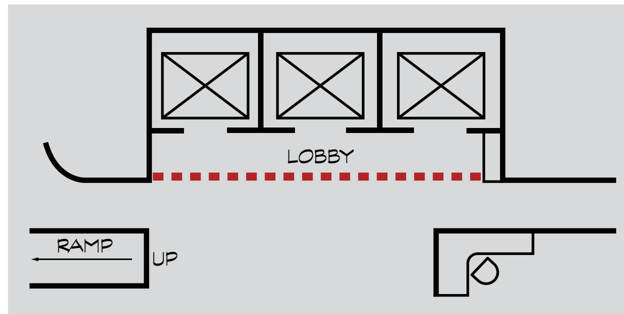


ELEVATOR SEPARATION

CASE 4: Vertical Acting with Multiple Complying Swing Egress Doors

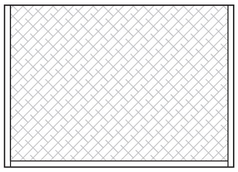


This project introduces the use of fire protective curtain assemblies that have been approved in accordance with the current editions of the model buildings codes (see IBC Section 3006.3, Item #2. Specific reference to this technology is now approved as opening protectives without hose stream performance [UL 10D 20-minute fire rated] for publication in the 2021 edition of the IBC [See Appendix, Resource IBC 2021]).

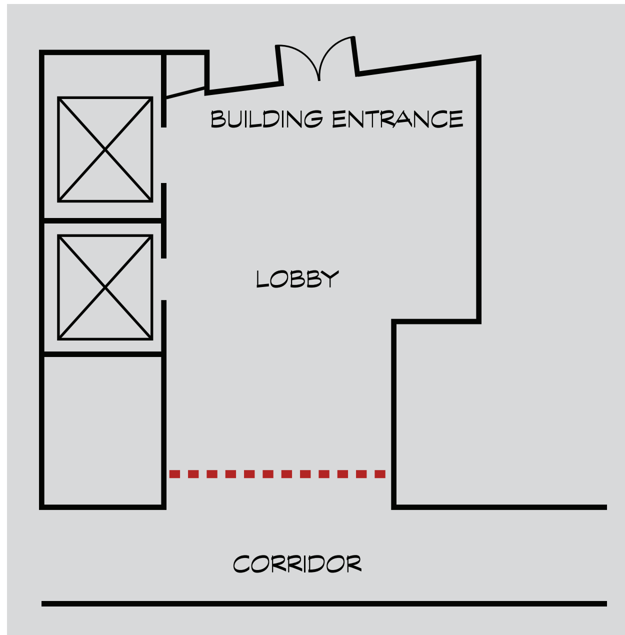


ELEVATOR SEPARATION

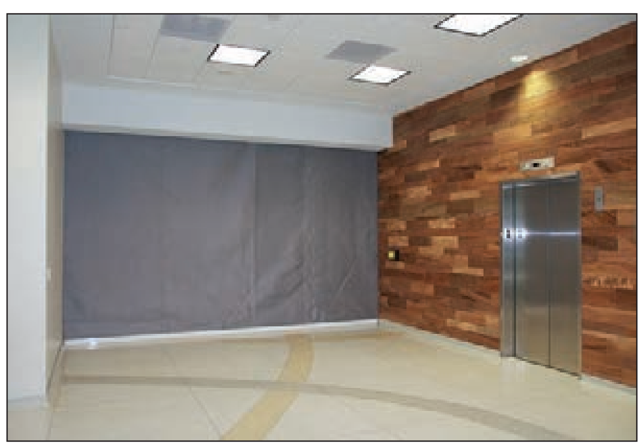
CASE 5: Vertical Acting without Egress



For the same reasons of acceptance explained in CASE 4, Fire Protective Curtain Assemblies satisfied two code compliance challenges in this design. Even though an elevator lobby is not necessarily required on the level of exit discharge in a sprinklered building, this separation takes on the form of a lobby since it protects the remaining structure from the vertical features of the building. Egress is not required though the fire protective curtain due to exiting out of the lobby or separated space through the main entrance.



Specific reference to this technology is now approved as opening protectives without hose stream performance (UL 10D 20-minute fire rated) for publication in the 2021 edition of the IBC (See Appendix, Resource IBC 2021).



Inquiry Discussion & Questions

There has been much discussion in the regulatory arena about the purpose and usefulness of the elevator lobby. It can be argued the lobby is a dual application fire and life safety component of the structure, a barrier against smoke migration in and out of the vertical shaft as well as an area of refuge for building occupants. These fundamental occupant safety features are tempered with sprinkler exceptions but consistently remain as salient provisions each code development cycle.

If there is a trend in preference it appears to be for more passive redundant protection surrounding the elevator shaft rather than less. For example, the code requirements outlined in this application study include several sprinkler exceptions that allow the elimination of the elevator lobby for normal-use passenger elevators in Section 3006. However, once the building goes into alarm, Section 3007 Fire Service Access Elevator and Section 3008 Occupant Evacuation Elevators do not allow the same exceptions. Not only are lobbies required in these two applications, with no exemptions, each lobby must be fully fire and smoke rated with prescribed physical size requirements. Interestingly, in a fire event the elevator often becomes an integral part of the means of egress system.

Elevator lobbies can be considered a viable choice based on three premises. Let's use the layout as diagrammed in Case Study #2 as an example. First, from a design ambiance perspective, it is cumbersome to provide independent separation at the point of each elevator car to simply eliminate the lobby. The space would certainly be interrupted at each elevator car opening. A single separation creating a full space lobby would have less impact on the overall design.

Secondly, a single separation opening protective is clearly less costly than multiple systems located at each car opening. The third and perhaps the most important consideration is fire and life safety. By creating a conforming full space lobby we stop smoke and heat from penetrating the shaft, and provide an area of refuge for building occupants. In other words, rather than provide closures at each individual point-of-access location to the elevator car, why not create an elevator lobby that is unobstrusive, costs less and will adequately serve as an area of refuge.

Elevator Smoke & Draft

Section 3006.3

Elevator car doors are typically fire-rated but cannot comply with smoke and draft requirements. Smoke & draft rated assemblies eliminate the passage of smoke and are usually located at the point of access to an elevator car as an alternative to the elevator lobby.

Fire & Life Safety Concerns

Elevator shafts commonly represent the majority of inter-connecting vertical shafts in multi-story buildings. These shafts become conduits for heat, smoke and other toxins between the fire floor(s) and additional floors. In buildings with more than three interconnected stories, the conventional elevator lobby is designed to stop the spread of fire and smoke before it reaches the elevator shaft enclosure doors. However, if the lobby is eliminated smoke could quickly penetrate the shaft at the point of access. Thus, all fire-rated assemblies used at the point of access must maintain a smoke and draft rating. *(UL 1784)*

Code Requirements

There are two primary provisions that drive the need for elevator protection in the IBC. First, Section 3006.2 requires protection where the elevator hoistway connects more than three stories and any of the following conditions apply:

1. The building is not protected throughout with sprinklers …
2. The building contains an I-1 Condition 2 occupancy
3. The building contains an I-2 occupancy
4. The building contains an I-3 occupancy
5. The building is a hi-rise … more than 75 feet

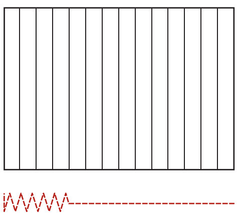
The second primary provision is found in Section 3006.2.1 requiring elevator hoistway protection when the corridors in the structure are fire-resistance rated.

ELEVATOR SEPARATION

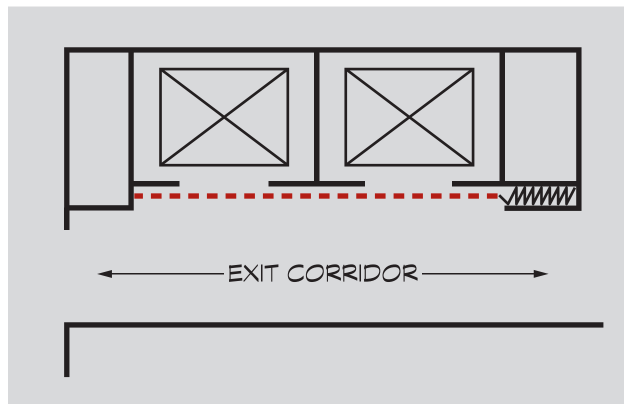
Section 3006.3, Item #3 allows the elimination of the lobby by placing a minimum UL 1784 (smoke) rated assembly at the point of access to the elevator hoistway door opening. Please note: All assemblies located at the point of access to an elevator car must be readily openable from the car side without a key, tool, special knowledge or effort. *(3002.6)*

Design Solutions

CASE 1: Side Acting Accordion with Power-assisted Egress

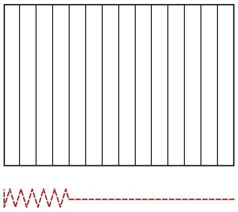


Due to the several configuration options of the McKEON door assemblies multiple or single elevator openings can easily be protected. Egress can be placed at each elevator car door opening to accommodate conforming exit requirements.

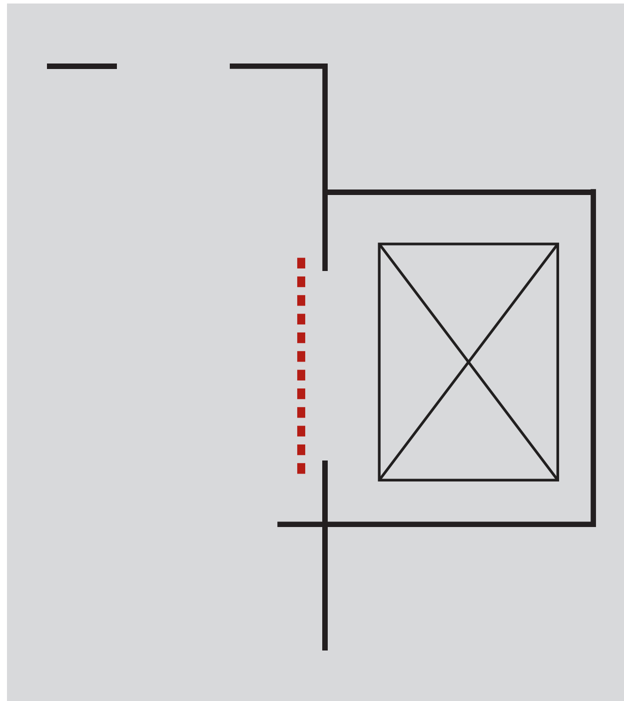


ELEVATOR SEPARATION

CASE 2: Side Acting Accordion with Manual Egress

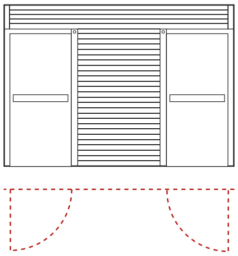


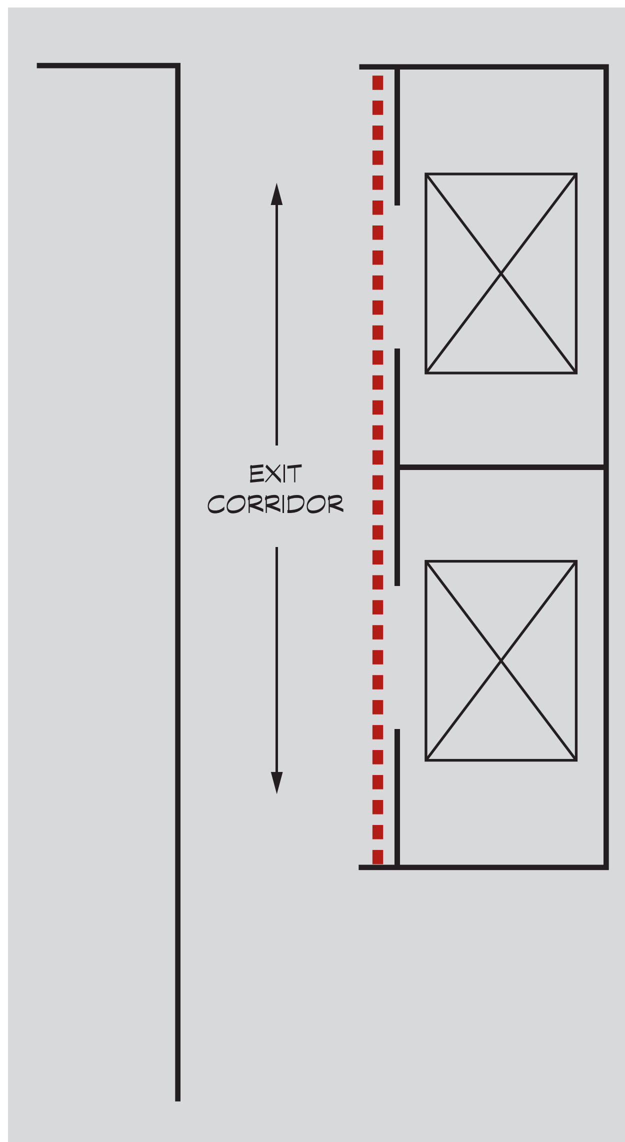
This simple, manually operated, bolt-up pre-fabricated unit can be installed at the point of access to any elevator car in a matter of hours. No pocket, stud or drywall construction is necessary. The door, held open by an electromagnet, is released at the command of a smoke detector and the fire and smoke rated assembly closes. Building occupants or first responders can pass through the opening as the door self-closes behind them.



ELEVATOR SEPARATION

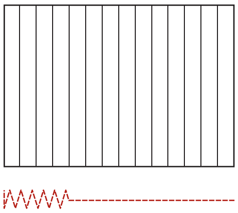
CASE 3: Vertical Coiling with Complying Swing Egress Door(s)



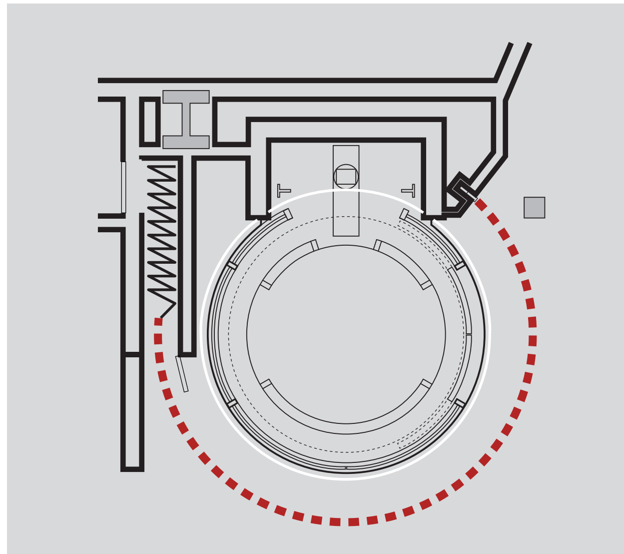


ELEVATOR SEPARATION

CASE 4: Side Acting Accordion with Power-assisted Egress

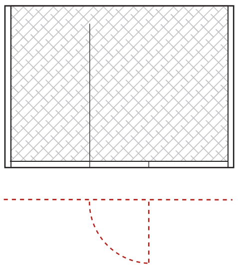


The single track 3-hour rated accordion will accommodate 18" radius to custom curves. Along with complying egress, McKEON resolved a very difficult challenge without life safety or design compromise.

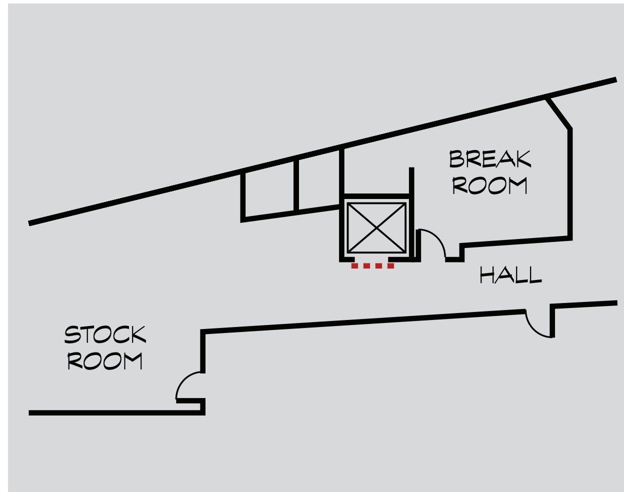


ELEVATOR SEPARATION

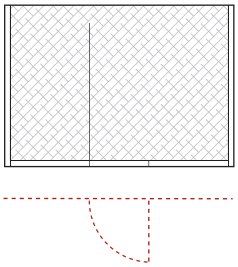
CASE 5: Vertical Acting with Egress



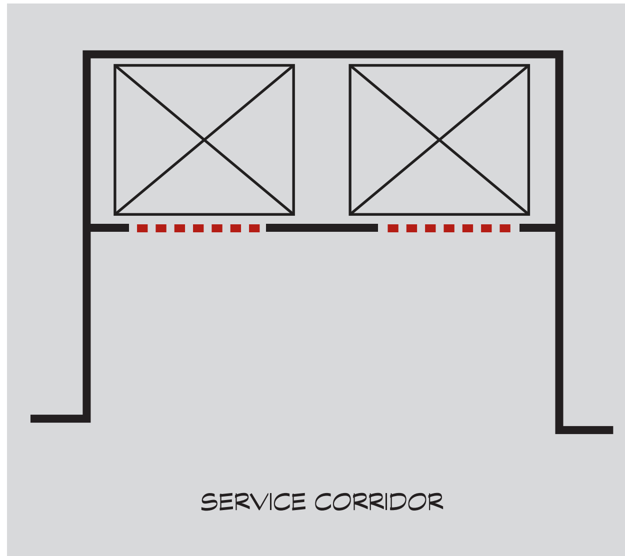
Typically, the elevator car or elevator shaft door is fire rated but does not carry a UL 1784 smoke rating. The SmokeFighter® D150E is a listed and labeled UL 1784 assembly with a complying egress feature. Located at the point of access to the elevator car, this assembly protects the opening mitigating smoke migration.

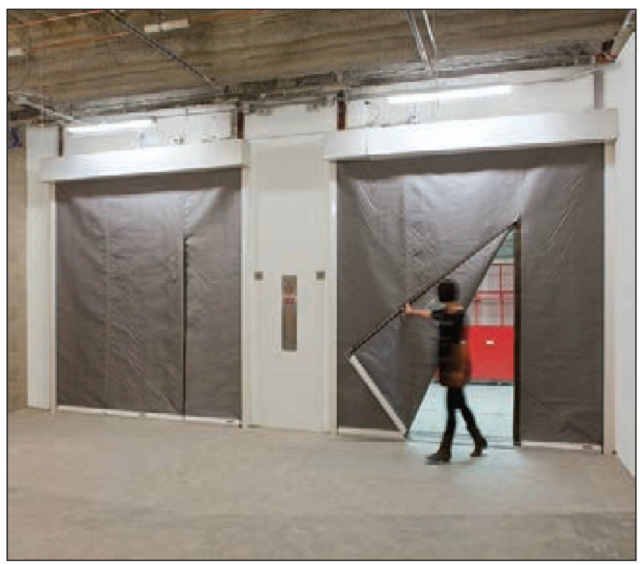


CASE 6: Vertical Acting with Egress



Similar to the previous case study, the elevator car or elevator shaft door is fire rated but does not carry a UL 1784 smoke rating. But on this project the design team elected to use the FireFighter® D200E which is listed and labeled as a 20-minute UL 10D & UL 1784 assembly with a complying egress feature. By applying the 20-minute fire-rated assembly in this design, McKEON provided redundancy in the fire-rated requirements. Located at the point of access to the elevator car, this assembly protects the opening mitigating smoke migration as well as fire and heat penetration.





ELEVATOR SEPARATION

Inquiry Discussion & Questions

Please consult the Inquiry Discussion & Question section of the Elevator Lobby case study.

Notes:

2 Exit Access Separation

Horizontal Exit

Exit Passageways

Pedestrian Walkways & Tunnels

Horizontal Exit

Section 1026

Horizontal exits are designed to move building occupants on a floor from any point in the exit access system to a fire and smoke protected area.

Fire & Life Safety Concerns

The horizontal exit differs fundamentally from the typical code-defined exit. The horizontal exit is meant to “defend in place” by creating an area of safe refuge for building occupants within the confines of the building structure. All other exits are designed to exit occupants out of and away from the building.

Code Requirements

Because building occupants are not being removed from the building when using the horizontal exit, specific precautionary requirements are based upon the following fundamental principles:

Principle #1: Separation. A 2-hour fire wall or fire barrier must be used to separate safe refuge areas connected with a horizontal exit *(Section 1026.2)*. The determination between the use of a wall, fire barrier or horizontal assembly is the function of the wall as it relates to other code requirements.

Principle #2: Opening Protective. The opening within the horizontal exit must be protected with a self-closing or automatic closing fire door when activated by a smoke detector. The fire rating of the door must be a minimum of 90 minutes. *(Section 1026.3)*

Principle #3: Area of Refuge Capacity. Based on a net floor allowance of 3 square feet for each person with the following guidelines:

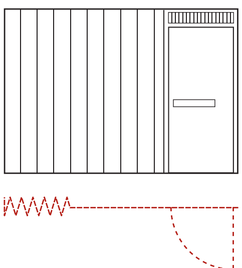
Where the horizontal exit also forms a smoke compartment, the capacity of the refuge area for Group I-1, I-2 and I-3 occupancies and Group B ambulatory care facilities shall comply with Section 407.5.3, 408.6.2, 420.6.1 and 422.3.2 as applicable.

Principle #4: Number of Exits. The refuge area into which a horizontal exit leads shall be provided with exits adequate to meet the occupant requirements of this chapter, but not including the added occupant load imposed by persons entering the refuge area through horizontal exits from other areas. Not less than one refuge area exit shall lead directly to the exterior or to an interior exit stairway or ramp.

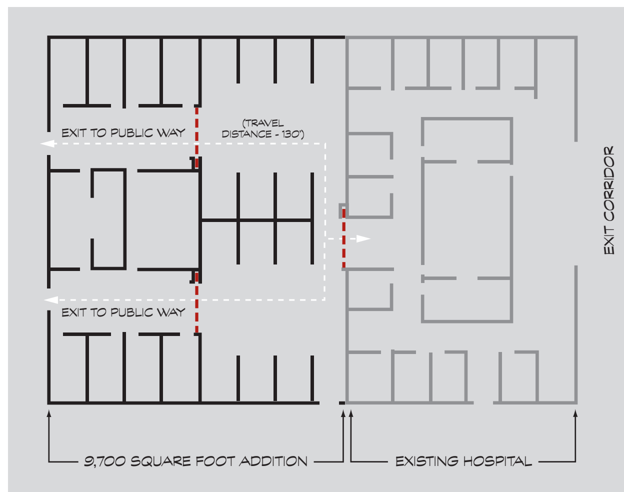
Exception: The adjoining compartment shall not be required to have a stairway or door leading directly outside, provided the area of refuge area into which a horizontal exit leads has stairways or doors leading directly outside and are so arranged that egress shall not require the occupants to return through the compartment from which egress originates.

Design Solutions

CASE 1: Side Acting Accordion with Complying Swing Egress Door



The intent is to add a 10,200 square foot critical care suite onto an existing I-2 (hospital). However code requirements come into play that affect the design dramatically:



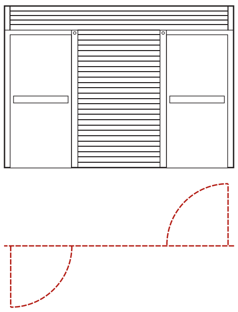
- First, suites of sleeping rooms cannot exceed 10,000 square feet in a sprinklered structure. In this case a 10,200 square foot suite is being added. *(407.4.3.5.1)*
- Second, there must be two exits from each suite. *(407.4.4.5.1)*
- Third, the travel distance between any point in a suite of sleeping rooms and an exit access exit door shall not exceed 125 feet with automatic smoke detection. *(407.4.4.3)*

By utilizing the horizontal exit concept, the following will preserve the original design intent and provide code compliance:

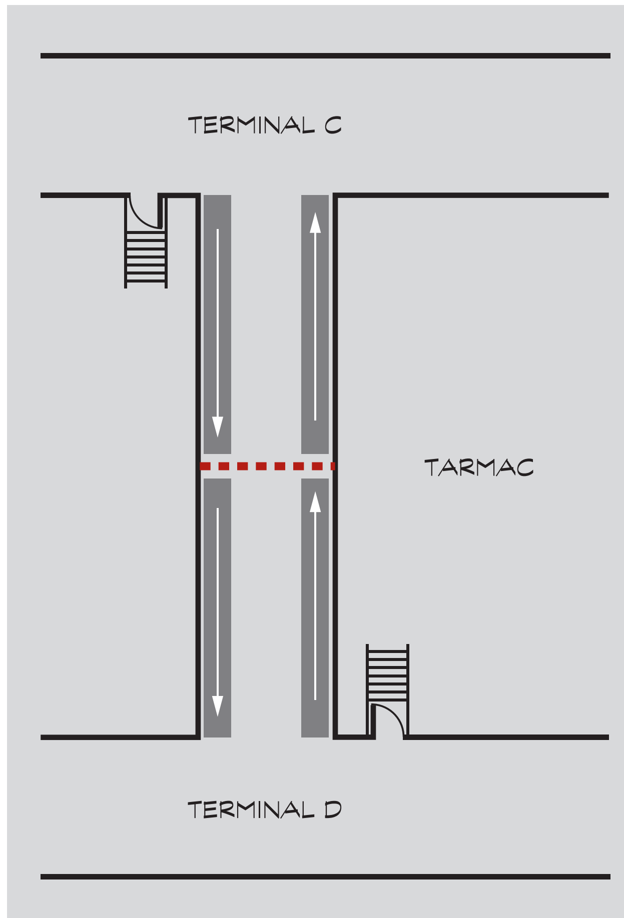
- Separate the intended 10,200 square foot space into two suites, each less than 10,000 square feet.
- Provide a 2-hour fire barrier wall as the separation. *(Section 1026.2)*
- Provide a horizontal exit in the separation as one of two required exits from each space. *(Section 407.4.4.5.2)*
- Provide a 90-minute opening protective. *(Table 716.5)*

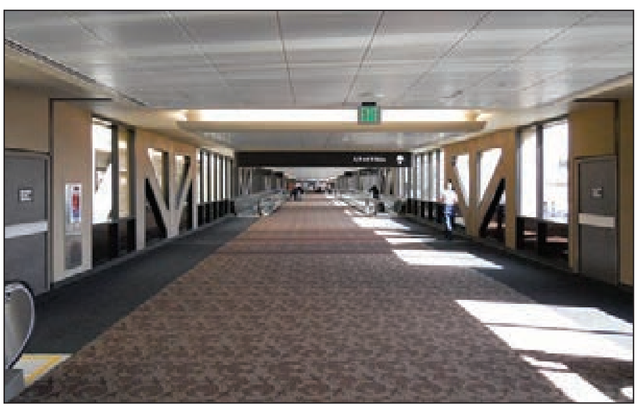
EXIT ACCESS SEPARATION

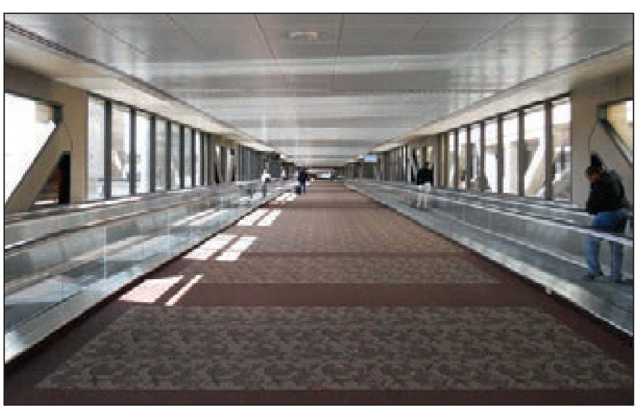
CASE 2: Vertical Coiling with Complying Swing Egress Door(s)

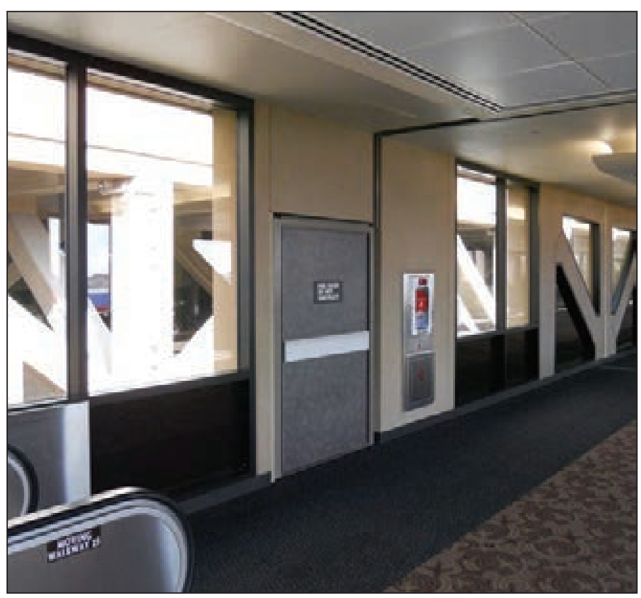


McKEON offers a particularly unique resolve for this airport design. Because the concourse is located above ground level and in a TSA secure area, it is not possible to provide exiting to the exterior. Also, there is not room for build-outs or pocket spaces, therefore unique to the T2500 technology a 90-minute opening protective is provided with no side room and as little as 26 inches of head-room with conforming dual egress doors. In essence each side of a long fire and smoke rated concourse forms one of two areas of refuge.









Inquiry Discussion and Questions

It has been said by many that the horizontal exit is probably one of the least understood and least utilized concepts of the building code. The following questions may be helpful in promoting awareness:

- Do you encounter travel distance problems in areas of the code other than the standard travel distance tables? (This case study for example.)
- When designing a horizontal exit, does the 2-hour wall inhibit the openness of the space under consideration?
- In health care or prison design may I show you how a required smoke barrier can also serve as a horizontal exit?

Notes:

Exit Passageways

Section 1024

An exit passageway provides the designer with an acceptable way of connecting a required exit stair to the exit discharge. Because the code requires an exit stair to open directly into an exit discharge to the exterior of the building, this provision will allow the stair to terminate at convenient locations away from the exterior walls. Also, the exit passageway can extend the path of travel when travel distances in the exit access system have been exceeded.

Fire & Life Safety Concerns

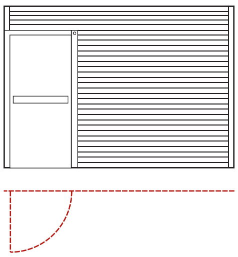
Extending the path of egress beyond the terminated travel distance or beyond the exit vestibule increases the potential for building occupants to be exposed to fire, smoke or hot and toxic gases. For these reasons exit passageways are designed with more strict provisions.

Code Requirements

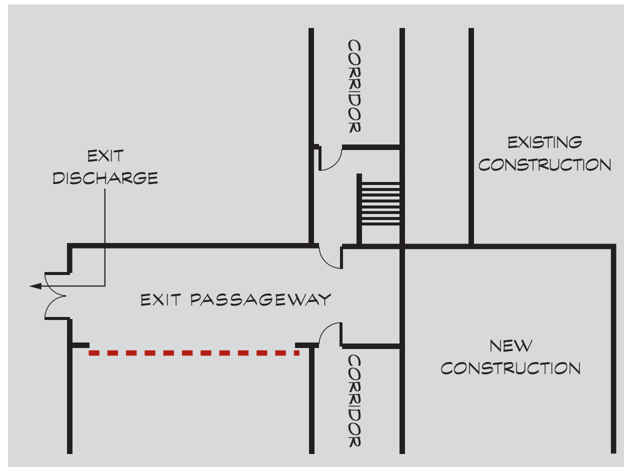
1. An exit passageway shall not be used for any purpose other than as a means of egress. *(1024.1)*
2. Exit passageway enclosures shall have walls, floors and ceilings of not less than 1 hour … and be constructed as fire barriers or horizontal assemblies. *(1024.3)*
3. Elevators shall not open into an exit passageway. *(1024.5)*
4. Opening protectives shall comply with Section 716 … and shall be limited to those necessary for exit access into the exit passageway from normally occupied spaces and for egress from the exit passageway. *(1024.5)*
5. Where an interior exit stairway or ramp is extended to an exit discharge or a public way by an exit passageway, the exit passageway shall comply with Section 1023.3.1. In other words, the interior exit stair must be separated from the exit passageway by a fire barrier wall equal in rating to the requirement for the interior exit stairway.

Design Solution

CASE 1: Vertical Coiling with Complying Swing Egress Door(s)



In this case study the required exit stair from the floors above terminated several feet from the exterior of the building. The McKEON opening protective forms the rated enclosure during a fire emergency, extending the exit path to exit discharge.



Inquiry Discussion and Questions

Because exit passageways are constructed under strict opening provisions, designs rarely incorporate them unless there is no other choice. With the use of the McKEON wide-span opening protectives, openings are not limited in size and little or no design compromise is noticed by building occupants. The following questions can be helpful in assisting the design professional to recognize new options:

- Have you ever desired to terminate a required exit enclosure on the interior of the building rather than at the exterior exit?
- Do you find challenges in connecting an exit enclosure with the exit to the exterior of the building?
- Did you know that solving a travel distance problem by providing an exit passageway can open your design rather than close it down?

Notes:

Pedestrian Walkways & Tunnels

Section 3014

Walkways and tunnels are designed to provide connection between buildings. They can be located at, above or below grade level and are used as a means of travel by persons.

Fire & Life Safety Concerns

Buildings located across lot lines from each other are required to have fire-rated exterior walls to prevent fire and smoke from passing between them (705; Table 602). Walkways and tunnels that connect and penetrate these rated exterior walls compromise this protection, potentially allowing heat and smoke to pass from one building to another.

Code Requirements

Section 3104 details specific requirements to ensure building occupant safety based upon the following fundamental principles:

Principle #1: Separate Structures. Connected buildings shall be considered to be separate structures *(3104.2)*. Unless the buildings are all on the same lot or exempt under specific accessibility requirements each building will be considered as a separate building when determining fire resistance, exterior wall ratings and egress.

Principle #2: Construction. The pedestrian walkway shall be of noncombustible construction *(3104.3)*. Unless each building being connected is of combustible construction the connecting element must be noncombustible to minimize the travel of heat and smoke.

Principle #3: Fire Barriers. Once the rated exterior walls have been penetrated to accommodate a noncombustible connecting walkway, the interior of each building must be further protected with fire barriers of not less than 2-hour rated construction *(3104.5.1).* In order to avoid this requirement the following criteria must be met:

A. Exterior walls - 2 hour rated, extend not less than 10' in every direction surrounding the perimeter of the pedestrian walkway.

EXIT ACCESS SEPARATION

B. Openings in exterior walls of connected buildings - opening protectives not less than 3/4 hour.

C. Supporting construction - See Section 707.5.1.

Principle #4: Alternative Separation

A Distance between connected buildings is more than 10 feet.

B. Walkway and connected buildings fully sprinklered.

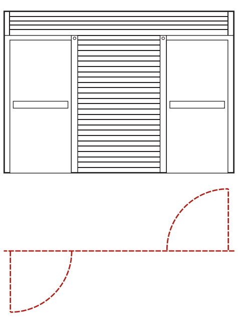
C. The wall shall be capable of resisting smoke.

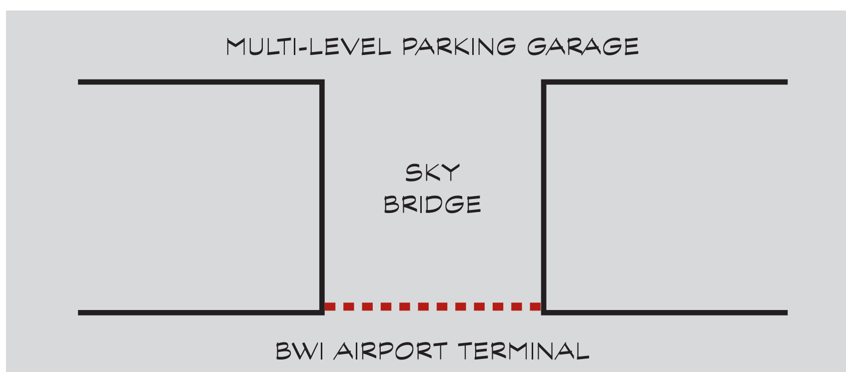
D. The wall and doors can be constructed of wired or tempered glass that is protected with sprinklers. All glass in gasketed frames.

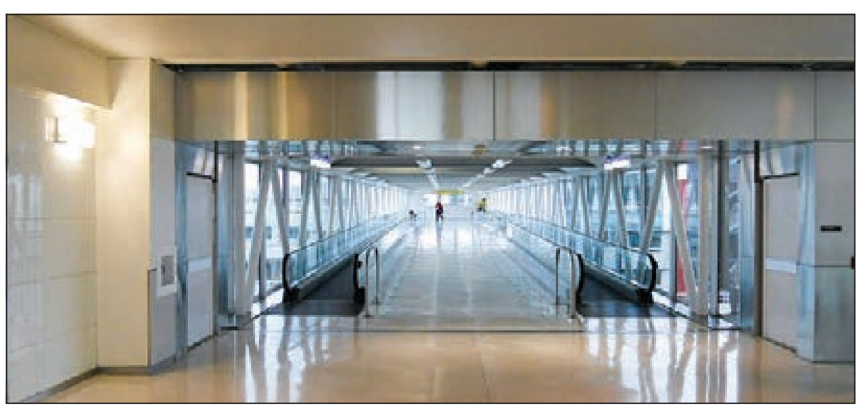
Design Solutions

The alternatives to fire barrier separations as listed above are very costly. Complying with the 2-hour separation requirement in Section 3104.5 is the least expensive option. A listed and labeled wide span McKEON assembly will easily protect any size opening. In the following case studies, McKEON showcases three distinctly different technologies to resolve the same code application problem. Diverse design requirements were not a challenge, rather routine applications of standard products.

CASE 1: Vertical Coiling with Complying Swing Egress Door(s)

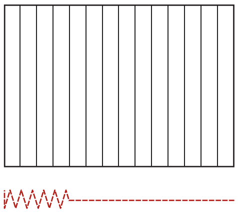


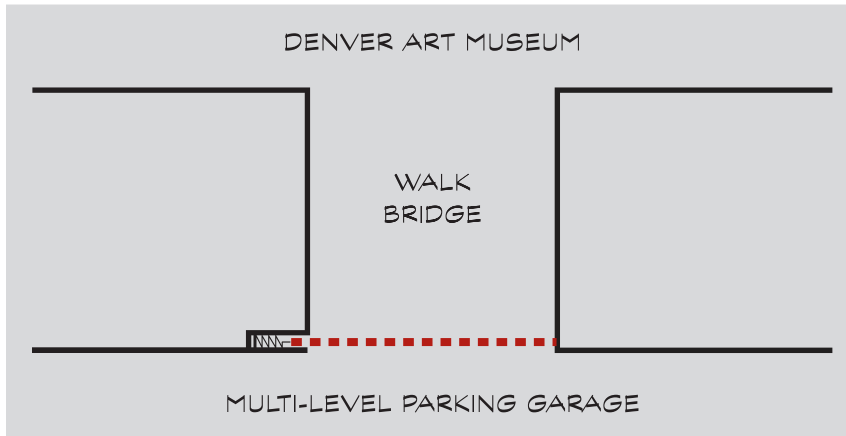




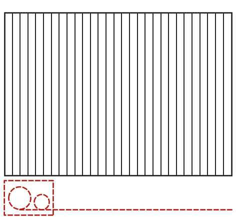
EXIT ACCESS SEPARATION

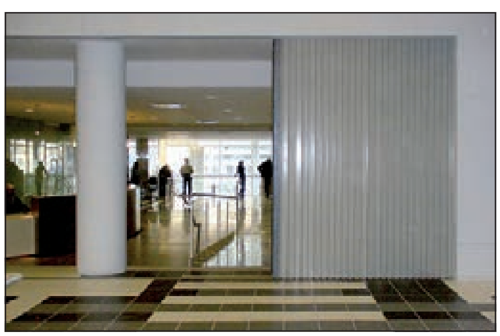
CASE 2: Side Acting Accordion with Power-assisted Egress

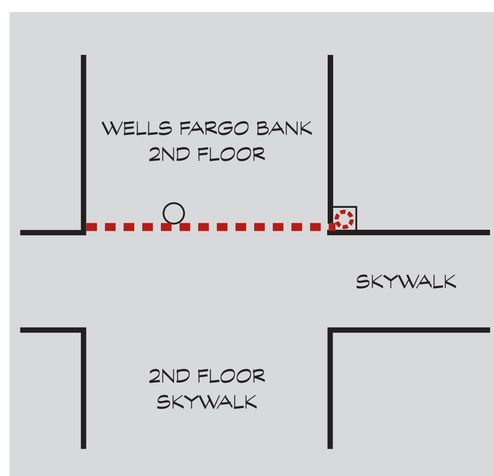




CASE 3: Side Coiling without Egress







EXIT ACCESS SEPARATION

Inquiry Discussion and Questions

Pedestrian walkways can be located overhead connecting two or more buildings or underground as tunnels connecting two or more buildings. This connecting construction is viewed as a definite threat to life safety. The code attempts to build in safety measures that are intended as substitutes for complete and optimum separation. These substitutes include extensive active wet sprinkler systems, open side walls, and tempered and/or wire glass components. It would certainly make more sense to use the "real thing" by easily providing rated barriers with wide-span opening protectives at each end eliminating any threat of fire and smoke entering the walkways.

The following questions may be helpful:

- Have you been able to run a cost comparison separating the building from the walkway as opposed to protecting the walkway?
- Even though a pedestrian walkway will most likely be constructed of non-combustible materials, would you like to avoid the cost of sprinklers, limiting interior design and costly tempered and/or wired glass components?

Notes:

3 Vertical Opening Separation

Fundamental Guidelines

Draft Curtains

Exit Access Stairways

Vertical Openings – Escalator

Interior Exit Stairways

Atriums

Vertical Compartmentation

Fundamental Guidelines

Sections 404, 712, 713, 1019, 1023 & 1027

Vertical openings between floors are designed consistently in multi-story buildings in many different shapes, heights and uses. For the purposes of code enforcement the following general categories are described in the building code:

1. **Shaft Enclosures** ***(713)***
   a. **Escalators** ***(712.1.3)***
   b. **Mezzanines** ***(712.1.11, 505)***
   c. **Stairs** ***(712.1.12, 1019, 1023, 1027)***
   d. **Elevators** ***(3006)***
2. **Atriums** ***(404)***
3. **Interior Exit Stairways and Ramps** ***(Section 1023)***
4. **Exit Access Stairways** ***(712.1.12, 1019)***

Typically anytime two or more floors are open to each other a vertical opening is created and the phrase “floors are common with each other” is used to characterize the condition.

Two fundamental principles drive the requirements of vertical opening protection. First, the migration of smoke, heat and toxic gases floor to floor. Second, egress of building occupants from upper levels to a safe level of exit discharge.

The case studies in this section illustrate the balance between these two principles in the enforcement of fire & life safety provisions for building occupants in multi-story buildings.

Understanding Draft Curtains & Closely Spaced Sprinklers as Vertical Space Fire Protection Features

Sections 712.1.3.1 & 1019.3, #4

Draft curtains and closely spaced sprinklers, in accordance with NFPA 13, may be used in lieu of shaft enclosure construction in specific vertical opening applications.

Because of the chimney effect that can take place in vertical openings in multi-story structures, smoke, heat, toxic fumes and gases easily transfer throughout the structure. The optimum regulatory provision that prevents or mitigates this condition is the construction of solid fixed walls that are fire-rated as shaft enclosures separating vertical spaces from the remaining structure and floor areas. However, certain conditions allow the use of draft curtains in lieu of Fire Barrier walls.

Draft curtains are intended to accelerate the activation of sprinklers placed around the perimeter of vertical openings in order to provide an instant water barrier. This is a level of protection that can take the place of the rated wall construction and mitigate the transfer of smoke, heat, toxic fumes and gases which may be transferring vertically through the structure during a fire event.

The code addresses the use of draft curtains in two specific applications only. Both are penetrations through floor openings with the first being the escalator and the second, exit access stairways.

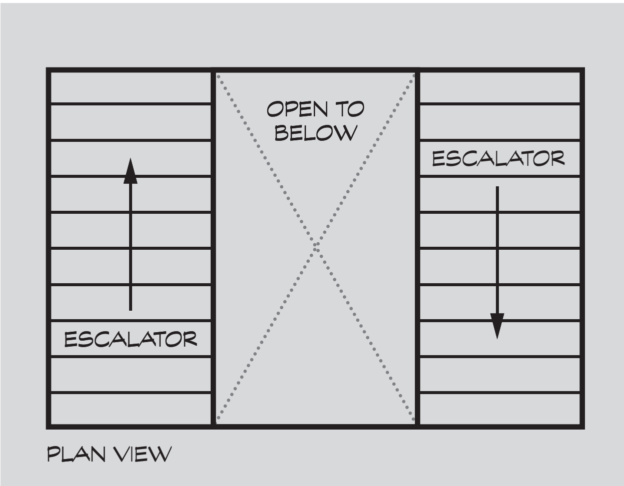
Escalator Openings

Section 712.1.3 Escalator openings. Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, vertical openings for escalators shall be permitted where protected in accordance with Section 712.1.3.1 or 712.1.3.2.

Section 712.1.3.1 Opening size. Protection by a draft curtain and closely spaced sprinklers in accordance with NFPA 13 shall be permitted where the area of the vertical opening between stories does not exceed twice the horizontal projected area of the escalator. In other than Groups B and M, this application is limited to openings that do not connect more than four stories.

Section 712.1.3.2 Automatic shutters. (Please see the application study in this document titled, "Vertical Openings – Escalator.")

The use of the draft curtains with closely spaced sprinklers in escalator openings as outlined in the aforementioned code language only applies when the area of the escalator itself obstructs at least half of the area of the opening being penetrated. The following diagram illustrates a compliant application of this criteria. It is important to remember, this condition is acceptable only when the building is fully sprinklered.

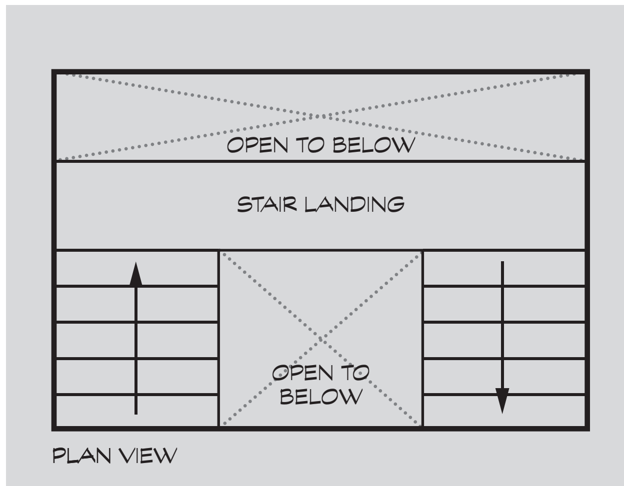


Exit Access Stairway Openings

Section 1019.3 Occupancies other than I-2 and I-3. In other than Group I-2 and I-3 occupancies, floor openings containing exit access stairways or ramps that do not comply with one of the conditions listed in this section shall be enclosed with a shaft enclosure constructed in accordance with Section 713.

Condition 4. Exit access stairways and ramps in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, where the area of the vertical opening between stories does not exceed twice the horizontal projected area of the stairway or ramp and the opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13. In other than Group B and M occupancies, this provision is limited to openings that do not connect more than four stories.

Using language similar to the escalator provisions, the use of draft curtains with closely spaced sprinklers in exit access stairway openings only applies when the area of the stair, to include any landings, obstructs at least half of the area of the opening being penetrated. The diagram below illustrates a compliant application of this criteria. It is important to remember, this condition is acceptable only when the building is fully sprinklered.



A Code Discussion for Clarification

The design and code provisions governing the application and use of draft curtains do not require side-guide components or fire endurance testing and do not parallel typical opening protective acceptance criteria. Since the adoption and development of the *2015 edition of the International Building Code (IBC),* the use of draft curtains in any project are for the sole purpose of creating barriers to force heat to activate sprinkler heads in vertical openings such as escalators and exit access stairways. Draft curtains are not intended to prevent smoke from migrating floor to floor, rather their purpose is to assist in immediate activation of the closely spaced sprinklers, associated with them, which are intended to mitigate the migration of smoke and/or heat floor to floor.

Background

In the legacy model building codes and all editions of the IBC prior to the published 2015 edition, draft curtains were a requirement in two separate areas of the code with criteria and detailed definition in one area only. First, we will explore the use where these criteria and definitions occurred, Factory and Storage occupancies, as defined in *Chapter 9, Fire Protection Systems. Section 910.3.5.1* stated: *Construction. Draft curtains shall be constructed of sheet metal, lath and plaster, gypsum board or other approved materials which provide equivalent performance to resist the passage of smoke. Joints and connections shall be smoke tight.* In essence, draft curtains could be constructed of cardboard and duct tape … as long as they channeled smoke.

This code language was written around the stringent requirements of Group F-1 and S-1 occupancies as indicated in *Table 910.3.* In these hi-pile storage occupancies there was no requirement for draft curtains to be fire rated, only that they "resist the passage of smoke." Achieving smoke tight joints and connections were critical due to exceptions in the code section that allowed the reduction of smoke vents, their sizes and placement with the use of draft curtains. In other words, this specific language was confined to these two aforementioned occupancy types. Incidentally, this code requirement was eliminated in the 2015 edition of the IBC, the term draft curtain no longer exists for F-1 and S-1 occupancies. These particular smoke removal systems no longer require draft curtains for directing smoke.

Current Provisions

Section 712 Vertical Openings, 712.1.3.2 allows unprotected escalator openings that are protected by draft curtains. *Section 1019* addresses *Exit Access Stairways* allowing draft curtains to protect vertical openings. However, these two code sections (applications) did not reference *Section 910* prior to 2015 confirming separate and distinct uses of the provision. However, both the escalator and exit access stairway applications include a pointer to *NFPA 13* as the standard for the use of this building feature. *Section 712.1.3.1 Opening size* at the escalator opening and *Section 1091.3, Item #4* at the exit access stairway opening state the following: "… protection[ed] by a draft curtain and closely spaced sprinklers in accordance with NFPA 13 …"

Please note, there are no other definitions or criteria for the term draft curtain in the model building codes with exception of the reference to *NFPA 13.* Yet, the term draft curtain is called out in both aforementioned code sections. Further to confuse the issue the term Draft Stop is found in *IBC Section 202.* After reading this definition, clearly it is addressing a building feature located in *"… concealed areas of building components such as crawl spaces, floor/ceiling assemblies, roof/ceiling assemblies and attics."*

As if the issue is not confusing enough, *NFPA 13* addresses vertical openings such as escalator openings and stair openings with regard to this level of protection as Draft Stops rather than using the term Draft Curtain. Please note:

NFPA 13, Section 8.15.4 Vertical Openings

8.15.4.1 General. Unless the requirements of 8.15.4.4 are met, where moving stairways, stair-

cases, or similar floor openings are unenclosed and where sprinkler protection is serving as the alternative to enclosure of the vertical opening, the floor openings involved shall be protected by closely spaced sprinklers in combination with draft stops in accordance with 8.15.4.2 and 8.15.4.3.

8.15.4.2 Draft Stops. Draft stops shall meet all of the following criteria:

1. *The draft stops shall be located immediately adjacent to the opening.*
2. *The draft stops shall be at least 18 in. (457 mm) deep.*
3. *The draft stops shall be of noncombustible or limited combustible material that will stay in place before and during sprinkler operation.*

The term draft curtain does appear in *NFPA 13,* however, only in reference to the old method of channeling smoke to smoke and heat vents in “F” & “S” occupancies. Therefore, the use of draft curtains in our current model building codes is limited to escalator and exit access stairway openings only. Since NFPA 13 criteria for use of draft curtains in vertical openings does not require the channeling of smoke, rather to simply force heat and smoke against the sprinkler heads for immediate activation, the criteria does not include large depths of drop beyond 18 inches nor does it require smoke sealed corners or joints in the curtain installation.

If we examine this concept from a more pragmatic view we can see that the criteria makes sense. As mentioned above, the maximum drop in the draft stop criteria for these applications is 18 inches. If the intent of the draft curtain application was to stop the transfer of smoke or heat to other floors, this depth would have to be much greater. At some point, very quickly upon contact the smoke will easily pass over these draft curtains and the curtains become academic at that point. Hence, draft curtain applications in escalators and stairs always have gaps at the joints, are typically constructed of polymethyl methacrylates which by trade-name are better known as clear acrylics or Plexiglass. These or other materials are usually not continuous or installed in a fashion to actually prevent smoke from migrating floor to floor … their only purpose is to force enough heat against the sprinkler heads to activate them.

For this reason there is not a test standard or criteria for testing draft curtains. *NFPA 13* simply requires, *“The draft stops shall be of noncombustible or limited combustible material …”* The D100 technology significantly exceeds these basic requirements. The McKEON SmokeFighter® Model D100 is manufactured from fabric that has been tested and certified for a 3-hour UL 10D fire label. This material has also been tested and certified for a 20 minute UL 10B fire label. Both labels certify use to span unlimited widths and heights. The test criteria included side-guide components in order to maintain full integrity opening protective hose stream performance.

The D100 technology exceeds the minimum requirements, creating a substantial fire and smoke barrier to expeditiously activate the closely spaced sprinklers surrounding the vertical opening. Sprinkler activation at the unprotected shaft opening mitigates the migration of heat, smoke, toxic fumes and gases from traveling throughout the structure.

Exit Access Stairways

Sections 712, 1019

These case studies deal with a condition wherein several floors are common to each other. The floors are inter-connected with an interior exit access or communicating stairway. Previous editions of the code addressed these stair features as non-egress stairs. The code now defines Exit Access Stairways as a stairway within the exit access portion of the means of egress system. *(202)*

Fire & Life Safety Concerns

Multiple floors open to each other is perhaps one of the most vulnerable conditions to fire danger threats in any multi-story building. Fire suppression is concerned with confining a fire to the floor of origin and preventing the fire, or the products of the fire (smoke, heat and hot/toxic gases) from spreading to other levels. Such conditions are not conducive to defend in-place strategies. Rather, it is preferable that building occupants move quickly out of harm's way. These requirements expressly demonstrate the overlap between passive, active and egress fire & life safety provisions.

Code Requirements

In occupancies other than I-2 and I-3, floor openings containing exit access stairs that do not comply with one of the following … shall be enclosed in a shaft enclosure. *(1019.3)*

- The exit access stairway must be included in the exit access travel distance measurement. *(1017.3.1)*
- Serve or atmospherically communicate between only two stories *(1019.3, Item #1)*
- Options to open four stories or more than four stories using draft curtains and closely spaced sprinklers (1019.3, Item #4, please see page 34, Draft Curtains)

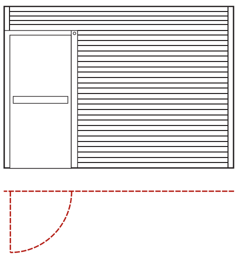
For additional code language and acceptance criteria for two-story openings please see "Inquiry Discussion & Questions" on page 42 of this application study.

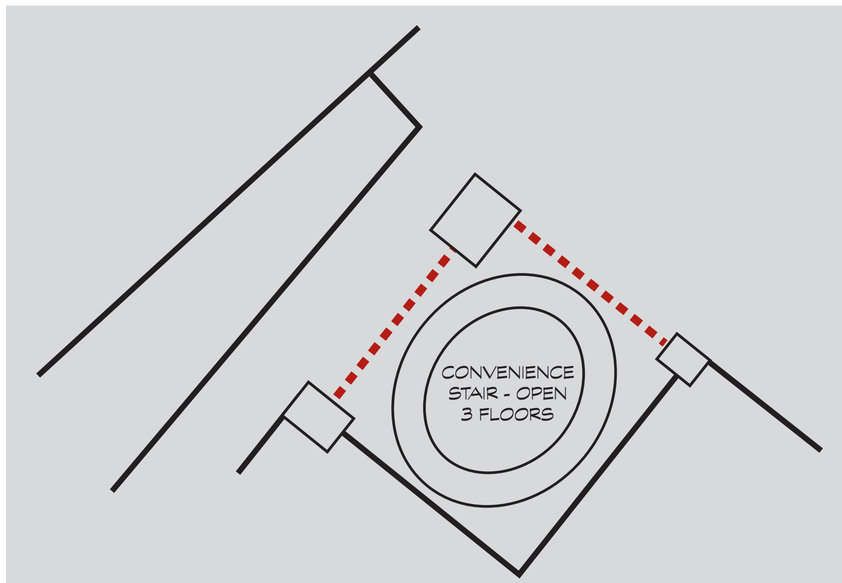
VERTICAL OPENING SEPARATION

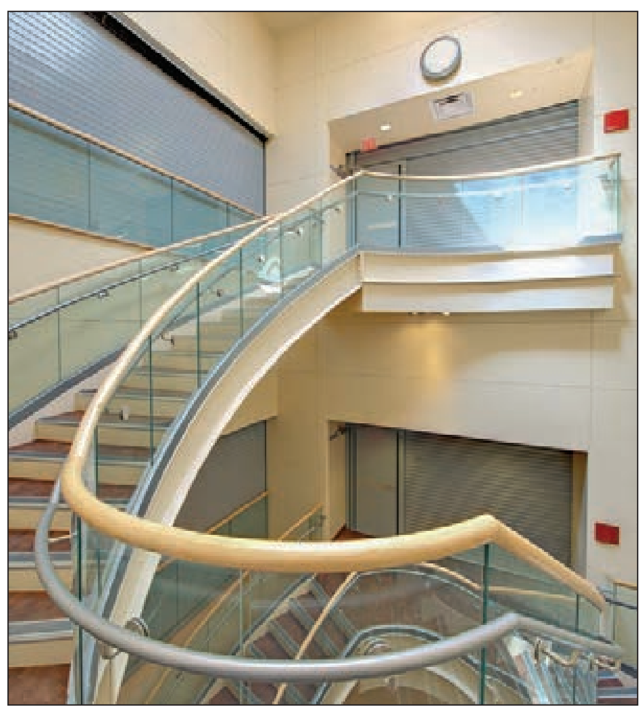
Design Solutions

Because each space contains a stair the code will allow two floors common. In the following case studies, McKEON offers different products for very diverse design needs, yet there is not a compromise in fire and life safety.

CASE 1: Vertical Coiling with Complying Swing Egress Door(s)

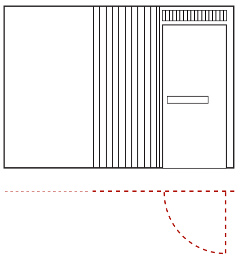




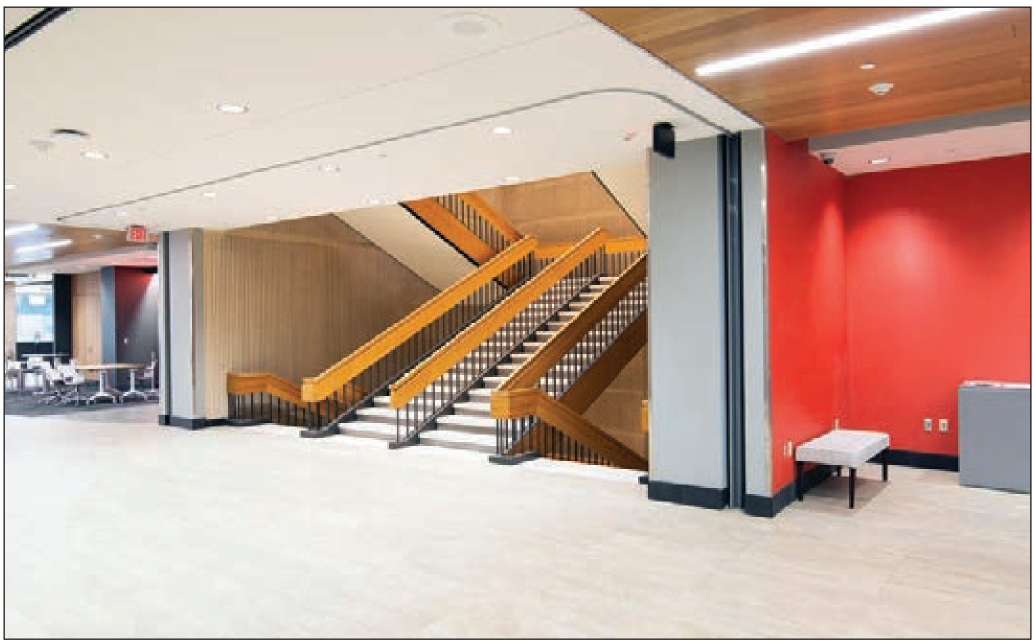


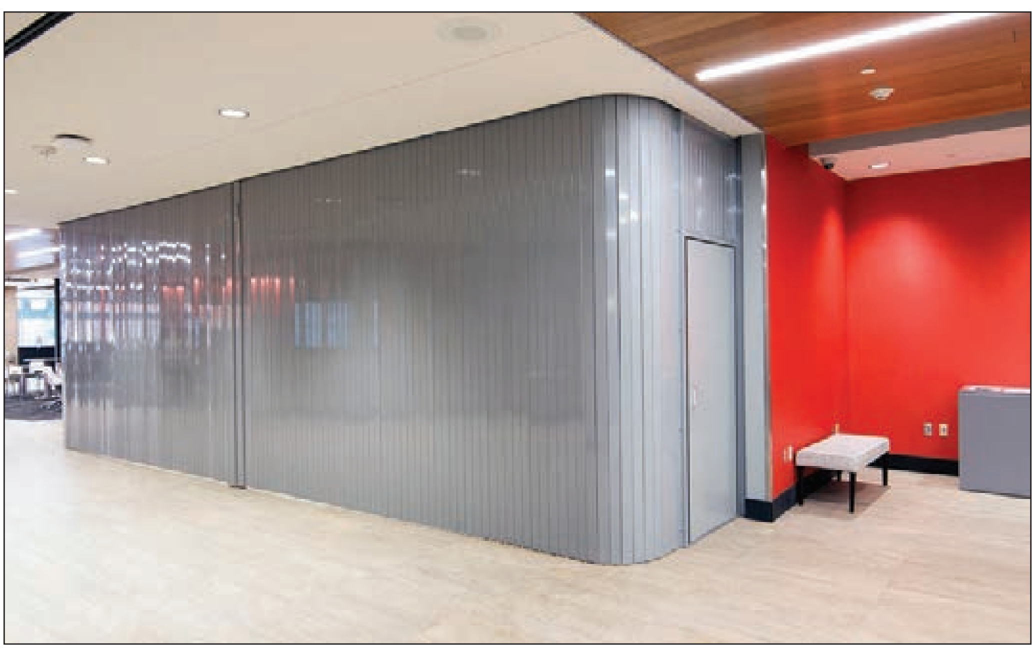
VERTICAL OPENING SEPARATION

CASE 2: Side Acting with Complying Egress Door(s)



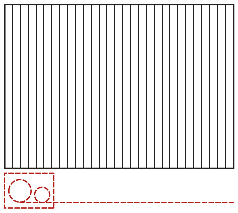
In the second case study a convenience stair within a university learning center is open to each floor it connects during normal school operation. When the building goes into alarm two McKEON 3-hour side acting assemblies, each with a conforming egress swing door and conventional fire exit hardware, combine to provide shaft enclosure protection.



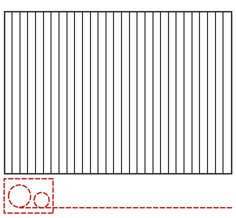


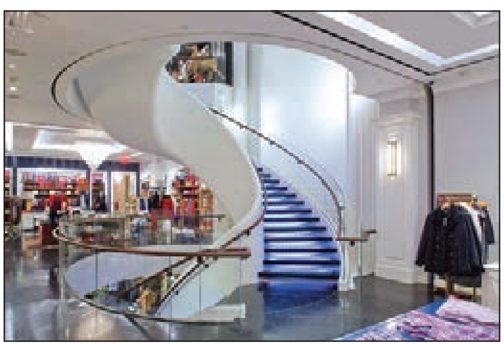
VERTICAL OPENING SEPARATION

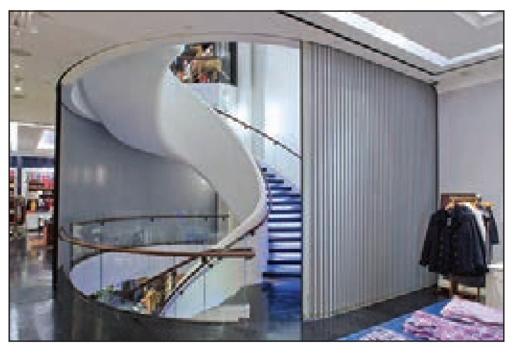
CASE 3: Extreme Height & Width Side Coiling without Egress

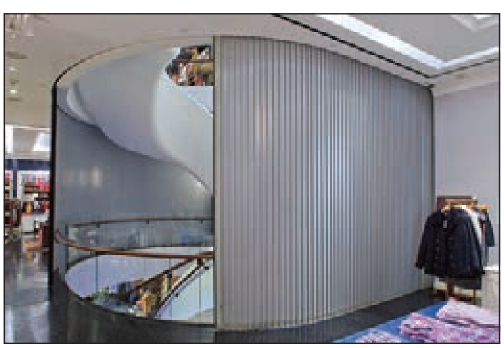


CASE 4: Side Coiling without Egress

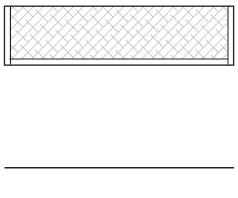




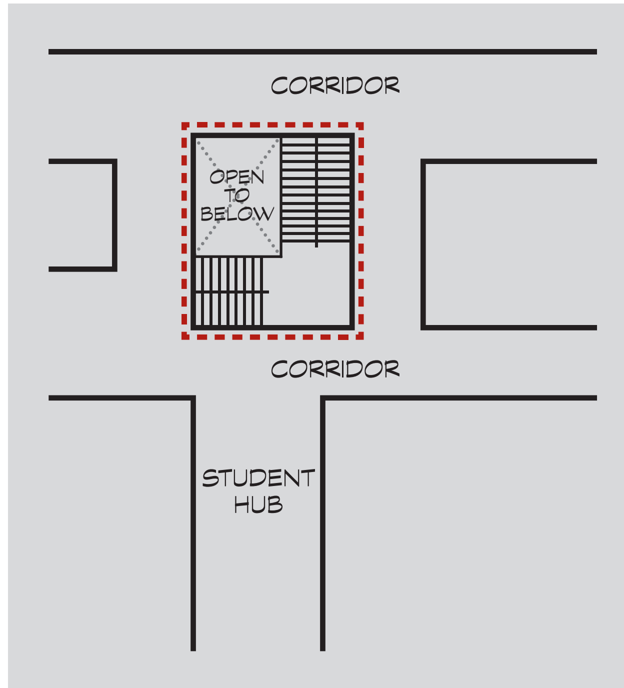




CASE 5: Deployable Draft Curtains & Closely Spaced Sprinklers



The McKEON D100 draft curtains deploy when there is a fire emergency. During normal hours of building occupancy, unlike conventional fixed draft curtains, the ceiling space around the vertical opening is clear of any obstacles.



Inquiry Discussion & Questions

These applications, at first glance, would seem to fall under the atrium provisions because there are at least two floors common to each other. Notwithstanding the third floor is separated from the other two, the definition of an atrium is two or more floors interconnected. The purpose for separating floors in order to create only two floors common is to consider the space under the vertical opening provisions of Section 712 in lieu of the atrium provisions in Section 404. Aside from the exit access stairway provisions referenced in Section 712 and detailed in Section 1019, the code includes additional acceptance criteria for two-story openings. Essentially, in other than Groups I-2 and I-3 a floor opening that is not used as one of the applications already listed in Section 1019 or 712.1.9 shall be permitted if it complies with all of the following seven criteria:

1. Does not connect more than two stories.
2. Does not contain a stairway or ramp required by Chapter 10.
3. Does not penetrate a horizontal assembly that separates fire areas or smoke barriers that separate smoke compartments.
4. Is not concealed within the construction of a wall or floor/ceiling assembly.
5. Is not open to a corridor in Group I and R occupancies.
6. Is not open to a corridor on nonsprinklered floors.
7. Is separated from floor openings and air transfer openings serving other floors by construction conforming to require shaft enclosures. *(712.1.9)*

The following questions may be helpful:

- Do you have clients who wish to occupy multiple floors with a vertical common area connecting all floors?
- Can I show you how interconnecting unenclosed stairs can be incorporated into the design without creating shaft enclosures or complying with atrium provisions?
- Have you been concerned attempting vertical space separation avoiding the closed-in shaft appearance?
- Did you know there is technology available to offer a wide-span opening protective to separate vertical spaces that can also serve as the required exit from unenclosed stairways?

Notes:

Vertical Openings – Escalator

Sections 712.1.3

An escalator provides convenient movement for building occupants communicating multiple floors. However, escalators are typically not a part of the required means of egress.

Fire & Life Safety Concerns

Openings through floors allow fire – or the products of fire (smoke, heat and hot toxic gases) – to spread to other floors. Enclosing these spaces in rated shaft enclosures is certainly the most proficient method of mitigating fire and smoke migration between floors. However, the code incorporates optional provisions as exceptions to the completely sealed vertical shaft.

Code Requirements

The following exceptions are allowed in lieu of creating a shaft:

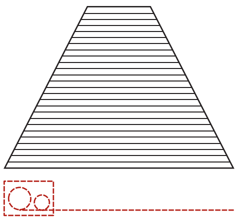
Escalators must be enclosed unless the design incorporates the following requirements: *(712.1.2)*

First, an automatic sprinkler system must be installed throughout the entire building and, secondly an escalator must NOT be in a portion of the means of egress system. If both of these issues are satisfied then the following criteria must be met:

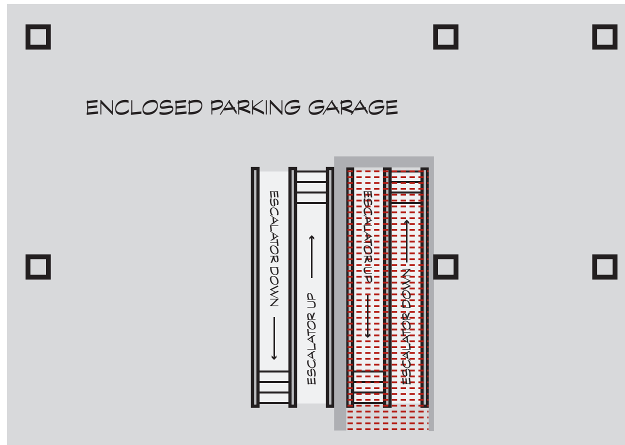
1. The area of the floor opening between stories does not exceed twice the horizontal area of the escalator. *(712.1.3.1)*
2. The opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13. *(712.1.3.1)*
3. In other than Groups B and M, this application is limited to openings that do not connect more than four stories. *(712.1.3.1)*

Design Solutions

CASE 1: L-Shape Horizontal Shutter

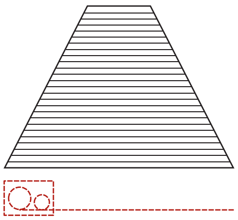


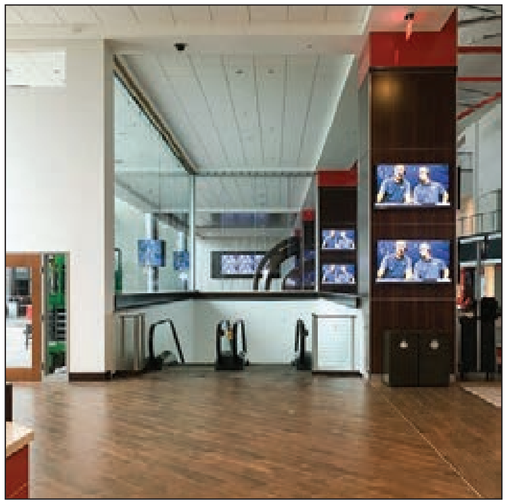
While a parking garage doesn't require an aesthetically pleasing solution, from a life safety perspective the need for fire and smoke protection is the same. A 2-hour rated horizontal shutter satisfies both the basic requirement of opening protection and enclosure of the escalator.



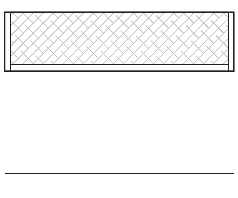
VERTICAL OPENING SEPARATION

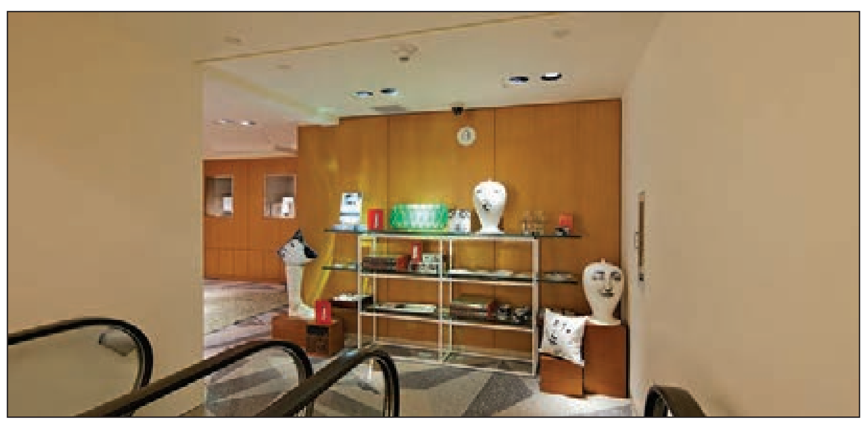
CASE 2: L-Shape Horizontal Shutter

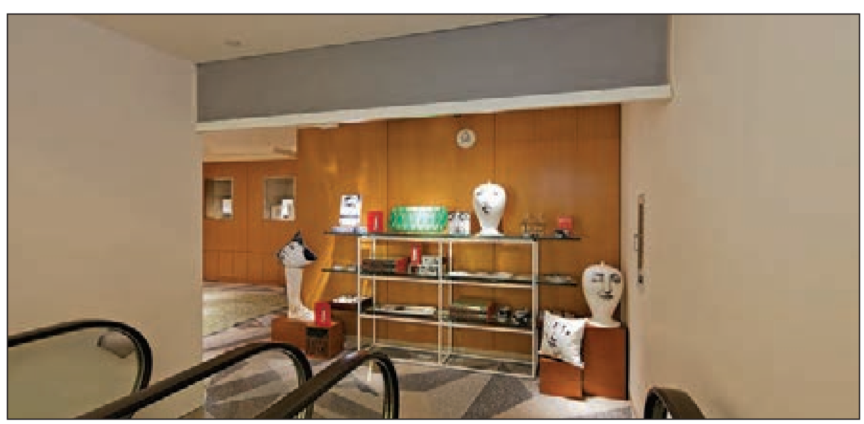




CASE 3: Deployable Draft Curtains & Closely Spaced Sprinklers







Inquiry Discussion & Questions

Escalators, whether in high-profile locations or low-profile parking garages, cannot be limited to the design criteria as stated above and maintain the desired ambiance of the space.

The following questions may be helpful:

- Would you like to use the escalator as a required exit?
- Have you considered the cost difference between a shaft enclosure and the open escalator design requirements?
- Have you considered wide-span opening protectives as an alternative to conventional swing doors in shaft enclosure walls?

Notes:

Interior Exit Stairways

Section 1023

Exit enclosures extend vertically through the interior of multi-story buildings in order to ensure timely and safe evacuation of occupants during an emergency. These enclosures include exit stairs and exit ramps.

Fire & Life Safety Concerns

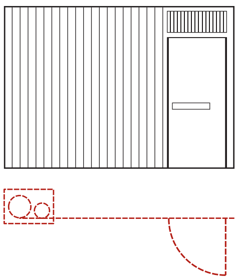
Because exit enclosures penetrate horizontal floor and ceiling assemblies, fire, heat, smoke and toxic gases can potentially penetrate into building spaces at each floor level. Therefore, enclosures become critical barriers of protection for building occupants. The protected enclosure will be a non-contaminated exit path for at least one hour in buildings less than four stories and two hours in buildings four stories or more.

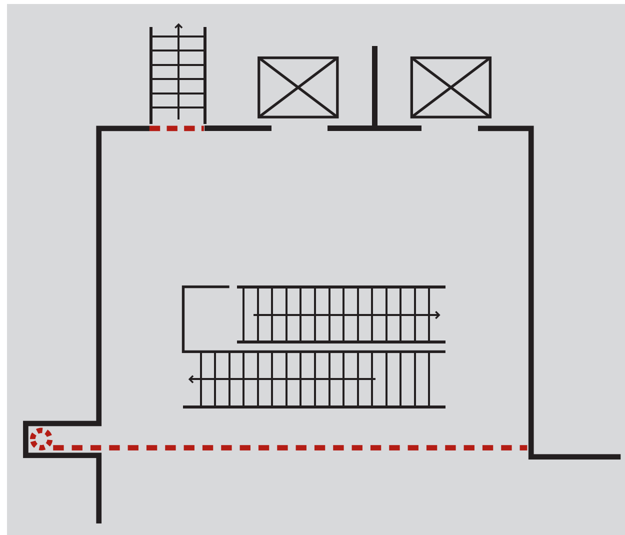
Code Requirements

1. Interior exit stairways shall be enclosed with fire barriers in accordance with Section 707. *(1023.2)*
2. Exit enclosures in buildings connecting four stories or more shall be rated at 2 hours; less than four stories at 1 hour. *(1023.2)*
3. Openings and penetrations shall be rated in accordance with Section 716. *(1023.4)*

Design Solutions

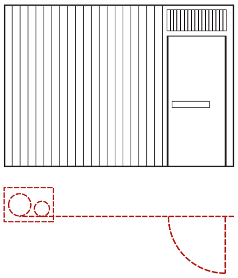
CASE 1: Side Coiling with Complying Swing Egress Door(s)



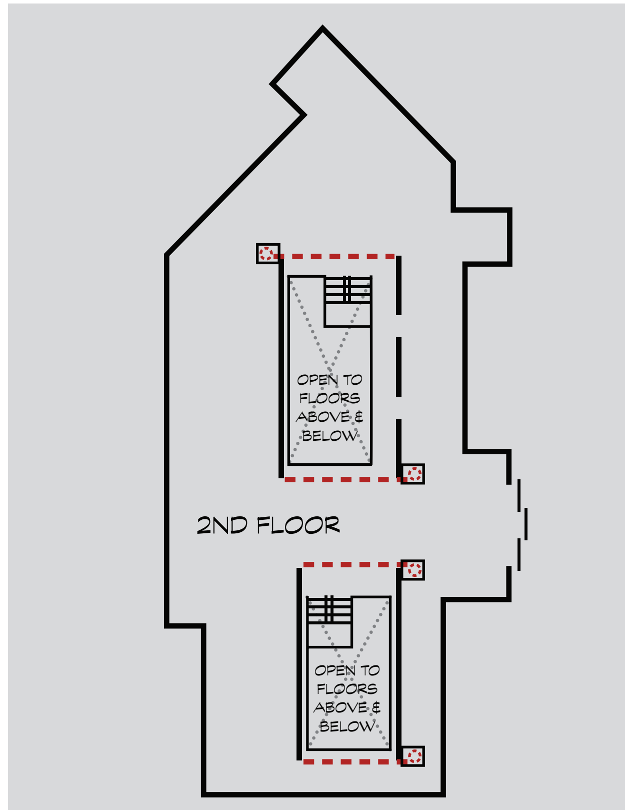


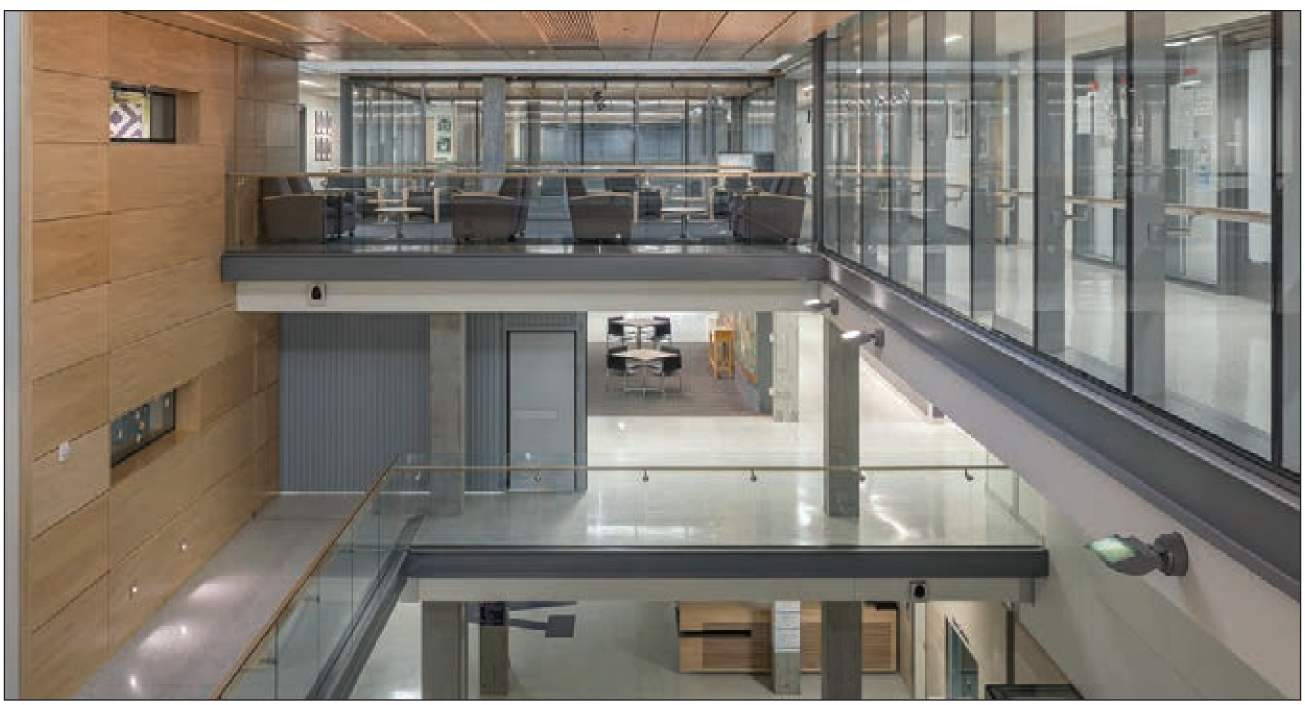
An absence of stacking space dictated use of a unique McKEON product to seal this exit enclosure. The side coiling assembly requires a small box-like space, projecting the 3-hour steel curtain with conventional egress door along a very narrow pocket entry point and header slot path. When deployed, complete compliance with shaft enclosure opening protective requirements is achieved.

CASE 2: Side Coiling with Egress



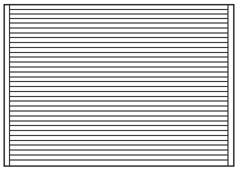
A fixed swing door within the parameters of a lengthy side coiling 3-hour assembly provides a simple resolve in a multi-floor challenge of vertical separation and egress.



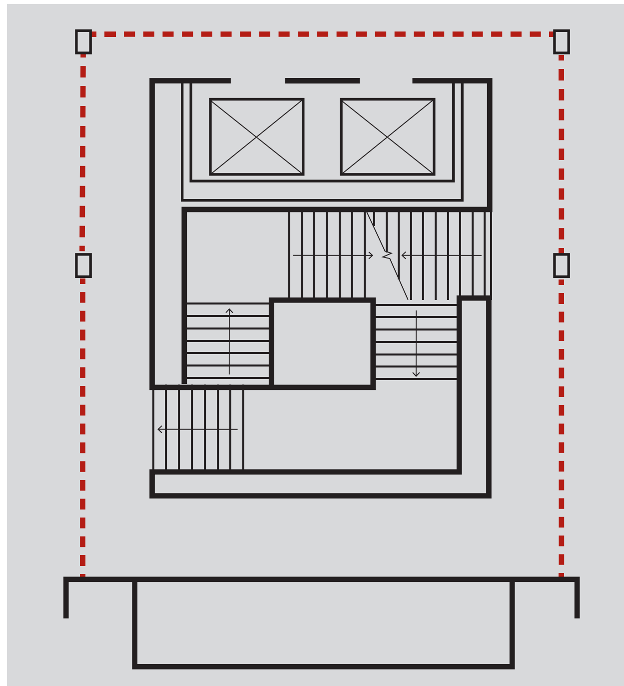


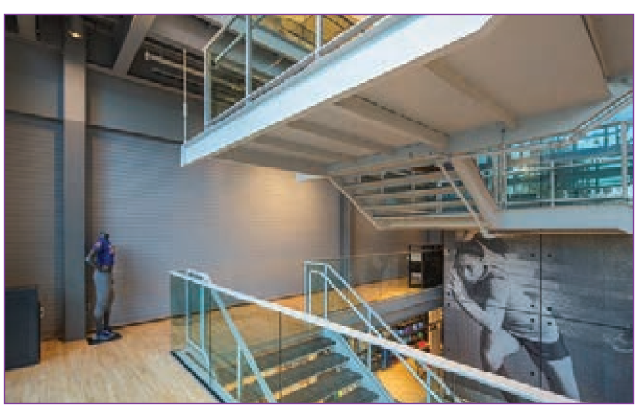
VERTICAL OPENING SEPARATION

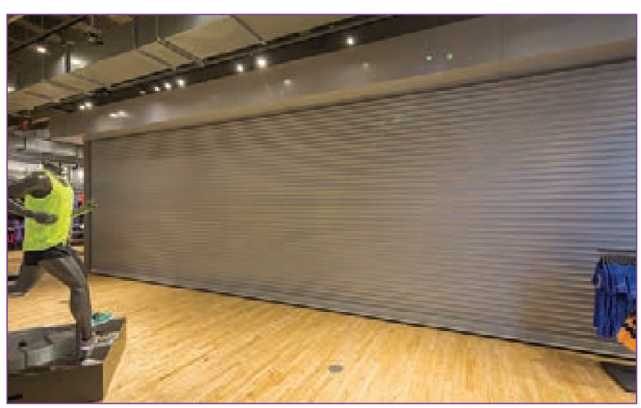
CASE 3: Vertical Coiling without Egress



Shaft enclosures that protect a required means of egress are extremely critical to the life safety of building occupants. From a design perspective it is often challenging to incorporate opening protectives in hi-profile open spaces. This extreme width vertical coiling assembly fits narrow header lines, has inconspicuous side guides, and deploys with adequate separation only when the building goes into alarm.







VERTICAL OPENING SEPARATION

Inquiry Discussion & Questions

Required exit stairs in vertical shaft enclosures ensure building occupant safe evacuation. Historically the designs of openings at the level of exit discharge have been limited to conventional side-hinged swinging doors. The acceptance of the McKEON products as both wide-span opening protectives as well as a complying egress doors provide the designer flexibility without compromising code compliance.

The following questions may be helpful:

- Do you find building owners and maintenance groups struggling with door swing and maintenance on door hardware in high-traffic spaces?
- Do you seek an open and spacious appearance at the landing area of vertical stair enclosures?
- Would you like to use a required vertical exit stair shaft as an aesthetically pleasing communicating stair by opening the enclosure area at each floor?

Notes:

Atriums

Section 404

An atrium is a floor opening, or a series of floor openings, that connects the environment of adjacent stories. By code definition an atrium is a space within a building that extends vertically and connects two or more stories. Atriums are designed to provide open and spacious vertical areas common with other building elements.

Fire & Life Safety Concerns

Unprotected vertical openings are often cited as the factor responsible for fire spread in incidents involving fire fatalities and/or extensive property damage. Section 404 addresses the need for protection of these specific building features in lieu of providing a complete floor and/or vertical shaft separation. In simple terms, the atrium provisions are extremely restrictive because a complying atrium is a shaft enclosure.

Code Requirements

Vertical common areas that comprise an atrium are not considered unprotected, rather the atrium is considered a protected space by means other than a conventional "walled-in" shaft enclosure. Listed below are the specific provisions allowing atriums to be open and spacious yet considered a conforming shaft enclosure:

1. The atrium floor area is permitted to be used only for low-hazard uses unless the individual space is provided with an automatic sprinkler system. *(Section 404.2)*
2. An approved automatic sprinkler system shall be installed throughout the entire building. *(Section 404.3)*
3. A fire alarm system shall be provided. *(Section 404.4)*
4. Engineered smoke control system – this system shall be installed in accordance with Section 909 when the atrium space exceeds more than two floors. *(Section 404.5)*
5. Atrium spaces shall be separated from adjacent spaces by 1-hour fire barrier construction unless at least one of the following exceptions are met: *(Section 404.6)*
   - A glass wall forming a smoke partition where automatic sprinklers are spaced 6 feet or less along both sides of the separation wall, or on the room side only if there is not a walkway

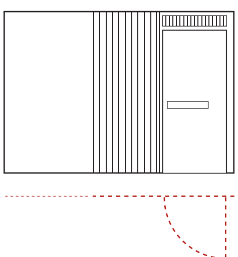
on the atrium side, and between 4 and 12 inches away from the glass … the entire glass surface must be wet upon activation … the glass shall be mounted in a gasketed frame … *(404.6)*

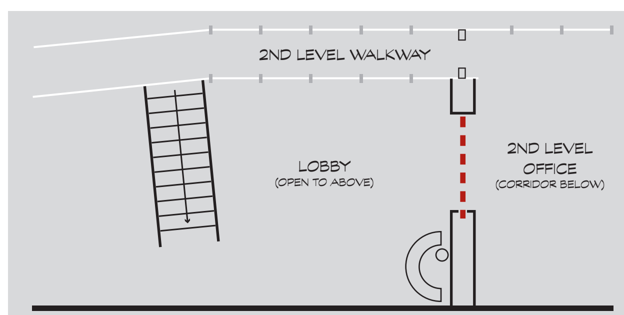
- Provide a glass block wall assembly in accordance with Section 2110 … *(404.6)*
- Fire barrier walls are not required between the atrium and adjoining spaces where the atrium is not required to have a smoke control system. *(404.6)*
- The adjacent spaces of any three floors of the atrium shall not be required to be separated from the atrium … if included in the smoke control calcs. *(404.6)*
- Smoke control equipment must be on a standby power system. *(Section 404.7)*
- The atrium interior finish of walls and ceilings must be not less than Class B. *(404.8)*
- With the exception of the lowest atrium level, the required means of egress in the exit access system travel distance shall not exceed 200 feet. *(404.9)*

Design Solutions

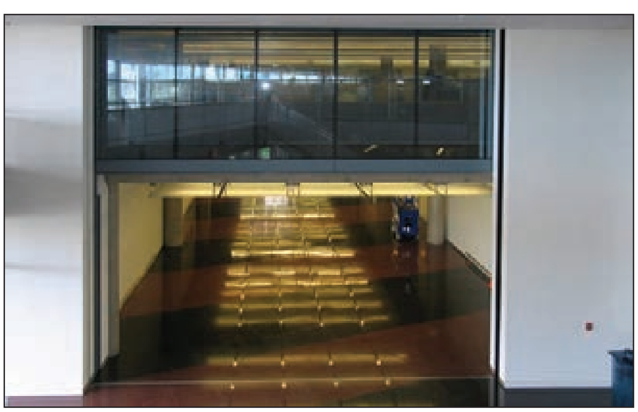
The use of deployable wide-span opening protectives in vertical atrium spaces, both vertically and horizontally, can significantly reduce construction and maintenance costs.

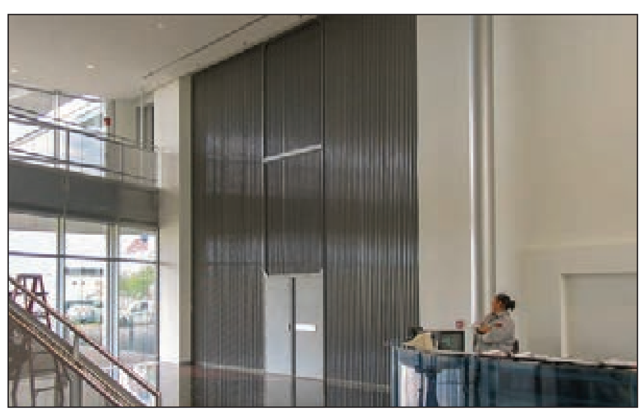
CASE 1: Side Acting with Complying Swing Egress Door(s)



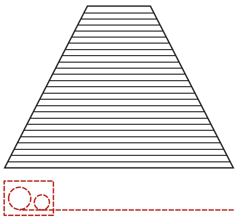


This unique case study features another McKEON product for resolving multiple design/code challenges simultaneously. The lower floor travel path is a required design feature for egress and – combined with the non-rated second floor overlook – is certainly a very creative solution. However, without the side acting, extreme height and egress conforming McKEON assembly this would not be possible!

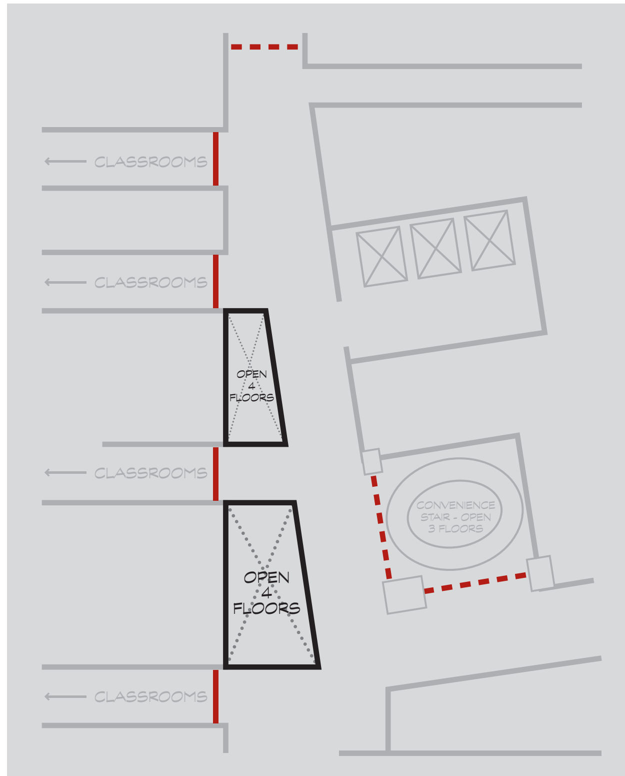


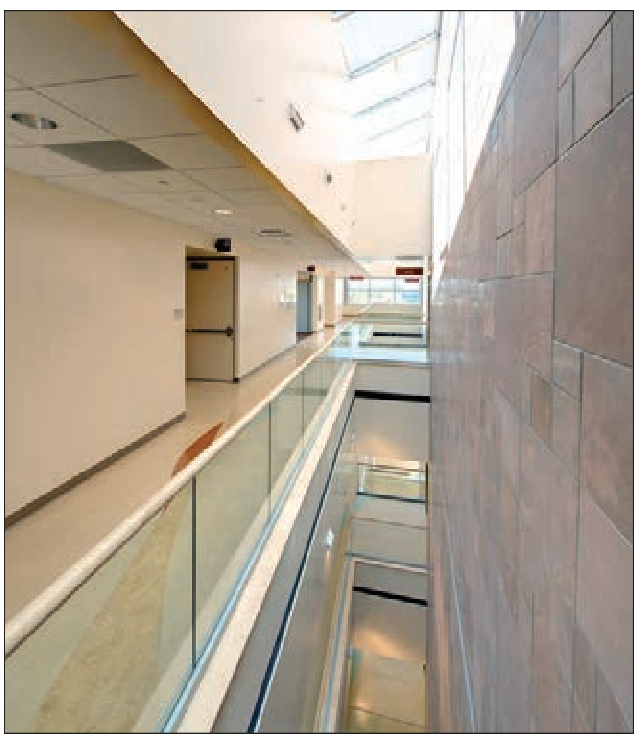


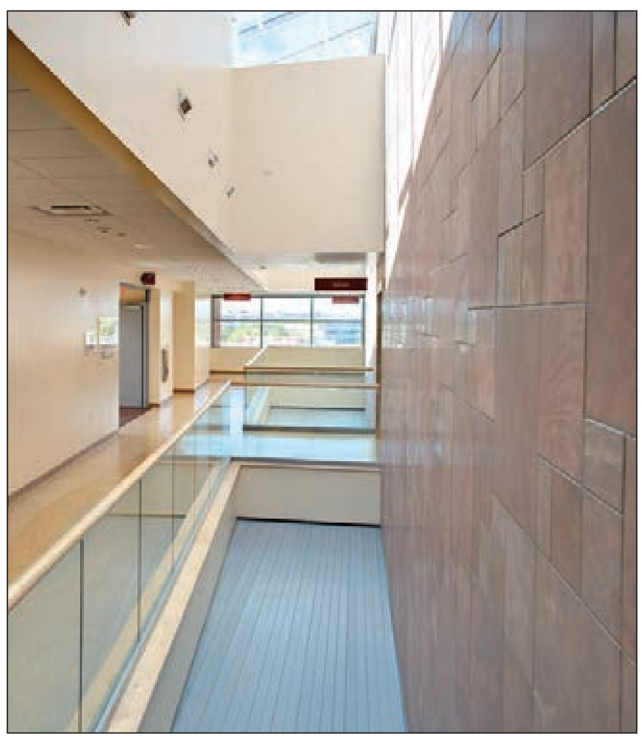
CASE 2: Horizontal (Floor) Shutter



In this case study the atrium space is essentially converted to a vertical compartment separation using the McKEON horizontal shutter. Please refer to the "vertical compartmentation" case studies at the end of this section for more information. Note the absence of any smoke evacuation systems!

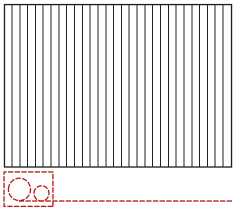


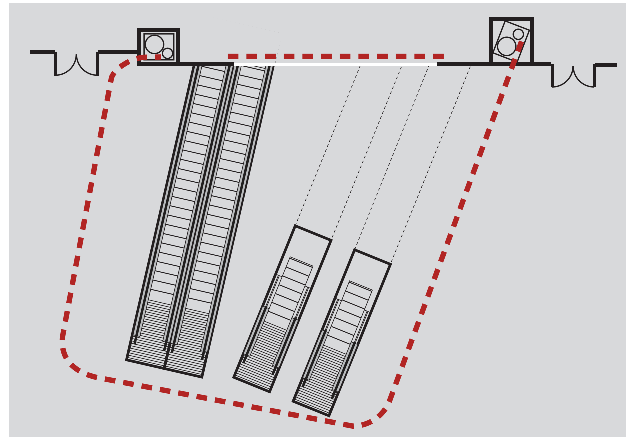




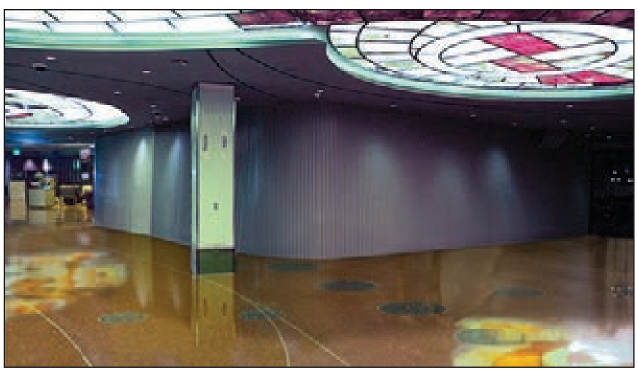
VERTICAL OPENING SEPARATION

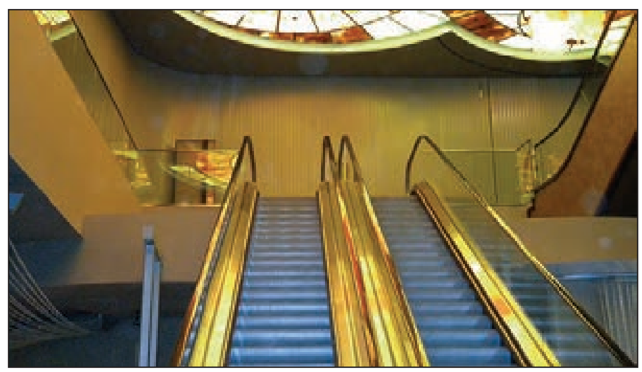
CASE 3: Side Coiling without Egress

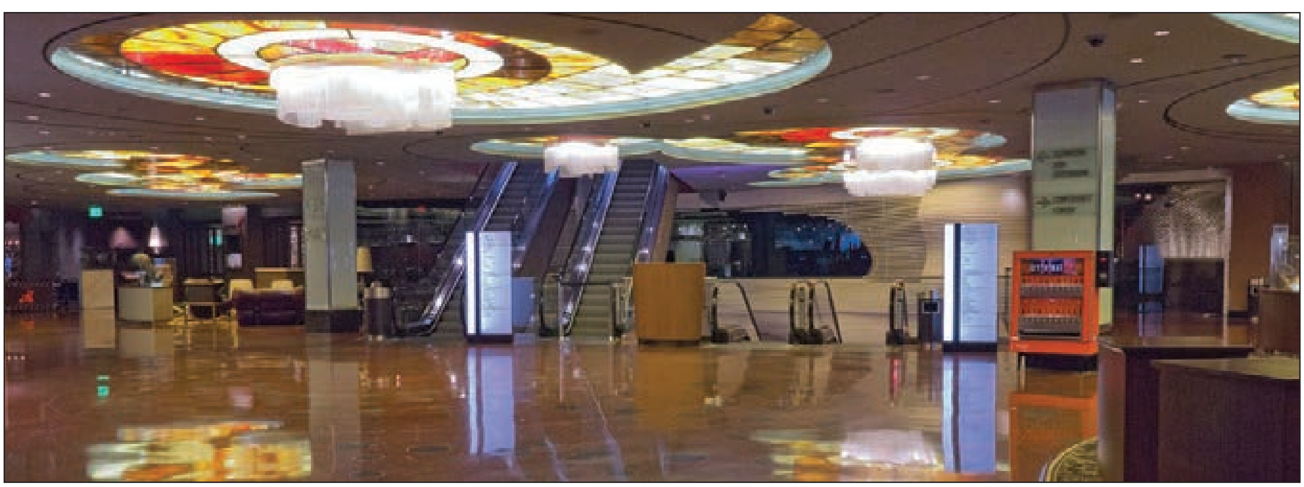




Even though this design incorporates an escalator, Item #2.1 under Exception #2 can only be applied if the area of the floor opening between stories does not exceed twice the horizontal projected area of the escalator. Since the area in this vertical open space is greater, the next option is to explore the possibility of creating a vertical shaft enclosure allowing no more than two floors common or interconnecting. With a 2.25" head-track design, 3-hour fire listing and unlimited width capacity, McKEON easily solved the problem with a triple curve, non-floor track 140' bi-part opening protective.







Inquiry Discussion & Questions

The following questions may be helpful:

- The size of the smoke evacuation system is based upon the calculation of total cubic footage of not only the atrium space but all spaces that open into the atrium space. Can I help you minimize this system cost by reducing the cubic footage with wide-span opening protectives at critical locations in the atrium?
- Have you considered the cost savings if eliminating all of the atrium requirements by creating a fully enclosed shaft or horizontal compartmentation in this vertical space?

Notes:

Vertical Compartmentation

Combined Code Principles from Chapters 4, 7 & 10

Protecting openings that connect multiple floors are currently addressed by the building and fire codes by way of vertical type shaft enclosures, atrium provisions or requirements relative to small floor or roof hatch type openings. In the following case studies a new technology and product application will be discussed wherein vertical compartments can be created separating any number of stories from each other. This will be accomplished by coordinating in one application the intent of the provisions found in both atrium and shaft enclosure requirements.

Fire & Life Safety Concerns

As stated in the atrium case studies, vertical spaces that are interconnected and common with each other allow heat, smoke, and hot/toxic gases to migrate throughout an entire structure.

Code Requirements

Currently the code examines vertical opening conditions in Section 712, Vertical Openings and Section 713, Shaft Enclosures. In earlier editions of the code, all vertical openings were considered under the shaft enclosure provisions only. The older Section 708.2, Shaft Enclosure included 16 exceptions, or different ways of creating vertical spaces as shaft enclosures. The 2012 edition created a new Section 712 titled Vertical Openings, wherein the old 16 exceptions in Section 708.2 were moved and edited. These items, originally written as exceptions to the shaft requirements, became stand-alone provisions defining vertical opening conditions, rather than exceptions or re-writes to strict shaft enclosure requirements. Although the fundamental content did not change, placing the shaft provisions under the title of Vertical Openings significantly affects one's perspective regarding their intended purpose. Perhaps this paradigm shift, from shaft enclosure provisions to vertical opening provisions is, in fact, a monumental shift not seen in many years! However, none of these accepted methods specifically address the exclusive use of horizontal shutters to eliminate a vertical condition. Unless an escalator opening is being protected or a door-hatch assembly is used to protect small structural openings in floors and roof assemblies, the code is vague regarding protection of vertical openings in the creation of vertical compartments.

VERTICAL OPENING SEPARATION

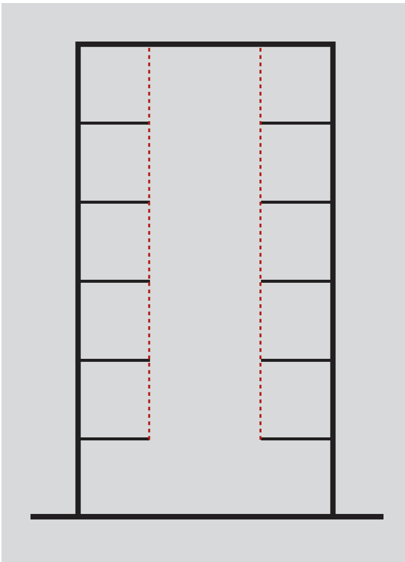


Figure 1

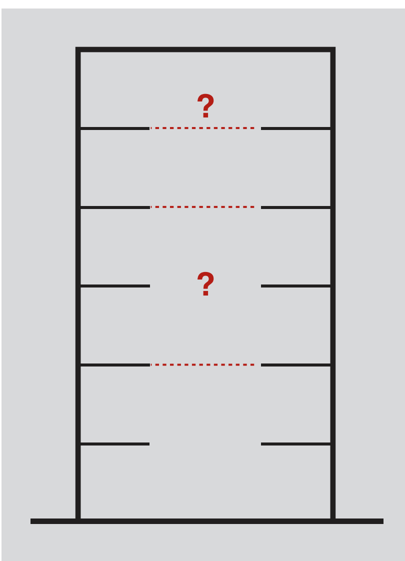


Figure 2

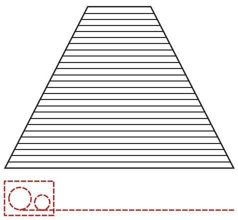
Figure 1, shown at the left, addresses a vertical opening condition complying with Sections 712 and 713 requirements to seal the space. Note, the atrium requirements are designed to essentially replicate this condition. By definition an atrium is a shaft enclosure.

Within the current provisions set forth in Sections 712 and 713, the basic core and shell of this structure is still going to be a protected shaft. For example as shown in **Figure 2,** when one uses certain provisions of Section 404, by way of exception two floors can be common and the smoke evacuation can be eliminated from those two floors, while all the other vertical separation or atrium provisions are retained. Yet in other provisions of Sections 712 and 1019 the incorporation of an exit access stairway allows two unprotected floors common. In fact, the 2015 and 2018 editions separate exit access stairs into their own Section 1019 and in definitions in Section 202 declares exit access stairways as "a stairway within the exit access portion of the means of egress system."

The question is, is it possible to eliminate the "vertical" open condition "horizontally" without a stair by protecting the vertical opening in the spirit of compartmentation since a structural floor was never in the original design as shown in **Figure 2,** and if so how many floors can be common? Exact code language is not found, however if the vertical opening is eliminated horizontally with a rated and hose-stream tested assembly, has the potential for migration of smoke, heat and hot/toxic gases been mitigated? The answer is a resounding yes with one important caveat. Since this configuration is defining a 2-story atrium it is critical to meet the atrium separation requirements. Section 404.6, Enclosure of atriums, specifically requires that atrium spaces be separated from adjacent spaces by 1-hour construction both vertically and horizontally. Therefore, defining atriums as 2-story spaces can be achieved with 1-hour construction only. In other words, non-hose stream tested assemblies that are limited to 20-minute ratings under UL 10B, 10C or 10D cannot be used to define an atrium in either the vertical or horizontal orientation.

Design Solutions

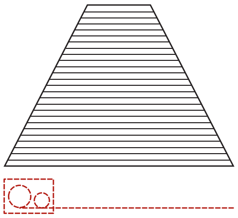
CASE 1: Horizontal (Floor) Shutter

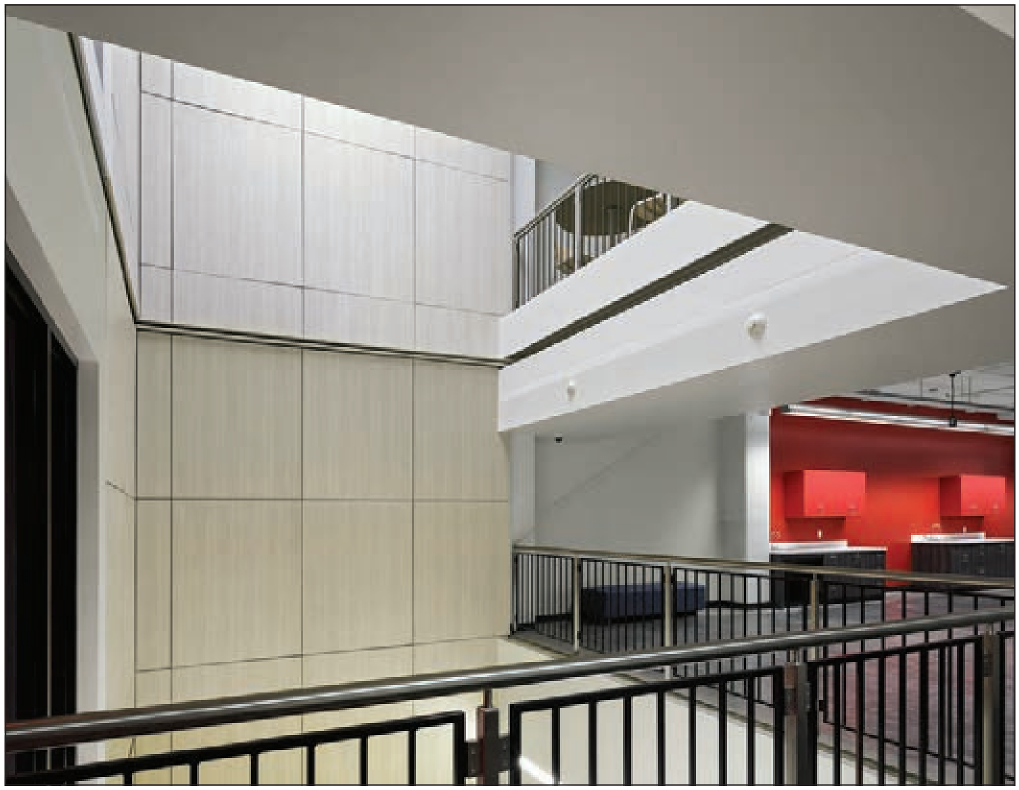


UL 10B 2-hour & UL 1784 "S" labeled, hose stream tested assembly.

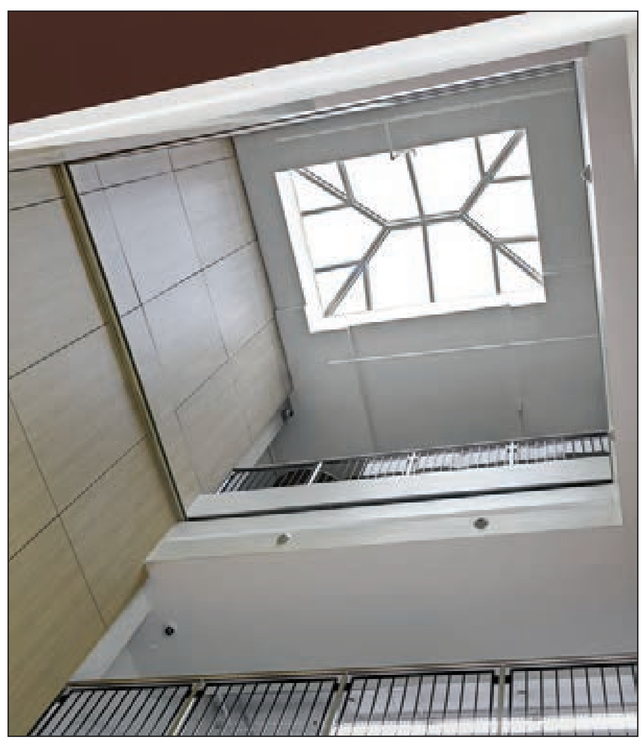
VERTICAL OPENING SEPARATION

Case 2: Horizontal (Floor) Shutter



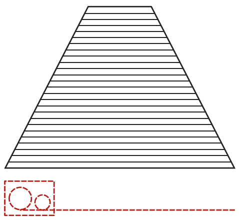


UL 10B 2-hour & UL 1784 "S" labeled, hose stream tested assembly.

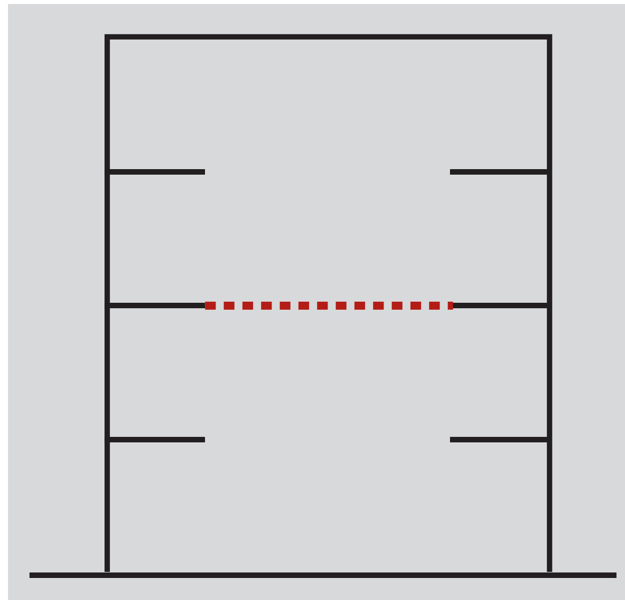


VERTICAL OPENING SEPARATION

CASE 3: Horizontal (Floor) Shutter

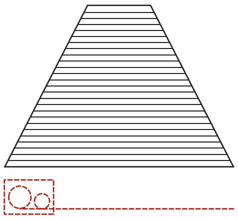


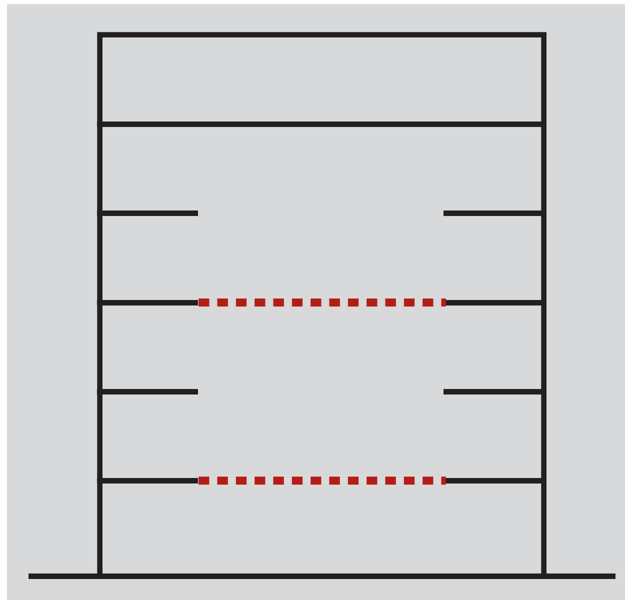
UL 10B 2-hour & UL 1784
"S" labeled, hose stream
tested assembly.



VERTICAL OPENING SEPARATION

CASE 4: Horizontal (Floor) Shutter





UL 10B 2-hour & UL 1784 "S" labeled, hose stream tested assembly.

McKEON®

4 Occupancy Separation

Fundamental Guidelines

Mixed Occupancy – Accessory Use

Mixed Occupancy Use – Non-Separated vs. Separated

Fundamental Guidelines

Table 508

Most buildings are designed for multiple uses that will typically result in more than one occupancy classification. The code provides three basic options for mixed occupancies in Section 508:

1. **Accessory occupancies: Section 508.2**
2. **Non-separated occupancies: Section 508.3**
3. **Separated occupancies: Section 508.4**

Chapter 3 of the building code specifically classifies a building according to its use and occupancy. The level of fire hazard varies with specific uses and occupancies in a building. However, this level of hazard and its potential affect on the building occupants is determined not only by the use and occupancy classification by construction type, height and area size, but also the use of passive and active fire protection systems. Chapter 5 combines fire-resistance levels, construction types and occupancy types to determine size and height limitations as well as separation requirements.

Increased fire resistance of the structural members of the building along with increased active and passive fire protection systems permits greater height and area allowances. Notwithstanding, the use and occupancy of the structure will become a determining factor regarding the extent of separation and compartmentation required. For example, a "B" (business occupancy) is allowed occupant load floor area to be calculated at 100 gross sq. ft. per occupant. However, a group "I-2" occupancy (hospital) which is a similar occupant load as far as quantity of people, is required to be calculated at 240 gross sq. ft. per occupant, more than double that of a "B" occupancy. The difference between these requirements is the use of the facility. Occupants in a hospital need better protection for a greater amount of time because they are non-ambulatory and most are dependent upon others for mobility or even life support. Therefore, the fire and life safety requirements designed to help protect building occupants are very different for each of these occupancies.

When buildings are designed as mixed occupancies there is a concern because basic fire and life safety requirements are being mixed within the same structure. Three basic options to eliminate confusion and ensure building occupant safety are outlined as follows:

Accessory Occupancy:

1. Accessory occupancies are those which are different from the main occupancy but ancillary to or a portion thereof. *(508.2)*
2. Aggregate accessory occupancies shall not occupy more than 10% of the area of the story. *(508.2.3)*
3. Aggregate accessory occupancies shall not exceed the tabular values in Table 506.2 without height and area increases. *(508.2.3)*
4. Accessory occupancies shall be individually classified in accordance with Section 302.1. *(508.2.1)*

Non-Separated Use:

To consider spaces under the Non-Separated Use requirements, the following must be met allowing NO separation between occupancies:

1. Each occupancy use shall be individually classified. *(508.3.1)*
2. Code requirements shall apply to each portion of the building based upon the occupancy classification of the space under consideration. *(508.3.1)*
3. The most restrictive applicable provisions of Section 403 and Chapter 9 shall apply to the building or portion thereof in which the non-separated occupancies are located, Section 403 in hi-rise and Chapter 9 in all others.
4. The allowable building area and height of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration for the type of construction of the building in accordance with Section 503.1. *(508.3.2)*

Separated Use:

The following requirements under the provisions of Separated Occupancies will bring these spaces into compliance without compromising design if separated with fire barrier walls according to Table 508.4:

1. Separated occupancies shall be classified in accordance with Section 302.1. *(508.4.1)*
2. Each separated space shall comply with the code based upon the occupancy classification of that portion of the building. *(508.4.1)*
3. In each story, the building area shall be such that the sum of the ratios of the actual building area of each separated occupancy divided by the allowable building area of each separated occupancy shall not exceed 1. *(508.4.2)*
4. Each separated occupancy shall comply with the building height limitations based on the type of construction of the building in accordance with Section 503.1. *(508.4.3)*

Mixed Occupancy – Accessory Use

Section 508.2

Post grade 12 educational occupancies are typically classified as "B" occupancies and usually incorporate mixed occupancies that are often considered accessory – full service kitchens and cafeterias (A-2), assembly areas (A), and dormitories (R-2) occupancies. Even though these spaces are ancillary to and a functional portion of the original larger occupancy they must be separated when they exceed the 10% rule.

Fire and Life Safety Concerns

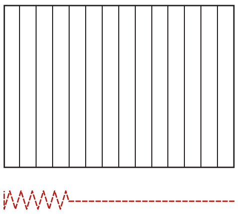
In this case study we will examine the potential fire and life safety threats posed due to the use of open flames, combustible gases and solids, and exhaust hood extinguishing systems. These kitchens (A-2) are often common with other areas (B or R-2) in the facility potentially exposing large groups of building occupants to the associated hazards. In these cases and similar situations, where the spaces are greater than 10%, separation is required.

Code Requirements

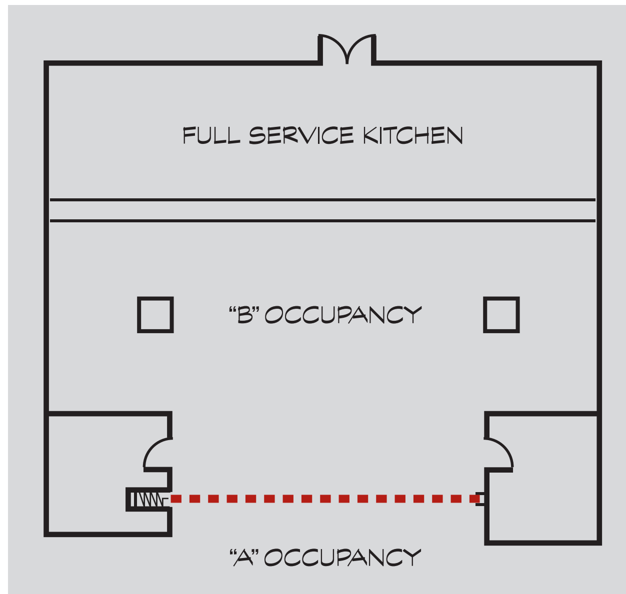
Table 508.4 in Chapter 5 provides the requirements for separation of occupancy types. Should an accessory occupancy exceed the 10% rule, this table becomes the determining factor. Since the separation must be a fire barrier wall *(508.4.4.1)*, Table 508.4 requires a 1-hour separation between an "A" and "B" occupancy or "R" and "B" occupancy when the building is fully sprinklered and 2-hour in non-sprinklered buildings.

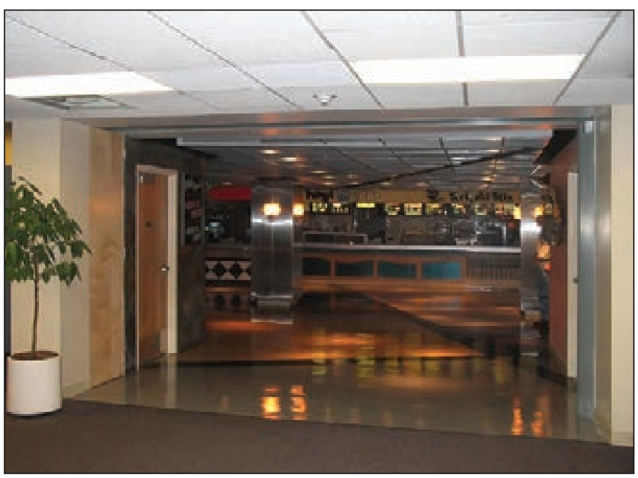
Design Solutions

CASE 1: Side Acting Accordion with Power-assisted Egress



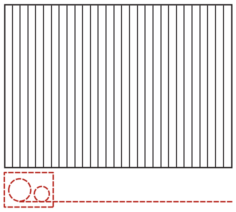
This first case study examines the use of the McKEON Side Acting Accordion fire door. The assembly is hidden from view unless there is a fire when it is activated by the smoke detector. Egress is accomplished by compliance to 1010.1.4.3.





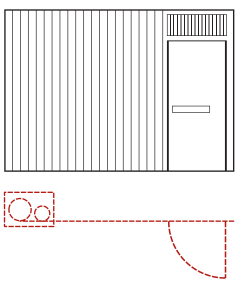
OCCUPANCY SEPARATION

CASE 2: Side Coiling without Egress

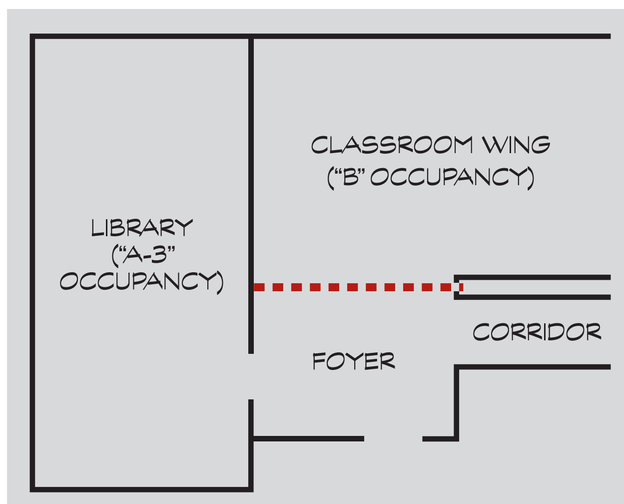


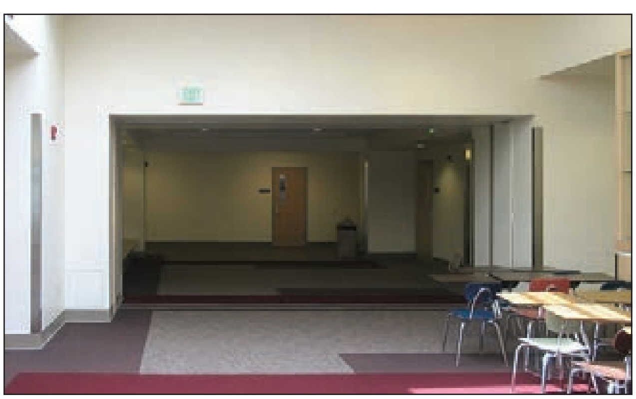
This case study is very similar to the previous application with the exception of an egress requirement. The McKEON side coiler without egress became the most economical solution without compromising life safety.

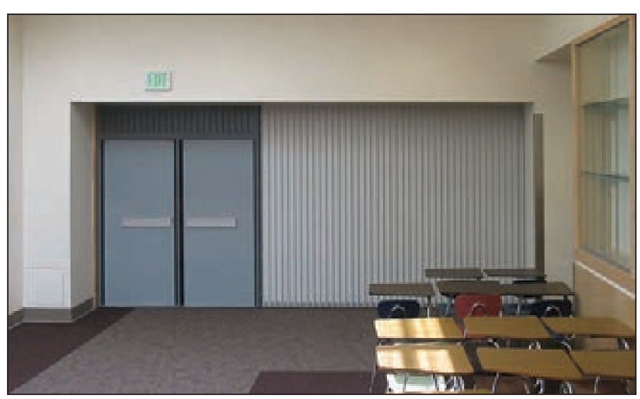
CASE 3: Side Coiling with Complying Swing Egress Door(s)



This third case study features a different product under the same code premise, the requirement to separate an “A-3” occupancy (library) from the rest of the “B” occupancy, school. The feature product is the Side Coiling with Conventional Egress Assembly due to limited width of pocket space.







Inquiry Discussion and Questions

The 10% rule mentioned before refers to an area limitation imposed upon aggregate accessory occupancies. As stated in Section 508, aggregate accessory occupancies are allowed, however specific restrictions apply as detailed on page 65 of this section.

The following questions may be helpful:

- What is the classification of a full-service kitchen within an occupancy type “B” structure?
- Do you perceive a full-service kitchen that requires a Type 1 exhaust hood extinguishing system as per the International Fire Code (IFC, Section 610.2 & IBC 904.2.1) as a potential threat to the students?
- When you are required to separate the kitchen from the rest of the space are you concerned about easy access and traffic flow in front of the serving area?
- Would it be more convenient for your client to have the wide-span opening protective located in front of the serving area, separating the kitchen space, to also act as a security door when the kitchen is not in use?

Notes:

Mixed Occupancy Use – Non-Separated vs. Separated

Section 508; Table 508.4

Complying with Table 508.4 and providing fire barrier walls to separate occupancies can be limiting to the design. Also, using non-separated provisions to eliminate restrictive fire barrier walls becomes extremely costly due to added fire and life safety requirements that affect the entire structure.

Fire & Life Safety Concerns

Building structures are classified based on their occupancy and use. The purpose for classifying structures is to configure optimum safety requirements commensurate to the need as dictated by each individual use. These areas of concern are general building limitations, means of egress, fire protection systems and interior finishes. The challenge comes when buildings contain rooms or spaces that are different than the original building occupancy classification thereby creating a mixed use or mixed occupancy structure.

Code Requirements

In this case study the Conference/Training room is 1,188 square feet with an occupant load of 79. It is classified as an A-3 occupancy located in a 5-story Group B office building of Type IIIA construction. The conference room is classified as an A-3 because it is used for gathering a large number of people for assembly purposes (Section 303.1). It cannot be considered an accessory space because it exceeds both occupant load and area square footage of the accessory use exceptions.

First, let's look at the requirements imposed if we attempt to eliminate all separations as indicated in Table 508.4, in other words non-separated use.

Non-Separated Use:

1. Each use shall be individually classified. *(508.3.1)*
    - The entire building is classified as a "B" occupancy. The

space under consideration (Conference/Training room) is an A-3 occupancy.

2. The allowable building area and height of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration … *(508.3.2)*

3. The most restrictive applicable provisions of Section 403 and Chapter 9 shall apply to the entire building or portion thereof. *(508.3.1)*

   - Section 403 encompasses the requirements for hi-rise construction and Chapter 9 include the provisions for fire protection systems. In other words, the building will have to incorporate the most protective and restrictive requirements of these chapters. For example:

     - Standpipe system *(403.4.3)*

     - Smoke detection *(403.4.1)*

     - Fire Alarm systems *(403.4.2)*

     - Emergency voice/alarm communication system *(403.4.4)*

     - Fire command *(403.4.6)*

     - Smoke removal *(403.4.7)*

     - Emergency responder radio coverage *(403.4.5)*

     - Standby power *(403.4.8)*

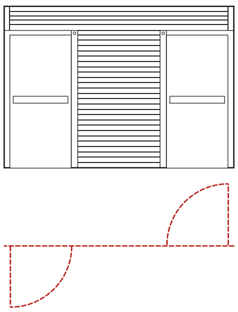
     - Emergency power systems *(403.4.8.4)*

4. The allowable height and area of the building or portion thereof shall be based on the MOST RESTRICTIVE allowances for the occupancy group under consideration for the types of construction of the building in accordance with Section 503.1. *(508.3.2)*

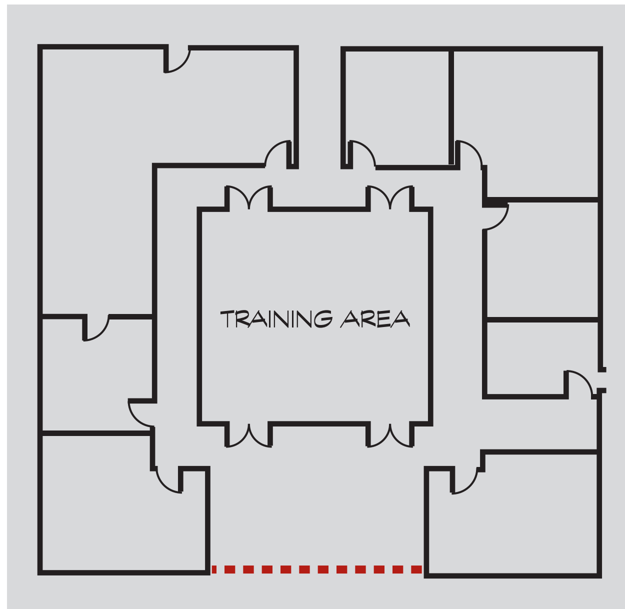
   - The height and area allowances for this requirement would not allow the building to be five stories. Most likely only three at best.

Design Solutions

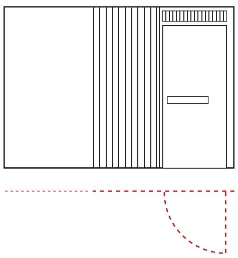
CASE 1: Vertical Coiling with Complying Swing Egress Door(s)



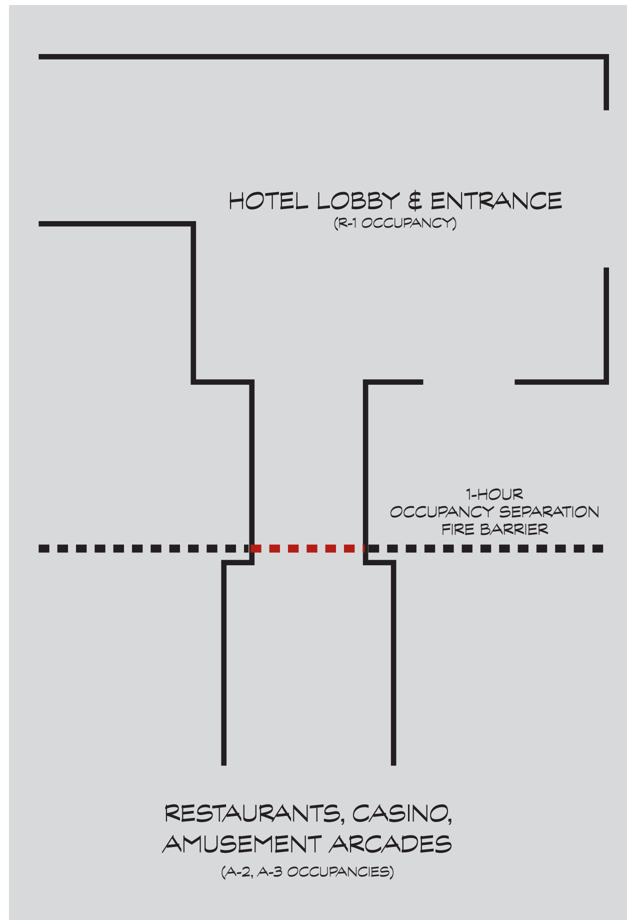
The use of wide span opening protectives enables occupancy separation without compromising open and spacious design. In this case study a simple deployable separation prevents the overall structure from being subject to the most restrictive provisions of non-separated use.



CASE 2: Side Acting with Complying Swing Egress Door(s)

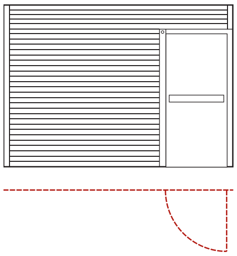


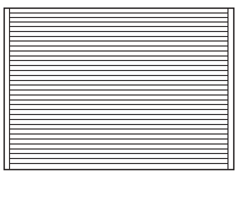
This case study is a text book example of occupancy separation, but is very unique in product application problem-solving from an architectural perspective. Pocket space was limited in width, but not depth, and headroom was extremely limited. Given the ambiance of the space, conventional swing doors on magnetic hold-opens were not an option. McKEON provided the S7000 series which requires only a 7" pocket width and no more than a 2 1/4" reveal in the ceiling for the head track. With patented side acting technology the entire assembly, incorporating four conventional swing doors, fits into a narrow space parallel to the fire barrier wall. Upon command of the smoke detector the 3-hour assembly slides into place providing occupancy separation and conforming egress.



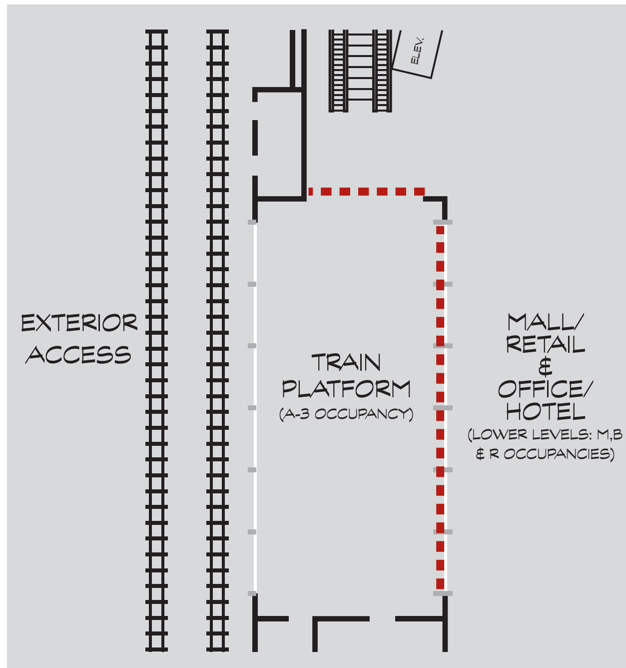
OCCUPANCY SEPARATION

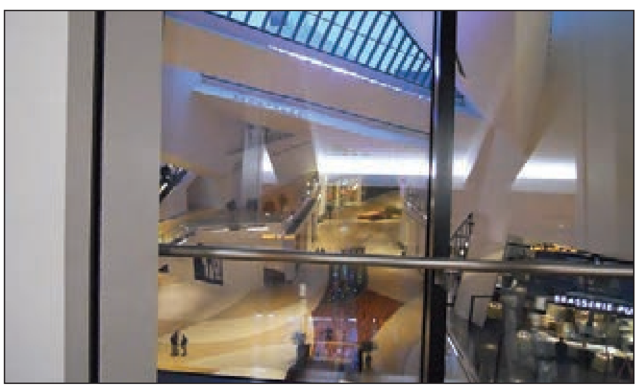
CASE 3: Vertical Coiling with Complying Swing Egress Door(s) & Vertical Coiling without Egress

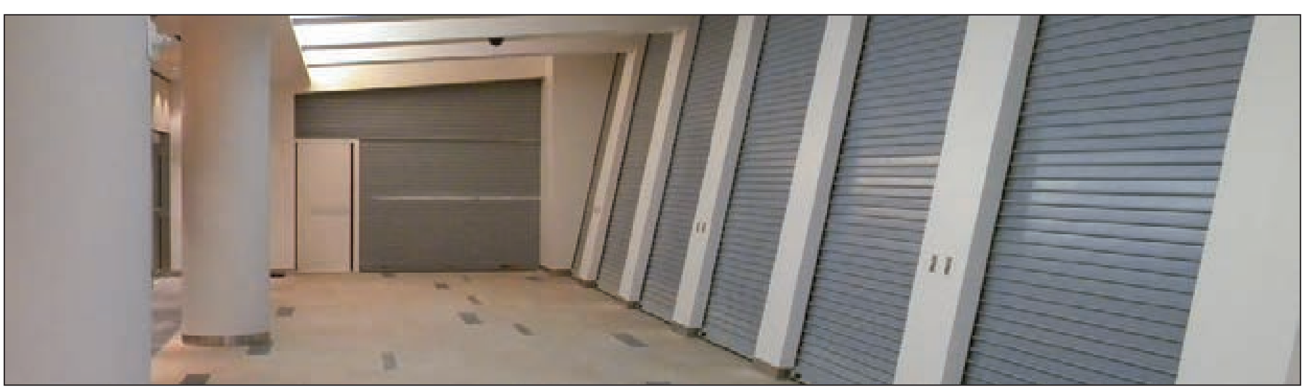




In this case study McKEON offers a solution to a difficult challenge by providing two different products within the same space. A combination of six fire-rated vertical rolling shutters installed on a diagonal path of travel and one vertical coiling assembly with conventional egress for exiting from the space. This solution preserves the beauty of the space without compromising mixed occupancy separation requirements.

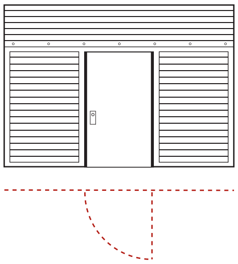




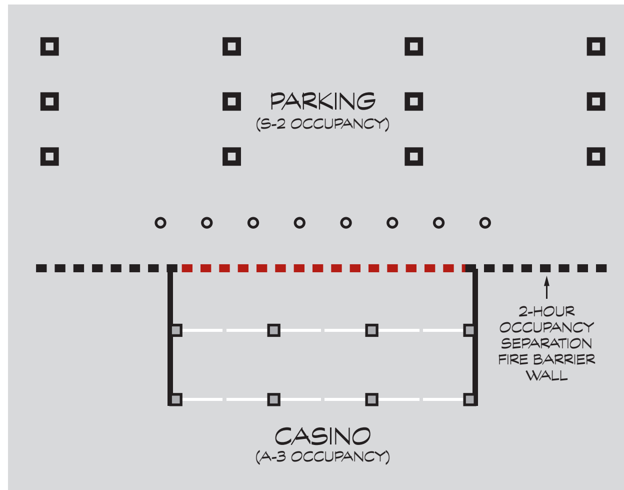


OCCUPANCY SEPARATION

CASE 4: Vertical Acting with Complying Swing Egress Door(s)



This application illustrates McKEON's capacity to provide 3-hour separation, conforming to a large occupant load exit width without occupying side stacking space. Deploying only in case of fire or emergency, both egress and fire separation requirements are satisfied without compromising design.



Inquiry Discussion and Questions

Fundamentally, separating the interior of buildings with fire barriers wherever occupancies change as required in Table 508.4 is simple and straightforward. However when designs promote mixed occupancies without separation, the code is left to create alternate means of protection to compensate for the loss of fixed barriers. Hence, in the absence of passive redundant systems, code enforcement becomes a tremendous challenge and the non-separated use provisions govern. These provisions are extremely costly.

The following questions may be helpful:

- Are you frustrated because open design is difficult when incorporating fire barrier walls as occupancy separations?
- Can I show you how wide-span opening protectives can eliminate the need to design non-separated structures?
- Have you considered the additional cost incurred by conforming to the non-separated use requirements?
- Do you really want to impose the most restrictive requirements of Chapter 4, Section 403 hi-rise provisions as well as the most restrictive requirements of Chapter 9 on the entire building?

Notes:

5 Area Separation

Allowable Area

Allowable Area

Section 706; Tables 504.3, 504.4, 506.2

The allowable height and area of a building structure is determined largely by two basic factors; first, the combustibility of its structural materials and second, occupancy type or use and purpose of the building. When a building design exceeds the established values, the intent of the code is to create another separate building structure to incorporate the increase. Since this is not always desirable, the code will allow interior fire walls to serve as separations sufficient to consider each space a separate structure within the tabular value allowance. In essence multiple compliant buildings can be created within the same structure and under a common roof.

Fire & Life Safety Concerns

Building height and area are calculated to accommodate three fundamentals principles in fire and life safety. First, the structural elements, rated or non-rated, are intended to maintain structural integrity during fire and other life threatening emergencies. This means the greater the protection of the structural elements, the larger the height and area. Second, additional height and area are allowed when active fire suppression systems such as sprinklers are used. Finally, passive redundant elements are used to compartmentalize the area and provide protection for building occupants as they egress the structure. Rated construction protects the structural elements, sprinklers protect the building contents, and egress protects building occupants by removing them from harm's way. All three principles overlap and work together to ensure a building occupant has adequate time to safely exit the structure. The reduction or absence of any of these components can compromise the safety of building occupants and cause property damage.

Another concern is the size of openings allowed in the passive redundant system, particularly in fire walls that are crucial to the area limitations. Opening size limitations are imposed to maintain the integrity of the wall during fire conditions. Opening protectives inherently accommodate strict requirements to adequately protect and maintain the integrity of the openings. The structural integrity of the fire wall must be maintained regardless of the wall opening size or its opening protective. It is critical to remember; the opening protective protecting an opening in a fire wall is not required to conform to structural integrity provisions. The opening protective is protecting the opening – NOT the wall. A fire wall used for area separation is allowed openings and opening protectives, however, a fire wall used as a party wall cannot have openings.

Code Requirements

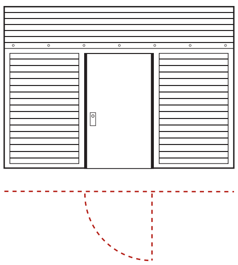
1. The above referenced tables of Chapter 5 indicate the tabular height and area allowances for specific building construction types and occupancies.
2. Each portion of a building separated by one or more fire walls shall be considered a separate building. (*503.1)*
3. Openings in fire walls are subject to the following criteria *(706.8):*

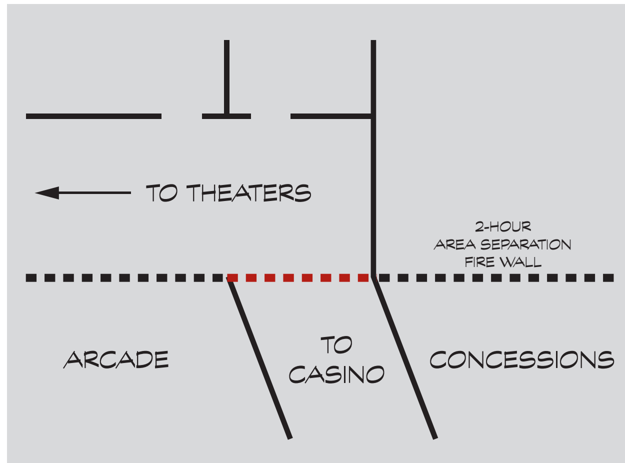
Non-sprinklered buildings – Openings shall not exceed 156 square feet and the aggregate width of openings at any floor shall not exceed 25 percent of the length of the wall.

Sprinklered buildings – Openings shall not be limited to 156 square feet and the aggregate width of openings at any floor shall not exceed 25 percent of the length of the wall.

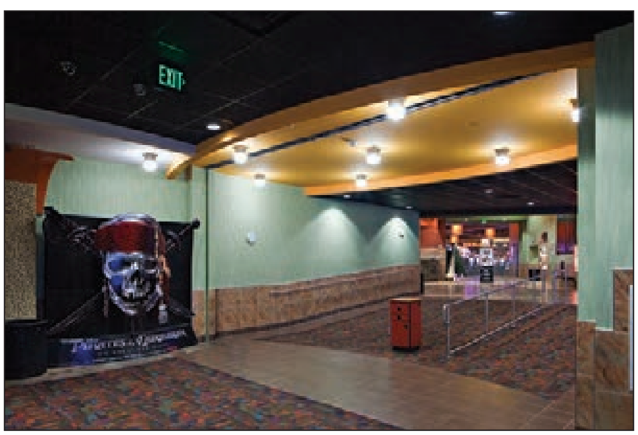
Design Solutions

CASE 1: Vertical Acting with Complying Swing Egress Door(s)



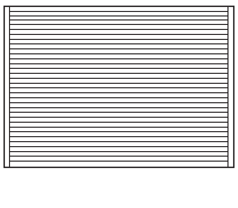


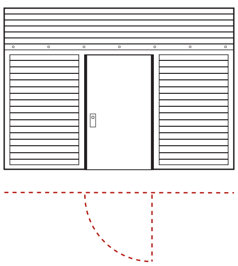
In this application McKEON resolved two significant design code compliance problems without sacrificing wide span open appearance. First, nearly the entire opening was necessary to meet the exit width requirements located in the primary means of egress system in an “A” occupancy. Using the McKEON accordion assembly would not comply because of a) the large distance to be covered and b) the length of time required to open wide enough to allow for immediate egress. Second, there was not sufficient stacking space for any of the McKEON side acting models. However, because headroom was plentiful and large occupant load egress was a necessity, the T5000 series incorporating six egress conventional swings doors, three doors set in each direction to accommodate dual egress, was the perfect fit and the only viable solution.

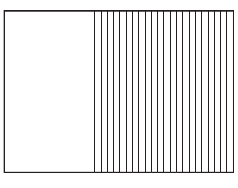


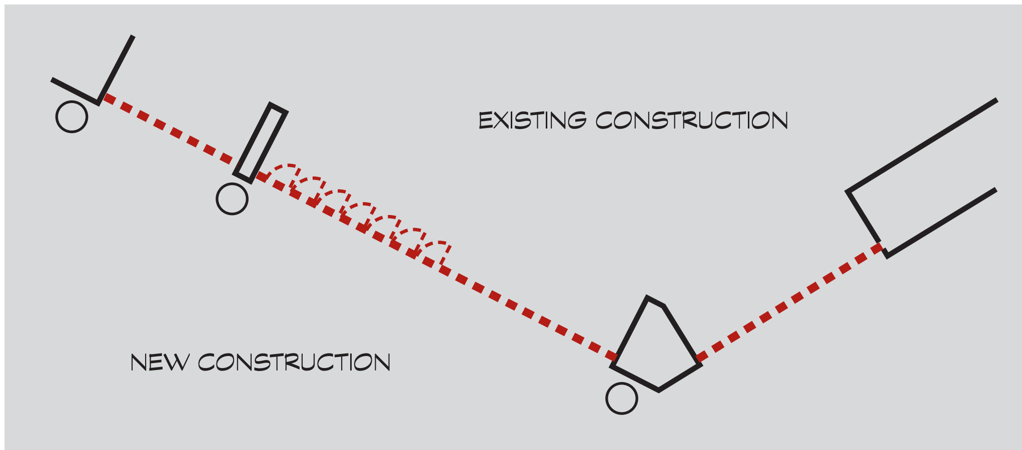
AREA SEPARATION

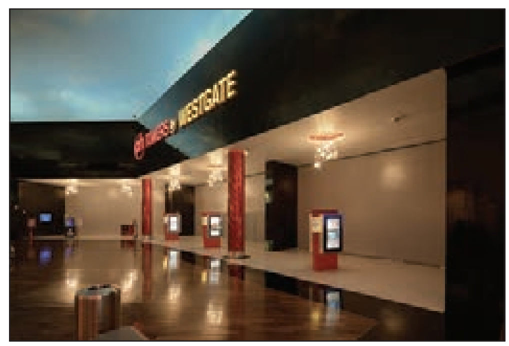
CASE 2: Vertical Coiling without Egress, Vertical Acting with Complying Swing Egress Door(s) & Side Acting without Egress











Inquiry Discussion and Questions

The decision to use the area separation strategy is determined early in the conceptual design phase of the project.

Resistance to incorporate fire walls may be due to the following:

- Limited understanding of the code allowances for considering one structure as multiple buildings.
- The structural integrity of the fire wall design appears costly and overwhelming compared to the basic design; i.e. parapets, return exterior walls, etc.
- Limited understanding of diverse wide-span opening protectives. Conventionally, openings in any wall seem to follow the swing door model, largely due to the perception that complying egress is limited to these kinds of doors and mullions. This traditional way of traversing throughout the building is very limiting and simply prohibitive to open design.

The following questions may be helpful:

- Have you ever been frustrated designing a structure because you exceeded the area allowances and were pushed to increase the construction type?
- When you are required to change a construction type to accommodate additional area, what is the increase in cost? How does your client feel about the increase?
- Are you hesitant to consider an area separation wall because of the limitations for openings as implied with conventional swing doors?

Notes:

6 Corridor Separation

Corridor Separation – Healthcare

Corridor Separation – Healthcare

Section 407.2.4

Gift shops focus on retail exposure to the public. Nonetheless they are located in hospitals and typically open to corridors that fall under strict provisions for life safety. Compliance with these strict provisions using conventional opening protectives can limit market exposure.

Fire & Life Safety Concerns

The corridor system in a hospital is designed to protect non-ambulatory patients and their attendants from the transfer of smoke from adjacent spaces. Gift shops and their associated storage offer a particular threat because of the potential fuel load created by large quantities of merchandise. The smaller the shop the lesser the threat of contents that are burning during a fire emergency, so the code requires no separation at the corridor opening of a gift shop if the square footage in minimal.

Code Requirements

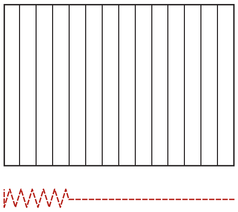
Gift shops are allowed to be open to the corridor where the total square footage does not exceed 500 square feet. *(407.2.4)*

To better understand the opening protective requirements let's review the corridor provisions for I-2 occupancies (hospitals).

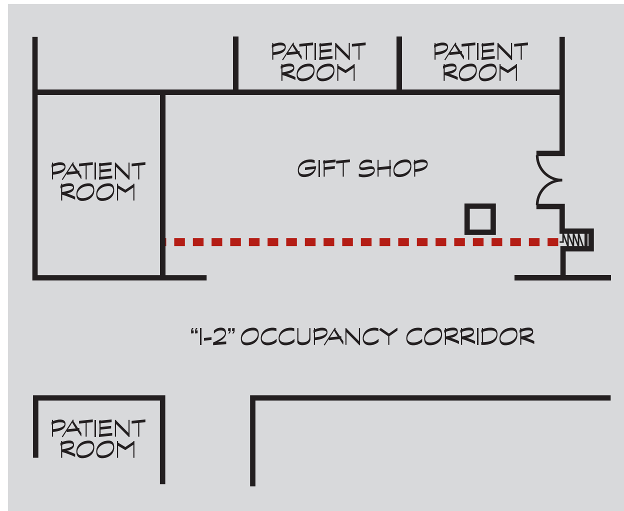
1. The corridor wall shall be constructed as a smoke partition. *(407.3)*
2. Smoke partitions are not required to be fire-rated. *(710.3)*
3. Doors protecting openings in smoke partitions in I-2 occupancies are as follows:
   - Non-fire-rated. *(407.3.1)*
   - Not required to be self-closing or automatic-closing. *(407.3.1)*
   - Must be positive latching. *(407.3.1)*
   - Shall provide an effective barrier to limit the transfer of smoke. *(407.3.1)*
   - Must be a smoke and draft control door listed under UL 1784. *(710.5.2)*

Design Solutions

CASE 1: Side Acting Accordion with Power-assisted Egress

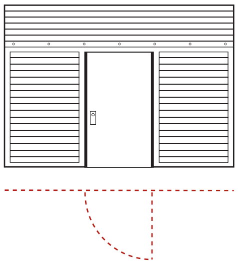


Incorporating the McKEON wide-span side acting accordion allows this space to be open for business without restricting view into the gift shop or customer access. At the command of a smoke detector the large width opening is rapidly protected and the fire and life safety corridor provisions are not compromised.

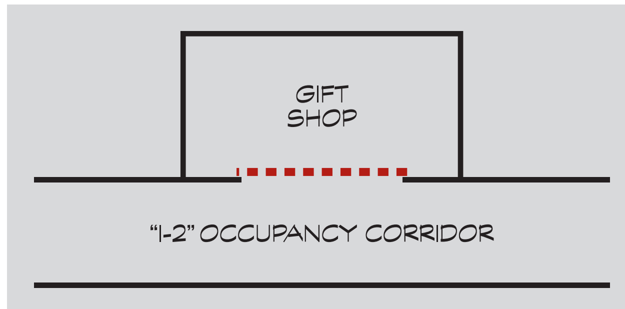


CORRIDOR SEPARATION

CASE 2: Vertical Acting with Complying Swing Egress Door(s)

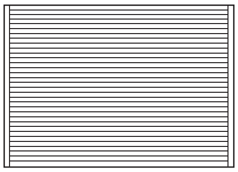


Incorporating the McKEON T5000 technology, the egress doors are completely concealed in the vertical space above, to close only in case of fire.

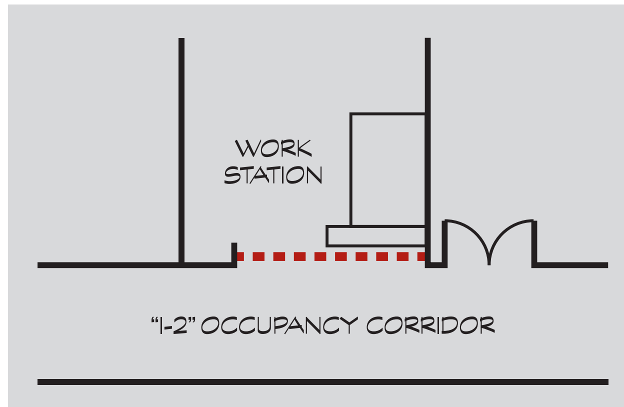


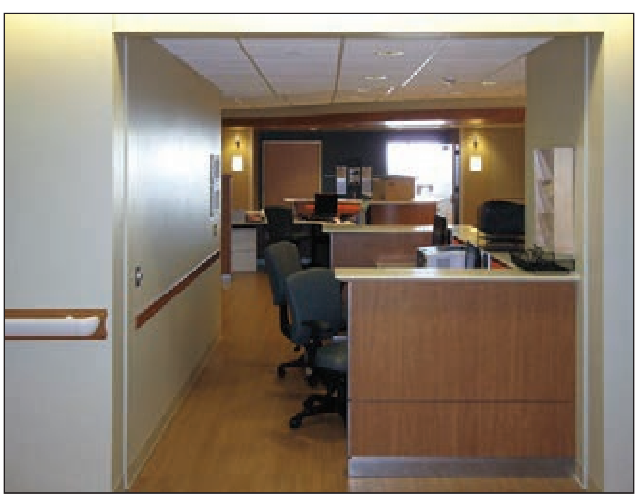
CORRIDOR SEPARATION

CASE 3: Vertical Coiling without Egress



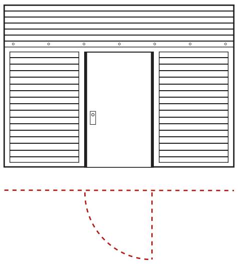
Egress is not required but a 2-hour fire rating is. This work station is left open during normal business hours. The protective assembly is easily lowered and locked after hours. Completely automated, whether in fire or security mode, any building occupant can operate the assembly.



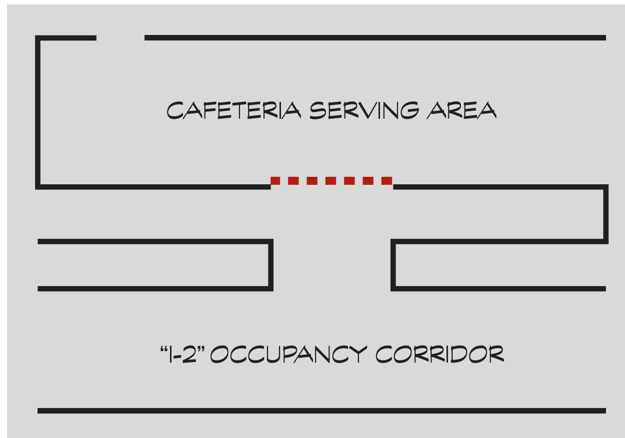


CORRIDOR SEPARATION

CASE 4: Vertical Acting with Complying Swing Egress Door(s)

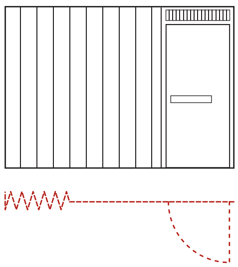


In this unique application, the McKEON T5000 technology, with integral code complying conventional egress doors, descends from the overhead space when the building goes into alarm. During normal business hours cafeteria patrons easily traverse the space from the corridor without obstruction.

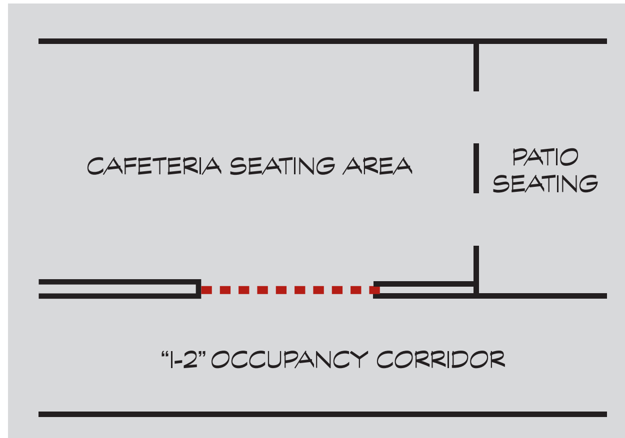


CORRIDOR SEPARATION

CASE 5: Side Acting Accordion with Complying Swing Egress Door

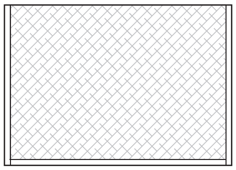


The McKEON accordion technology easily accommodates a conventional egress door.

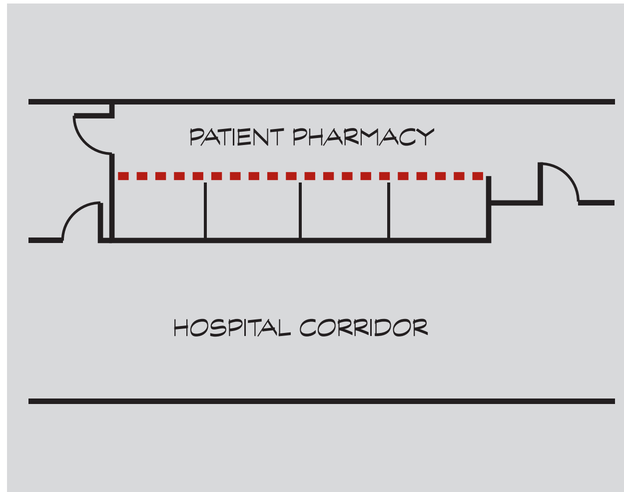


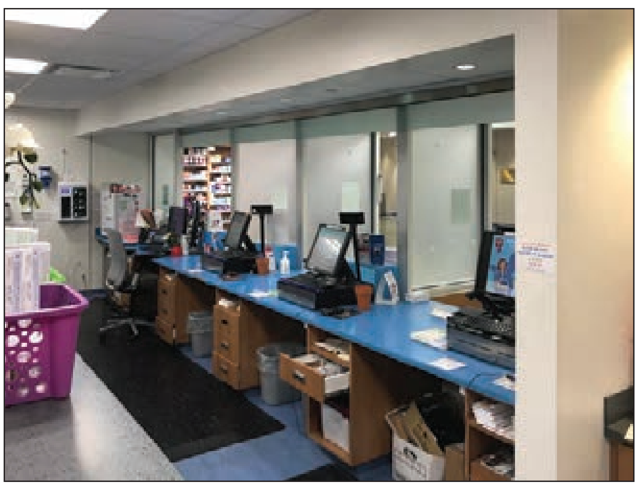
CORRIDOR SEPARATION

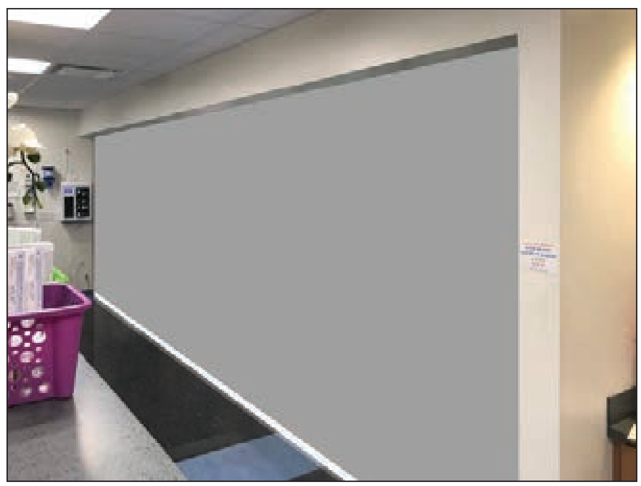
CASE 6: Vertical Acting without Egress



In I-2 occupancies corridor walls are required to be smoke rated only (Section 407.3). The SmokeFighter® D150 is an excellent re-solve to minimal headroom space allowances. This hospital patient pharmacy is easily separated from the corridor with one of the lat-est technologies offered by McKEON.



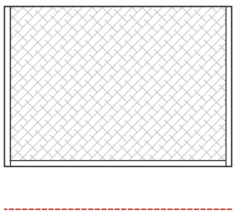




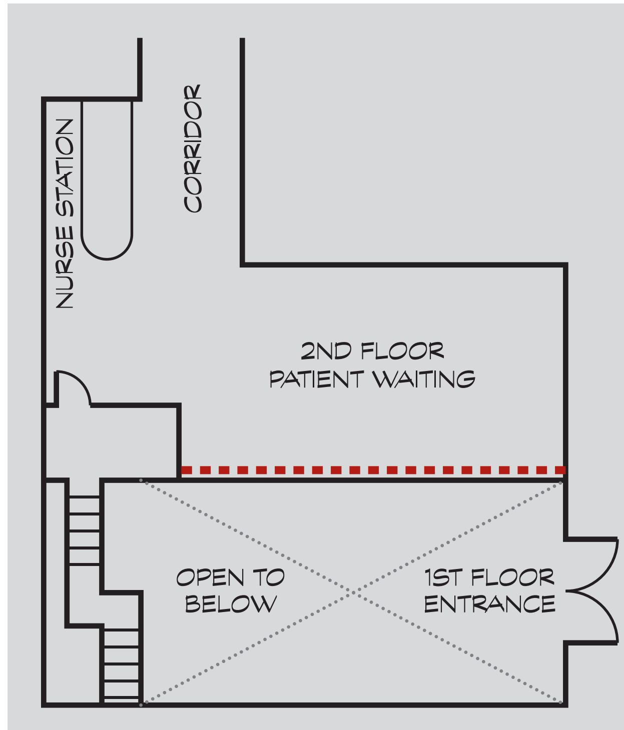
SIMULATION

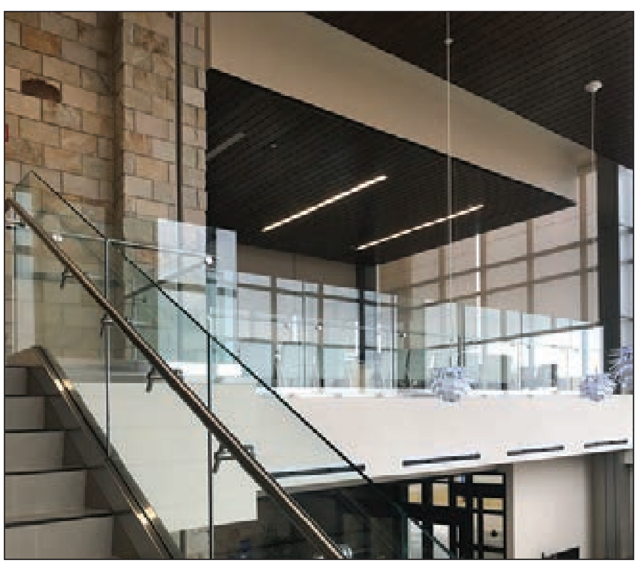
CORRIDOR SEPARATION

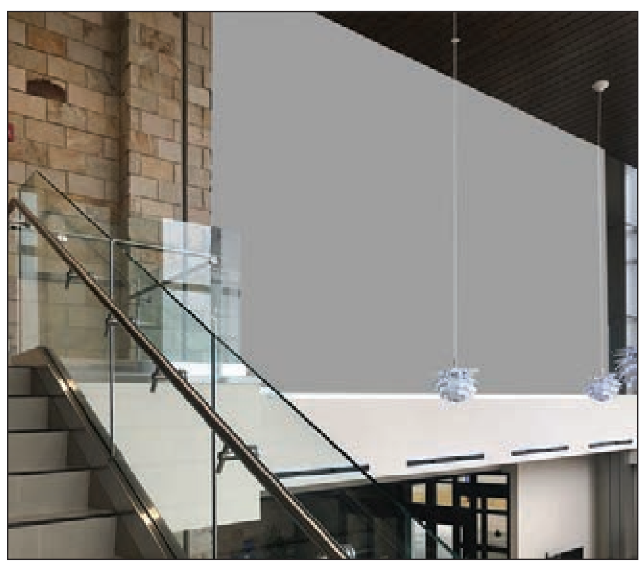
CASE 7: Vertical Acting without Egress



In I-2 occupancies the corridor walls are required to be smoke rated only (Section 407.3). Section 712.1.9 also instructs the design team that 2-story unprotected openings are not allowed in these same “I” occupancies. McKEON provides a unique solution to this challenge with the SmokeFighter® D150. This smoke rated curtain is deployable and will only close when the building goes into emergency alarm. During normal business hours the entire 2-story space is free of any visual obstacles.



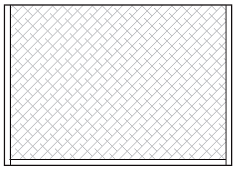




SIMULATION

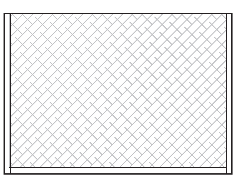
CORRIDOR SEPARATION

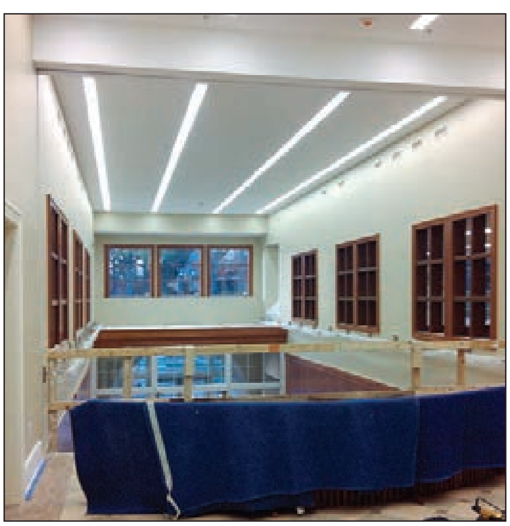
CASE 8: Vertical Acting without Egress

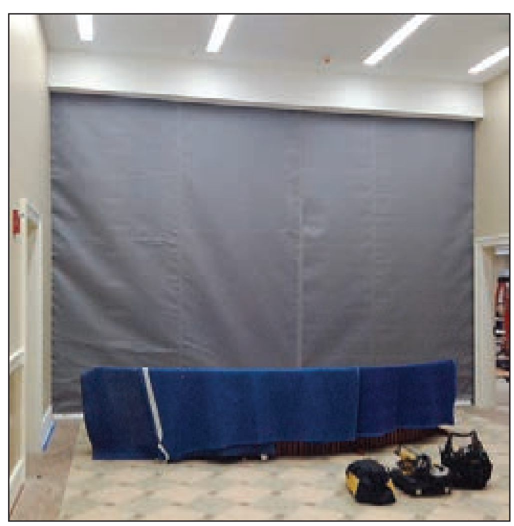


In this case study we will examine the requirements of the R-2 occupancy (congregate living facility with more than 16 occupants) pertaining to corridor rating and vertical space allowances. All corridors are required to be constructed of fire rated walls with a minimum rating of 30 minutes (1020.1). Also, these “R” occupancies cannot have unprotected 2-story openings (712.1.9, #4). These requirements can be challenging when spacious open designs are desired. Because the opening protectives for these walls can be rated 20-minutes (716.5.3), the McKEON FireFighter® D200 is the perfect solution. Take a look, too, at CASE 9. It is right across the hall!

CASE 9: Vertical Acting without Egress







CORRIDOR SEPARATION

Inquiry Discussion & Questions

A gift shop space is considered a potential fire hazard when it exceeds 500 square feet. Most designs will limit this space to 500 square feet or incorporate sheet rock, swing doors and wire glass to accommodate greater area spaces that open to the corridor. During a fire event, deployed wide-span opening protectives seal off large fuel load areas – such as gift shops that exceed 500 square feet – and protect building occupants who are moving through corridors. These assemblies can also serve as security doors when the gift shop is closed.

The following questions may be helpful in understanding pertinent challenges:

- Do you desire to have a gift shop larger than 500 square feet?
- Even though a gift shop, larger than 500 square feet, is not shown on Table 509 as an incidental use space … why is it required to be separated with 1-hour construction?
- May I show you how McKEON can help you eliminate a closed-in appearance at the corridor bordering gift shops exceeding 500 square feet in area?

Notes:

McKEON®

7 Smoke Compartmentation

Smoke Compartments – Healthcare

Smoke Barriers – Healthcare

Smoke Compartments – Healthcare

Section 407

The compartmentation requirements in these case studies are unique to hospital occupancies and are driven, for the most part, by means of egress provisions.

Fire & Life Safety Concerns

The code allows patient rooms to be arranged in open suites. However, this type of arrangement supposes a low patient-to-staff ratio where the staff is directly responsible for the safety of the patients in the event of a fire. To ensure safety, small smoke compartments with short-distance egress to protected exits become critical.

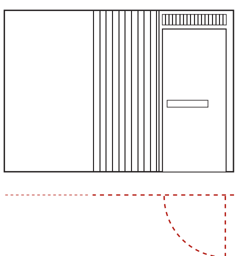
Code Requirements

1. Habitable rooms or suites in Group I-2 occupancies shall have an exit access door leading directly to a corridor. *(407.4.1)*
2. Care suites containing patient sleeping rooms shall not exceed 7,500 square feet, sprinklered areas with automatic smoke detection,10,000 square feet. *(407.4.4.5.1)*
3. Care suites containing other than patient sleeping rooms shall not exceed 12,500 square feet, sprinklered 15,000 square feet. *(407.4.4.6.1)*
4. Any patient sleeping room, or any care suite that includes patient sleeping rooms, of more than 1,000 square feet shall have at least two exit access doors remotely located from each other. *(407.4.4.5.2)*
5. Any room or suite of rooms other than patient sleeping rooms of more than 2,500 square feet shall have at least two access doors remotely located from each other. *(407.4.4.6.2)*
6. Travel distance between any point and an exit access door in a room not located in a care suite shall not exceed 50 feet. *(407.4.2)*

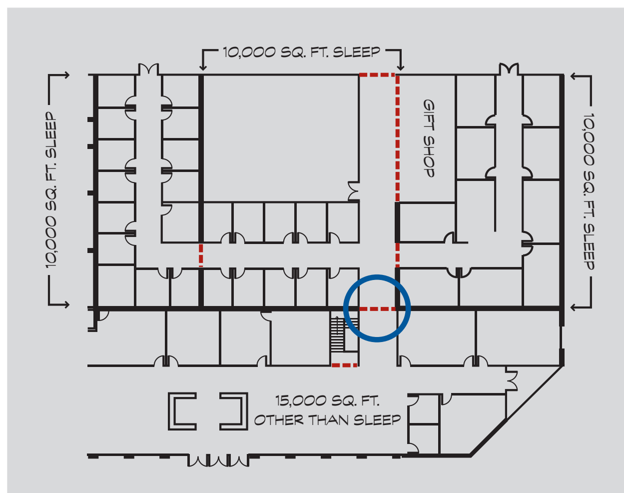
7. Travel distance between any point in a suite of sleeping rooms shall not exceed 100 feet, automatic smoke detection 125 feet. *(407.4.4.3)*
8. Vision panels are required in cross-corridor application of I-2 occupancies. *(709.5.1)*
9. Walls designed to create separate suites shall be construction as non-rated smoke partitions. *(407.4.4.2)*
10. Openings within smoke compartment walls that are not used to protect a vertical opening or an exit are not required to have a fire-rating but shall provide an effective barrier to limit the transfer of smoke. Also, these opening protectives do not have to be self-closing. *(Section 407.3.1)*

Design Solutions

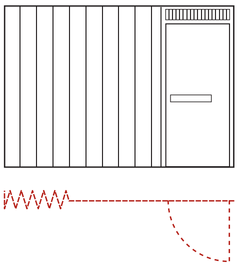
CASE 1: Side Acting with Complying Swing Egress Door(s)



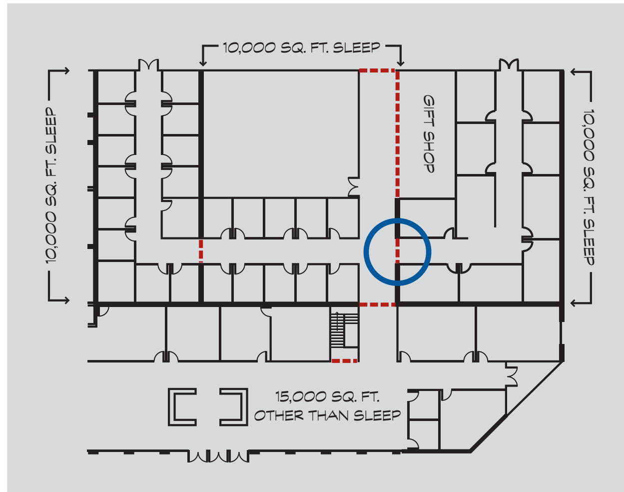
In this case study we find it difficult to maintain continuity with compartmentation when passing through corridors or other open areas with smoke partition walls. With the wide-span capabilities of the McKEON door assembly there is no compromise between building functionality and code compliance.



CASE 2: Side Acting Accordion with Complying Swing Egress Door

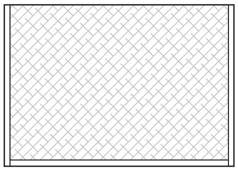


This side acting accordion offers conventional egress with a swing door attached to wide panels that provide a compact profile for less stack space.

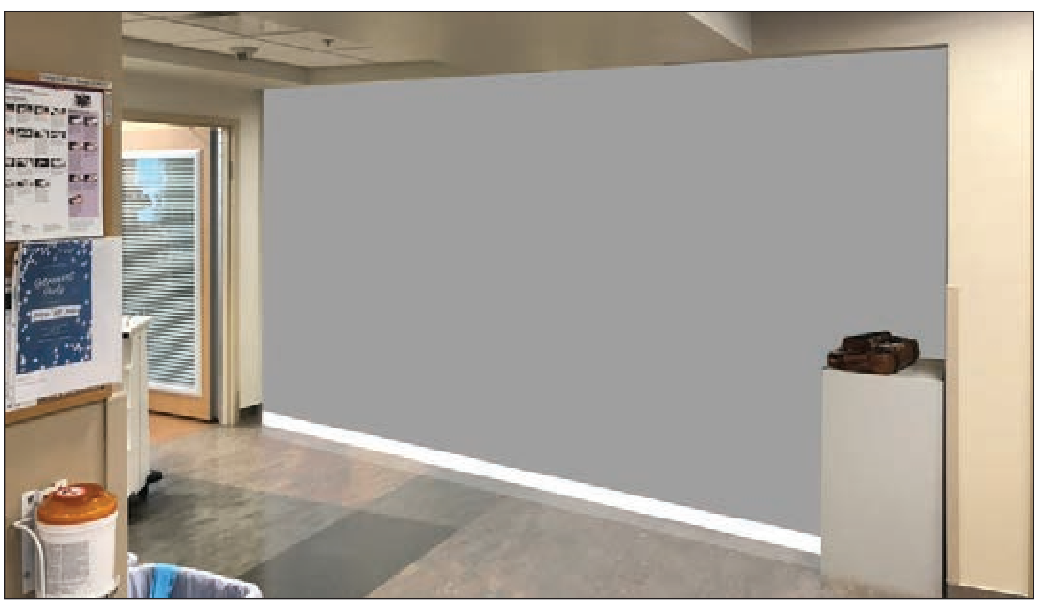


SMOKE COMPARTMENTATION

CASE 2: Vertical Acting without Egress



Designing care suites, particularly critical units in large hospitals, can be challenging when complying with restrictive smoke compartment provisions. The maximum area limit in care suites containing patient sleeping rooms with sprinklers and automatic smoke detection is 10,000 square feet. This case study features a critical suite that far exceeds these limits. The SmokeFighter® D150 came to the rescue and provided necessary separation where head room was limited and side room would only allow for very discreet side guides.



SIMULATION

Inquiry Discussion and Questions

Often more desirable floor plans will be compromised to accommodate smoke compartmentation requirements. Rooms become smaller, corridors often inhibited with opening protectives, nurses stations altered, etc. to create life-saving smoke free spaces. Most often these adjustments become routine without an understanding of wide span opening protective technology.

The following questions may be helpful:

- May I show you how a smoke compartment separation can cross a corridor without compromising the space?
- Did you know that a side acting accordion door can be used in a means of egress across a corridor regardless of the occupant load served?
- Smoke compartments are no respecter of open spaces. Can I show you how you can span virtually any distance without compromising the space?

Notes:

Smoke Barriers – Healthcare

Section 709

Smoke barriers divide areas of a building into separate smoke compartments. These dividing walls allow building occupants time to be evacuated or relocated to other smoke compartments. In other words, smoke barriers separate portions of buildings into areas of refuge capable of resisting the passage of smoke and fire for 1 hour. *(Section 709)*

Fire & Life Safety Concerns

Smoke barriers are specifically required in I-2 (hospital) occupancies due to the non-ambulatory status of the building occupants (Section 407.5). Usually these occupants require assistance and care when being evacuated or relocated during an emergency. There must be a protected area where these patients can be placed until safely evacuated from the building. Smoke barriers in Group I-2 occupancies provide this defend-in-place mechanism.

Code Requirements

The following five requirements designate the use of smoke barriers in Group I-2 occupancies:

1. Group I-2 occupancies are required to subdivide every story into smoke compartments with an area not more than 22,500 square feet. *(407.5)*
2. Smoke compartments are to be divided using smoke barrier walls in accordance with Section 709. *(407.5)*
3. Smoke barriers are required to subdivide every story used by patients for sleeping or treatment with an occupant load of 50 or more persons into at least two compartments. *(407.5)*
4. Travel distance in smoke compartments shall not exceed 200 feet. *(407.5)*
5. Independent egress – A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originated. *(Section 407.5.2)*

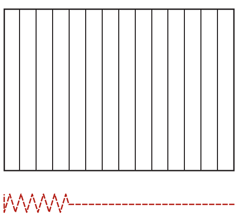
SMOKE COMPARTMENTATION

In order to accommodate an opening in a smoke barrier wall the following opening protective requirements must be met:

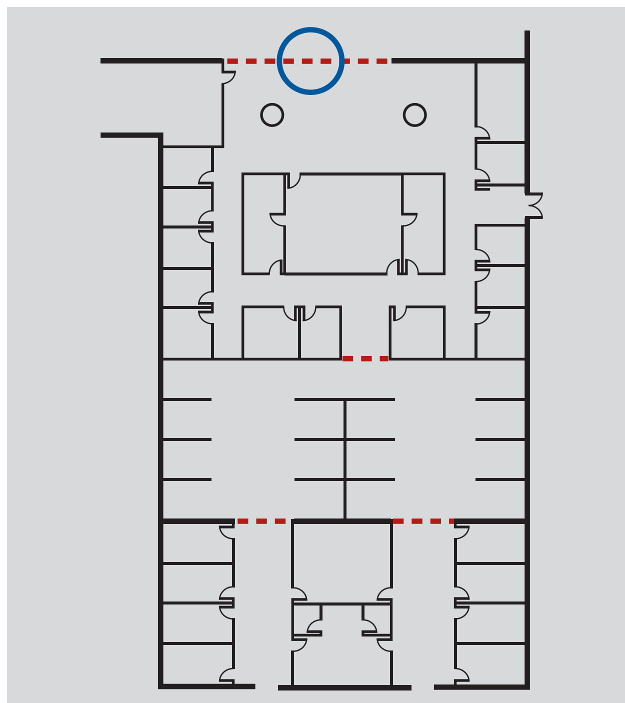
1. Minimum fire rating of 20 minutes. *(Section 716.5.3 & Table 716.5)*
2. Vision panels. *(709.5.1)*

Design Solutions

CASE 1: Side Acting Accordion with Power-assisted Egress

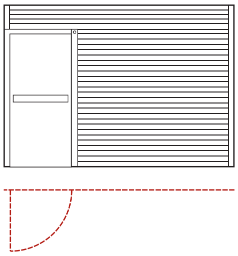


In this case study the intent is to add to an existing I-2 occupancy a 9,700 square foot Critical Care Suite. The existing building construction type is IIIA with 21,324 square feet and the desire is to have the new suite as open as possible to the existing hospital corridor system. The placement of a smoke barrier wall at this new addition connection is a specific code requirement in order to fall within the 22,500 square foot limitation. With the use of the McKEON wide-span labeled assembly approved for egress, the opening protective requirements are met without compromising the spacious clear open ambiance desired.

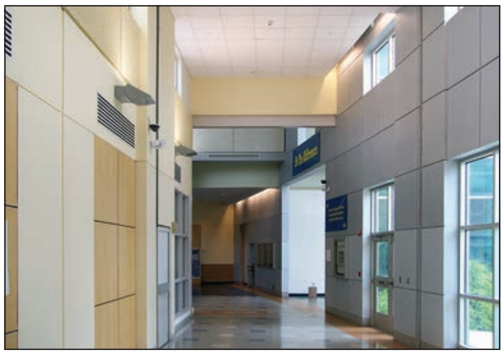


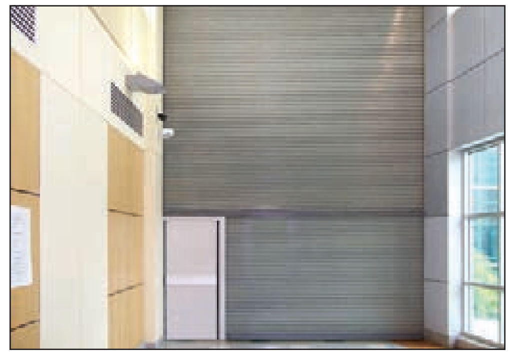
SMOKE COMPARTMENTATION

CASE 2: Vertical Coiling with Complying Swing Egress Door(s)

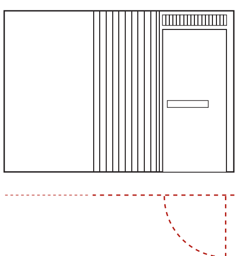


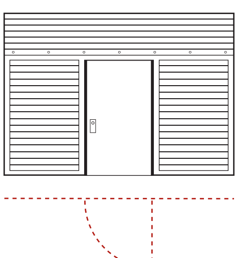
Regardless of the size of the space, smoke barriers must be maintained throughout the building. McKEON can easily protect these unusually large openings without compromising building ambiance.



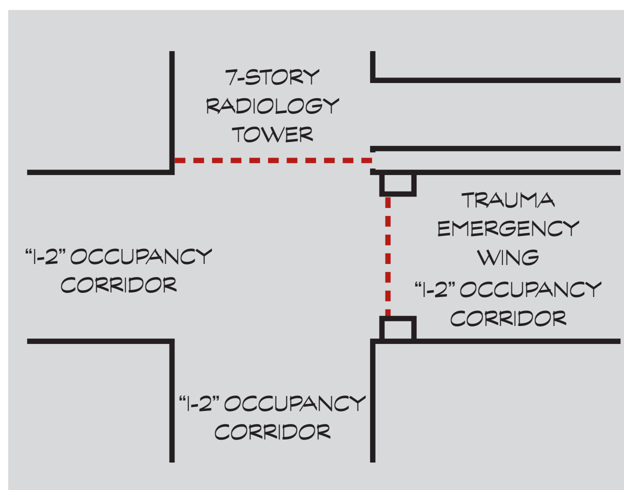


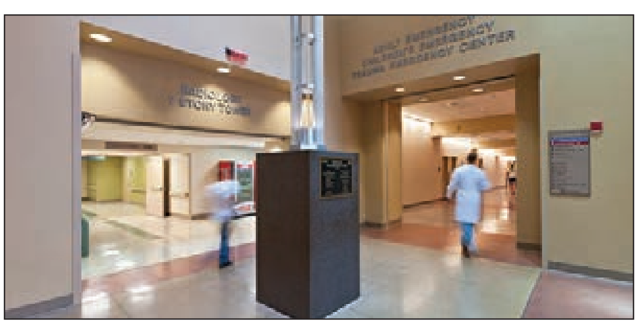
CASE 3: Side Acting with Conventional Egress Door(s) & Vertical Acting with Complying Swing Egress Door(s)

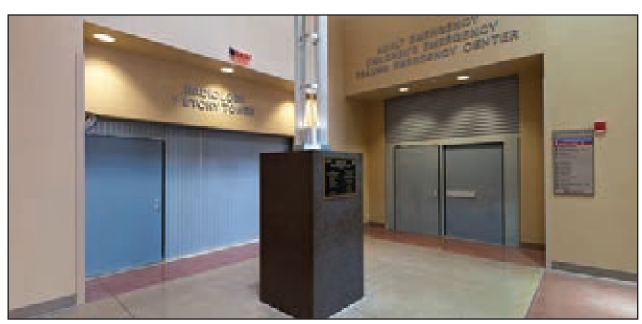




These two very different technologies converge on the inside corner of the structure to complete the smoke barrier separation creating separate refuge area compartments. Op-erating as duel function assemblies they are also located to separate the corridors from additional spaces.







Inquiry Discussion & Questions

In principle, smoke compartmentation and smoke barrier separation are the same with minor differences. Smoke barriers are created using 1-hour rated walls (Table 716.5) and the separations are incurred at a minimum of 22,500 square feet. Smoke compartments are created using non-rated smoke partitions and the separations are incurred at a minimum of 10,000 square feet in suites of sleeping rooms and 15,000 square feet in non-patient room areas. Smoke compartment applications occur in Group I-2 occupancies/hospitals and smoke barrier applications occur in Group I-2 and/or Group I-3 occupancies/prisons.

Helpful questions for smoke barrier applications can be found in the smoke compartmentation case study.

Notes:

8 Resilient Construction

Storm Shelters

Storm Shelters

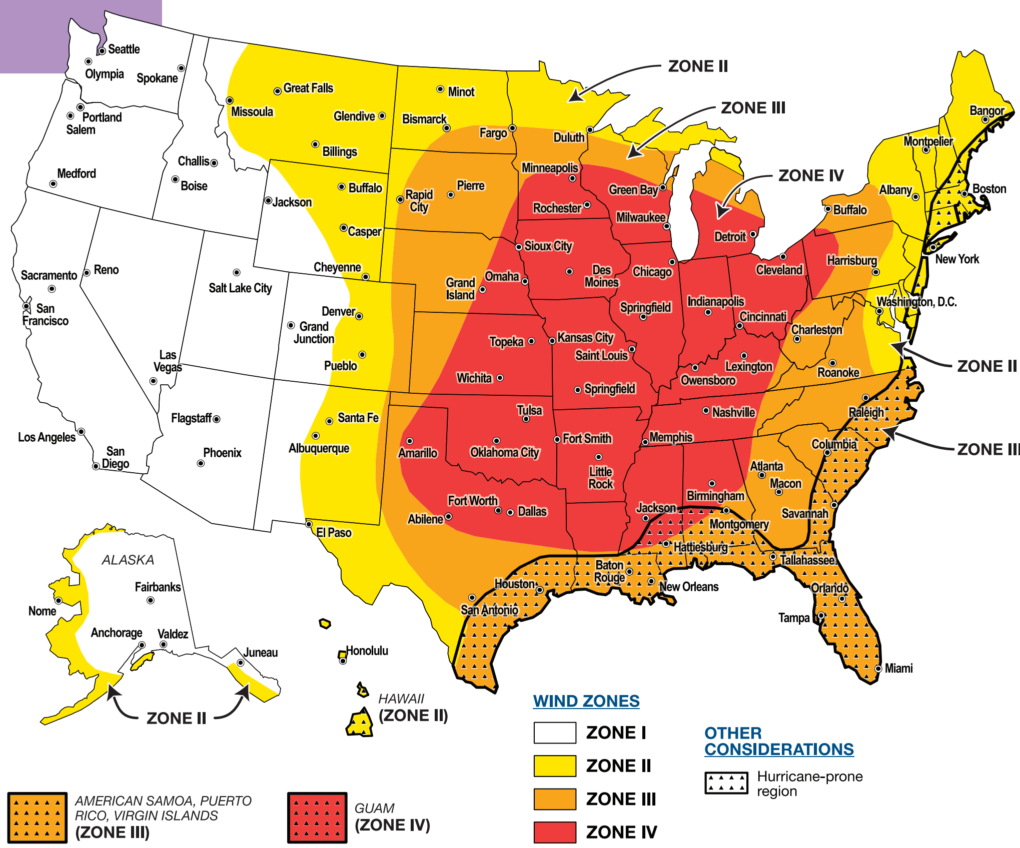
Section 423

Storm shelters can be constructed as separate detached buildings or as safe rooms within new or existing buildings. These types of structures are required to be designated hurricane shelters, tornado shelters or a combination thereof.

Fire & Life Safety Concerns

International Building Code committee staff worked closely with the Federal Emergency Management Agency (FEMA), in particular consulting the FEMA 361 Standard, when creating a formal ICC safety standard for buildings constructed in high-wind-load areas where tornadoes and hurricanes are a prevalent threat. The ICC 500 Standard has been adopted and incorporated into Section 423 of the code to provide safe areas of refuge from these storms.

WIND ZONES IN THE UNITED STATES*



* If you are uncertain of your location because of the level of detail and size of the map, or if you live on or near one of the delineation lines, use the highest adjacent wind zone.

Code Requirements

Section 423.3 Critical emergency operations. In areas where the shelter design wind speed for tornadoes in accordance with Figure 304.2(1) of ICC 500 is 250 MPH, 911 call stations, emergency operation center and fire, rescue, ambulance and police stations shall have a storm shelter constructed in accordance with ICC 500.

Exception: Buildings meeting the requirements for shelter design in ICC 500.

Section 423.4 Group E occupancies. In areas where the shelter design wind speed for tornadoes is 250 MPH in accordance with Figure 304.1(1) of ICC 500, all Group E occupancies with an aggregate occupant load of 50 or more shall have a storm shelter constructed in accordance with ICC 500. The shelter shall be capable of housing the total occupant load of the Group E occupancy.

Exceptions:

1. Group E day care facilities
2. Group E occupancies accessory to places of religious worship
3. Buildings meeting the requirements for shelter design in ICC 500

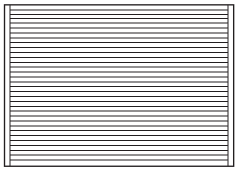
Design Solutions

In the case studies that follow the McKEON SafeSpace™ 500 is featured – an opening protective that complies with the stringent requirements of FEMA 361. Specifically passing the ASTM E1886 based missile impact test and withstanding wind pressures at 240 psf in accordance with ASTM E330, designers can now create large openings in exterior walls of ICC 500 compliant structures or compliant spaces within structures. Please note: When required the SafeSpace 500 can be labeled with a UL 10B 3-hour fire rating and UL 1784 smoke rating, the SafeSpace 500F model.

Missile impact test proves ability to withstand wind-borne debris from a hurricane or tornado.

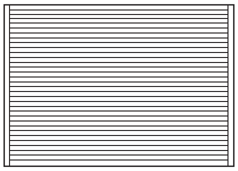
The SafeSpace 500 was subjected to both a positive and a negative 255 mph wind load.

CASE 1: Vertical Coiling without Egress

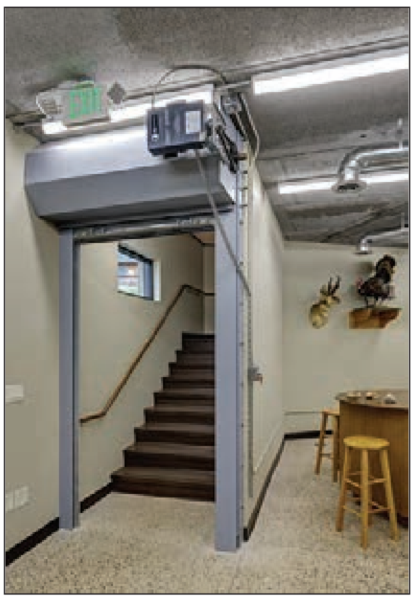


This elementary school cafeteria addition was required to comply with the FEMA 361/ICC 500 provisions. Without the SafeSpace™ 500 the three large window openings in the front of the structure would not have been possible. The cafeteria entrances would have been limited to small swing door openings and the space would have had to be artificially lit. The casual observer would not know this addition is tornado safe, it looks like a typical school multi-purpose cafeteria!

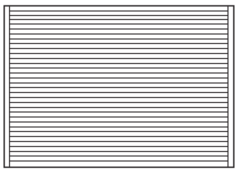
CASE 2: Vertical Coiling without Egress



Located within the 250 MPH wind zone, a two-story summer camp facility turned the lower level into a storm shelter. With SafeSpace™ 500 technology the structure is compliant without sacrificing natural light and appearance.



CASE 3: Vertical Coiling without Egress



Similar to the previous cases, this beautiful library in the Ida Freeman Elementary School is also a tornado shelter. Thanks to SafeSpace™ 500 technology large windows and storefront doors let in plenty of daylight. It is easy to imagine that this area is simply a spacious, inviting area for reading and learning.

Inquiry Discussion and Questions

Often design teams struggle with creating storm shelters because the code seems to allow openings no larger than the typical ICC 500 rated swing doors. Rolling steel assemblies that are FEMA 361/ICC 500 compliant offer design flexibility and allow the space to meet the requirements of a resilient structure. When incorporating a storm shelter into a typical non-FEMA rated structure this same design flexibility is available with the SafeSpace™ technology because in most cases the separation walls are required to be fire and smoke rated as well.

The following questions may be helpful:

- Are you concerned the structure under design will look like a "prison" when the requirements of ICC 500 or FEMA 361 are a part of your design?
- Did you know that if your jurisdiction is the recipient of FEMA funding, it is possible that associated construction may have to follow the FEMA 361 guidelines?
- Do you know if the area wherein you are designing an E occupancy or emergency operations facility structure is under the provisions of FEMA 361 or ICC 500?

Notes:

Appendix

Definitions

Resources

Fire Walls – Section 706

Definition

A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall. *(202)*

Fire Ratings: *(Table 706.4)*

2-hour

3-hour

4-hour

Opening Protection: *(706.8)*

Non-sprinklered buildings – Openings shall not exceed 156 square feet and the aggregate width of openings shall not exceed 25 percent of the length of the wall.

Sprinklered buildings – Openings may exceed 156 square feet but the aggregate width of all openings shall not exceed 25 percent of the length of the wall.

Design Notes

- Each portion of a building separated by one or more fire walls shall be considered a separate building. *(503.1)*
- Where a fire wall separates occupancies that are required to be separated by a fire barrier wall, the most restrictive requirements of each separation shall apply. *(706.1)*
- Regardless of the rating of the opening protective, fire walls cannot have openings that exceed 25 percent of the length of the wall. *(706.8)*
- Fire walls constructed as party walls shall NOT have openings. *(706.1.1)*

Applications

- Exceeding area allowances (*Tables 504.3, 504.4, 506.2)*
- Horizontal Exits *(1026)*

Fire Barriers – Section 707

Definition

A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained. *(202)*

Fire Ratings: *(Tables 716.5; 707.3.10)*

1-hour

2-hour

3-hour

4-hour

Opening Protection

Non-sprinklered Buildings – Openings shall be limited to a maximum aggregate width of 25 percent of the length of the wall, and the maximum area of any single opening shall not exceed 156 square feet. *(707.6)*

Sprinklered Buildings – Openings may exceed 156 square feet but must be limited to a maximum aggregate width of 25 percent of the length of the wall, unless the opening protective assembly has been tested in accordance with ASTM E119 and has a minimum fire-resistance rating not less than the fire-resistance rating of the wall. *(707.6 Exceptions #1 & #3)*

Design Notes

- A fire barrier may have an opening exceed the 25 percent rule if the building is sprinklered and the opening protective assembly is tested under the provisions of ASTM E-119. As seen below, most fire-rated walls used in building design will fall under Section 707, Fire Barrier Walls.

Applications

- Shaft Enclosures *(713.4)*
- Interior Exit Stairways *(1023.1)*
- Exit Passageways *(1024.3)*
- Horizontal Exits *(1026.1)*
- Atriums *(404.6)*
- Incidental Use Areas *(Table 509)*
- Control Areas *(414.2.4)*
- Separated Occupancies *(Table 508.4)*
- Fire Areas *(Table 707.3.10)*
- Enclosures for Exit Access Stairways *(713.4)*

Fire Partitions – Section 708

Definition

A vertical assembly of materials designed to restrict the spread of fire in which openings are protected. *(202)*

Fire Ratings *(708.3)*

1-hour

1/2-hour *(708.3, Exceptions #1 & #2)*

Opening Protection

Opening protectives in fire partitions shall have a minimum fire rating of 20 minutes and a maximum of 45 minutes *(Table 716.5)* and shall be smoke tested under UL 1784. *(716.53)*

Design Notes

- Most rated corridor walls fall into this category. *(708.1 and Table 1020.1)*
- Typically corridor walls are not required to be rated unless the structure is non-sprinklered. *(Table 1020.1)*

Applications

- Separation walls as required by Section 420.2 for Groups I-1, R-1, R-2 and R-3 *(708.1, Item #1)*
- Egress balconies as required by Section 1019.2 *(708.1, Item #5)*
- Walls separating tenant spaces in covered mall buildings as required by Section 402.4.2.1 *(708.1, Item #2)*
- Corridor walls as required by Section 1020.1 *(708.1, Item #3)*
- Elevator lobby separation as required by Section 3006.2 *(708.1, Item #4)*

Smoke Barriers – Section 709

Definition

A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly that is designed and constructed to restrict the movement of smoke. *(202)*

Fire Ratings *(709.3)*

1-hour

Opening Protection

Opening protectives in smoke barriers shall have a minimum 20 minute fire rating and UL 1784 smoke test rating. *(Table 716.5)*

Design Notes

- Door assemblies in cross-corridor smoke barriers of I-2 Occupancies (Hospitals) shall have vision panels. *(709.5.1)*
- Smoke barriers constructed of minimum 0.10-inch-thick steel in I-3 Occupancies (Jails & Prisons) are not required to be 1-hour rated. *(709.3)*

Applications

In I-2 Occupancies (Hospitals) smoke barriers are required to subdivide every story used by patients for sleeping or treatment. *(407.5)* As per the following:

- 50 or more persons / minimum 2 smoke compartments
- Each compartment cannot exceed 22,500 square feet
- Travel distance shall not exceed 200 feet to a smoke barrier door

In I-3 Occupancies (Jails & Prisons) smoke barriers are required to divide every story occupied by residents for sleeping. *(408.6)* As per the following:

- 50 or more persons / minimum 2 smoke compartments
- Maximum number of residents in any smoke compartment is 200
- Travel distance to any exit access component shall not exceed 150 feet
- Travel distance to any smoke barrier door shall not exceed 200 feet

Smoke Partitions – Section 710

Definition

A partition constructed to limit the transfer or passage of smoke. *(710.4)*

Fire Ratings *(710.3)*

Non-rated

Opening Protection

Door assemblies shall be UL 1784 tested and self closing by smoke detection. *(710.5.2)*

Design Notes

- Corridor walls in an I-2 Occupancy (Hospital) shall be constructed as Smoke Partitions. *(407.3 & 710)*

Applications

- Corridor walls of I-2 Occupancies (Hospitals) *(407.3)*
- Elevator Lobbies *(3006.3, Item #2)*
- Separation of care suites in Group I-2 Occupancies *(407.4.4.2)*

International Building Code, 2018

Means of Egress (AC8800 Series)

1010.1.2 Door Swing. Egress doors shall be side-hinged swinging.

Exceptions:

6. In other than Group H occupancies, horizontal sliding doors complying with Section 1010.1.4.3 are permitted in a means of egress.

1010.1.4.3 Special purpose horizontal sliding accordion or folding doors. In other than Group H occupancies, horizontal sliding doors permitted to be a component of a means of egress in accordance with Exception 6 to Section 1008.1.2 shall comply with all of the following criteria:

1. The doors shall be power operated and shall be capable of being operated manually in the event of power failure.
2. The door shall be openable by a simple method from both sides without special knowledge or effort.
3. The force required to operate the door shall not exceed 30 pounds (133 N) to set the door in motion and 15 pounds (67 N) to close the door or open it to the minimum required width.
4. The door shall be openable with a force not to exceed 15 pounds (67 N) when a force of 250 pounds (1100 N) is applied perpendicular to the door adjacent to the operating device.
5. The door assembly shall comply with the applicable fire protection rating and, where rated, shall be self-closing or automatic closing by smoke detection in accordance with Section 716.5.9.3 and shall be installed in accordance with NFPA 80 and shall comply with Section 716.
6. The door assembly shall have an integrated standby power supply.
7. The door assembly power supply shall be electrically supervised.
8. The door shall open to the minimum required width within 10 seconds after activation of the operating device.

NFPA 101 Life Safety Code, 2018

Means of Egress

7.2.1.4 Swing and Force to Open

7.2.1.4.1.4a, b, c Special-purpose horizontally sliding accordion or folding door assemblies complying with 7.2.1.14 shall be permitted.

7.2.1.14 Special-Purpose Horizontally Sliding Accordion or Folding Door Assemblies. Special-purpose horizontally sliding accordion or folding door assemblies shall be permitted in a means of egress, provided that the following criteria are met:

1. The door leaf is readily operable from either side without special knowledge or effort.
2. The force that, when applied to the operating device in the direction of egress, is required to operate the door leaf is not more than 15 lbf (67 N).
3. The force required to operate the door leaf in the direction of door travel is not more than 30 lbf (133 N) to set the leaf in motion and is not more than 15 lbf (67 N) to close the leaf or open it to the minimum required width.
4. The door leaf is operable using a force of not more than 50 lbf (222 N) when a force of 250 lbf (1100 N) is applied perpendicularly to the leaf adjacent to the operating device, unless the door is an existing special-purpose horizontally sliding accordion or folding exit access door assembly serving an area with an occupant load of fewer than 50.
5. The door assembly complies with the fire protection rating, if required, and, where rated, is self-closing or automatic-closing by means of smoke detection in accordance with 7.2.1.8 and is installed in accordance with *NFPA 80, Standard for Fire Doors and Fire Windows.*

INTERTEK Code Compliance Research Report

CCRR 1086

For access to this report:

- Download from the Intertek website: intertek.com/building/ccrr/
- Download from the McKEON website: mckeondoor.com

International Building Code, 2021

202 Definitions, 716 Opening Protectives, Referenced Standards

The development and final vote of the following code sections have been completed and will be published in the 2021 edition of the IBC:

Section 202 Definitions

FIRE PROTECTIVE CURTAIN ASSEMBLY. An assembly consisting of a fabric curtain, bottom bar, guides, coil, operating and closing system.

Section 716 Opening Protectives

716.4 Fire protective curtain assembly. Approved fire protective curtain assemblies shall be constructed of any materials or assembly of component materials tested without hose stream in accordance with UL 10D, and shall comply with Sections 716.4.1 through 716.4.3.

716.4.1 Label. Fire protective curtain assemblies used as opening protectives in fire rated walls and smoke partitions shall be labeled in accordance with 716.2.9.

716.4.2 Smoke and draft control. Fire protective curtain assemblies used to protect openings where smoke and draft control assemblies are required shall comply with Section 716.2.1.4.

716.4.3 Installation. Fire protective curtain assemblies shall be installed in accordance with NFPA 80.

Referenced Standards

UL 10D-17, Standard for Fire Tests of Fire Protective Curtain Assemblies (shown below)

4 FIRE TESTS OF FIRE-PROTECTIVE CURTAIN ASSEMBLIES - UL 10D SEPTEMBER 29, 2017

INTRODUCTION

1 Scope

1.1 These requirements cover the evaluation of fire-protective curtain assemblies intended to provide supplemental, passive fire protection as part of an engineered fire protection system. Fire-protective curtain assemblies are horizontally or vertically oriented. Horizontally or vertically oriented fire-protective curtain assemblies provide nonstructural separation only, and are not intended to be substituted for structural hourly rated partitions or opening protectives that have been tested for fire endurance and hose stream performance.

McKEON FireFighter® Egress Feature

All FireFighter models that incorporate the egress feature can be placed in a required path of egress. Compliance with the criteria detailed in IBC Chapter 10, Means of Egress means building occupants can easily exit through this unique curtain assembly regardless of its application in the building.

Code Requirements

Section 1010.1.2 Door Swing. Egress doors shall be of the pivoted or side-hinged swinging type.

The FireFighter egress door includes a hinged bottom bar located at 90 degrees to the fabric so that when the fabric is pushed to the open position both bottom bar and fabric easily swing providing complying egress width to allow building occupants to exit.

Section 1010.1.1 Size of doors. The required capacity of each door opening shall be sufficient for the occupant load thereof and shall provide a minimum clear opening width of 32 inches (813 mm) … The minimum clear opening height of doors shall be not less than 80 inches (2032 mm).

The following photo/dimensions and table will help you determine compliance with this code requirement.

Product	Opening Height from Floor	Opening (swing) Force (LBF)	Opening Dimensions
Fire & Smoke Curtain	18"	Less than 1/2 lbf	36"
Fire & Smoke Curtain	36"	Less than 1/2 lbf	22 1/2"
Fire & Smoke Curtain	54"	Less than 1/2 lbf	20"
Fire & Smoke Curtain	72"	Less than 1/2 lbf	12"
Fire & Smoke Curtain	84"	Less than 1/2 lbf	6"

Section 1010.1.3 Door opening force … the door latch shall release when subjected to a 15-pound (67 N) force. The door shall be set in motion when subjected to a 30-pound (133 N) force. The door shall swing to a full-open position when subjected to a 15-pound (67 N) force.

The following test data confirms that the FireFighter egress feature complies with these requirements.

Flexible Fabric Door Compliance Test	
Force A (LBF) Opening force to set egress in motion, hook & loop ripped open	26
Force B (LBF) Swing force to swing egress door to fully open position	0.5
Force C (LBF) Force required to hold egress door in the fully open 90 position	4
Height	34"

ADA Notes:

- Doors designated as fire doors must have the minimum opening force allowed by the local authority.
- Interior accessible doors should require no more than 5 lbs. of force to open.
- Threshold cannot be higher than 1/2 inch at accessible doors.

McKEON®

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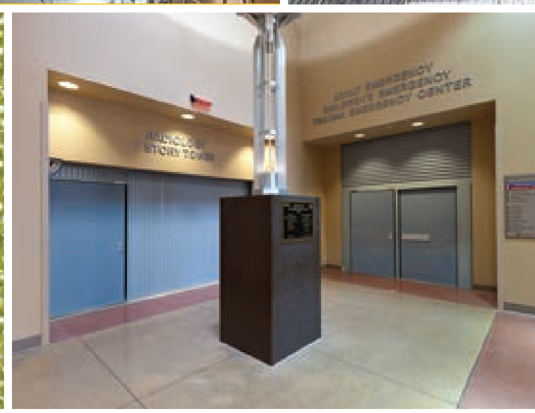
www.McKeonDoor.com



File Attachments for Item:

ER-2 Fire Door Systems for Elevator Lobbies (McKeon Door - OBOA/ODPCA Conference)

All Certifications (2 hours)

Staff Notes: Slides are chapters 1 and 2 and the appendix of the attached book. At course provider's request, reviewed again: course is based on 2018 IBC, with mentions of changes in the 2021 IBC. Recommend approval.

Committee Recommendation:

1. **Elevator Shaft Protection**, 2 hours, *BBS 2021-XXX*, McKeon Door, David Dodge
    a. *(Certifications; BI, BO, BPE, EPE, ESI, FPI, FPPE, LPE, MPE, MI, MechPE, NRIU, PI, PPE, RBI, RBO, REPE, RIUI, RMI, RPE, RPI, application for course will be submitted by McKeon to OBBS)*
    b. Outline; Course will provide 2018 IBC information on the fire and smoke protection requirements for elevator shafts to include all the provisions of Section 3006 Hoistway Protection, 3007 Fire Service Elevators & 3008 Occupant Evacuation Elevators with emphasis on more of the controversial interpretations and protection methods. This course will also discuss fire and smoke protection provisions for horizontal exits, exit passageways, pedestrian walkways & tunnels.

David L. Dodge, CSI, CDT

VICE PRESIDENT, BUSINESS AND CODE DEVELOPMENT

David has been involved in the construction industry since 1975. With an extensive background in project estimating and management and a bachelor's degree in business management, David soon realized a great deal of success in building product marketing and sales. Within this venue he found his passion – building code development and architectural design compliance. Since 1988, he has assisted architectural firms in understanding and implementing the provisions of the model codes as they pertain to fire and life safety. His particular focus is on the fire door industry, promoting cutting edge technology to resolve code compliance challenges.

David is a corporate member of the International Code Council (ICC) and earned his Construction Document Technologist (CDT) from the Construction Specifications Institute. He has served on several ICC committees, both local, regional and national, for the adoption and implementation of the International Building Code throughout the US. He is a recognized speaker and instructor, teaching the fire and life safety provisions of the model codes to design professionals and regulatory officials. David is a certified CEU instructor under the ICC Education Provider program. As part of the McKeon Door Company team David draws on his 30-plus years of experience in the building code arena when assisting design professionals and product representatives with code and design compliance challenges.

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

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

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

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

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

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

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

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

APPLICATION
FOR
Continuing Education Course Approval

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

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

COURSE SUBMITTER:

Course Submitter: David Dodge
(Contact Name)
Organization: McKeon Door Company
(Organization/Company)
Address: 44 Sawgrass Drive,
(Include Room Number, Suite, etc.)
City: Bellport State: NY Zip: 11713
E-Mail: ddodge@mckeondoor.com
Telephone: 801-471-7210 Fax:
Course Sponsor: McKeon Door

COURSE INFORMATION:

Course Title: Fire Door Systems for Elevator Lobbies, Exit Access Separation, & Corridor Separation

New Course Submittal: ■ Update Course: ■ Prior Approval Number: BBS2017-138

Purpose and Objective: Provide building code information (updated to the 2018 IBC) on fire doors and their role in Elevator lobbies & Hoistway Protection. Include information of requirements for Elevator smoke & draft control.
Provide information on horizontal exists, exit passageways, and pedestrian walkways & tunnels and how fire doors can be used to meet fire resistance ratings for these items. The PPT slides used for this course duplicate the textbook as found in Chapters 1 & 2 and the Appendix.
NOTE: We are simply splitting the original approved course into two 2-hour courses. Please see attached pdf workbook that each attendee will receive as party of the course materials.

Number of Instructional Contact Hours that can be obtained upon completion: (2) hour

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

Program Applicable for the Following Participants:

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

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

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

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

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

McKEON

REV. 6/19

Updated! Based on the 2018 Edition of the IBC

Fire Door Systems

A Guide to Code Compliance

McKEON®

Fire Door Systems

A Guide to Code Compliance

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PH: 800-266-9392 • FAX: 631-803-3030
info@mckeondoor.com • www.mckeondoor.com

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12th Edition - June 2019

Introduction

THIS EDITION of *Fire Door Systems, A Guide to Code Compliance* is based on the 2018 IBC with inserts from the "Group A" portion of the 2021 IBC code development cycle. The insertions reflect code changes that have been approved by the voting membership in both the general sessions and the subsequent on-line voting forum, and will be published in the next printing of the IBC.

THE INTERNATIONAL BUILDING CODE has been widely accepted in the United States and is recognized as a uniform code addressing the design and installation of building systems with performance-based requirements. The current International Building Code has been developed over the last two decades through the extensive work and efforts of code enforcement personnel organized at both local and national levels under the direction of the International Code Council. A vital part of the development of the building code is the involvement of industry and nationally recognized organizations with interests in building product development and the protection of public health, safety and welfare.

McKEON develops and manufactures numerous fire and smoke rated assemblies that function as wide-span opening protectives. These building products enter the marketplace specifically to assist design professionals and code enforcement personnel in satisfying open design without compromising fire and life safety requirements. This document is formatted to present the building code as it pertains to the use of opening protectives; first, recite specific prescriptive code requirements, second, performance-based language in laymen's terms for common sense understanding, and third, illustrate product case studies presented as design solutions to frequently approached complex code application challenges. The building code interpretations found herein represent the opinion and experience of the preparer, intended only to assist the reader in recognizing and understanding the potential use and application of McKEON fire and smoke rated opening protective assembly products.

McKEON®

1 Elevator Separation

Elevator Lobbies & Hoistway Protection

Elevator Smoke & Draft

Elevator Lobbies & Hoistway Protection

Section 3006

Hoistway protection is designed to isolate fire, smoke, heat and toxic gases or fumes from migrating floor to floor through vertical hoistways in multi-story structures. There are two fundamental methods prescribed in this code section – elevator lobbies or protection at the point of access to the elevator car.

Fire & Life Safety Concerns

Elevator shafts are the most common inter-connecting vertical shafts in multi-story buildings. These shafts become conduits for fire, heat, smoke and other toxins between the fire floor(s) and additional floors.

Code Requirements

3006.1 General. Elevator hoistway openings and enclosed elevator lobbies shall be provided with the following:

1. Where hoistway opening protection is required by Section 3006.2, such protection shall be in accordance with Section 3006.3.
2. Where enclosed elevator lobbies are required for underground buildings, such lobbies shall comply with Section 405.4.3.
3. Where an area of refuge is required and an enclosed elevator lobby is provided to serve as an area of refuge, the enclosed elevator lobby shall comply with Section 1009.6.
4. Where fire service access elevators are provided, enclosed elevator lobbies shall comply with Section 3007.6.
5. Where occupant evacuation elevators are provided, enclosed elevator lobbies shall comply with Section 3008.6.

3006.2 Hoistway opening protection required. Elevator hoistway door openings shall be protected in accordance with Section 3006.3 where an elevator hoistway connects more than three stories, is required to be enclosed within a shaft enclosure in accordance with Section 712.1.1 and any of the following conditions apply:

1. The building is not protected throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. The building contains a Group I-1 Condition 2 occupancy.
3. The building contains a Group I-2 occupancy.
4. The building contains a Group I-3 occupancy.
5. The building is a high rise and the elevator hoistway is more than 75 feet (22 860 mm) in height. The height of the hoistway shall be measured from the lowest floor to the highest floor of the floors served by the hoistway.

Exceptions:

1. Protection of elevator hoistway door openings is not required where the elevator serves only open parking garages in accordance with Section 406.5.
2. Protection of elevator hoistway door openings is not required at the level(s) of exit discharge, provided the level(s) of exit discharge is equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. Enclosed elevator lobbies and protection of elevator hoistway door openings are not required on levels where the elevator hoistway opens to the exterior.

3006.2.1 Rated Corridors. Where corridors are required to be fire-resistance rated in accordance with Section 1020.1, elevator hoistway openings shall be protected in accordance with Section 3006.3.

3006.3 Hoistway opening protection. Where Section 3006.2 requires protection of the elevator hoistway door opening, the protection shall be provided by one of the following:

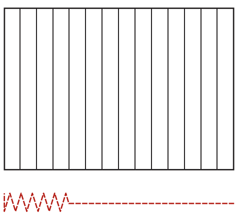
1. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway shaft enclosure doors from each floor by fire partitions in accordance with Section 708. In addition, doors protecting openings in the elevator lobby enclosure walls shall comply with Section 716.5.3 as required for corridor walls. Penetrations of the enclosed elevator lobby by ducts and air transfer openings shall be protected as required for corridors in accordance with Section 717.5.4.1.
2. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway shaft enclosure doors from each floor by smoke partitions in accordance with Section 710 where the building is equipped with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2. In addition, doors protecting openings in the smoke partitions shall comply with Sections 710.5.2.2, 710.5.2.3 and 716.5.9. Penetrations of the enclosed elevator lobby by ducts and air transfer openings shall be protected as required for corridors in accordance with Section 717.5.4.1. Note: Smoke partitions as defined in Section 710.3 are not required to be fire rated. The doors located in smoke partition walls referenced in Section 710.5.2.2 are required to be UL 1784 labeled as smoke & draft control assemblies.
3. Additional doors shall be provided at each elevator hoistway door opening in accordance with Section 3002.6. Such door shall comply with the smoke and draft control door assembly requirements in Section 716.5.3.1 when tested in accordance with UL 1784 without an artificial bottom seal.
4. The elevator hoistway shall be pressurized in accordance with Section 909.21.

3006.4 Means of egress. Elevator lobbies shall be provided with at least one means of egress complying with Chapter 10 and other provisions in this code. Egress through an elevator lobby shall be permitted in accordance with Item 1 of Section 1016.2.

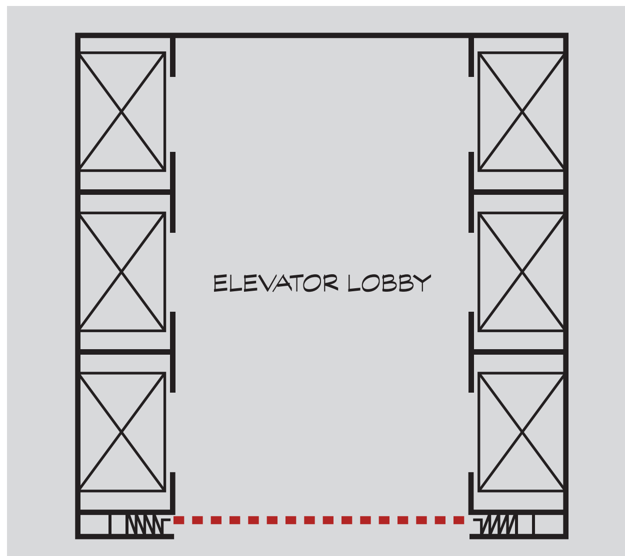
Design Solutions

A diverse line-up of McKEON door assemblies can easily accommodate wide-span openings, radius applications, and egress.

CASE 1: Side Acting Accordion with Power-assisted Egress

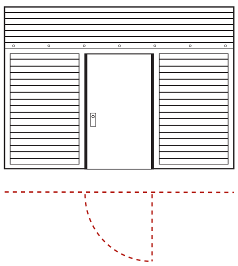


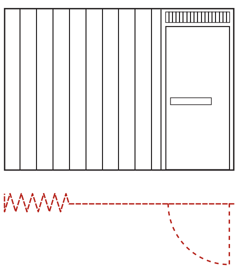
In the first case study, there is no headroom and side stacking space is limited. The McKEON bi-parting accordion fire door technology stepped up to meet the demand of hi-end design without compromising specific code requirements including conforming side acting accordion fire door egress acceptance.



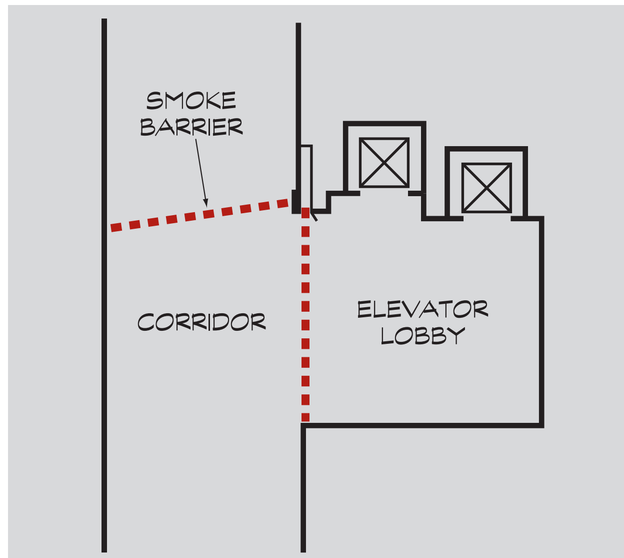
ELEVATOR SEPARATION

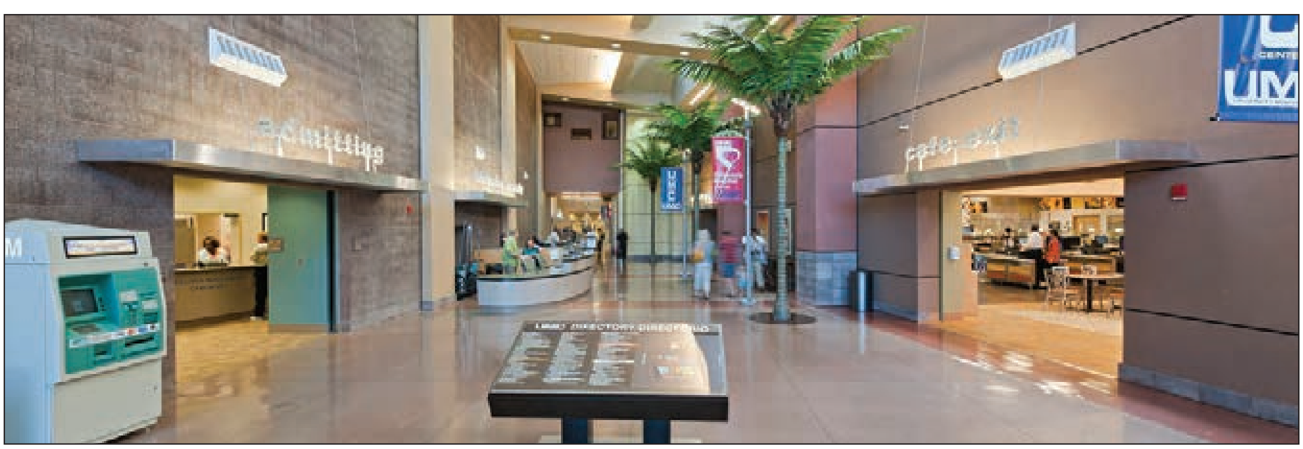
CASE 2: Side Acting Accordion with Complying Swing Egress Door & Vertical Acting with Complying Swing Egress Door(s)



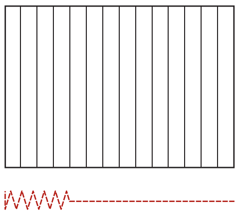


This case study includes both a side acting accordion with conventional egress elevator lobby separation and a vertical acting with conventional egress smoke barrier opening protective.

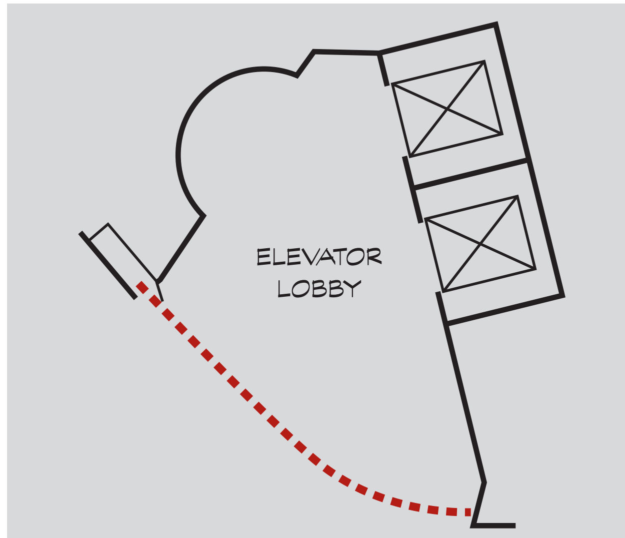


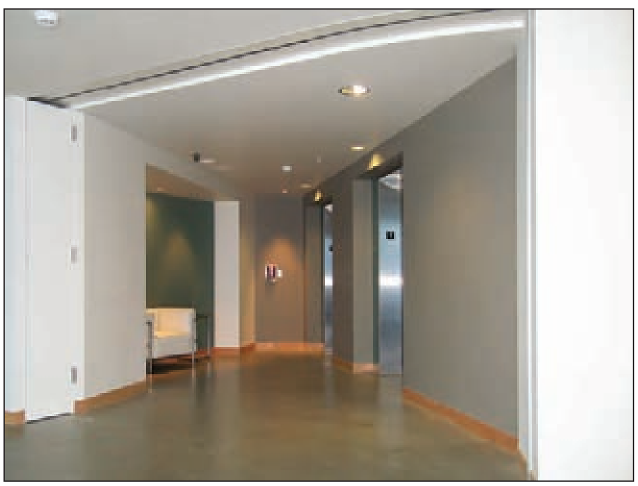


CASE 3: Side Acting Accordion with Power-assisted Egress

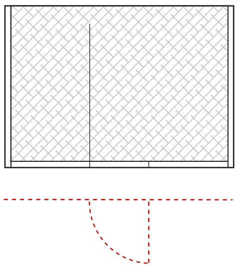


The side acting accordion technology will accommodate custom radius applications as well as serve as the primary means of egress from the space.

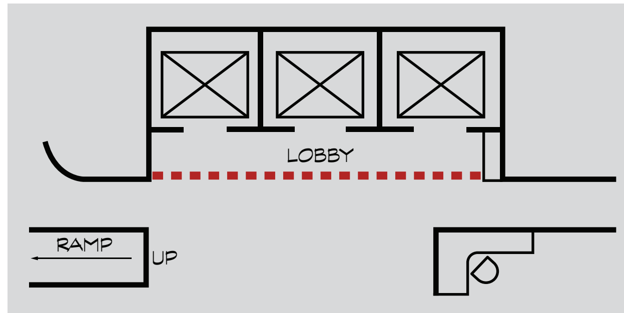




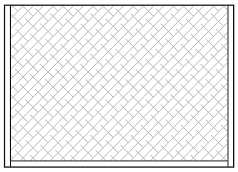
CASE 4: Vertical Acting with Multiple Complying Swing Egress Doors



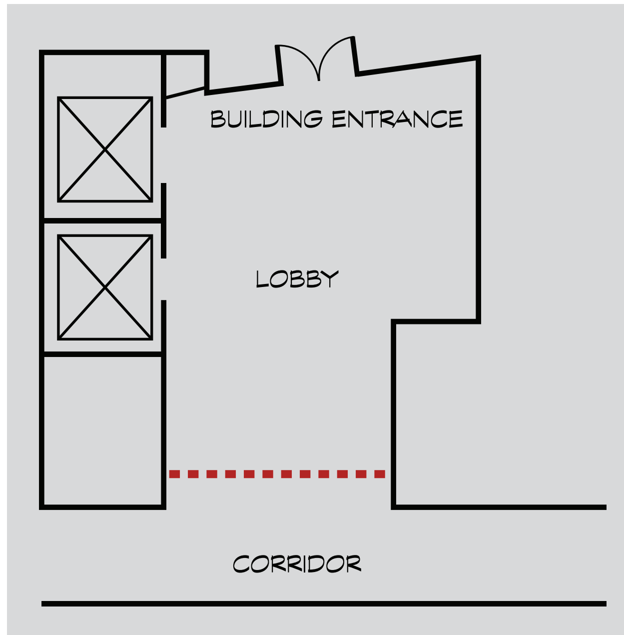
This project introduces the use of fire protective curtain assemblies that have been approved in accordance with the current editions of the model buildings codes (see IBC Section 3006.3, Item #2. Specific reference to this technology is now approved as opening protectives without hose stream performance [UL 10D 20-minute fire rated] for publication in the 2021 edition of the IBC [See Appendix, Resource IBC 2021]).



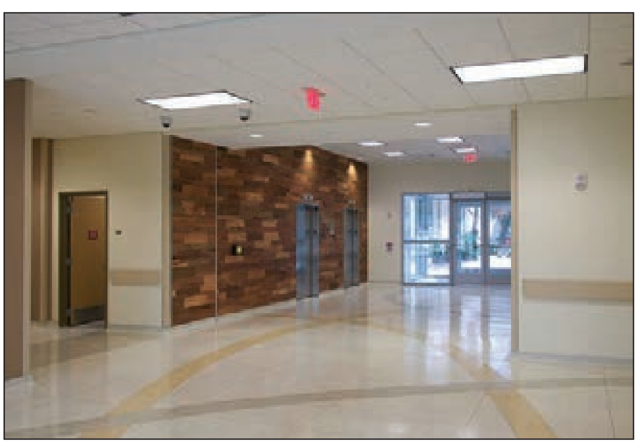
CASE 5: Vertical Acting without Egress

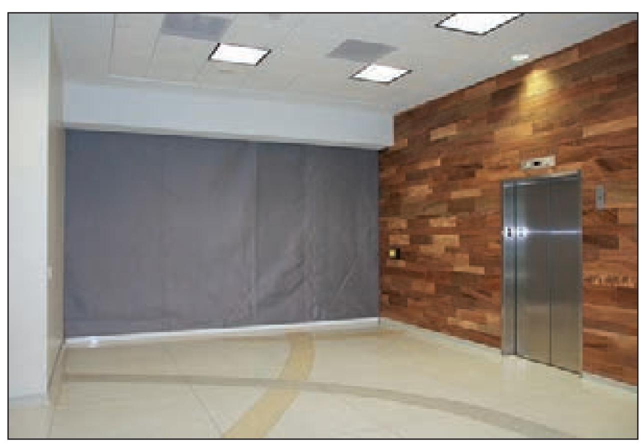


For the same reasons of acceptance explained in CASE 4, Fire Protective Curtain Assemblies satisfied two code compliance challenges in this design. Even though an elevator lobby is not necessarily required on the level of exit discharge in a sprinklered building, this separation takes on the form of a lobby since it protects the remaining structure from the vertical features of the building. Egress is not required though the fire protective curtain due to exiting out of the lobby or separated space through the main entrance.



Specific reference to this technology is now approved as opening protectives without hose stream performance (UL 10D 20-minute fire rated) for publication in the 2021 edition of the IBC (See Appendix, Resource IBC 2021).





ELEVATOR SEPARATION

Inquiry Discussion & Questions

There has been much discussion in the regulatory arena about the purpose and usefulness of the elevator lobby. It can be argued the lobby is a dual application fire and life safety component of the structure, a barrier against smoke migration in and out of the vertical shaft as well as an area of refuge for building occupants. These fundamental occupant safety features are tempered with sprinkler exceptions but consistently remain as salient provisions each code development cycle.

If there is a trend in preference it appears to be for more passive redundant protection surrounding the elevator shaft rather than less. For example, the code requirements outlined in this application study include several sprinkler exceptions that allow the elimination of the elevator lobby for normal-use passenger elevators in Section 3006. However, once the building goes into alarm, Section 3007 Fire Service Access Elevator and Section 3008 Occupant Evacuation Elevators do not allow the same exceptions. Not only are lobbies required in these two applications, with no exemptions, each lobby must be fully fire and smoke rated with prescribed physical size requirements. Interestingly, in a fire event the elevator often becomes an integral part of the means of egress system.

Elevator lobbies can be considered a viable choice based on three premises. Let's use the layout as diagrammed in Case Study #2 as an example. First, from a design ambiance perspective, it is cumbersome to provide independent separation at the point of each elevator car to simply eliminate the lobby. The space would certainly be interrupted at each elevator car opening. A single separation creating a full space lobby would have less impact on the overall design.

Secondly, a single separation opening protective is clearly less costly than multiple systems located at each car opening. The third and perhaps the most important consideration is fire and life safety. By creating a conforming full space lobby we stop smoke and heat from penetrating the shaft, and provide an area of refuge for building occupants. In other words, rather than provide closures at each individual point-of-access location to the elevator car, why not create an elevator lobby that is unobstrusive, costs less and will adequately serve as an area of refuge.

Elevator Smoke & Draft

Section 3006.3

Elevator car doors are typically fire-rated but cannot comply with smoke and draft requirements. Smoke & draft rated assemblies eliminate the passage of smoke and are usually located at the point of access to an elevator car as an alternative to the elevator lobby.

Fire & Life Safety Concerns

Elevator shafts commonly represent the majority of inter-connecting vertical shafts in multi-story buildings. These shafts become conduits for heat, smoke and other toxins between the fire floor(s) and additional floors. In buildings with more than three interconnected stories, the conventional elevator lobby is designed to stop the spread of fire and smoke before it reaches the elevator shaft enclosure doors. However, if the lobby is eliminated smoke could quickly penetrate the shaft at the point of access. Thus, all fire-rated assemblies used at the point of access must maintain a smoke and draft rating. *(UL 1784)*

Code Requirements

There are two primary provisions that drive the need for elevator protection in the IBC. First, Section 3006.2 requires protection where the elevator hoistway connects more than three stories and any of the following conditions apply:

1. The building is not protected throughout with sprinklers …
2. The building contains an I-1 Condition 2 occupancy
3. The building contains an I-2 occupancy
4. The building contains an I-3 occupancy
5. The building is a hi-rise … more than 75 feet

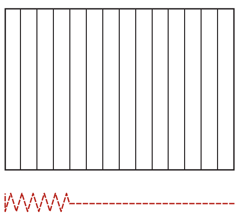
The second primary provision is found in Section 3006.2.1 requiring elevator hoistway protection when the corridors in the structure are fire-resistance rated.

ELEVATOR SEPARATION

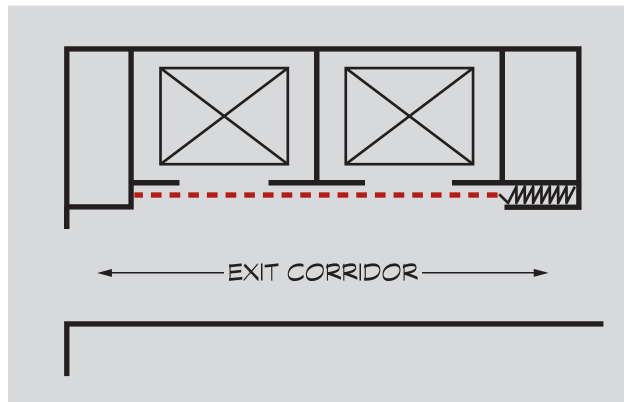
Section 3006.3, Item #3 allows the elimination of the lobby by placing a minimum UL 1784 (smoke) rated assembly at the point of access to the elevator hoistway door opening. Please note: All assemblies located at the point of access to an elevator car must be readily openable from the car side without a key, tool, special knowledge or effort. *(3002.6)*

Design Solutions

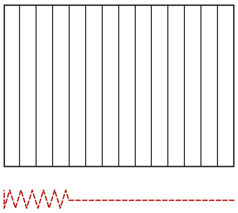
CASE 1: Side Acting Accordion with Power-assisted Egress



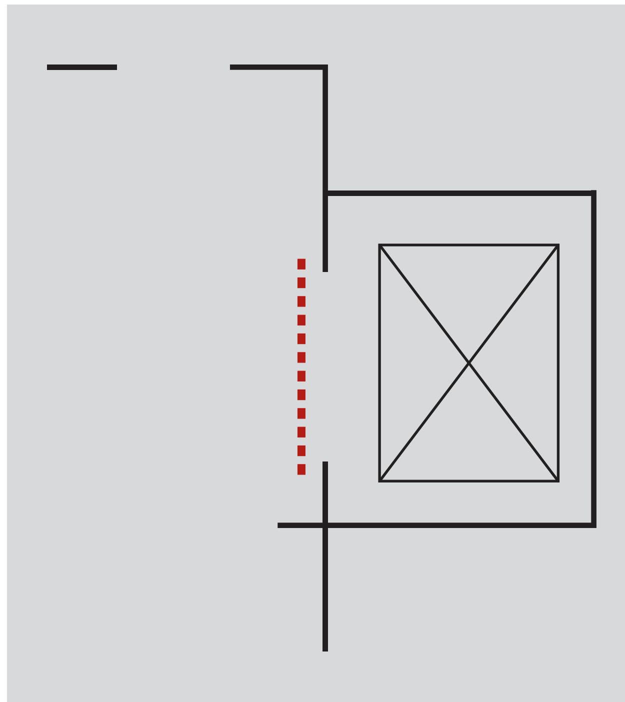
Due to the several configuration options of the McKEON door assemblies multiple or single elevator openings can easily be protected. Egress can be placed at each elevator car door opening to accommodate conforming exit requirements.



CASE 2: Side Acting Accordion with Manual Egress

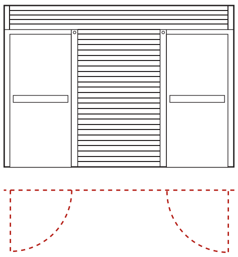


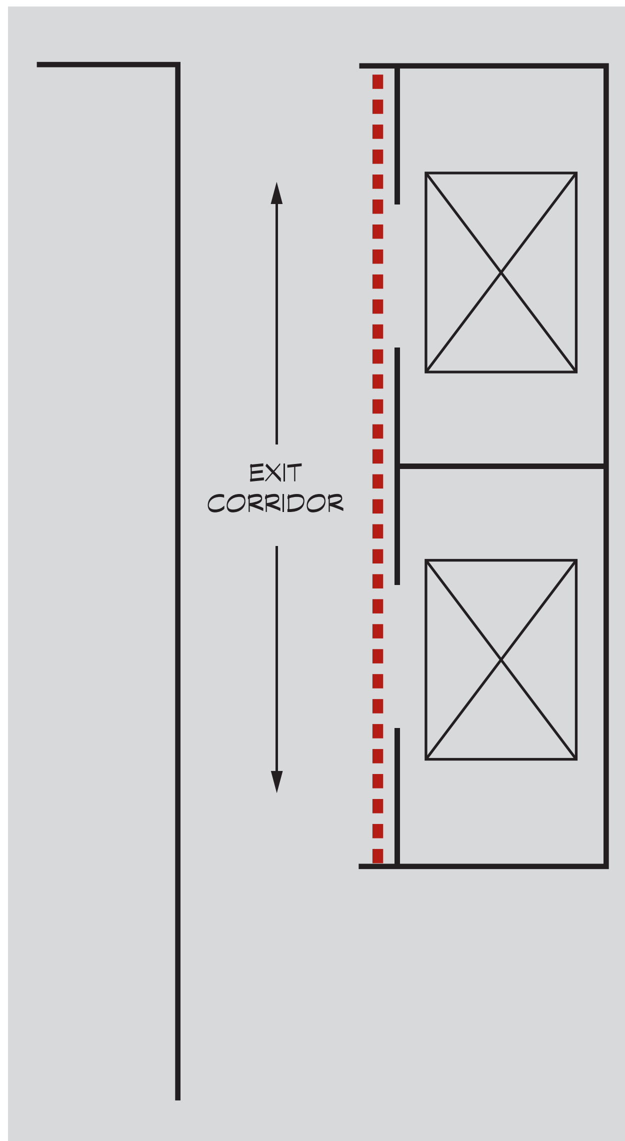
This simple, manually operated, bolt-up pre-fabricated unit can be installed at the point of access to any elevator car in a matter of hours. No pocket, stud or drywall construction is necessary. The door, held open by an electromagnet, is released at the command of a smoke detector and the fire and smoke rated assembly closes. Building occupants or first responders can pass through the opening as the door self-closes behind them.



ELEVATOR SEPARATION

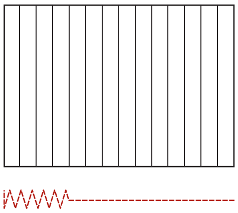
CASE 3: Vertical Coiling with Complying Swing Egress Door(s)



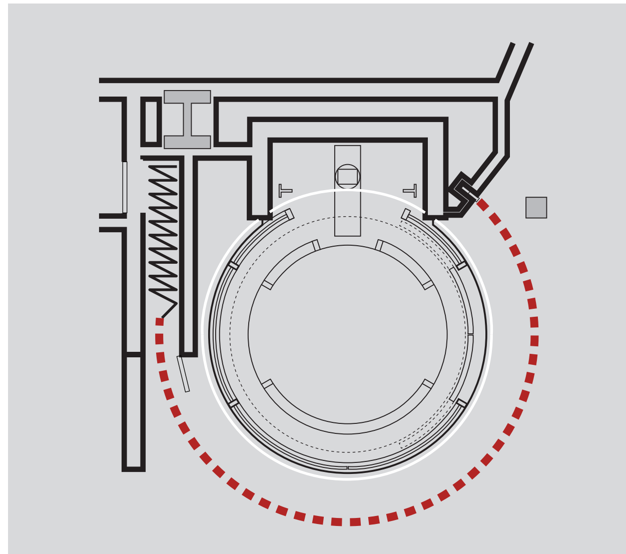


ELEVATOR SEPARATION

CASE 4: Side Acting Accordion with Power-assisted Egress

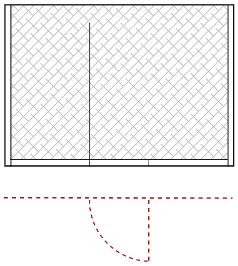


The single track 3-hour rated accordion will accommodate 18" radius to custom curves. Along with complying egress, McKEON resolved a very difficult challenge without life safety or design compromise.

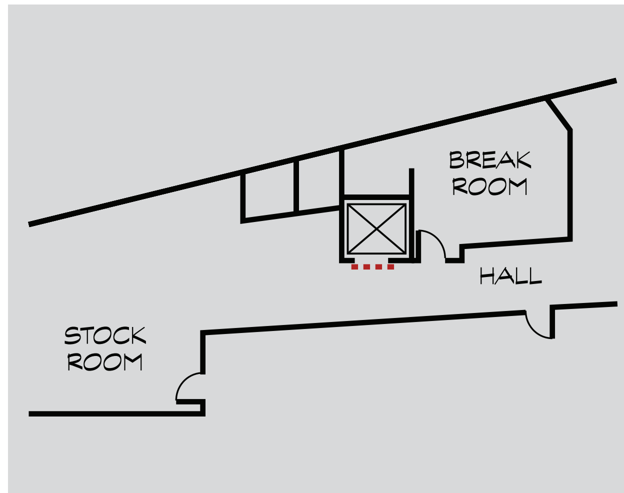


ELEVATOR SEPARATION

CASE 5: Vertical Acting with Egress

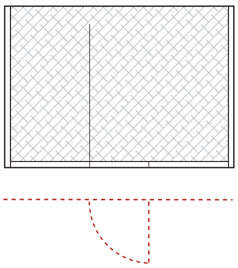


Typically, the elevator car or elevator shaft door is fire rated but does not carry a UL 1784 smoke rating. The SmokeFighter® D150E is a listed and labeled UL 1784 assembly with a complying egress feature. Located at the point of access to the elevator car, this assembly protects the opening mitigating smoke migration.

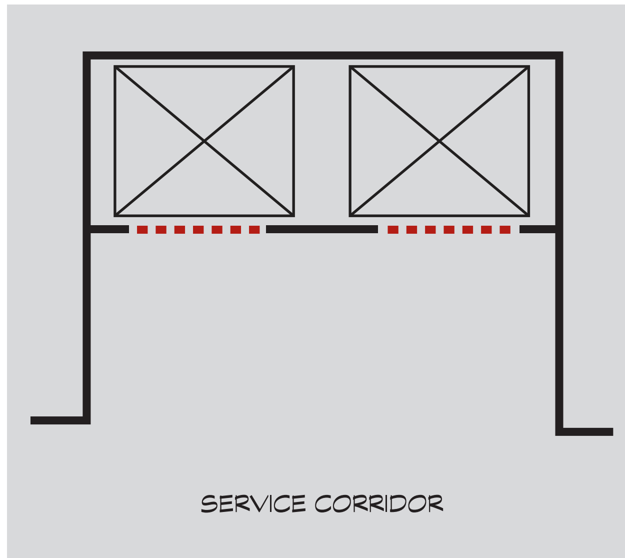


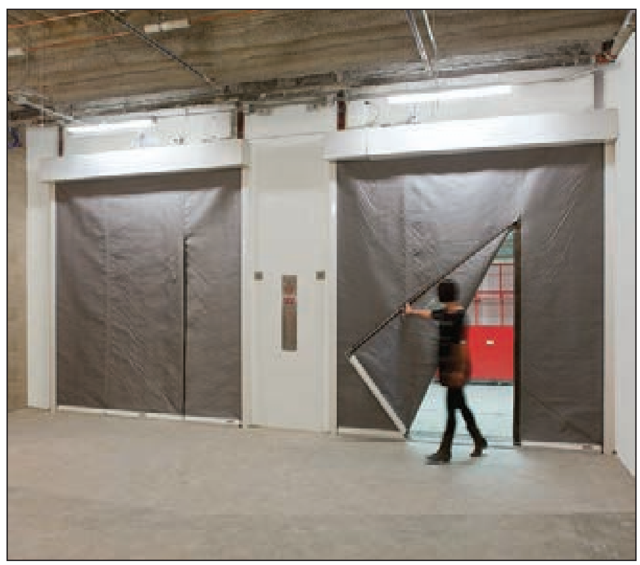
ELEVATOR SEPARATION

CASE 6: Vertical Acting with Egress



Similar to the previous case study, the elevator car or elevator shaft door is fire rated but does not carry a UL 1784 smoke rating. But on this project the design team elected to use the FireFighter® D200E which is listed and labeled as a 20-minute UL 10D & UL 1784 assembly with a complying egress feature. By applying the 20-minute fire-rated assembly in this design, McKEON provided redundancy in the fire-rated requirements. Located at the point of access to the elevator car, this assembly protects the opening mitigating smoke migration as well as fire and heat penetration.





ELEVATOR SEPARATION

Inquiry Discussion & Questions

Please consult the Inquiry Discussion & Question section of the Elevator Lobby case study.

Notes:

McKEON®

2 Exit Access Separation

Horizontal Exit

Exit Passageways

Pedestrian Walkways & Tunnels

Horizontal Exit

Section 1026

Horizontal exits are designed to move building occupants on a floor from any point in the exit access system to a fire and smoke protected area.

Fire & Life Safety Concerns

The horizontal exit differs fundamentally from the typical code-defined exit. The horizontal exit is meant to "defend in place" by creating an area of safe refuge for building occupants within the confines of the building structure. All other exits are designed to exit occupants out of and away from the building.

Code Requirements

Because building occupants are not being removed from the building when using the horizontal exit, specific precautionary requirements are based upon the following fundamental principles:

Principle #1: Separation. A 2-hour fire wall or fire barrier must be used to separate safe refuge areas connected with a horizontal exit *(Section 1026.2)*. The determination between the use of a wall, fire barrier or horizontal assembly is the function of the wall as it relates to other code requirements.

Principle #2: Opening Protective. The opening within the horizontal exit must be protected with a self-closing or automatic closing fire door when activated by a smoke detector. The fire rating of the door must be a minimum of 90 minutes. *(Section 1026.3)*

Principle #3: Area of Refuge Capacity. Based on a net floor allowance of 3 square feet for each person with the following guidelines:

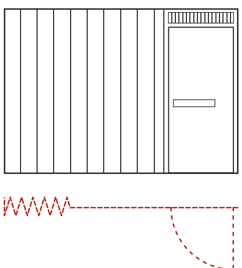
Where the horizontal exit also forms a smoke compartment, the capacity of the refuge area for Group I-1, I-2 and I-3 occupancies and Group B ambulatory care facilities shall comply with Section 407.5.3, 408.6.2, 420.6.1 and 422.3.2 as applicable.

Principle #4: Number of Exits. The refuge area into which a horizontal exit leads shall be provided with exits adequate to meet the occupant requirements of this chapter, but not including the added occupant load imposed by persons entering the refuge area through horizontal exits from other areas. Not less than one refuge area exit shall lead directly to the exterior or to an interior exit stairway or ramp.

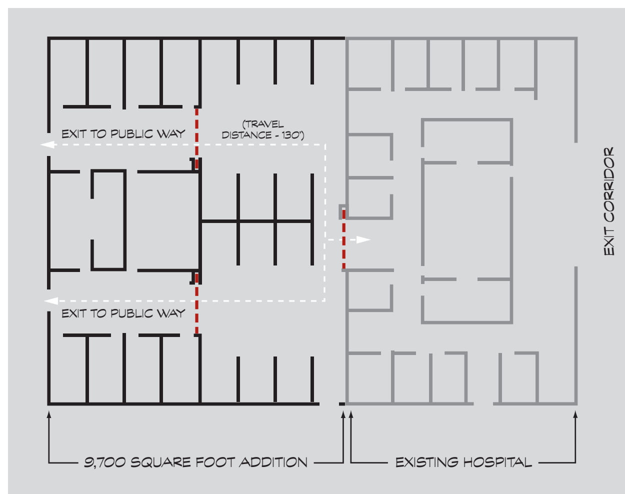
Exception: The adjoining compartment shall not be required to have a stairway or door leading directly outside, provided the area of refuge area into which a horizontal exit leads has stairways or doors leading directly outside and are so arranged that egress shall not require the occupants to return through the compartment from which egress originates.

Design Solutions

CASE 1: Side Acting Accordion with Complying Swing Egress Door



The intent is to add a 10,200 square foot critical care suite onto an existing I-2 (hospital). However code requirements come into play that affect the design dramatically:

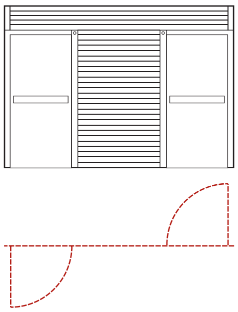


- First, suites of sleeping rooms cannot exceed 10,000 square feet in a sprinklered structure. In this case a 10,200 square foot suite is being added. *(407.4.3.5.1)*
- Second, there must be two exits from each suite. *(407.4.4.5.1)*
- Third, the travel distance between any point in a suite of sleeping rooms and an exit access exit door shall not exceed 125 feet with automatic smoke detection. *(407.4.4.3)*

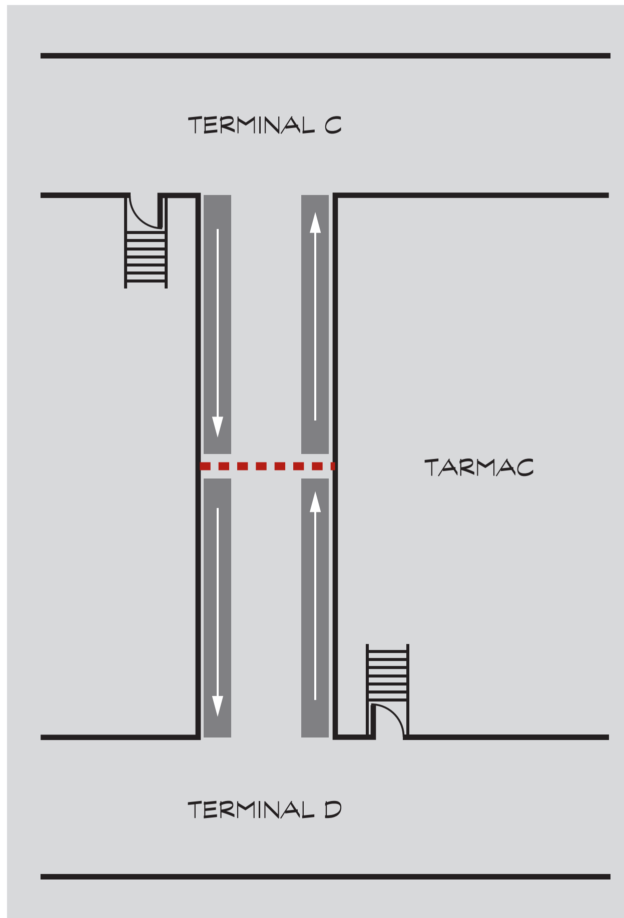
By utilizing the horizontal exit concept, the following will preserve the original design intent and provide code compliance:

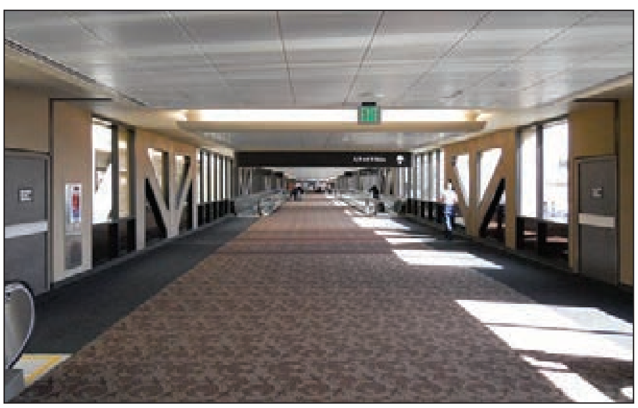
- Separate the intended 10,200 square foot space into two suites, each less than 10,000 square feet.
- Provide a 2-hour fire barrier wall as the separation. *(Section 1026.2)*
- Provide a horizontal exit in the separation as one of two required exits from each space. *(Section 407.4.4.5.2)*
- Provide a 90-minute opening protective. *(Table 716.5)*

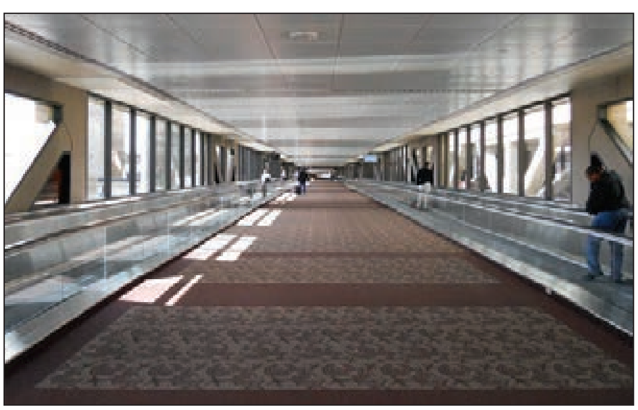
CASE 2: Vertical Coiling with Complying Swing Egress Door(s)



McKEON offers a particularly unique resolve for this airport design. Because the concourse is located above ground level and in a TSA secure area, it is not possible to provide exiting to the exterior. Also, there is not room for build-outs or pocket spaces, therefore unique to the T2500 technology a 90-minute opening protective is provided with no side room and as little as 26 inches of head-room with conforming dual egress doors. In essence each side of a long fire and smoke rated concourse forms one of two areas of refuge.







Inquiry Discussion and Questions

It has been said by many that the horizontal exit is probably one of the least understood and least utilized concepts of the building code. The following questions may be helpful in promoting awareness:

- Do you encounter travel distance problems in areas of the code other than the standard travel distance tables? (This case study for example.)
- When designing a horizontal exit, does the 2-hour wall inhibit the openness of the space under consideration?
- In health care or prison design may I show you how a required smoke barrier can also serve as a horizontal exit?

Notes:

Exit Passageways

Section 1024

An exit passageway provides the designer with an acceptable way of connecting a required exit stair to the exit discharge. Because the code requires an exit stair to open directly into an exit discharge to the exterior of the building, this provision will allow the stair to terminate at convenient locations away from the exterior walls. Also, the exit passageway can extend the path of travel when travel distances in the exit access system have been exceeded.

Fire & Life Safety Concerns

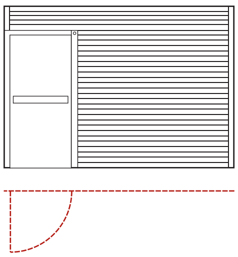
Extending the path of egress beyond the terminated travel distance or beyond the exit vestibule increases the potential for building occupants to be exposed to fire, smoke or hot and toxic gases. For these reasons exit passageways are designed with more strict provisions.

Code Requirements

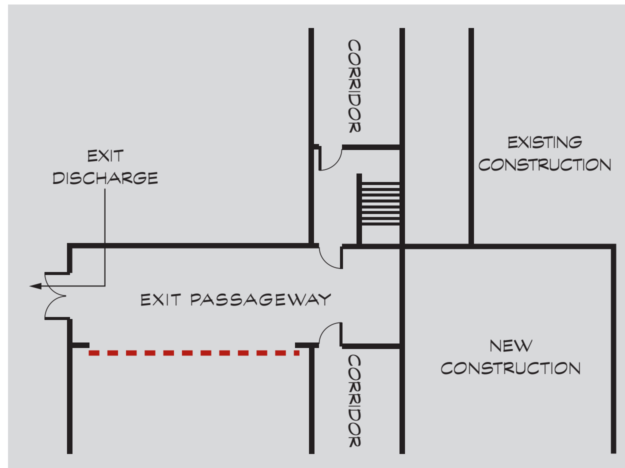
1. An exit passageway shall not be used for any purpose other than as a means of egress. *(1024.1)*
2. Exit passageway enclosures shall have walls, floors and ceilings of not less than 1 hour … and be constructed as fire barriers or horizontal assemblies. *(1024.3)*
3. Elevators shall not open into an exit passageway. *(1024.5)*
4. Opening protectives shall comply with Section 716 … and shall be limited to those necessary for exit access into the exit passageway from normally occupied spaces and for egress from the exit passageway. *(1024.5)*
5. Where an interior exit stairway or ramp is extended to an exit discharge or a public way by an exit passageway, the exit passageway shall comply with Section 1023.3.1. In other words, the interior exit stair must be separated from the exit passageway by a fire barrier wall equal in rating to the requirement for the interior exit stairway.

Design Solution

CASE 1: Vertical Coiling with Complying Swing Egress Door(s)



In this case study the required exit stair from the floors above terminated several feet from the exterior of the building. The McKEON opening protective forms the rated enclosure during a fire emergency, extending the exit path to exit discharge.



Inquiry Discussion and Questions

Because exit passageways are constructed under strict opening provisions, designs rarely incorporate them unless there is no other choice. With the use of the McKEON wide-span opening protectives, openings are not limited in size and little or no design compromise is noticed by building occupants. The following questions can be helpful in assisting the design professional to recognize new options:

- Have you ever desired to terminate a required exit enclosure on the interior of the building rather than at the exterior exit?
- Do you find challenges in connecting an exit enclosure with the exit to the exterior of the building?
- Did you know that solving a travel distance problem by providing an exit passageway can open your design rather than close it down?

Notes:

Pedestrian Walkways & Tunnels

Section 3014

Walkways and tunnels are designed to provide connection between buildings. They can be located at, above or below grade level and are used as a means of travel by persons.

Fire & Life Safety Concerns

Buildings located across lot lines from each other are required to have fire-rated exterior walls to prevent fire and smoke from passing between them (705; Table 602). Walkways and tunnels that connect and penetrate these rated exterior walls compromise this protection, potentially allowing heat and smoke to pass from one building to another.

Code Requirements

Section 3104 details specific requirements to ensure building occupant safety based upon the following fundamental principles:

Principle #1: Separate Structures. Connected buildings shall be considered to be separate structures *(3104.2)*. Unless the buildings are all on the same lot or exempt under specific accessibility requirements each building will be considered as a separate building when determining fire resistance, exterior wall ratings and egress.

Principle #2: Construction. The pedestrian walkway shall be of noncombustible construction *(3104.3)*. Unless each building being connected is of combustible construction the connecting element must be noncombustible to minimize the travel of heat and smoke.

Principle #3: Fire Barriers. Once the rated exterior walls have been penetrated to accommodate a noncombustible connecting walkway, the interior of each building must be further protected with fire barriers of not less than 2-hour rated construction *(3104.5.1)*. In order to avoid this requirement the following criteria must be met:

A. Exterior walls - 2 hour rated, extend not less than 10' in every direction surrounding the perimeter of the pedestrian walkway.

B. Openings in exterior walls of connected buildings - opening protectives not less than 3/4 hour.

C. Supporting construction - See Section 707.5.1.

Principle #4: Alternative Separation

A Distance between connected buildings is more than 10 feet.

B. Walkway and connected buildings fully sprinklered.

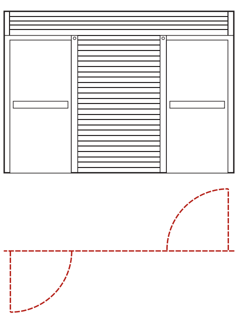
C. The wall shall be capable of resisting smoke.

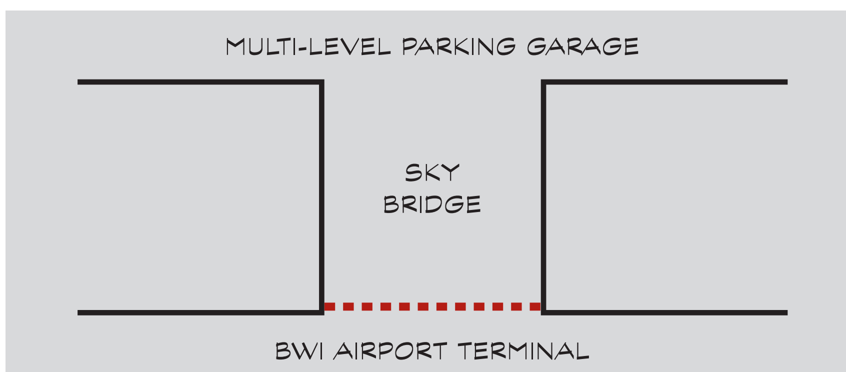
D. The wall and doors can be constructed of wired or tempered glass that is protected with sprinklers. All glass in gasketed frames.

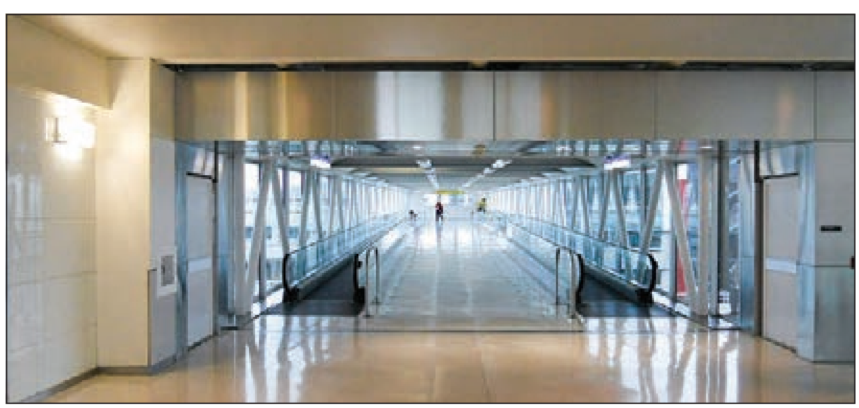
Design Solutions

The alternatives to fire barrier separations as listed above are very costly. Complying with the 2-hour separation requirement in Section 3104.5 is the least expensive option. A listed and labeled wide span McKEON assembly will easily protect any size opening. In the following case studies, McKEON showcases three distinctly different technologies to resolve the same code application problem. Diverse design requirements were not a challenge, rather routine applications of standard products.

CASE 1: Vertical Coiling with Complying Swing Egress Door(s)

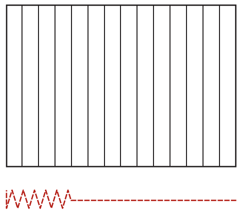


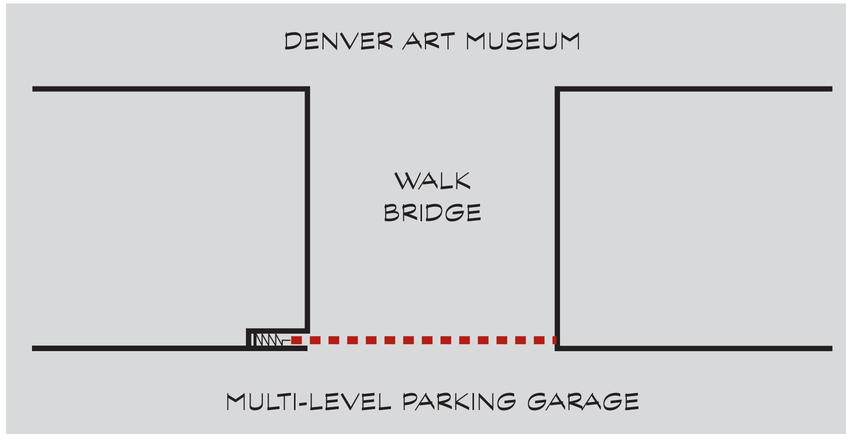




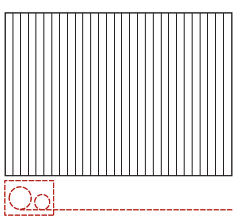
EXIT ACCESS SEPARATION

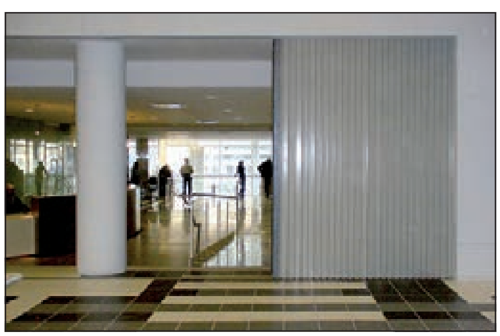
CASE 2: Side Acting Accordion with Power-assisted Egress

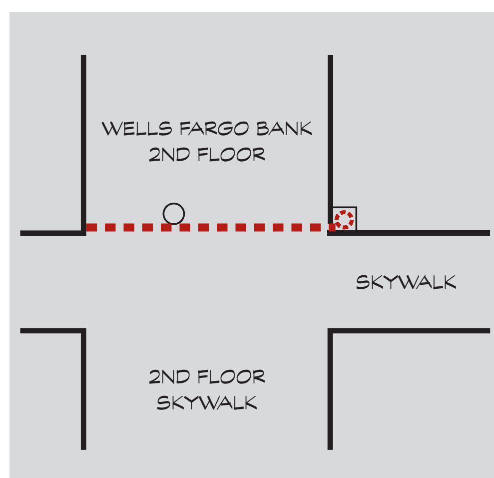




CASE 3: Side Coiling without Egress







EXIT ACCESS SEPARATION

Inquiry Discussion and Questions

Pedestrian walkways can be located overhead connecting two or more buildings or underground as tunnels connecting two or more buildings. This connecting construction is viewed as a definite threat to life safety. The code attempts to build in safety measures that are intended as substitutes for complete and optimum separation. These substitutes include extensive active wet sprinkler systems, open side walls, and tempered and/or wire glass components. It would certainly make more sense to use the "real thing" by easily providing rated barriers with wide-span opening protectives at each end eliminating any threat of fire and smoke entering the walkways.

The following questions may be helpful:

- Have you been able to run a cost comparison separating the building from the walkway as opposed to protecting the walkway?
- Even though a pedestrian walkway will most likely be constructed of non-combustible materials, would you like to avoid the cost of sprinklers, limiting interior design and costly tempered and/or wired glass components?

Notes:

McKEON®

3 Vertical Opening Separation

Fundamental Guidelines

Draft Curtains

Exit Access Stairways

Vertical Openings – Escalator

Interior Exit Stairways

Atriums

Vertical Compartmentation

VERTICAL OPENING SEPARATION

Fundamental Guidelines

Sections 404, 712, 713, 1019, 1023 & 1027

Vertical openings between floors are designed consistently in multi-story buildings in many different shapes, heights and uses. For the purposes of code enforcement the following general categories are described in the building code:

1. **Shaft Enclosures** ***(713)***
   a. **Escalators** ***(712.1.3)***
   b. **Mezzanines** ***(712.1.11, 505)***
   c. **Stairs** ***(712.1.12, 1019, 1023, 1027)***
   d. **Elevators** ***(3006)***
2. **Atriums** ***(404)***
3. **Interior Exit Stairways and Ramps** ***(Section 1023)***
4. **Exit Access Stairways** ***(712.1.12, 1019)***

Typically anytime two or more floors are open to each other a vertical opening is created and the phrase “floors are common with each other” is used to characterize the condition.

Two fundamental principles drive the requirements of vertical opening protection. First, the migration of smoke, heat and toxic gases floor to floor. Second, egress of building occupants from upper levels to a safe level of exit discharge.

The case studies in this section illustrate the balance between these two principles in the enforcement of fire & life safety provisions for building occupants in multi-story buildings.

Understanding Draft Curtains & Closely Spaced Sprinklers as Vertical Space Fire Protection Features

Sections 712.1.3.1 & 1019.3, #4

Draft curtains and closely spaced sprinklers, in accordance with NFPA 13, may be used in lieu of shaft enclosure construction in specific vertical opening applications.

Because of the chimney effect that can take place in vertical openings in multi-story structures, smoke, heat, toxic fumes and gases easily transfer throughout the structure. The optimum regulatory provision that prevents or mitigates this condition is the construction of solid fixed walls that are fire-rated as shaft enclosures separating vertical spaces from the remaining structure and floor areas. However, certain conditions allow the use of draft curtains in lieu of Fire Barrier walls.

Draft curtains are intended to accelerate the activation of sprinklers placed around the perimeter of vertical openings in order to provide an instant water barrier. This is a level of protection that can take the place of the rated wall construction and mitigate the transfer of smoke, heat, toxic fumes and gases which may be transferring vertically through the structure during a fire event.

The code addresses the use of draft curtains in two specific applications only. Both are penetrations through floor openings with the first being the escalator and the second, exit access stairways.

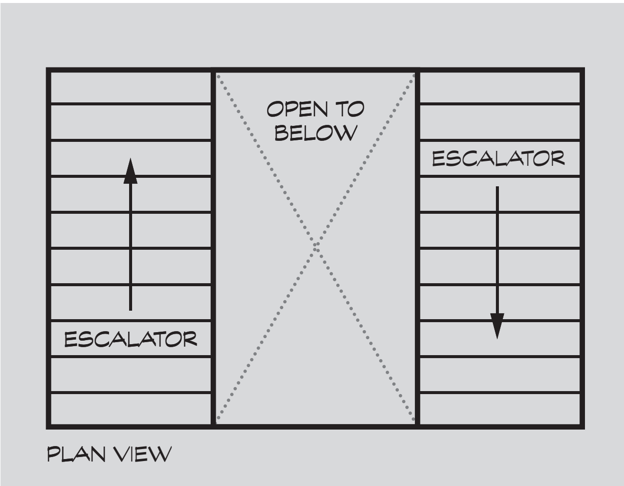
Escalator Openings

Section 712.1.3 Escalator openings. Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, vertical openings for escalators shall be permitted where protected in accordance with Section 712.1.3.1 or 712.1.3.2.

Section 712.1.3.1 Opening size. Protection by a draft curtain and closely spaced sprinklers in accordance with NFPA 13 shall be permitted where the area of the vertical opening between stories does not exceed twice the horizontal projected area of the escalator. In other than Groups B and M, this application is limited to openings that do not connect more than four stories.

Section 712.1.3.2 Automatic shutters. (Please see the application study in this document titled, “Vertical Openings – Escalator.”)

The use of the draft curtains with closely spaced sprinklers in escalator openings as outlined in the aforementioned code language only applies when the area of the escalator itself obstructs at least half of the area of the opening being penetrated. The following diagram illustrates a compliant application of this criteria. It is important to remember, this condition is acceptable only when the building is fully sprinklered.

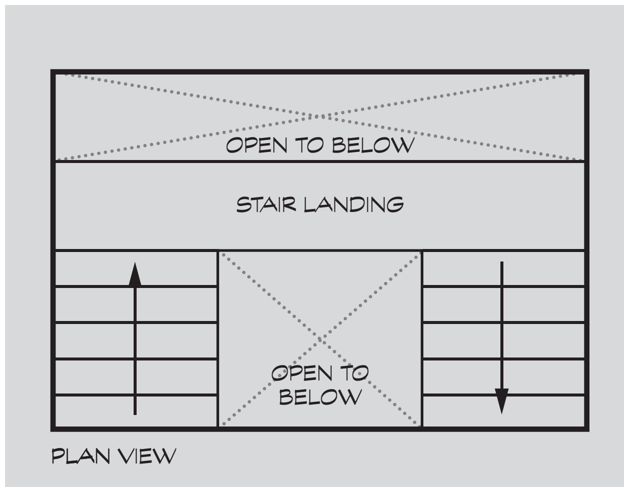


Exit Access Stairway Openings

Section 1019.3 Occupancies other than I-2 and I-3. In other than Group I-2 and I-3 occupancies, floor openings containing exit access stairways or ramps that do not comply with one of the conditions listed in this section shall be enclosed with a shaft enclosure constructed in accordance with Section 713.

Condition 4. Exit access stairways and ramps in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, where the area of the vertical opening between stories does not exceed twice the horizontal projected area of the stairway or ramp and the opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13. In other than Group B and M occupancies, this provision is limited to openings that do not connect more than four stories.

Using language similar to the escalator provisions, the use of draft curtains with closely spaced sprinklers in exit access stairway openings only applies when the area of the stair, to include any landings, obstructs at least half of the area of the opening being penetrated. The diagram below illustrates a compliant application of this criteria. It is important to remember, this condition is acceptable only when the building is fully sprinklered.



A Code Discussion for Clarification

The design and code provisions governing the application and use of draft curtains do not require side-guide components or fire endurance testing and do not parallel typical opening protective acceptance criteria. Since the adoption and development of the *2015 edition of the International Building Code (IBC),* the use of draft curtains in any project are for the sole purpose of creating barriers to force heat to activate sprinkler heads in vertical openings such as escalators and exit access stairways. Draft curtains are not intended to prevent smoke from migrating floor to floor, rather their purpose is to assist in immediate activation of the closely spaced sprinklers, associated with them, which are intended to mitigate the migration of smoke and/or heat floor to floor.

Background

In the legacy model building codes and all editions of the IBC prior to the published 2015 edition, draft curtains were a requirement in two separate areas of the code with criteria and detailed definition in one area only. First, we will explore the use where these criteria and definitions occurred, Factory and Storage occupancies, as defined in *Chapter 9, Fire Protection Systems. Section 910.3.5.1* stated: *Construction. Draft curtains shall be constructed of sheet metal, lath and plaster, gypsum board or other approved materials which provide equivalent performance to resist the passage of smoke. Joints and connections shall be smoke tight.* In essence, draft curtains could be constructed of cardboard and duct tape … as long as they channeled smoke.

This code language was written around the stringent requirements of Group F-1 and S-1 occupancies as indicated in *Table 910.3.* In these hi-pile storage occupancies there was no requirement for draft curtains to be fire rated, only that they "resist the passage of smoke." Achieving smoke tight joints and connections were critical due to exceptions in the code section that allowed the reduction of smoke vents, their sizes and placement with the use of draft curtains. In other words, this specific language was confined to these two aforementioned occupancy types. Incidentally, this code requirement was eliminated in the 2015 edition of the IBC, the term draft curtain no longer exists for F-1 and S-1 occupancies. These particular smoke removal systems no longer require draft curtains for directing smoke.

Current Provisions

Section 712 Vertical Openings, 712.1.3.2 allows unprotected escalator openings that are protected by draft curtains. *Section 1019* addresses *Exit Access Stairways* allowing draft curtains to protect vertical openings. However, these two code sections (applications) did not reference *Section 910* prior to 2015 confirming separate and distinct uses of the provision. However, both the escalator and exit access stairway applications include a pointer to *NFPA 13* as the standard for the use of this building feature. *Section 712.1.3.1 Opening size* at the escalator opening and *Section 1091.3, Item #4* at the exit access stairway opening state the following: "… protection[ed] by a draft curtain and closely spaced sprinklers in accordance with NFPA 13 …"

Please note, there are no other definitions or criteria for the term draft curtain in the model building codes with exception of the reference to *NFPA 13.* Yet, the term draft curtain is called out in both aforementioned code sections. Further to confuse the issue the term Draft Stop is found in *IBC Section 202.* After reading this definition, clearly it is addressing a building feature located in *"… concealed areas of building components such as crawl spaces, floor/ceiling assemblies, roof/ceiling assemblies and attics."*

As if the issue is not confusing enough, *NFPA 13* addresses vertical openings such as escalator openings and stair openings with regard to this level of protection as Draft Stops rather than using the term Draft Curtain. Please note:

NFPA 13, Section 8.15.4 Vertical Openings

8.15.4.1 General. Unless the requirements of 8.15.4.4 are met, where moving stairways, stair-

cases, or similar floor openings are unenclosed and where sprinkler protection is serving as the alternative to enclosure of the vertical opening, the floor openings involved shall be protected by closely spaced sprinklers in combination with draft stops in accordance with 8.15.4.2 and 8.15.4.3.

8.15.4.2 Draft Stops. Draft stops shall meet all of the following criteria:

1. *The draft stops shall be located immediately adjacent to the opening.*
2. *The draft stops shall be at least 18 in. (457 mm) deep.*
3. *The draft stops shall be of noncombustible or limited combustible material that will stay in place before and during sprinkler operation.*

The term draft curtain does appear in *NFPA 13,* however, only in reference to the old method of channeling smoke to smoke and heat vents in “F” & “S” occupancies. Therefore, the use of draft curtains in our current model building codes is limited to escalator and exit access stairway openings only. Since NFPA 13 criteria for use of draft curtains in vertical openings does not require the channeling of smoke, rather to simply force heat and smoke against the sprinkler heads for immediate activation, the criteria does not include large depths of drop beyond 18 inches nor does it require smoke sealed corners or joints in the curtain installation.

If we examine this concept from a more pragmatic view we can see that the criteria makes sense. As mentioned above, the maximum drop in the draft stop criteria for these applications is 18 inches. If the intent of the draft curtain application was to stop the transfer of smoke or heat to other floors, this depth would have to be much greater. At some point, very quickly upon contact the smoke will easily pass over these draft curtains and the curtains become academic at that point. Hence, draft curtain applications in escalators and stairs always have gaps at the joints, are typically constructed of polymethyl methacrylates which by trade-name are better known as clear acrylics or Plexiglass. These or other materials are usually not continuous or installed in a fashion to actually prevent smoke from migrating floor to floor … their only purpose is to force enough heat against the sprinkler heads to activate them.

For this reason there is not a test standard or criteria for testing draft curtains. *NFPA 13* simply requires, *“The draft stops shall be of noncombustible or limited combustible material …”* The D100 technology significantly exceeds these basic requirements. The McKEON SmokeFighter® Model D100 is manufactured from fabric that has been tested and certified for a 3-hour UL 10D fire label. This material has also been tested and certified for a 20 minute UL 10B fire label. Both labels certify use to span unlimited widths and heights. The test criteria included side-guide components in order to maintain full integrity opening protective hose stream performance.

The D100 technology exceeds the minimum requirements, creating a substantial fire and smoke barrier to expeditiously activate the closely spaced sprinklers surrounding the vertical opening. Sprinkler activation at the unprotected shaft opening mitigates the migration of heat, smoke, toxic fumes and gases from traveling throughout the structure.

Exit Access Stairways

Sections 712, 1019

These case studies deal with a condition wherein several floors are common to each other. The floors are inter-connected with an interior exit access or communicating stairway. Previous editions of the code addressed these stair features as non-egress stairs. The code now defines Exit Access Stairways as a stairway within the exit access portion of the means of egress system. *(202)*

Fire & Life Safety Concerns

Multiple floors open to each other is perhaps one of the most vulnerable conditions to fire danger threats in any multi-story building. Fire suppression is concerned with confining a fire to the floor of origin and preventing the fire, or the products of the fire (smoke, heat and hot/toxic gases) from spreading to other levels. Such conditions are not conducive to defend in-place strategies. Rather, it is preferable that building occupants move quickly out of harm's way. These requirements expressly demonstrate the overlap between passive, active and egress fire & life safety provisions.

Code Requirements

In occupancies other than I-2 and I-3, floor openings containing exit access stairs that do not comply with one of the following … shall be enclosed in a shaft enclosure. *(1019.3)*

- The exit access stairway must be included in the exit access travel distance measurement. *(1017.3.1)*
- Serve or atmospherically communicate between only two stories *(1019.3, Item #1)*
- Options to open four stories or more than four stories using draft curtains and closely spaced sprinklers (1019.3, Item #4, please see page 34, Draft Curtains)

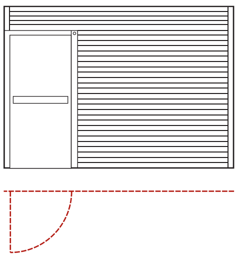
For additional code language and acceptance criteria for two-story openings please see "Inquiry Discussion & Questions" on page 42 of this application study.

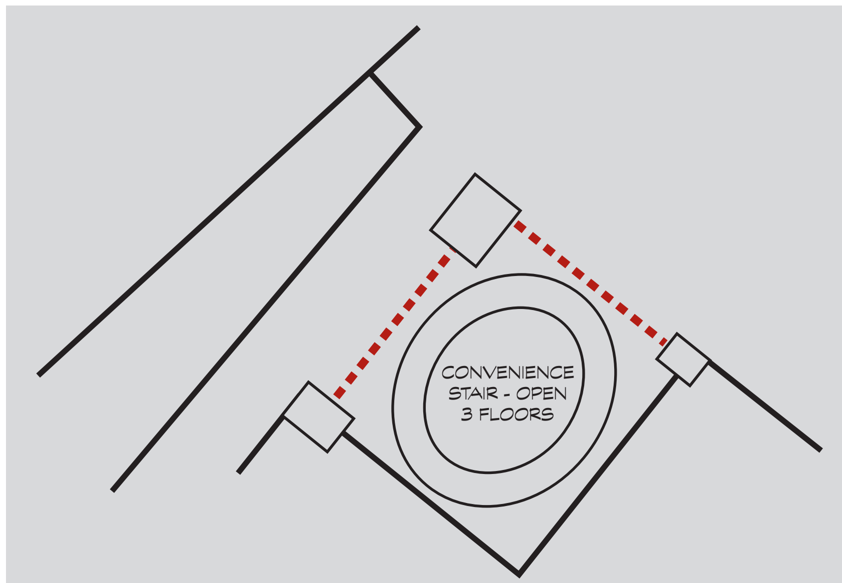
VERTICAL OPENING SEPARATION

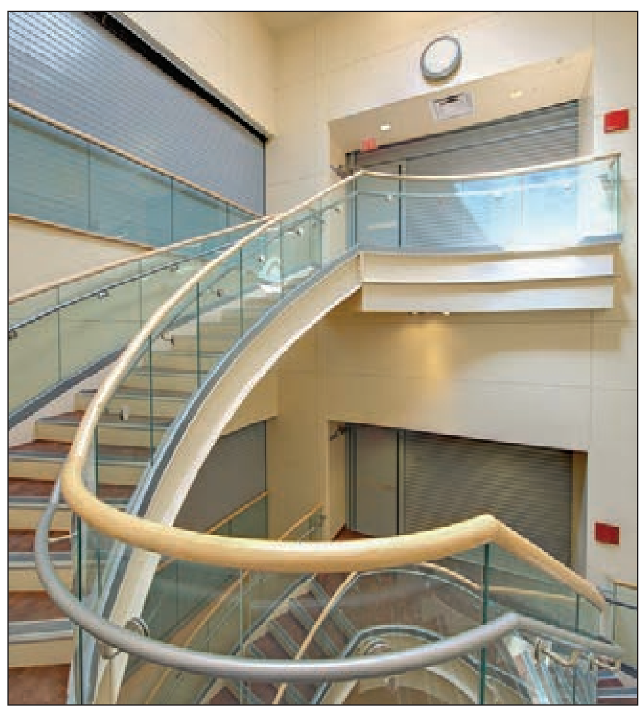
Design Solutions

Because each space contains a stair the code will allow two floors common. In the following case studies, McKEON offers different products for very diverse design needs, yet there is not a compromise in fire and life safety.

CASE 1: Vertical Coiling with Complying Swing Egress Door(s)

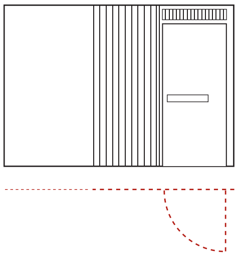




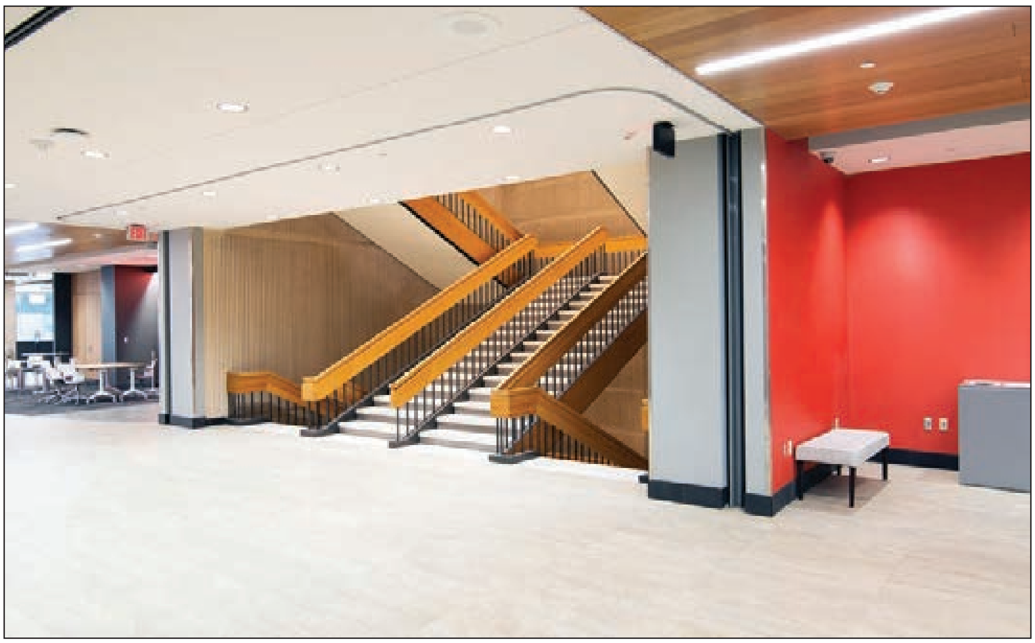


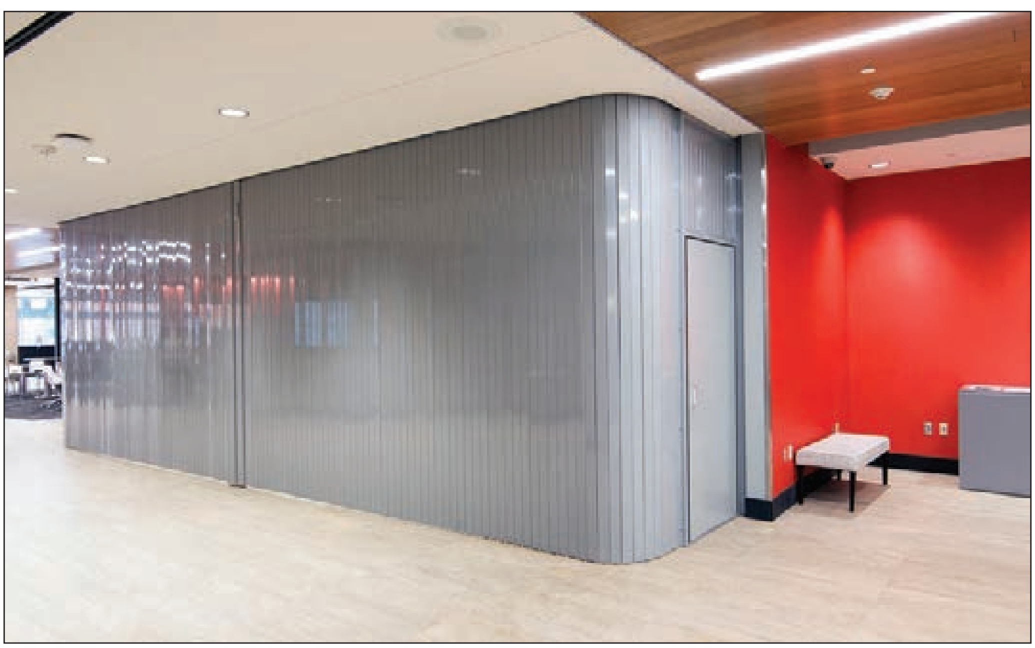
VERTICAL OPENING SEPARATION

CASE 2: Side Acting with Complying Egress Door(s)



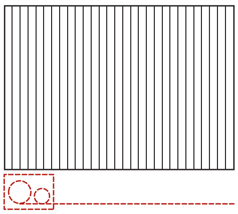
In the second case study a convenience stair within a university learning center is open to each floor it connects during normal school operation. When the building goes into alarm two McKEON 3-hour side acting assemblies, each with a conforming egress swing door and conventional fire exit hardware, combine to provide shaft enclosure protection.



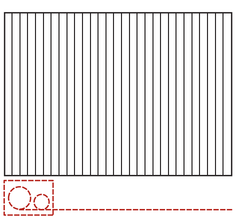


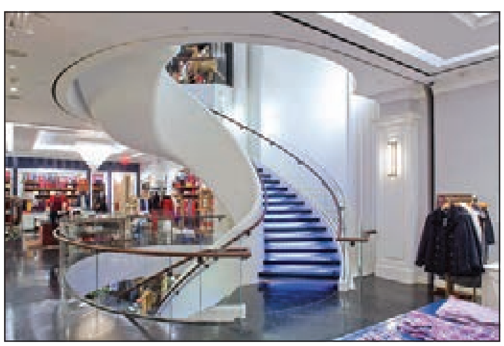
VERTICAL OPENING SEPARATION

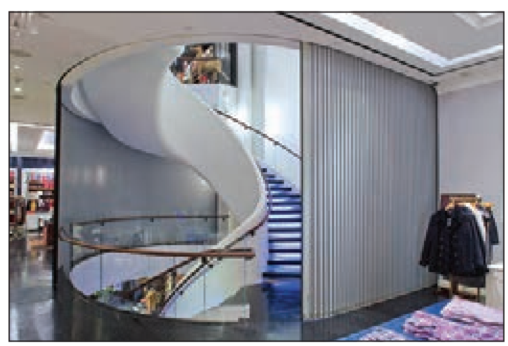
CASE 3: Extreme Height & Width Side Coiling without Egress

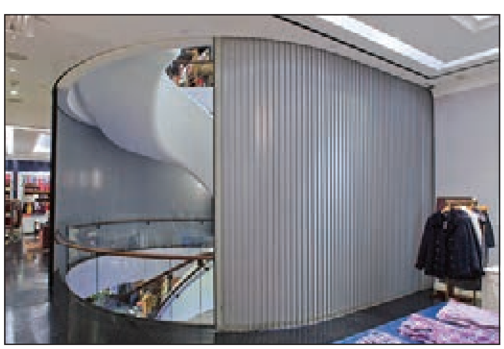


CASE 4: Side Coiling without Egress





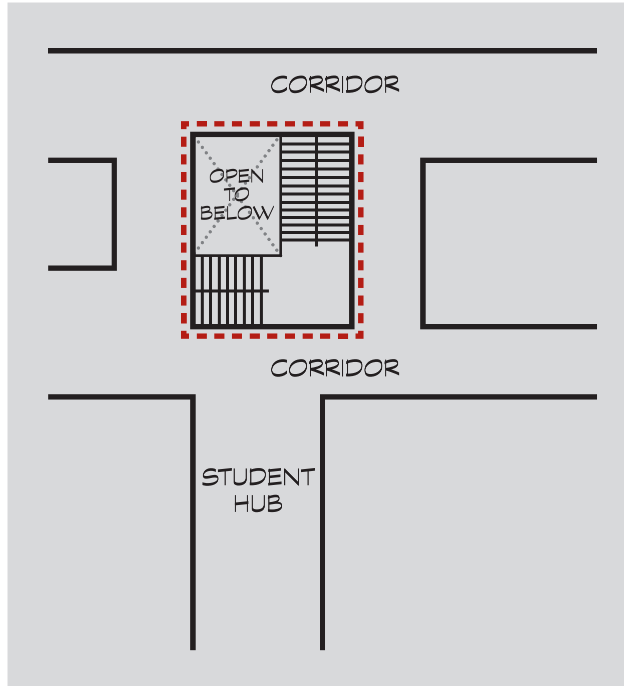




VERTICAL OPENING SEPARATION

CASE 5: Deployable Draft Curtains & Closely Spaced Sprinklers

The McKEON D100 draft curtains deploy when there is a fire emergency. During normal hours of building occupancy, unlike conventional fixed draft curtains, the ceiling space around the vertical opening is clear of any obstacles.



Inquiry Discussion & Questions

These applications, at first glance, would seem to fall under the atrium provisions because there are at least two floors common to each other. Notwithstanding the third floor is separated from the other two, the definition of an atrium is two or more floors interconnected. The purpose for separating floors in order to create only two floors common is to consider the space under the vertical opening provisions of Section 712 in lieu of the atrium provisions in Section 404. Aside from the exit access stairway provisions referenced in Section 712 and detailed in Section 1019, the code includes additional acceptance criteria for two-story openings. Essentially, in other than Groups I-2 and I-3 a floor opening that is not used as one of the applications already listed in Section 1019 or 712.1.9 shall be permitted if it complies with all of the following seven criteria:

1. Does not connect more than two stories.
2. Does not contain a stairway or ramp required by Chapter 10.
3. Does not penetrate a horizontal assembly that separates fire areas or smoke barriers that separate smoke compartments.
4. Is not concealed within the construction of a wall or floor/ceiling assembly.
5. Is not open to a corridor in Group I and R occupancies.
6. Is not open to a corridor on nonsprinklered floors.
7. Is separated from floor openings and air transfer openings serving other floors by construction conforming to require shaft enclosures. *(712.1.9)*

The following questions may be helpful:

- Do you have clients who wish to occupy multiple floors with a vertical common area connecting all floors?
- Can I show you how interconnecting unenclosed stairs can be incorporated into the design without creating shaft enclosures or complying with atrium provisions?
- Have you been concerned attempting vertical space separation avoiding the closed-in shaft appearance?
- Did you know there is technology available to offer a wide-span opening protective to separate vertical spaces that can also serve as the required exit from unenclosed stairways?

Notes:

Vertical Openings – Escalator

Sections 712.1.3

An escalator provides convenient movement for building occupants communicating multiple floors. However, escalators are typically not a part of the required means of egress.

Fire & Life Safety Concerns

Openings through floors allow fire – or the products of fire (smoke, heat and hot toxic gases) – to spread to other floors. Enclosing these spaces in rated shaft enclosures is certainly the most proficient method of mitigating fire and smoke migration between floors. However, the code incorporates optional provisions as exceptions to the completely sealed vertical shaft.

Code Requirements

The following exceptions are allowed in lieu of creating a shaft:

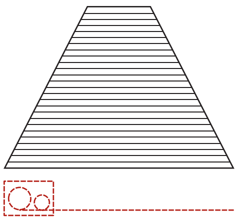
Escalators must be enclosed unless the design incorporates the following requirements: *(712.1.2)*

First, an automatic sprinkler system must be installed throughout the entire building and, secondly an escalator must NOT be in a portion of the means of egress system. If both of these issues are satisfied then the following criteria must be met:

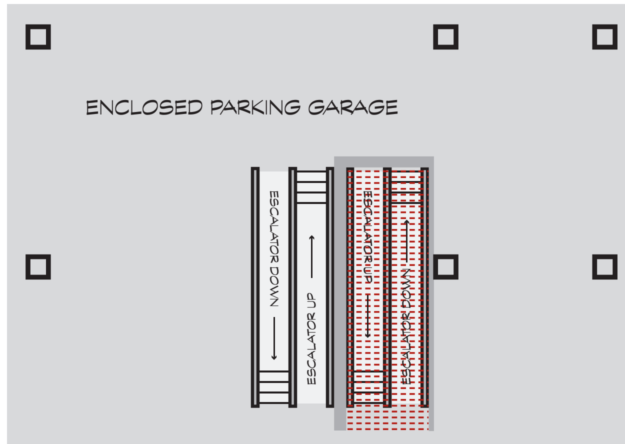
1. The area of the floor opening between stories does not exceed twice the horizontal area of the escalator. *(712.1.3.1)*
2. The opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13. *(712.1.3.1)*
3. In other than Groups B and M, this application is limited to openings that do not connect more than four stories. *(712.1.3.1)*

Design Solutions

CASE 1: L-Shape Horizontal Shutter

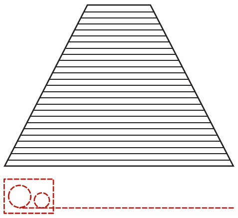


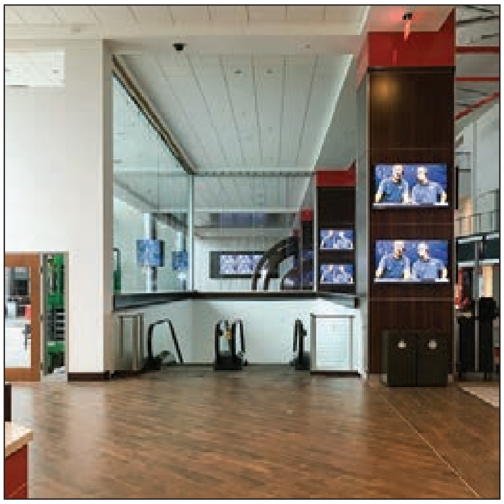
While a parking garage doesn't require an aesthetically pleasing solution, from a life safety perspective the need for fire and smoke protection is the same. A 2-hour rated horizontal shutter satisfies both the basic requirement of opening protection and enclosure of the escalator.



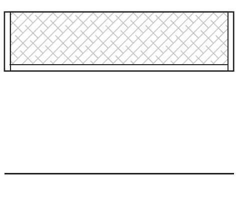
VERTICAL OPENING SEPARATION

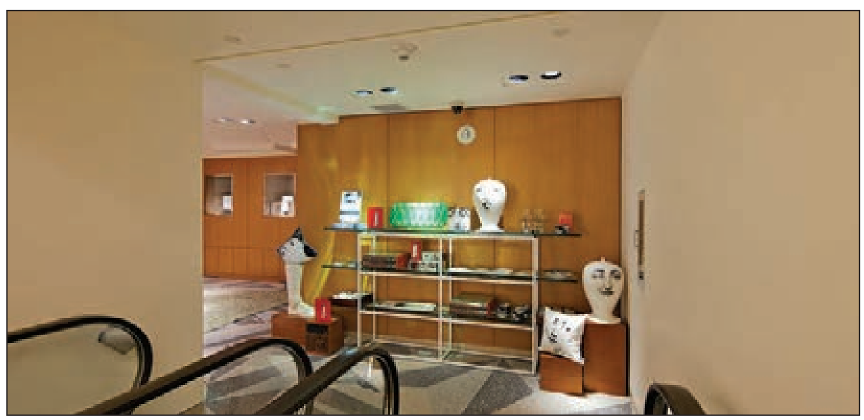
CASE 2: L-Shape Horizontal Shutter

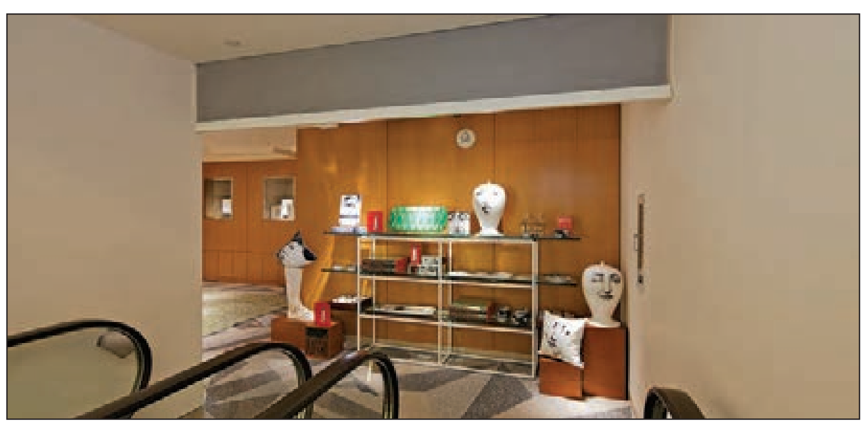




CASE 3: Deployable Draft Curtains & Closely Spaced Sprinklers







Inquiry Discussion & Questions

Escalators, whether in high-profile locations or low-profile parking garages, cannot be limited to the design criteria as stated above and maintain the desired ambiance of the space.

The following questions may be helpful:

- Would you like to use the escalator as a required exit?
- Have you considered the cost difference between a shaft enclosure and the open escalator design requirements?
- Have you considered wide-span opening protectives as an alternative to conventional swing doors in shaft enclosure walls?

Notes:

Interior Exit Stairways

Section 1023

Exit enclosures extend vertically through the interior of multi-story buildings in order to ensure timely and safe evacuation of occupants during an emergency. These enclosures include exit stairs and exit ramps.

Fire & Life Safety Concerns

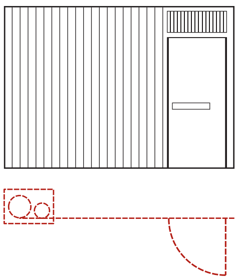
Because exit enclosures penetrate horizontal floor and ceiling assemblies, fire, heat, smoke and toxic gases can potentially penetrate into building spaces at each floor level. Therefore, enclosures become critical barriers of protection for building occupants. The protected enclosure will be a non-contaminated exit path for at least one hour in buildings less than four stories and two hours in buildings four stories or more.

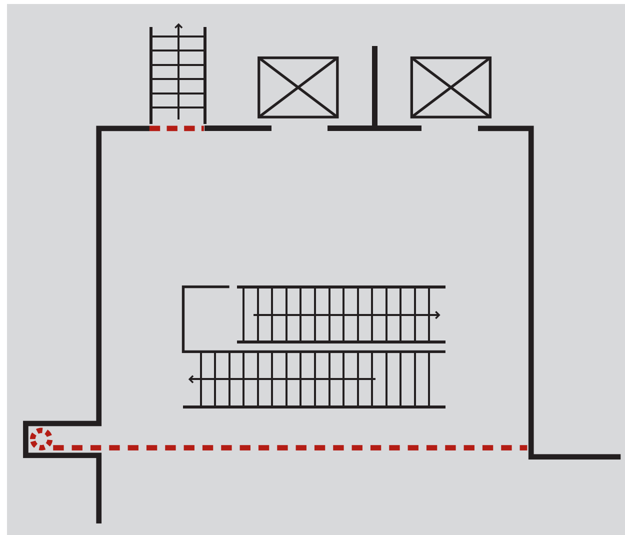
Code Requirements

1. Interior exit stairways shall be enclosed with fire barriers in accordance with Section 707. *(1023.2)*
2. Exit enclosures in buildings connecting four stories or more shall be rated at 2 hours; less than four stories at 1 hour. *(1023.2)*
3. Openings and penetrations shall be rated in accordance with Section 716. *(1023.4)*

Design Solutions

CASE 1: Side Coiling with Complying Swing Egress Door(s)

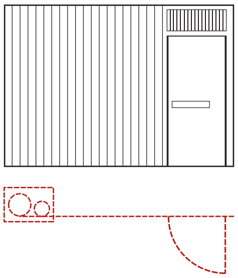




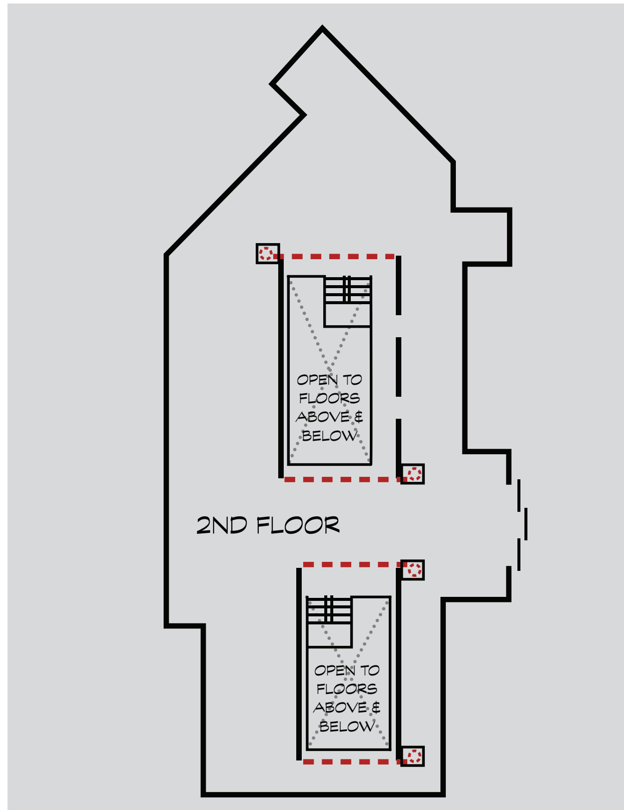
An absence of stacking space dictated use of a unique McKEON product to seal this exit enclosure. The side coiling assembly requires a small box-like space, projecting the 3-hour steel curtain with conventional egress door along a very narrow pocket entry point and header slot path. When deployed, complete compliance with shaft enclosure opening protective requirements is achieved.

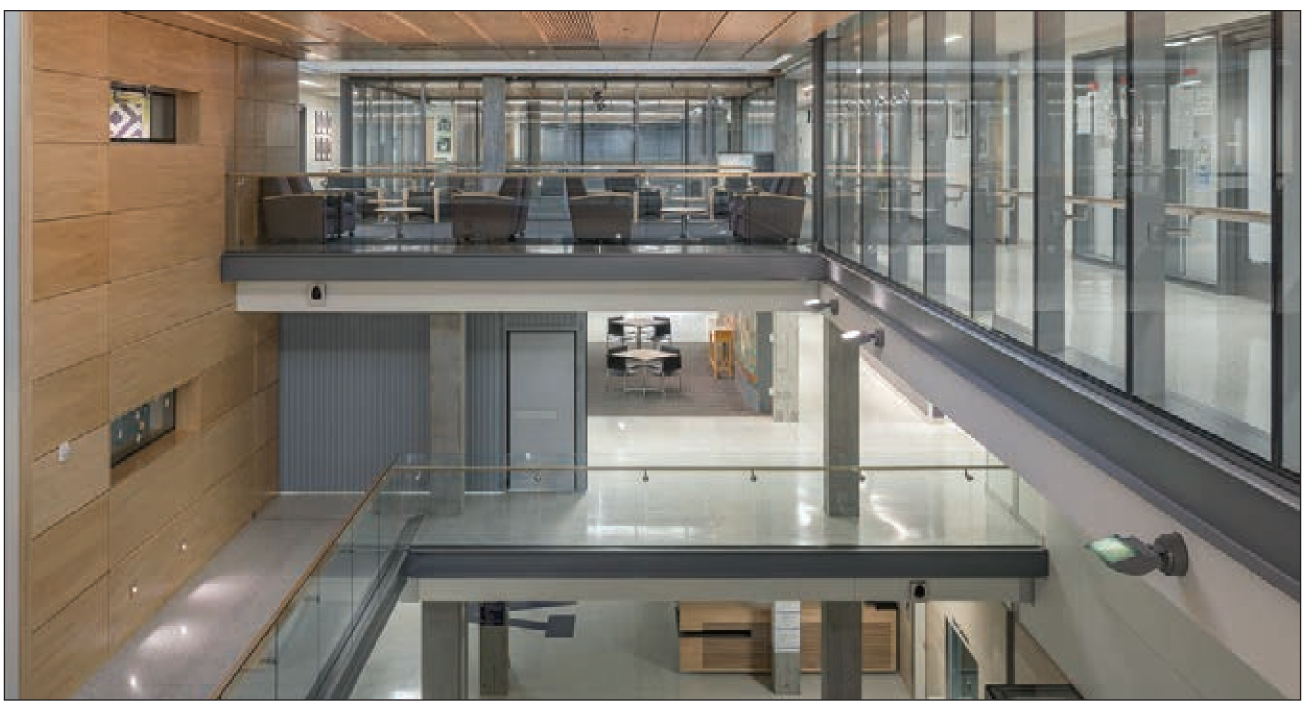
VERTICAL OPENING SEPARATION

CASE 2: Side Coiling with Egress



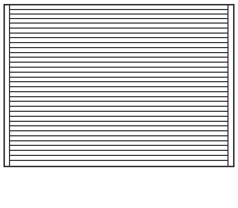
A fixed swing door within the parameters of a lengthy side coiling 3-hour assembly provides a simple resolve in a multi-floor challenge of vertical separation and egress.



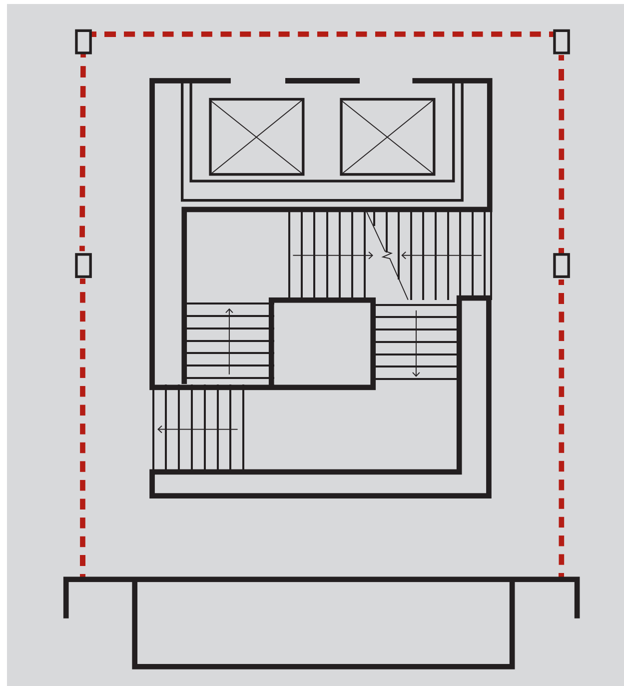


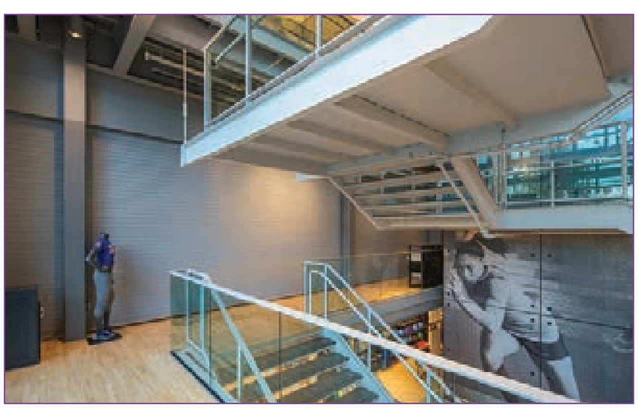
VERTICAL OPENING SEPARATION

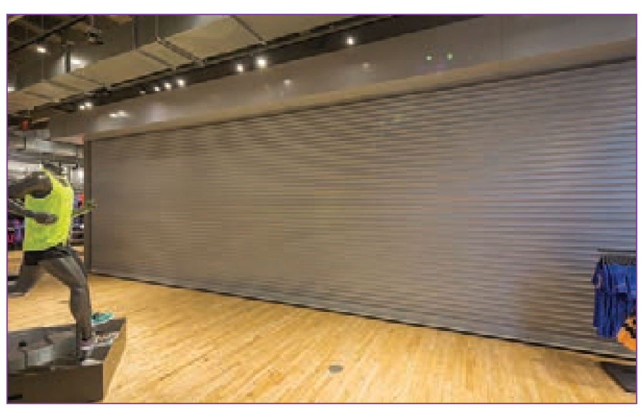
CASE 3: Vertical Coiling without Egress



Shaft enclosures that protect a required means of egress are extremely critical to the life safety of building occupants. From a design perspective it is often challenging to incorporate opening protectives in hi-profile open spaces. This extreme width vertical coiling assembly fits narrow header lines, has inconspicuous side guides, and deploys with adequate separation only when the building goes into alarm.







VERTICAL OPENING SEPARATION

Inquiry Discussion & Questions

Required exit stairs in vertical shaft enclosures ensure building occupant safe evacuation. Historically the designs of openings at the level of exit discharge have been limited to conventional side-hinged swinging doors. The acceptance of the McKEON products as both wide-span opening protectives as well as a complying egress doors provide the designer flexibility without compromising code compliance.

The following questions may be helpful:

- Do you find building owners and maintenance groups struggling with door swing and maintenance on door hardware in high-traffic spaces?
- Do you seek an open and spacious appearance at the landing area of vertical stair enclosures?
- Would you like to use a required vertical exit stair shaft as an aesthetically pleasing communicating stair by opening the enclosure area at each floor?

Notes:

Atriums

Section 404

An atrium is a floor opening, or a series of floor openings, that connects the environment of adjacent stories. By code definition an atrium is a space within a building that extends vertically and connects two or more stories. Atriums are designed to provide open and spacious vertical areas common with other building elements.

Fire & Life Safety Concerns

Unprotected vertical openings are often cited as the factor responsible for fire spread in incidents involving fire fatalities and/or extensive property damage. Section 404 addresses the need for protection of these specific building features in lieu of providing a complete floor and/or vertical shaft separation. In simple terms, the atrium provisions are extremely restrictive because a complying atrium is a shaft enclosure.

Code Requirements

Vertical common areas that comprise an atrium are not considered unprotected, rather the atrium is considered a protected space by means other than a conventional "walled-in" shaft enclosure. Listed below are the specific provisions allowing atriums to be open and spacious yet considered a conforming shaft enclosure:

1. The atrium floor area is permitted to be used only for low-hazard uses unless the individual space is provided with an automatic sprinkler system. *(Section 404.2)*
2. An approved automatic sprinkler system shall be installed throughout the entire building. *(Section 404.3)*
3. A fire alarm system shall be provided. *(Section 404.4)*
4. Engineered smoke control system – this system shall be installed in accordance with Section 909 when the atrium space exceeds more than two floors. *(Section 404.5)*
5. Atrium spaces shall be separated from adjacent spaces by 1-hour fire barrier construction unless at least one of the following exceptions are met: *(Section 404.6)*
   - A glass wall forming a smoke partition where automatic sprinklers are spaced 6 feet or less along both sides of the separation wall, or on the room side only if there is not a walkway

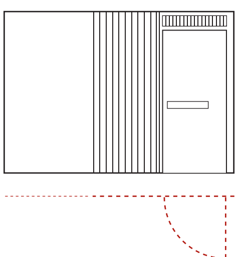
on the atrium side, and between 4 and 12 inches away from the glass … the entire glass surface must be wet upon activation … the glass shall be mounted in a gasketed frame … *(404.6)*

- Provide a glass block wall assembly in accordance with Section 2110 … *(404.6)*
- Fire barrier walls are not required between the atrium and adjoining spaces where the atrium is not required to have a smoke control system. *(404.6)*
- The adjacent spaces of any three floors of the atrium shall not be required to be separated from the atrium … if included in the smoke control calcs. *(404.6)*
- Smoke control equipment must be on a standby power system. *(Section 404.7)*
- The atrium interior finish of walls and ceilings must be not less than Class B. *(404.8)*
- With the exception of the lowest atrium level, the required means of egress in the exit access system travel distance shall not exceed 200 feet. *(404.9)*

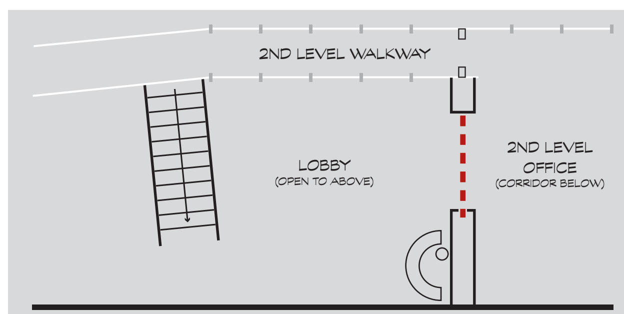
Design Solutions

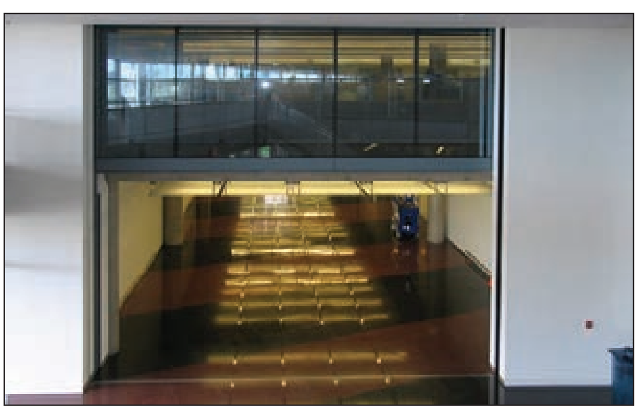
The use of deployable wide-span opening protectives in vertical atrium spaces, both vertically and horizontally, can significantly reduce construction and maintenance costs.

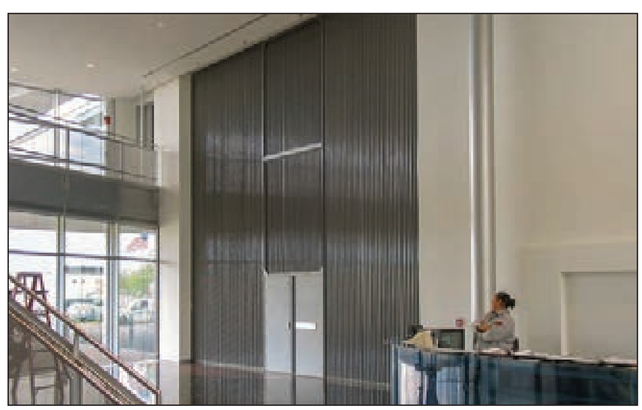
CASE 1: Side Acting with Complying Swing Egress Door(s)



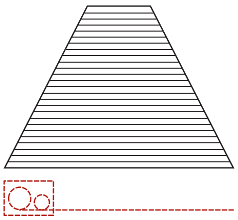
This unique case study features another McKEON product for resolving multiple design/code challenges simultaneously. The lower floor travel path is a required design feature for egress and – combined with the non-rated second floor overlook – is certainly a very creative solution. However, without the side acting, extreme height and egress conforming McKEON assembly this would not be possible!



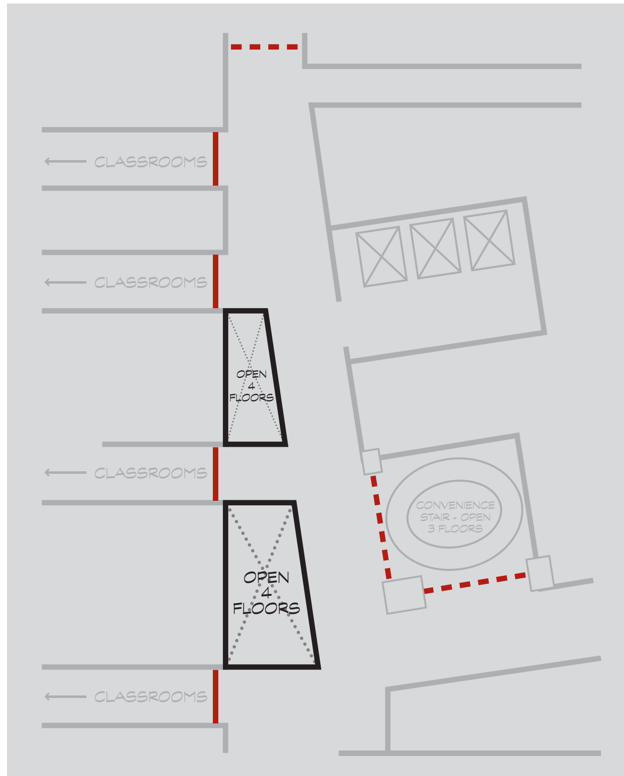


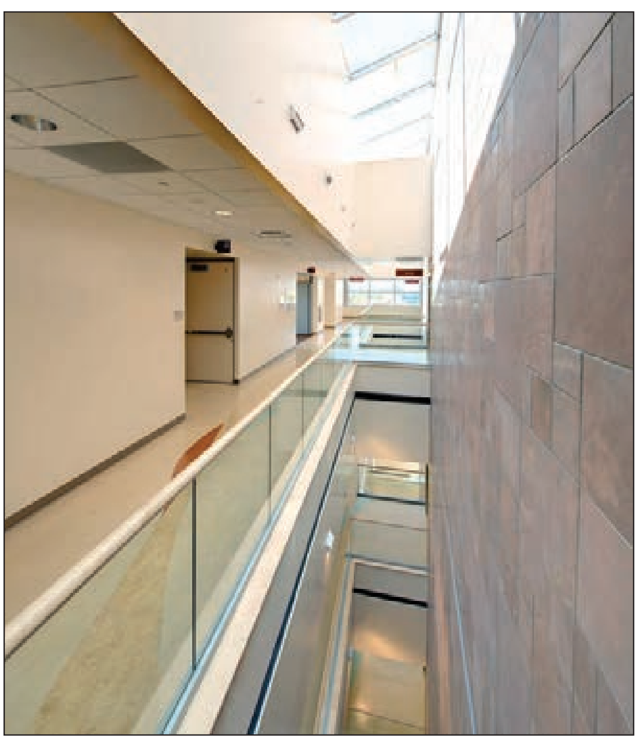


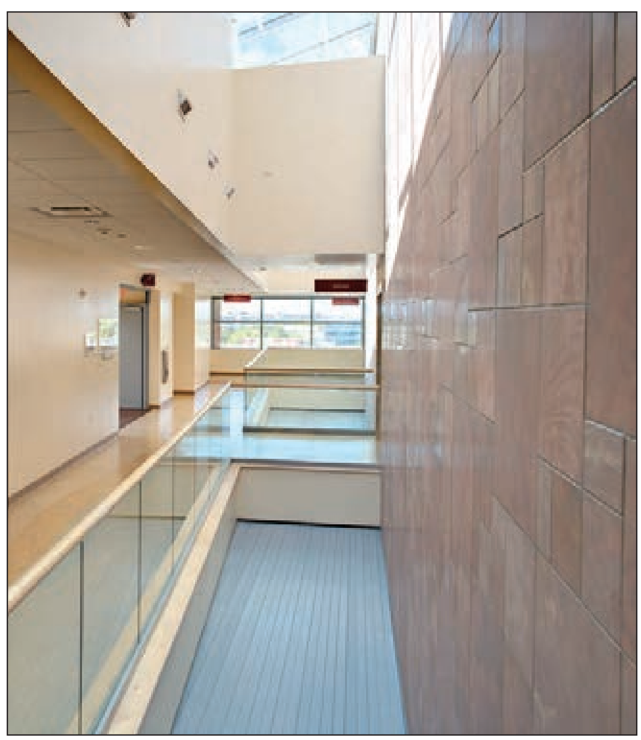
CASE 2: Horizontal (Floor) Shutter



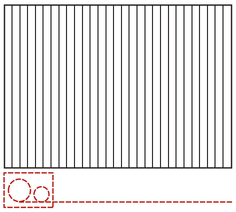
In this case study the atrium space is essentially converted to a vertical compartment separation using the McKEON horizontal shutter. Please refer to the "vertical compartmentation" case studies at the end of this section for more information. Note the absence of any smoke evacuation systems!

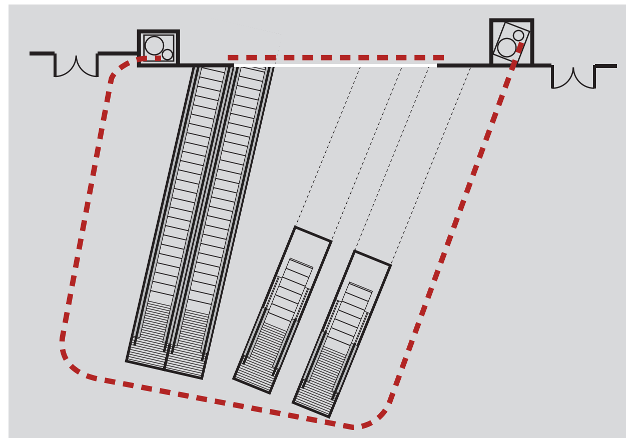




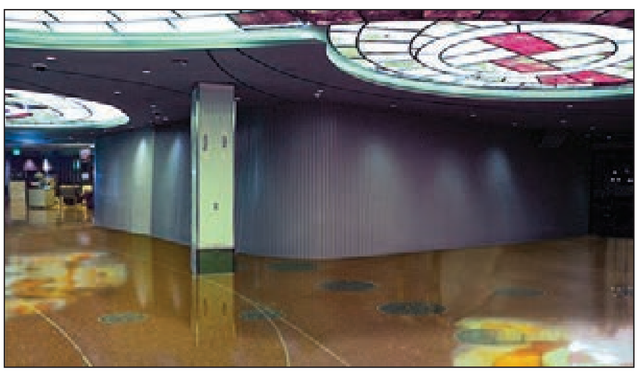


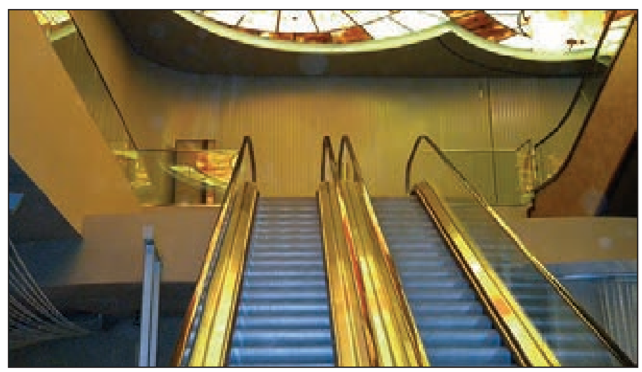
CASE 3: Side Coiling without Egress

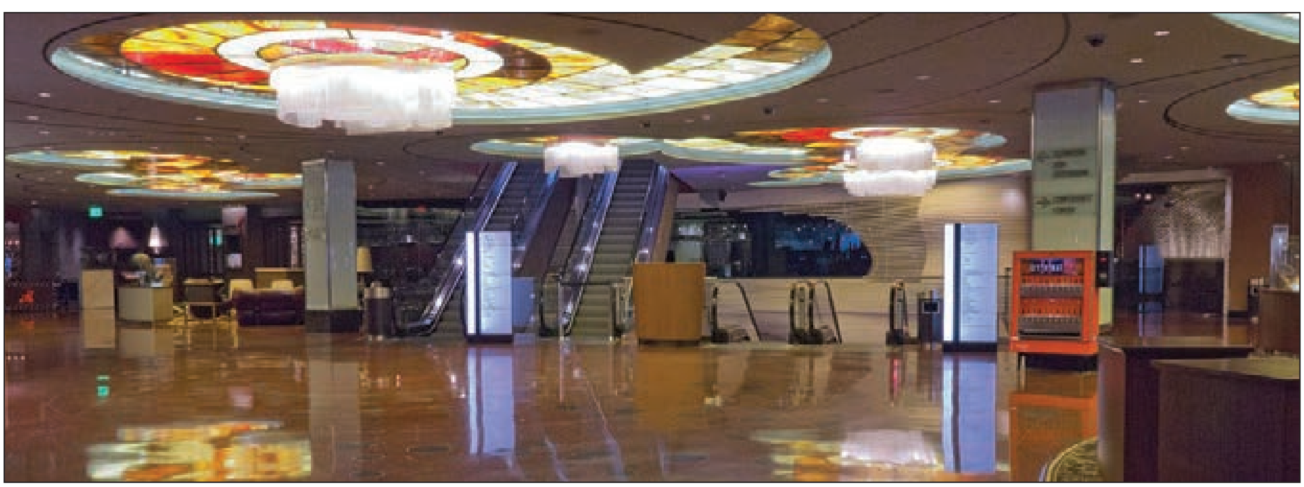




Even though this design incorporates an escalator, Item #2.1 under Exception #2 can only be applied if the area of the floor opening between stories does not exceed twice the horizontal projected area of the escalator. Since the area in this vertical open space is greater, the next option is to explore the possibility of creating a vertical shaft enclosure allowing no more than two floors common or interconnecting. With a 2.25" head-track design, 3-hour fire listing and unlimited width capacity, McKEON easily solved the problem with a triple curve, non-floor track 140' bi-part opening protective.







Inquiry Discussion & Questions

The following questions may be helpful:

- The size of the smoke evacuation system is based upon the calculation of total cubic footage of not only the atrium space but all spaces that open into the atrium space. Can I help you minimize this system cost by reducing the cubic footage with wide-span opening protectives at critical locations in the atrium?
- Have you considered the cost savings if eliminating all of the atrium requirements by creating a fully enclosed shaft or horizontal compartmentation in this vertical space?

Notes:

Vertical Compartmentation

Combined Code Principles from Chapters 4, 7 & 10

Protecting openings that connect multiple floors are currently addressed by the building and fire codes by way of vertical type shaft enclosures, atrium provisions or requirements relative to small floor or roof hatch type openings. In the following case studies a new technology and product application will be discussed wherein vertical compartments can be created separating any number of stories from each other. This will be accomplished by coordinating in one application the intent of the provisions found in both atrium and shaft enclosure requirements.

Fire & Life Safety Concerns

As stated in the atrium case studies, vertical spaces that are interconnected and common with each other allow heat, smoke, and hot/toxic gases to migrate throughout an entire structure.

Code Requirements

Currently the code examines vertical opening conditions in Section 712, Vertical Openings and Section 713, Shaft Enclosures. In earlier editions of the code, all vertical openings were considered under the shaft enclosure provisions only. The older Section 708.2, Shaft Enclosure included 16 exceptions, or different ways of creating vertical spaces as shaft enclosures. The 2012 edition created a new Section 712 titled Vertical Openings, wherein the old 16 exceptions in Section 708.2 were moved and edited. These items, originally written as exceptions to the shaft requirements, became stand-alone provisions defining vertical opening conditions, rather than exceptions or re-writes to strict shaft enclosure requirements. Although the fundamental content did not change, placing the shaft provisions under the title of Vertical Openings significantly affects one's perspective regarding their intended purpose. Perhaps this paradigm shift, from shaft enclosure provisions to vertical opening provisions is, in fact, a monumental shift not seen in many years! However, none of these accepted methods specifically address the exclusive use of horizontal shutters to eliminate a vertical condition. Unless an escalator opening is being protected or a door-hatch assembly is used to protect small structural openings in floors and roof assemblies, the code is vague regarding protection of vertical openings in the creation of vertical compartments.

VERTICAL OPENING SEPARATION

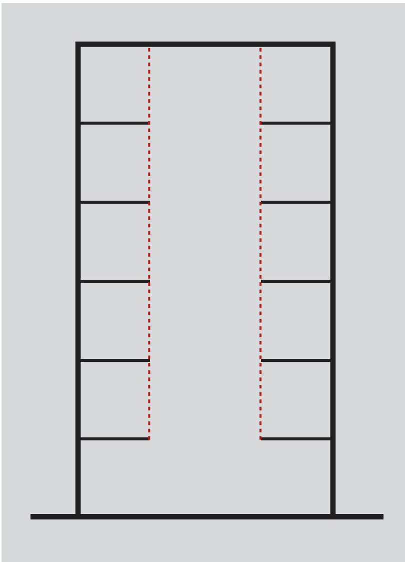


Figure 1

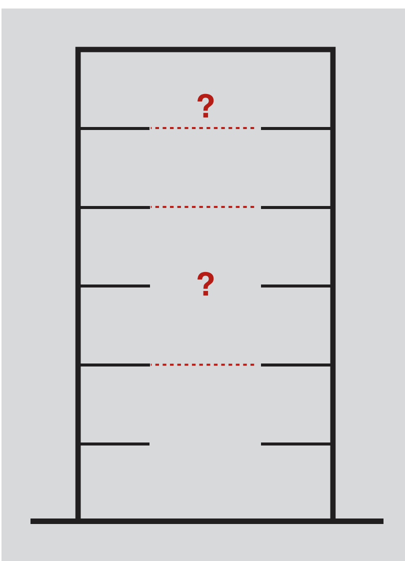


Figure 2

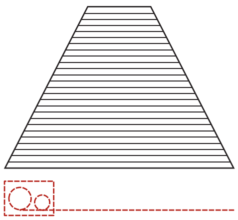
Figure 1, shown at the left, addresses a vertical opening condition complying with Sections 712 and 713 requirements to seal the space. Note, the atrium requirements are designed to essentially replicate this condition. By definition an atrium is a shaft enclosure.

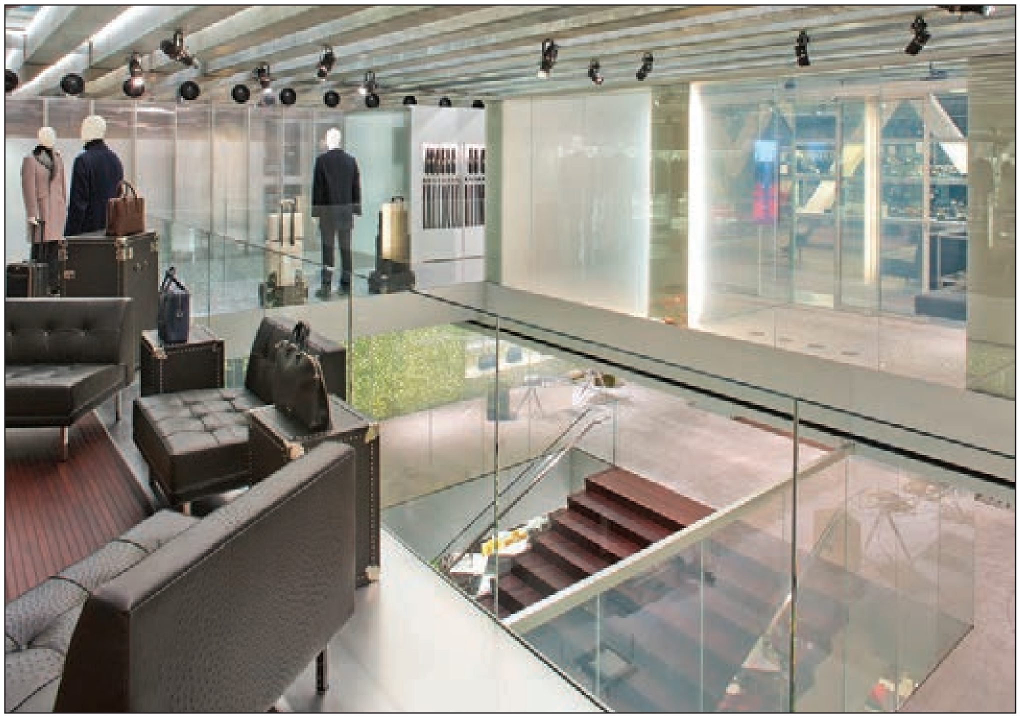
Within the current provisions set forth in Sections 712 and 713, the basic core and shell of this structure is still going to be a protected shaft. For example as shown in **Figure 2,** when one uses certain provisions of Section 404, by way of exception two floors can be common and the smoke evacuation can be eliminated from those two floors, while all the other vertical separation or atrium provisions are retained. Yet in other provisions of Sections 712 and 1019 the incorporation of an exit access stairway allows two unprotected floors common. In fact, the 2015 and 2018 editions separate exit access stairs into their own Section 1019 and in definitions in Section 202 declares exit access stairways as “a stairway within the exit access portion of the means of egress system.”

The question is, is it possible to eliminate the “vertical” open condition “horizontally” without a stair by protecting the vertical opening in the spirit of compartmentation since a structural floor was never in the original design as shown in **Figure 2,** and if so how many floors can be common? Exact code language is not found, however if the vertical opening is eliminated horizontally with a rated and hose-stream tested assembly, has the potential for migration of smoke, heat and hot/toxic gases been mitigated? The answer is a resounding yes with one important caveat. Since this configuration is defining a 2-story atrium it is critical to meet the atrium separation requirements. Section 404.6, Enclosure of atriums, specifically requires that atrium spaces be separated from adjacent spaces by 1-hour construction both vertically and horizontally. Therefore, defining atriums as 2-story spaces can be achieved with 1-hour construction only. In other words, non-hose stream tested assemblies that are limited to 20-minute ratings under UL 10B, 10C or 10D cannot be used to define an atrium in either the vertical or horizontal orientation.

Design Solutions

CASE 1: Horizontal (Floor) Shutter

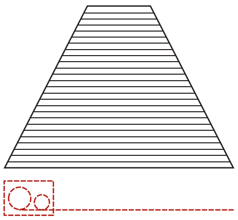




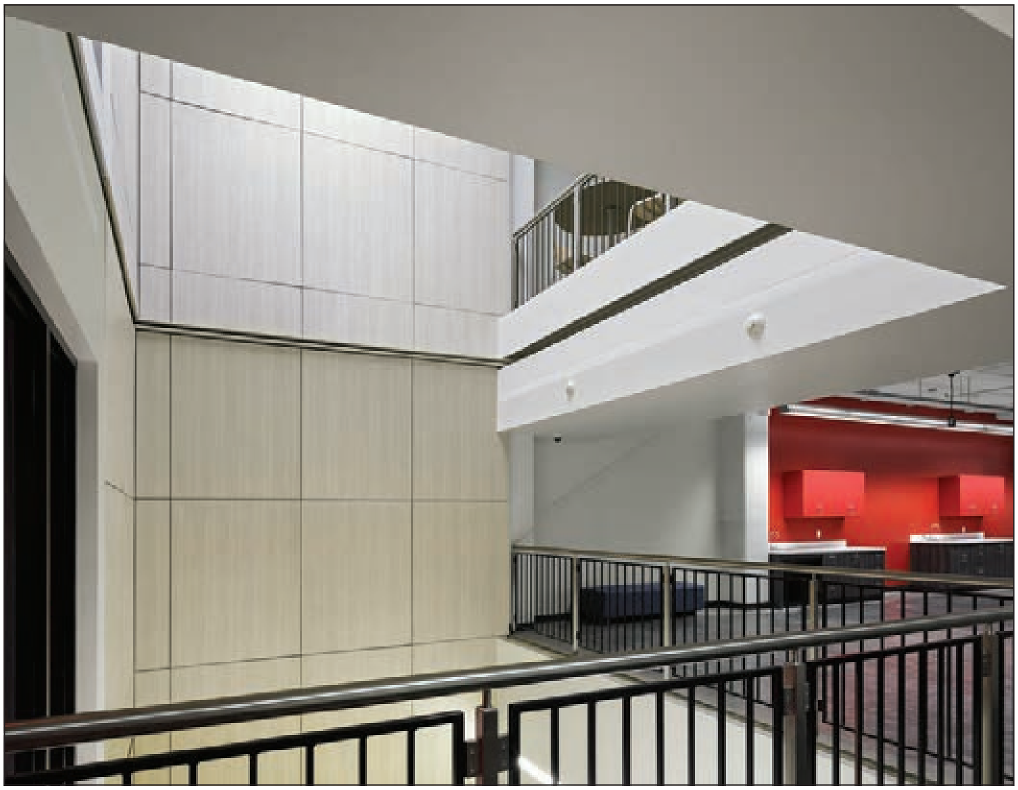
UL 10B 2-hour & UL 1784 “S” labeled, hose stream tested assembly.

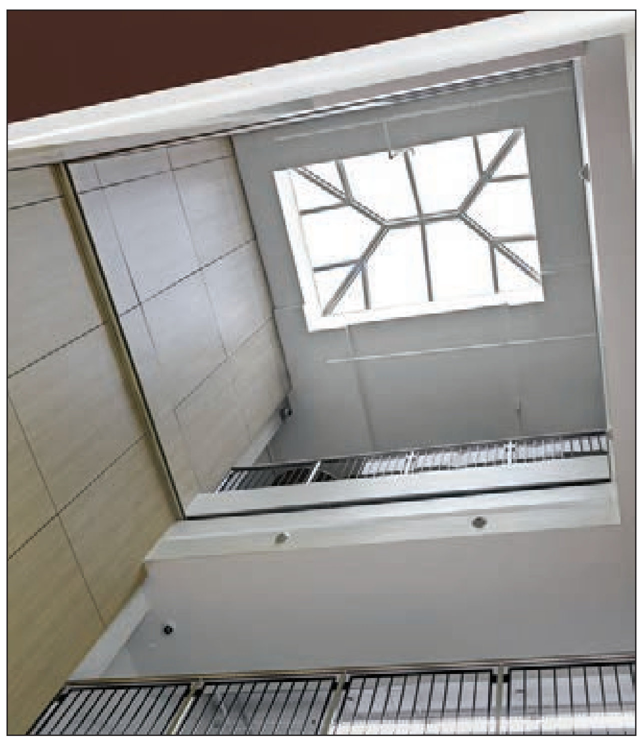
VERTICAL OPENING SEPARATION

Case 2: Horizontal (Floor) Shutter



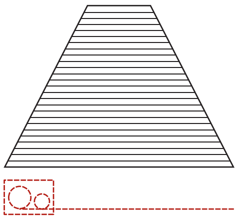
UL 10B 2-hour & UL 1784 "S" labeled, hose stream tested assembly.



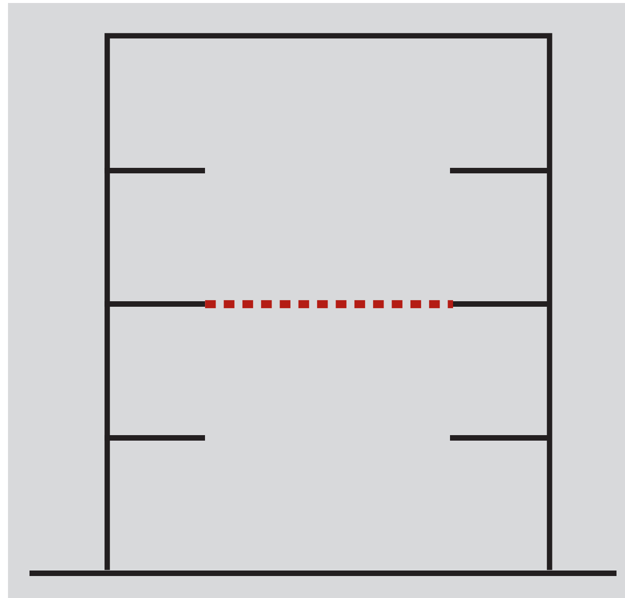


VERTICAL OPENING SEPARATION

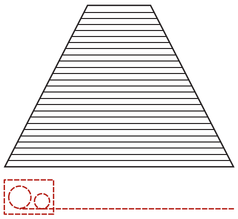
CASE 3: Horizontal (Floor) Shutter

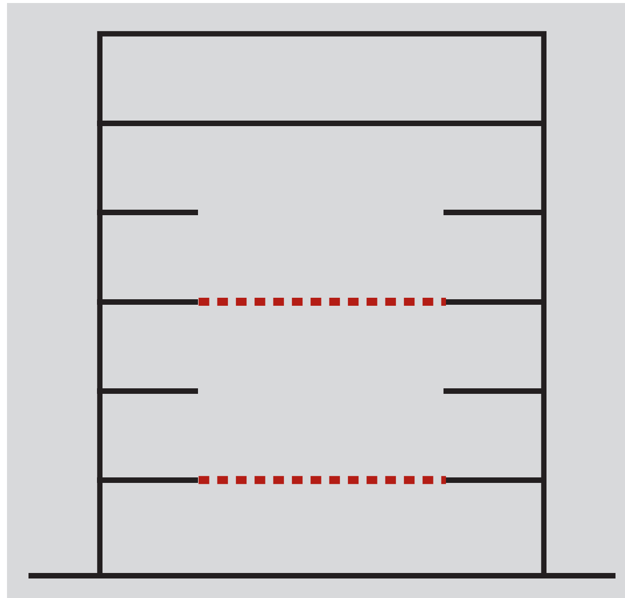


UL 10B 2-hour & UL 1784 "S" labeled, hose stream tested assembly.



CASE 4: Horizontal (Floor) Shutter





UL 10B 2-hour & UL 1784
"S" labeled, hose stream
tested assembly.

4 Occupancy Separation

Fundamental Guidelines

Mixed Occupancy – Accessory Use

Mixed Occupancy Use –
Non-Separated vs. Separated

Fundamental Guidelines

Table 508

Most buildings are designed for multiple uses that will typically result in more than one occupancy classification. The code provides three basic options for mixed occupancies in Section 508:

1. **Accessory occupancies: Section 508.2**
2. **Non-separated occupancies: Section 508.3**
3. **Separated occupancies: Section 508.4**

Chapter 3 of the building code specifically classifies a building according to its use and occupancy. The level of fire hazard varies with specific uses and occupancies in a building. However, this level of hazard and its potential affect on the building occupants is determined not only by the use and occupancy classification by construction type, height and area size, but also the use of passive and active fire protection systems. Chapter 5 combines fire-resistance levels, construction types and occupancy types to determine size and height limitations as well as separation requirements.

Increased fire resistance of the structural members of the building along with increased active and passive fire protection systems permits greater height and area allowances. Notwithstanding, the use and occupancy of the structure will become a determining factor regarding the extent of separation and compartmentation required. For example, a "B" (business occupancy) is allowed occupant load floor area to be calculated at 100 gross sq. ft. per occupant. However, a group "I-2" occupancy (hospital) which is a similar occupant load as far as quantity of people, is required to be calculated at 240 gross sq. ft. per occupant, more than double that of a "B" occupancy. The difference between these requirements is the use of the facility. Occupants in a hospital need better protection for a greater amount of time because they are non-ambulatory and most are dependent upon others for mobility or even life support. Therefore, the fire and life safety requirements designed to help protect building occupants are very different for each of these occupancies.

When buildings are designed as mixed occupancies there is a concern because basic fire and life safety requirements are being mixed within the same structure. Three basic options to eliminate confusion and ensure building occupant safety are outlined as follows:

Accessory Occupancy:

1. Accessory occupancies are those which are different from the main occupancy but ancillary to or a portion thereof. *(508.2)*
2. Aggregate accessory occupancies shall not occupy more than 10% of the area of the story. *(508.2.3)*
3. Aggregate accessory occupancies shall not exceed the tabular values in Table 506.2 without height and area increases. *(508.2.3)*
4. Accessory occupancies shall be individually classified in accordance with Section 302.1. *(508.2.1)*

Non-Separated Use:

To consider spaces under the Non-Separated Use requirements, the following must be met allowing NO separation between occupancies:

1. Each occupancy use shall be individually classified. *(508.3.1)*
2. Code requirements shall apply to each portion of the building based upon the occupancy classification of the space under consideration. *(508.3.1)*
3. The most restrictive applicable provisions of Section 403 and Chapter 9 shall apply to the building or portion thereof in which the non-separated occupancies are located, Section 403 in hi-rise and Chapter 9 in all others.
4. The allowable building area and height of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration for the type of construction of the building in accordance with Section 503.1. *(508.3.2)*

Separated Use:

The following requirements under the provisions of Separated Occupancies will bring these spaces into compliance without compromising design if separated with fire barrier walls according to Table 508.4:

1. Separated occupancies shall be classified in accordance with Section 302.1. *(508.4.1)*
2. Each separated space shall comply with the code based upon the occupancy classification of that portion of the building. *(508.4.1)*
3. In each story, the building area shall be such that the sum of the ratios of the actual building area of each separated occupancy divided by the allowable building area of each separated occupancy shall not exceed 1. *(508.4.2)*
4. Each separated occupancy shall comply with the building height limitations based on the type of construction of the building in accordance with Section 503.1. *(508.4.3)*

Mixed Occupancy – Accessory Use

Section 508.2

Post grade 12 educational occupancies are typically classified as "B" occupancies and usually incorporate mixed occupancies that are often considered accessory – full service kitchens and cafeterias (A-2), assembly areas (A), and dormitories (R-2) occupancies. Even though these spaces are ancillary to and a functional portion of the original larger occupancy they must be separated when they exceed the 10% rule.

Fire and Life Safety Concerns

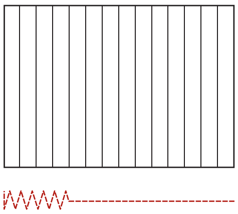
In this case study we will examine the potential fire and life safety threats posed due to the use of open flames, combustible gases and solids, and exhaust hood extinguishing systems. These kitchens (A-2) are often common with other areas (B or R-2) in the facility potentially exposing large groups of building occupants to the associated hazards. In these cases and similar situations, where the spaces are greater than 10%, separation is required.

Code Requirements

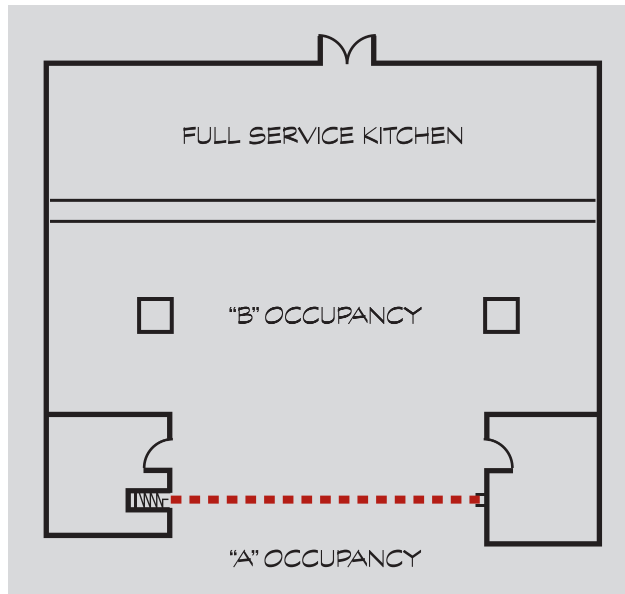
Table 508.4 in Chapter 5 provides the requirements for separation of occupancy types. Should an accessory occupancy exceed the 10% rule, this table becomes the determining factor. Since the separation must be a fire barrier wall *(508.4.4.1)*, Table 508.4 requires a 1-hour separation between an "A" and "B" occupancy or "R" and "B" occupancy when the building is fully sprinklered and 2-hour in non-sprinklered buildings.

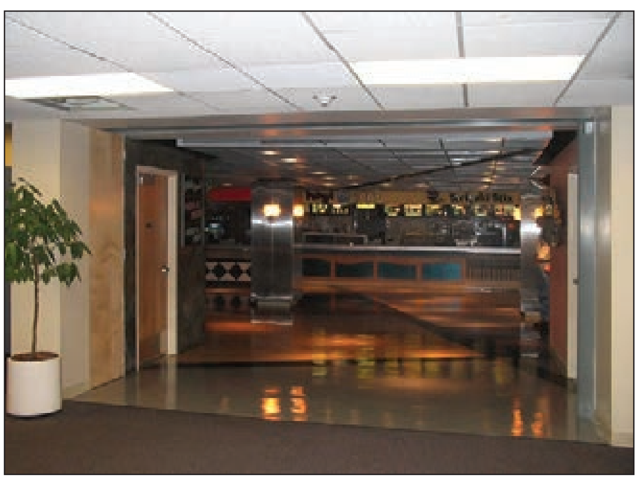
Design Solutions

CASE 1: Side Acting Accordion with Power-assisted Egress

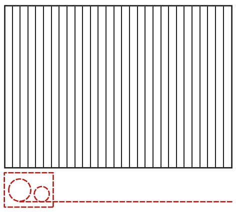


This first case study examines the use of the McKEON Side Acting Accordion fire door. The assembly is hidden from view unless there is a fire when it is activated by the smoke detector. Egress is accomplished by compliance to 1010.1.4.3.



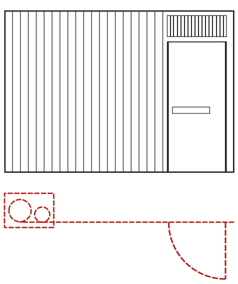


CASE 2: Side Coiling without Egress

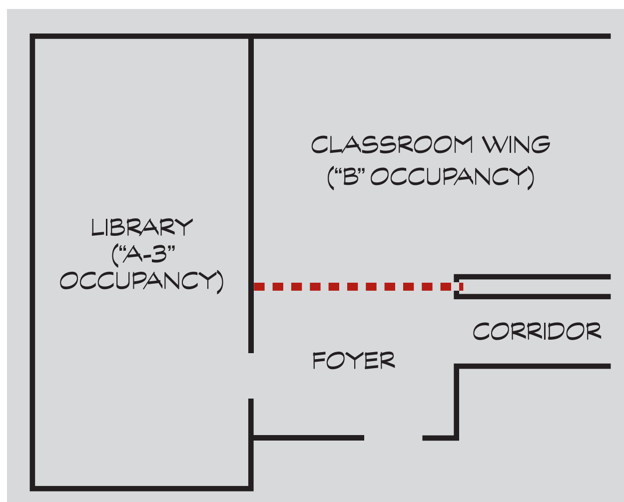


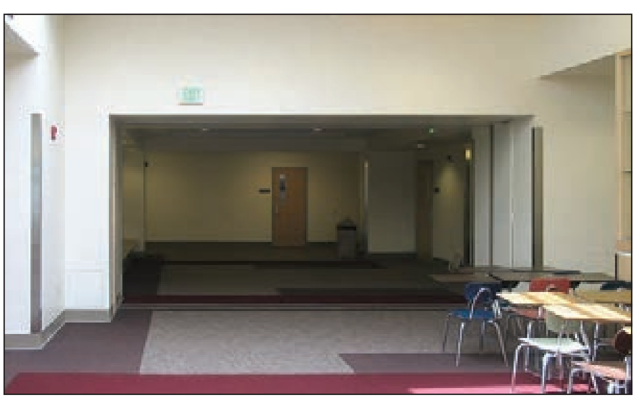
This case study is very similar to the previous application with the exception of an egress requirement. The McKEON side coiler without egress became the most economical solution without compromising life safety.

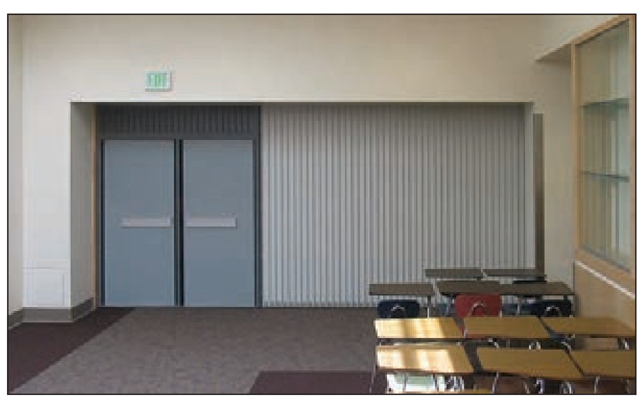
CASE 3: Side Coiling with Complying Swing Egress Door(s)



This third case study features a different product under the same code premise, the requirement to separate an “A-3” occupancy (library) from the rest of the “B” occupancy, school. The feature product is the Side Coiling with Conventional Egress Assembly due to limited width of pocket space.







Inquiry Discussion and Questions

The 10% rule mentioned before refers to an area limitation imposed upon aggregate accessory occupancies. As stated in Section 508, aggregate accessory occupancies are allowed, however specific restrictions apply as detailed on page 65 of this section.

The following questions may be helpful:

- What is the classification of a full-service kitchen within an occupancy type "B" structure?
- Do you perceive a full-service kitchen that requires a Type 1 exhaust hood extinguishing system as per the International Fire Code (IFC, Section 610.2 & IBC 904.2.1) as a potential threat to the students?
- When you are required to separate the kitchen from the rest of the space are you concerned about easy access and traffic flow in front of the serving area?
- Would it be more convenient for your client to have the wide-span opening protective located in front of the serving area, separating the kitchen space, to also act as a security door when the kitchen is not in use?

Notes:

Mixed Occupancy Use – Non-Separated vs. Separated

Section 508; Table 508.4

Complying with Table 508.4 and providing fire barrier walls to separate occupancies can be limiting to the design. Also, using non-separated provisions to eliminate restrictive fire barrier walls becomes extremely costly due to added fire and life safety requirements that affect the entire structure.

Fire & Life Safety Concerns

Building structures are classified based on their occupancy and use. The purpose for classifying structures is to configure optimum safety requirements commensurate to the need as dictated by each individual use. These areas of concern are general building limitations, means of egress, fire protection systems and interior finishes. The challenge comes when buildings contain rooms or spaces that are different than the original building occupancy classification thereby creating a mixed use or mixed occupancy structure.

Code Requirements

In this case study the Conference/Training room is 1,188 square feet with an occupant load of 79. It is classified as an A-3 occupancy located in a 5-story Group B office building of Type IIIA construction. The conference room is classified as an A-3 because it is used for gathering a large number of people for assembly purposes (Section 303.1). It cannot be considered an accessory space because it exceeds both occupant load and area square footage of the accessory use exceptions.

First, let's look at the requirements imposed if we attempt to eliminate all separations as indicated in Table 508.4, in other words non-separated use.

Non-Separated Use:

1. Each use shall be individually classified. *(508.3.1)*
    - The entire building is classified as a "B" occupancy. The

space under consideration (Conference/ Training room) is an A-3 occupancy.

2. The allowable building area and height of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration … *(508.3.2)*

3. The most restrictive applicable provisions of Section 403 and Chapter 9 shall apply to the entire building or portion thereof. *(508.3.1)*

   - Section 403 encompasses the requirements for hi-rise construction and Chapter 9 include the provisions for fire protection systems. In other words, the building will have to incorporate the most protective and restrictive requirements of these chapters. For example:

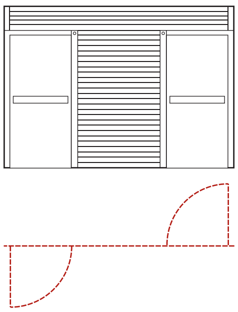
     - Standpipe system *(403.4.3)*
     - Smoke detection *(403.4.1)*
     - Fire Alarm systems *(403.4.2)*
     - Emergency voice/alarm communication system *(403.4.4)*
     - Fire command *(403.4.6)*
     - Smoke removal *(403.4.7)*
     - Emergency responder radio coverage *(403.4.5)*
     - Standby power *(403.4.8)*
     - Emergency power systems *(403.4.8.4)*

4. The allowable height and area of the building or portion thereof shall be based on the MOST RESTRICTIVE allowances for the occupancy group under consideration for the types of construction of the building in accordance with Section 503.1. *(508.3.2)*

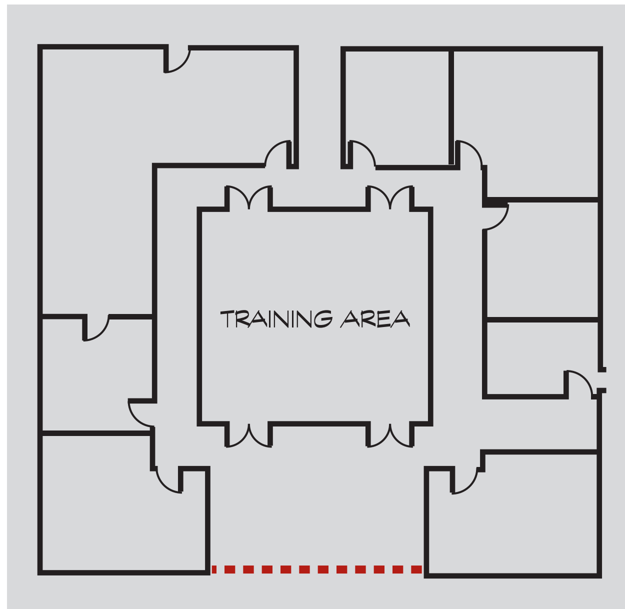
   - The height and area allowances for this requirement would not allow the building to be five stories. Most likely only three at best.

Design Solutions

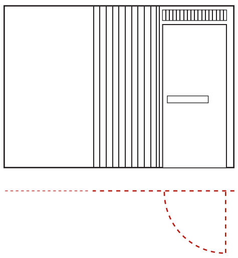
CASE 1: Vertical Coiling with Complying Swing Egress Door(s)



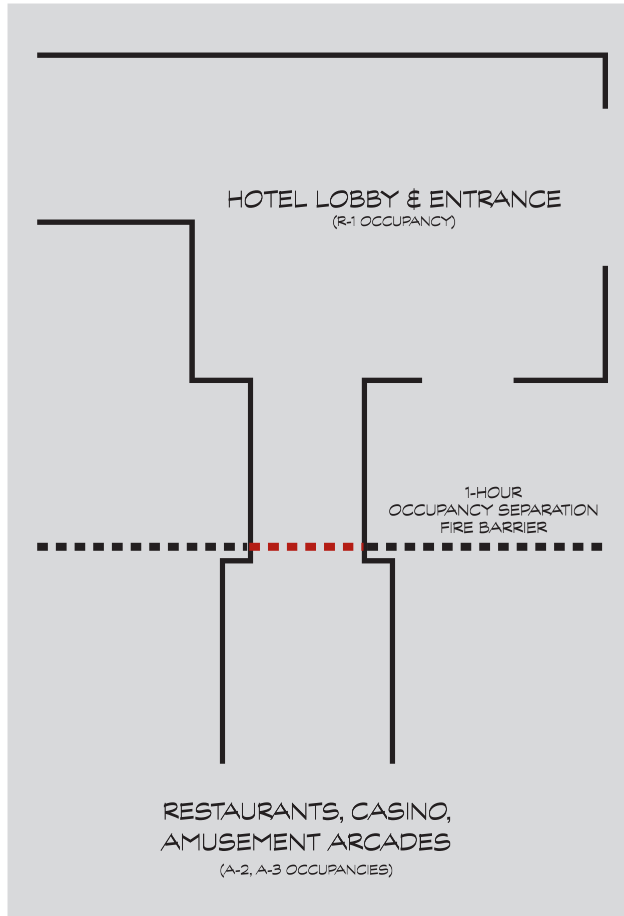
The use of wide span opening protectives enables occupancy separation without compromising open and spacious design. In this case study a simple deployable separation prevents the overall structure from being subject to the most restrictive provisions of non-separated use.



CASE 2: Side Acting with Complying Swing Egress Door(s)

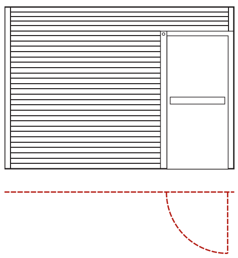


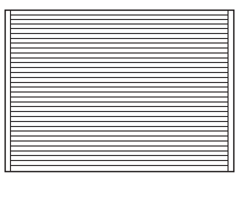
This case study is a text book example of occupancy separation, but is very unique in product application problem-solving from an architectural perspective. Pocket space was limited in width, but not depth, and headroom was extremely limited. Given the ambiance of the space, conventional swing doors on magnetic hold-opens were not an option. McKEON provided the S7000 series which requires only a 7" pocket width and no more than a 2 1/4" reveal in the ceiling for the head track. With patented side acting technology the entire assembly, incorporating four conventional swing doors, fits into a narrow space parallel to the fire barrier wall. Upon command of the smoke detector the 3-hour assembly slides into place providing occupancy separation and conforming egress.



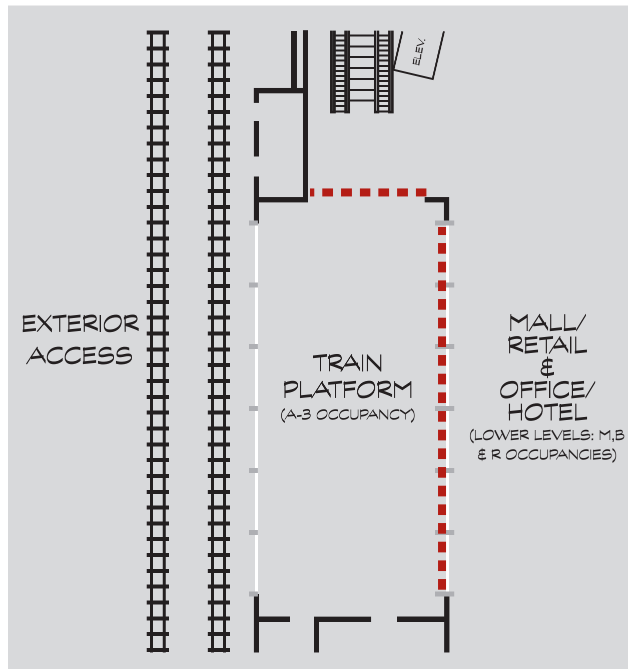
OCCUPANCY SEPARATION

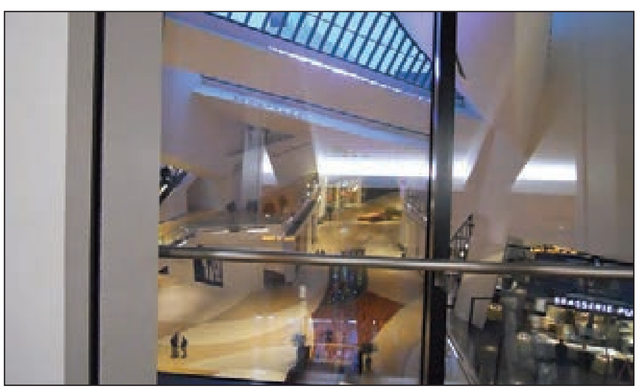
CASE 3: Vertical Coiling with Complying Swing Egress Door(s) & Vertical Coiling without Egress

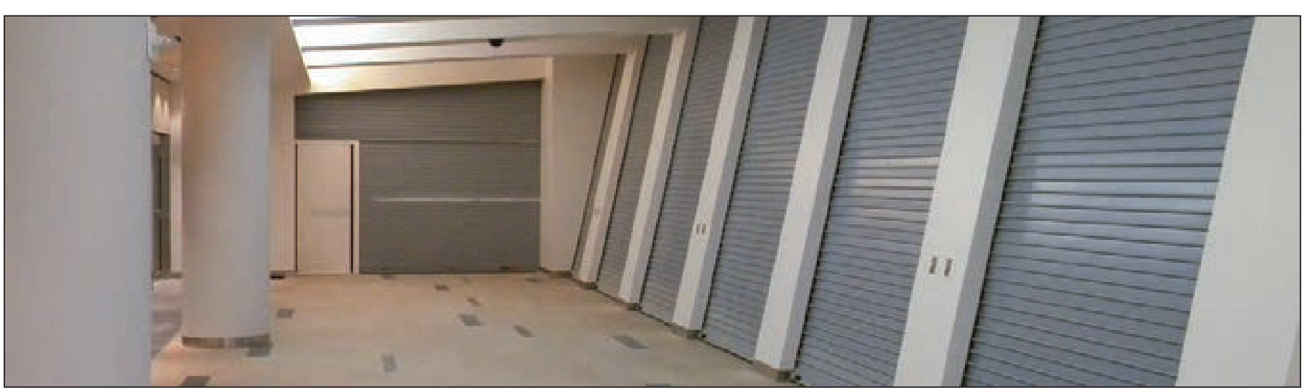




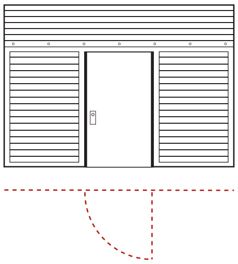
In this case study McKEON offers a solution to a difficult challenge by providing two different products within the same space. A combination of six fire-rated vertical rolling shutters installed on a diagonal path of travel and one vertical coiling assembly with conventional egress for exiting from the space. This solution preserves the beauty of the space without compromising mixed occupancy separation requirements.



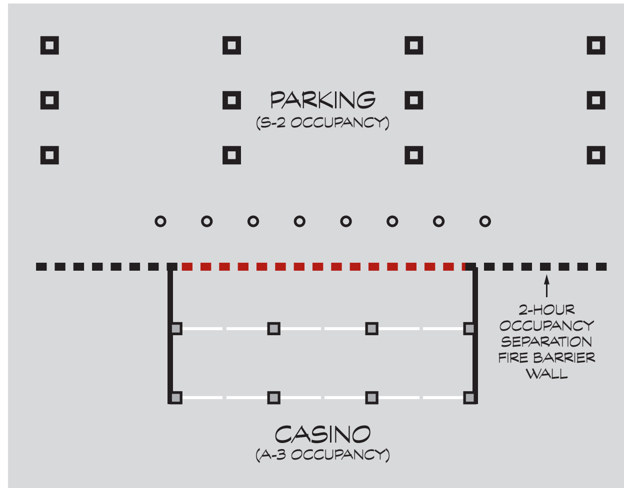




CASE 4: Vertical Acting with Complying Swing Egress Door(s)



This application illustrates McKEON's capacity to provide 3-hour separation, conforming to a large occupant load exit width without occupying side stacking space. Deploying only in case of fire or emergency, both egress and fire separation requirements are satisfied without compromising design.



Inquiry Discussion and Questions

Fundamentally, separating the interior of buildings with fire barriers wherever occupancies change as required in Table 508.4 is simple and straightforward. However when designs promote mixed occupancies without separation, the code is left to create alternate means of protection to compensate for the loss of fixed barriers. Hence, in the absence of passive redundant systems, code enforcement becomes a tremendous challenge and the non-separated use provisions govern. These provisions are extremely costly.

The following questions may be helpful:

- Are you frustrated because open design is difficult when incorporating fire barrier walls as occupancy separations?
- Can I show you how wide-span opening protectives can eliminate the need to design non-separated structures?
- Have you considered the additional cost incurred by conforming to the non-separated use requirements?
- Do you really want to impose the most restrictive requirements of Chapter 4, Section 403 hi-rise provisions as well as the most restrictive requirements of Chapter 9 on the entire building?

Notes:

McKEON®

5 Area Separation

Allowable Area

Allowable Area

Section 706; Tables 504.3, 504.4, 506.2

The allowable height and area of a building structure is determined largely by two basic factors; first, the combustibility of its structural materials and second, occupancy type or use and purpose of the building. When a building design exceeds the established values, the intent of the code is to create another separate building structure to incorporate the increase. Since this is not always desirable, the code will allow interior fire walls to serve as separations sufficient to consider each space a separate structure within the tabular value allowance. In essence multiple compliant buildings can be created within the same structure and under a common roof.

Fire & Life Safety Concerns

Building height and area are calculated to accommodate three fundamentals principles in fire and life safety. First, the structural elements, rated or non-rated, are intended to maintain structural integrity during fire and other life threatening emergencies. This means the greater the protection of the structural elements, the larger the height and area. Second, additional height and area are allowed when active fire suppression systems such as sprinklers are used. Finally, passive redundant elements are used to compartmentalize the area and provide protection for building occupants as they egress the structure. Rated construction protects the structural elements, sprinklers protect the building contents, and egress protects building occupants by removing them from harm's way. All three principles overlap and work together to ensure a building occupant has adequate time to safely exit the structure. The reduction or absence of any of these components can compromise the safety of building occupants and cause property damage.

Another concern is the size of openings allowed in the passive redundant system, particularly in fire walls that are crucial to the area limitations. Opening size limitations are imposed to maintain the integrity of the wall during fire conditions. Opening protectives inherently accommodate strict requirements to adequately protect and maintain the integrity of the openings. The structural integrity of the fire wall must be maintained regardless of the wall opening size or its opening protective. It is critical to remember; the opening protective protecting an opening in a fire wall is not required to conform to structural integrity provisions. The opening protective is protecting the opening – NOT the wall. A fire wall used for area separation is allowed openings and opening protectives, however, a fire wall used as a party wall cannot have openings.

Code Requirements

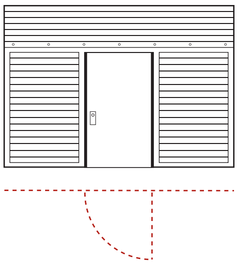
1. The above referenced tables of Chapter 5 indicate the tabular height and area allowances for specific building construction types and occupancies.
2. Each portion of a building separated by one or more fire walls shall be considered a separate building. (*503.1)*
3. Openings in fire walls are subject to the following criteria *(706.8):*

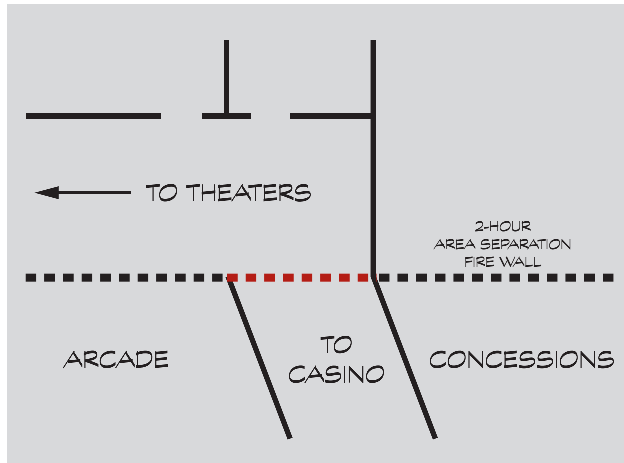
Non-sprinklered buildings – Openings shall not exceed 156 square feet and the aggregate width of openings at any floor shall not exceed 25 percent of the length of the wall.

Sprinklered buildings – Openings shall not be limited to 156 square feet and the aggregate width of openings at any floor shall not exceed 25 percent of the length of the wall.

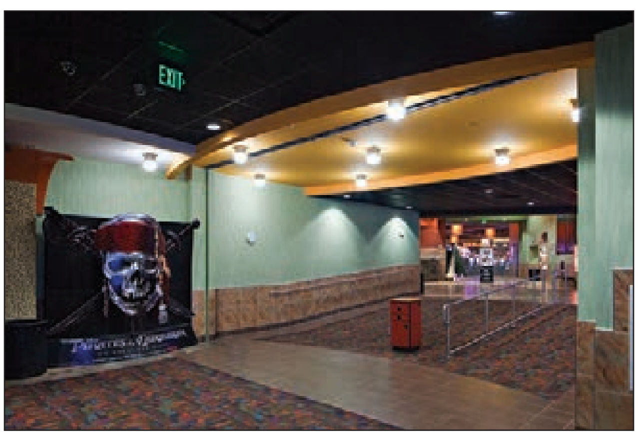
Design Solutions

CASE 1: Vertical Acting with Complying Swing Egress Door(s)



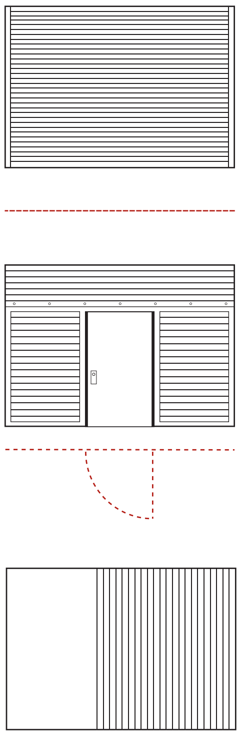


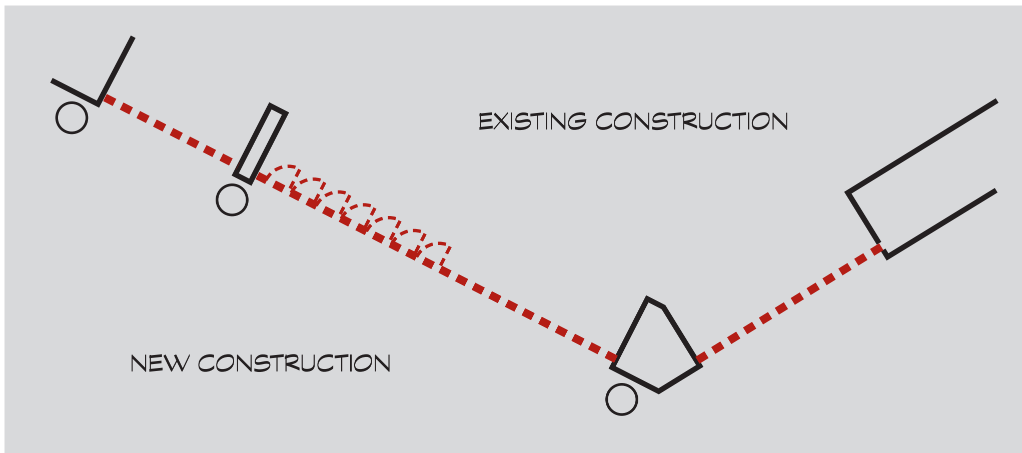
In this application McKEON resolved two significant design code compliance problems without sacrificing wide span open appearance. First, nearly the entire opening was necessary to meet the exit width requirements located in the primary means of egress system in an "A" occupancy. Using the McKEON accordion assembly would not comply because of a) the large distance to be covered and b) the length of time required to open wide enough to allow for immediate egress. Second, there was not sufficient stacking space for any of the McKEON side acting models. However, because headroom was plentiful and large occupant load egress was a necessity, the T5000 series incorporating six egress conventional swings doors, three doors set in each direction to accommodate dual egress, was the perfect fit and the only viable solution.

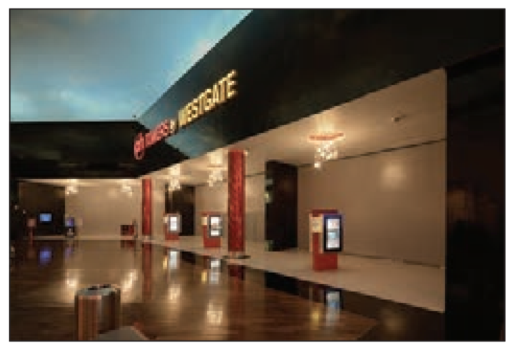


AREA SEPARATION

CASE 2: Vertical Coiling without Egress, Vertical Acting with Complying Swing Egress Door(s) & Side Acting without Egress







Inquiry Discussion and Questions

The decision to use the area separation strategy is determined early in the conceptual design phase of the project.

Resistance to incorporate fire walls may be due to the following:

- Limited understanding of the code allowances for considering one structure as multiple buildings.
- The structural integrity of the fire wall design appears costly and overwhelming compared to the basic design; i.e. parapets, return exterior walls, etc.
- Limited understanding of diverse wide-span opening protectives. Conventionally, openings in any wall seem to follow the swing door model, largely due to the perception that complying egress is limited to these kinds of doors and mullions. This traditional way of traversing throughout the building is very limiting and simply prohibitive to open design.

The following questions may be helpful:

- Have you ever been frustrated designing a structure because you exceeded the area allowances and were pushed to increase the construction type?
- When you are required to change a construction type to accommodate additional area, what is the increase in cost? How does your client feel about the increase?
- Are you hesitant to consider an area separation wall because of the limitations for openings as implied with conventional swing doors?

Notes:

6 Corridor Separation

Corridor Separation – Healthcare

Corridor Separation – Healthcare

Section 407.2.4

Gift shops focus on retail exposure to the public. Nonetheless they are located in hospitals and typically open to corridors that fall under strict provisions for life safety. Compliance with these strict provisions using conventional opening protectives can limit market exposure.

Fire & Life Safety Concerns

The corridor system in a hospital is designed to protect non-ambulatory patients and their attendants from the transfer of smoke from adjacent spaces. Gift shops and their associated storage offer a particular threat because of the potential fuel load created by large quantities of merchandise. The smaller the shop the lesser the threat of contents that are burning during a fire emergency, so the code requires no separation at the corridor opening of a gift shop if the square footage in minimal.

Code Requirements

Gift shops are allowed to be open to the corridor where the total square footage does not exceed 500 square feet. *(407.2.4)*

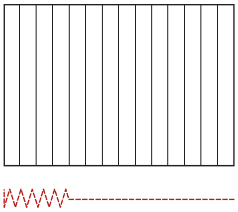
To better understand the opening protective requirements let's review the corridor provisions for I-2 occupancies (hospitals).

1. The corridor wall shall be constructed as a smoke partition. *(407.3)*
2. Smoke partitions are not required to be fire-rated. *(710.3)*
3. Doors protecting openings in smoke partitions in I-2 occupancies are as follows:
   - Non-fire-rated. *(407.3.1)*
   - Not required to be self-closing or automatic-closing. *(407.3.1)*
   - Must be positive latching. *(407.3.1)*
   - Shall provide an effective barrier to limit the transfer of smoke. *(407.3.1)*
   - Must be a smoke and draft control door listed under UL 1784. *(710.5.2)*

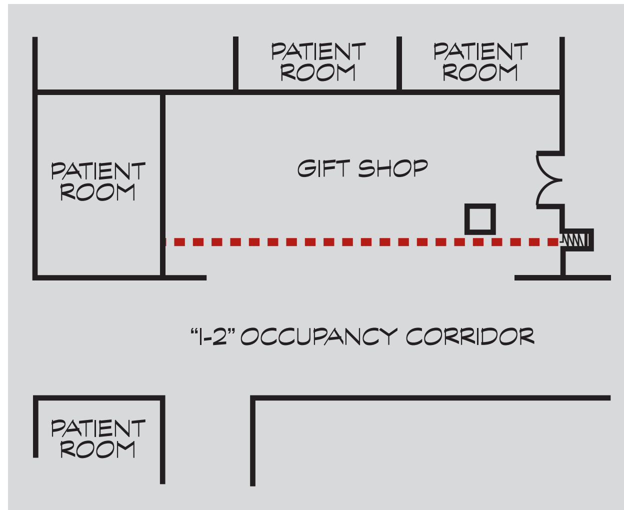
CORRIDOR SEPARATION

Design Solutions

CASE 1: Side Acting Accordion with Power-assisted Egress

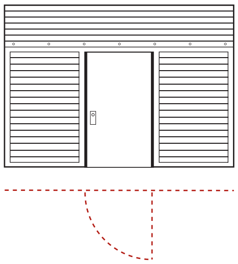


Incorporating the McKEON wide-span side acting accordion allows this space to be open for business without restricting view into the gift shop or customer access. At the command of a smoke detector the large width opening is rapidly protected and the fire and life safety corridor provisions are not compromised.

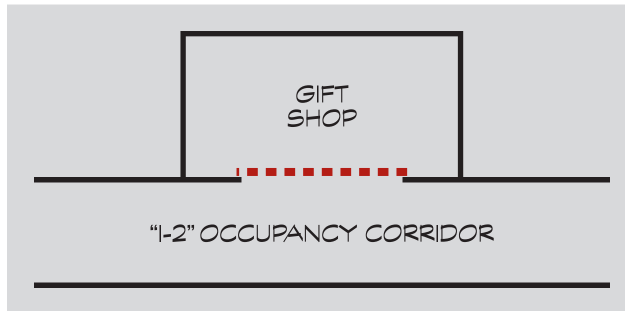


CORRIDOR SEPARATION

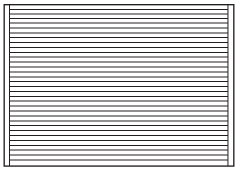
CASE 2: Vertical Acting with Complying Swing Egress Door(s)



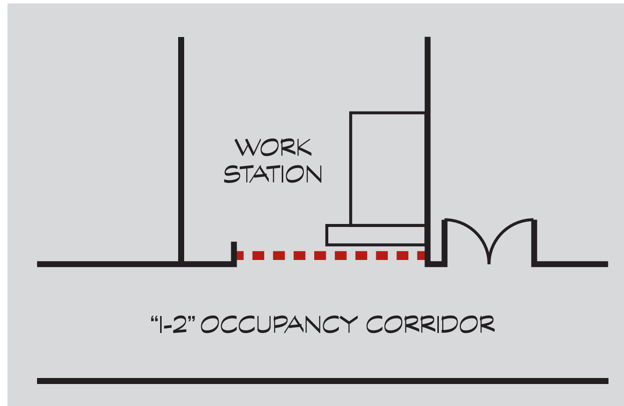
Incorporating the McKEON T5000 technology, the egress doors are completely concealed in the vertical space above, to close only in case of fire.

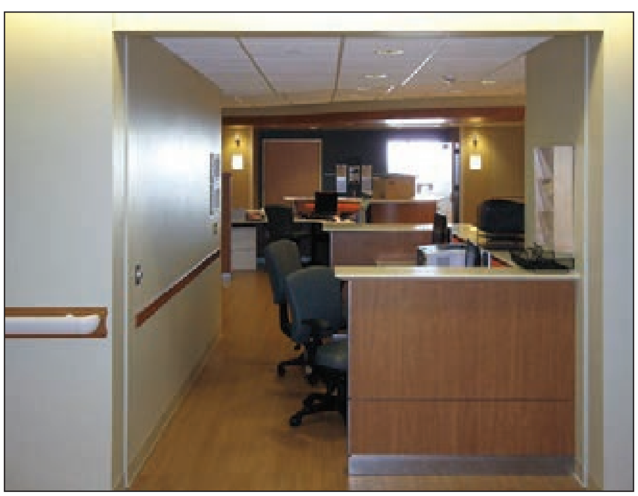


CASE 3: Vertical Coiling without Egress

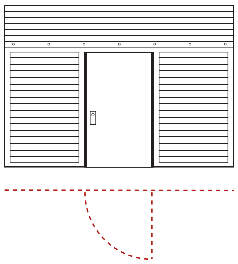


Egress is not required but a 2-hour fire rating is. This work station is left open during normal business hours. The protective assembly is easily lowered and locked after hours. Completely automated, whether in fire or security mode, any building occupant can operate the assembly.

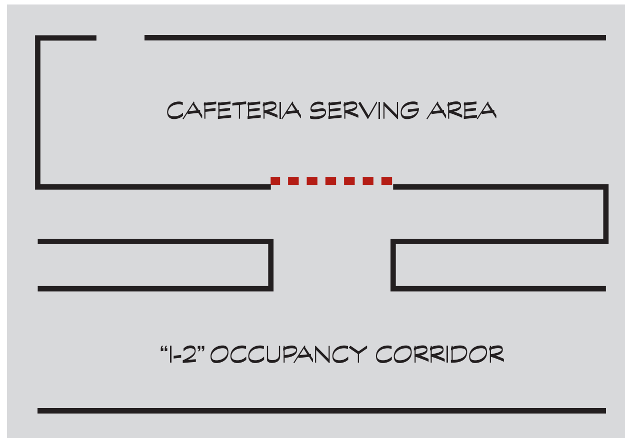




CASE 4: Vertical Acting with Complying Swing Egress Door(s)

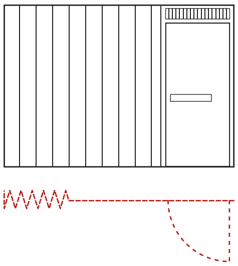


In this unique application, the McKEON T5000 technology, with integral code complying conventional egress doors, descends from the overhead space when the building goes into alarm. During normal business hours cafeteria patrons easily traverse the space from the corridor without obstruction.

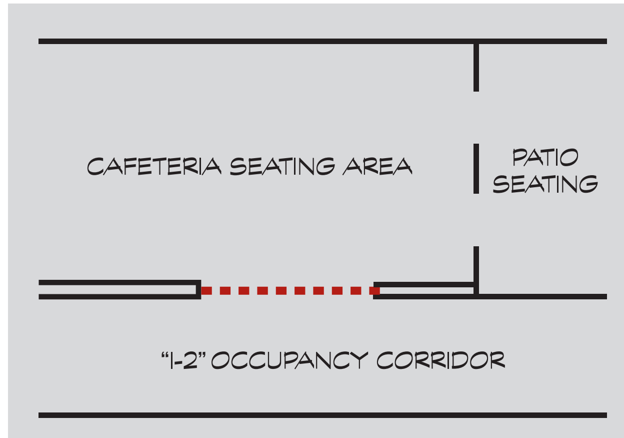


CORRIDOR SEPARATION

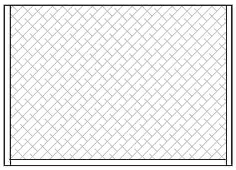
CASE 5: Side Acting Accordion with Complying Swing Egress Door



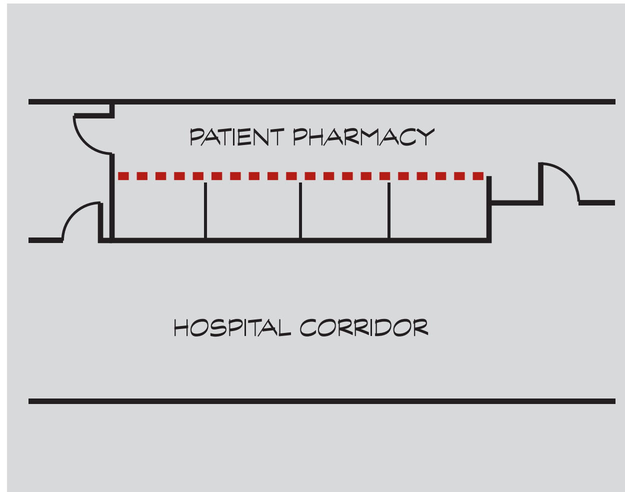
The McKEON accordion technology easily accommodates a conventional egress door.

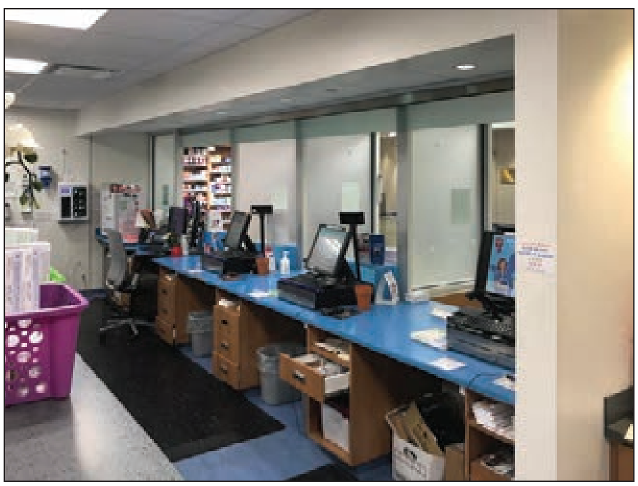


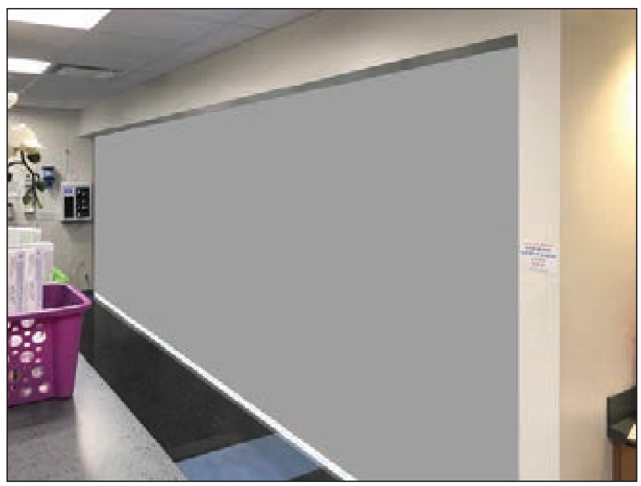
CASE 6: Vertical Acting without Egress



In I-2 occupancies corridor walls are required to be smoke rated only (Section 407.3). The SmokeFighter® D150 is an excellent resolve to minimal headroom space allowances. This hospital patient pharmacy is easily separated from the corridor with one of the latest technologies offered by McKEON.



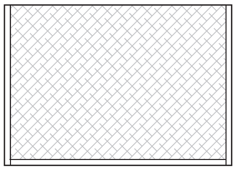




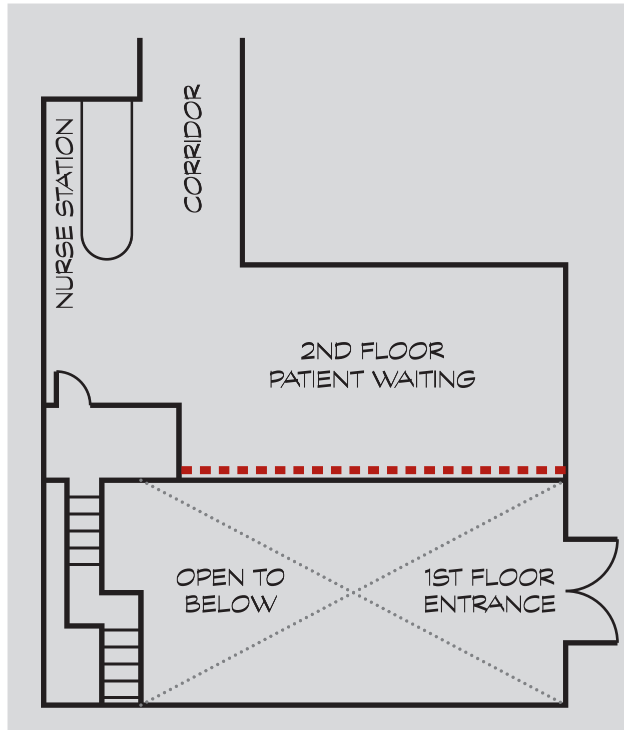
SIMULATION

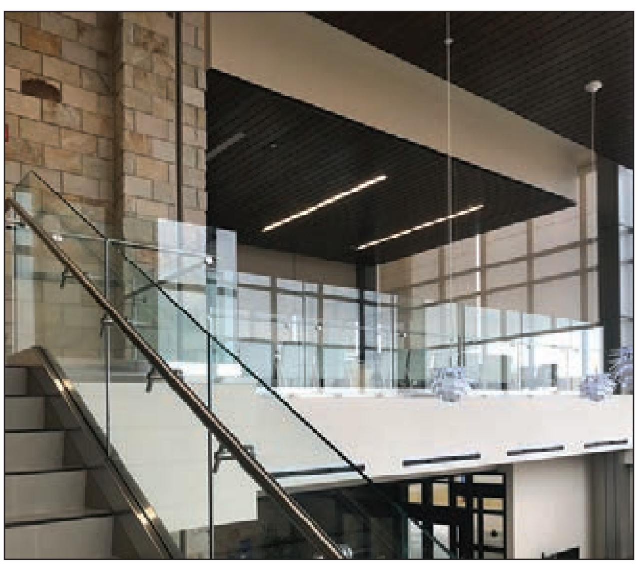
CORRIDOR SEPARATION

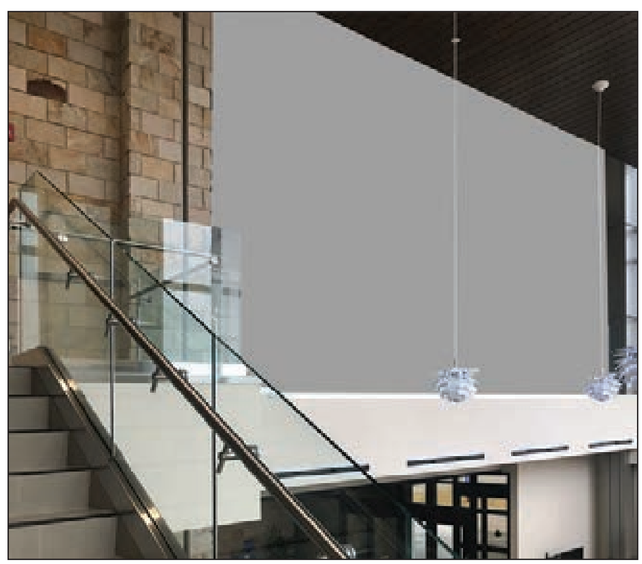
CASE 7: Vertical Acting without Egress



In I-2 occupancies the corridor walls are required to be smoke rated only (Section 407.3). Section 712.1.9 also instructs the design team that 2-story unprotected openings are not allowed in these same "I" occupancies. McKEON provides a unique solution to this challenge with the SmokeFighter® D150. This smoke rated curtain is deployable and will only close when the building goes into emergency alarm. During normal business hours the entire 2-story space is free of any visual obstacles.



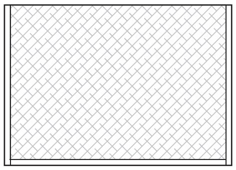




SIMULATION

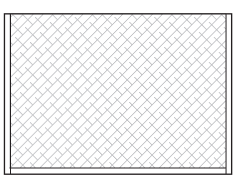
CORRIDOR SEPARATION

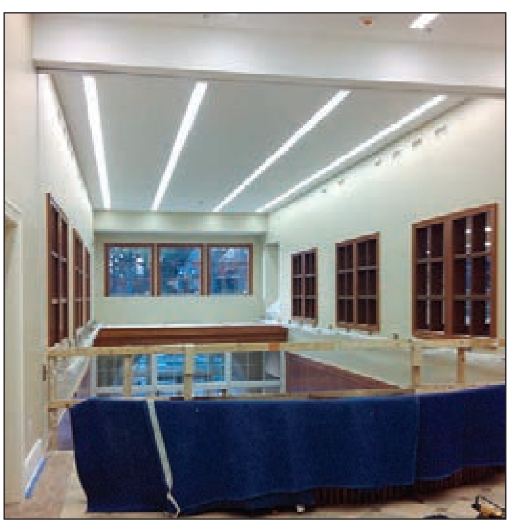
CASE 8: Vertical Acting without Egress

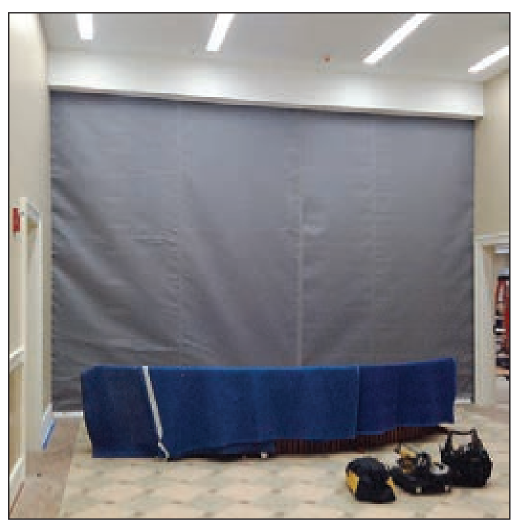


In this case study we will examine the requirements of the R-2 occupancy (congregate living facility with more than 16 occupants) pertaining to corridor rating and vertical space allowances. All corridors are required to be constructed of fire rated walls with a minimum rating of 30 minutes (1020.1). Also, these "R" occupancies cannot have unprotected 2-story openings (712.1.9, #4). These requirements can be challenging when spacious open designs are desired. Because the opening protectives for these walls can be rated 20-minutes (716.5.3), the McKEON FireFighter® D200 is the perfect solution. Take a look, too, at CASE 9. It is right across the hall!

CASE 9: Vertical Acting without Egress







CORRIDOR SEPARATION

Inquiry Discussion & Questions

A gift shop space is considered a potential fire hazard when it exceeds 500 square feet. Most designs will limit this space to 500 square feet or incorporate sheet rock, swing doors and wire glass to accommodate greater area spaces that open to the corridor. During a fire event, deployed wide-span opening protectives seal off large fuel load areas – such as gift shops that exceed 500 square feet – and protect building occupants who are moving through corridors. These assemblies can also serve as security doors when the gift shop is closed.

The following questions may be helpful in understanding pertinent challenges:

- Do you desire to have a gift shop larger than 500 square feet?
- Even though a gift shop, larger than 500 square feet, is not shown on Table 509 as an incidental use space … why is it required to be separated with 1-hour construction?
- May I show you how McKEON can help you eliminate a closed-in appearance at the corridor bordering gift shops exceeding 500 square feet in area?

Notes:

7 Smoke Compartmentation

Smoke Compartments – Healthcare

Smoke Barriers – Healthcare

Smoke Compartments – Healthcare

Section 407

The compartmentation requirements in these case studies are unique to hospital occupancies and are driven, for the most part, by means of egress provisions.

Fire & Life Safety Concerns

The code allows patient rooms to be arranged in open suites. However, this type of arrangement supposes a low patient-to-staff ratio where the staff is directly responsible for the safety of the patients in the event of a fire. To ensure safety, small smoke compartments with short-distance egress to protected exits become critical.

Code Requirements

1. Habitable rooms or suites in Group I-2 occupancies shall have an exit access door leading directly to a corridor. *(407.4.1)*
2. Care suites containing patient sleeping rooms shall not exceed 7,500 square feet, sprinklered areas with automatic smoke detection,10,000 square feet. *(407.4.4.5.1)*
3. Care suites containing other than patient sleeping rooms shall not exceed 12,500 square feet, sprinklered 15,000 square feet. *(407.4.4.6.1)*
4. Any patient sleeping room, or any care suite that includes patient sleeping rooms, of more than 1,000 square feet shall have at least two exit access doors remotely located from each other. *(407.4.4.5.2)*
5. Any room or suite of rooms other than patient sleeping rooms of more than 2,500 square feet shall have at least two access doors remotely located from each other. *(407.4.4.6.2)*
6. Travel distance between any point and an exit access door in a room not located in a care suite shall not exceed 50 feet. *(407.4.2)*

7. Travel distance between any point in a suite of sleeping rooms shall not exceed 100 feet, automatic smoke detection 125 feet. *(407.4.4.3)*

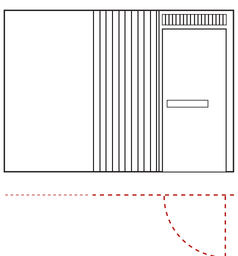
8. Vision panels are required in cross-corridor application of I-2 occupancies. *(709.5.1)*

9. Walls designed to create separate suites shall be construction as non-rated smoke partitions. *(407.4.4.2)*

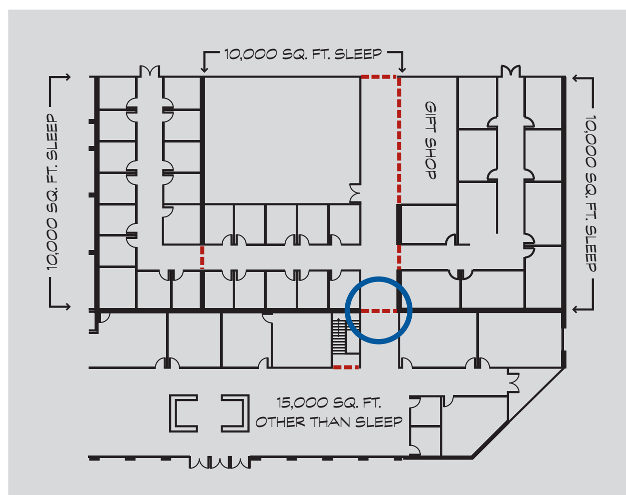
10. Openings within smoke compartment walls that are not used to protect a vertical opening or an exit are not required to have a fire-rating but shall provide an effective barrier to limit the transfer of smoke. Also, these opening protectives do not have to be self-closing. *(Section 407.3.1)*

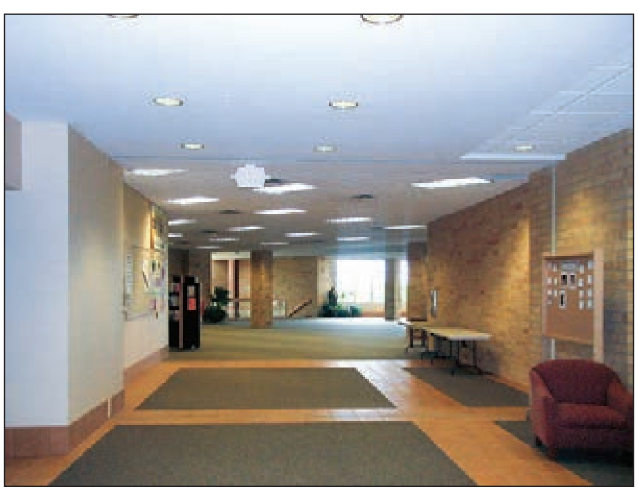
Design Solutions

CASE 1: Side Acting with Complying Swing Egress Door(s)

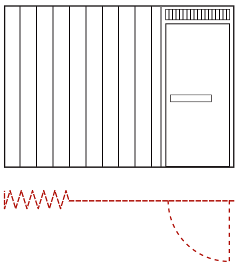


In this case study we find it difficult to maintain continuity with compartmentation when passing through corridors or other open areas with smoke partition walls. With the wide-span capabilities of the McKEON door assembly there is no compromise between building functionality and code compliance.

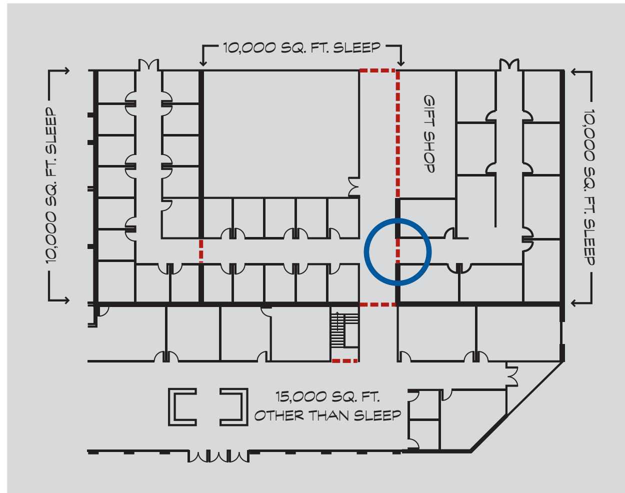




CASE 2: Side Acting Accordion with Complying Swing Egress Door



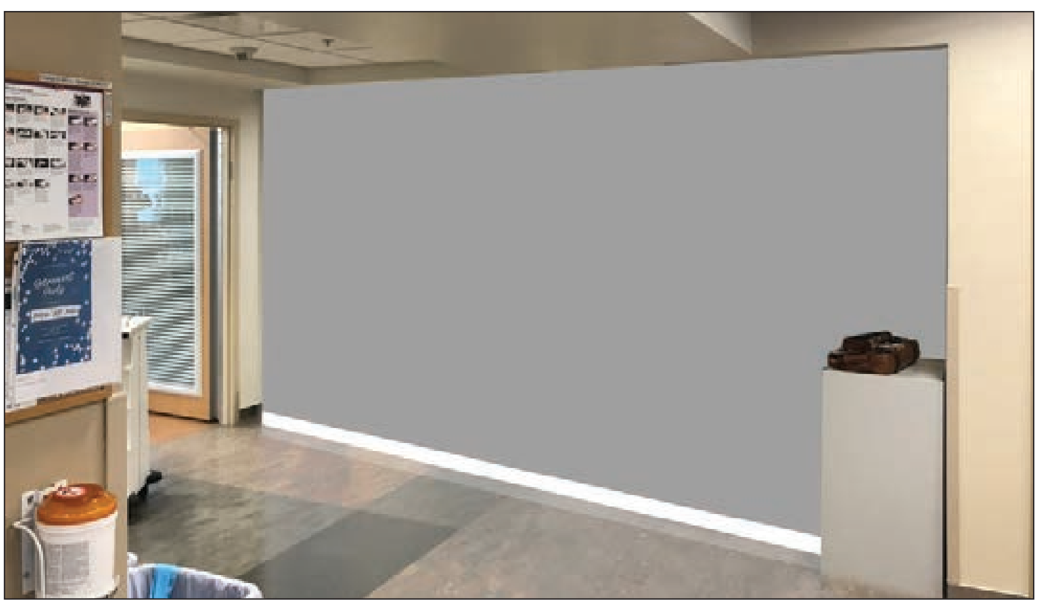
This side acting accordion offers conventional egress with a swing door attached to wide panels that provide a compact profile for less stack space.



SMOKE COMPARTMENTATION

CASE 2: Vertical Acting without Egress

Designing care suites, particularly critical units in large hospitals, can be challenging when complying with restrictive smoke compartment provisions. The maximum area limit in care suites containing patient sleeping rooms with sprinklers and automatic smoke detection is 10,000 square feet. This case study features a critical suite that far exceeds these limits. The SmokeFighter® D150 came to the rescue and provided necessary separation where head room was limited and side room would only allow for very discreet side guides.



SIMULATION

Inquiry Discussion and Questions

Often more desirable floor plans will be compromised to accommodate smoke compartmentation requirements. Rooms become smaller, corridors often inhibited with opening protectives, nurses stations altered, etc. to create life-saving smoke free spaces. Most often these adjustments become routine without an understanding of wide span opening protective technology.

The following questions may be helpful:

- May I show you how a smoke compartment separation can cross a corridor without compromising the space?
- Did you know that a side acting accordion door can be used in a means of egress across a corridor regardless of the occupant load served?
- Smoke compartments are no respecter of open spaces. Can I show you how you can span virtually any distance without compromising the space?

Notes:

Smoke Barriers – Healthcare

Section 709

Smoke barriers divide areas of a building into separate smoke compartments. These dividing walls allow building occupants time to be evacuated or relocated to other smoke compartments. In other words, smoke barriers separate portions of buildings into areas of refuge capable of resisting the passage of smoke and fire for 1 hour. *(Section 709)*

Fire & Life Safety Concerns

Smoke barriers are specifically required in I-2 (hospital) occupancies due to the non-ambulatory status of the building occupants (Section 407.5). Usually these occupants require assistance and care when being evacuated or relocated during an emergency. There must be a protected area where these patients can be placed until safely evacuated from the building. Smoke barriers in Group I-2 occupancies provide this defend-in-place mechanism.

Code Requirements

The following five requirements designate the use of smoke barriers in Group I-2 occupancies:

1. Group I-2 occupancies are required to subdivide every story into smoke compartments with an area not more than 22,500 square feet. *(407.5)*
2. Smoke compartments are to be divided using smoke barrier walls in accordance with Section 709. *(407.5)*
3. Smoke barriers are required to subdivide every story used by patients for sleeping or treatment with an occupant load of 50 or more persons into at least two compartments. *(407.5)*
4. Travel distance in smoke compartments shall not exceed 200 feet. *(407.5)*
5. Independent egress – A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originated. *(Section 407.5.2)*

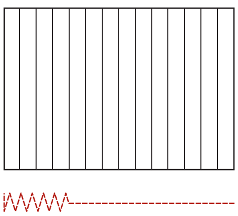
SMOKE COMPARTMENTATION

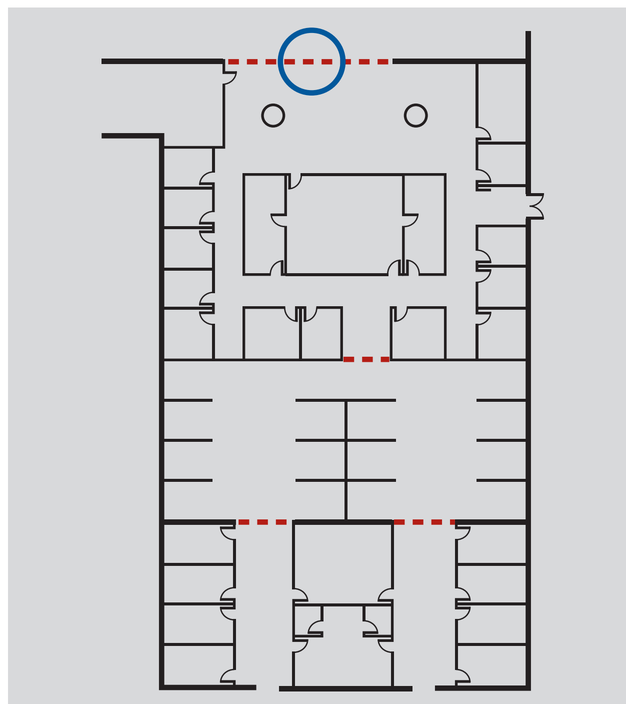
In order to accommodate an opening in a smoke barrier wall the following opening protective requirements must be met:

1. Minimum fire rating of 20 minutes. *(Section 716.5.3 & Table 716.5)*
2. Vision panels. *(709.5.1)*

Design Solutions

CASE 1: Side Acting Accordion with Power-assisted Egress

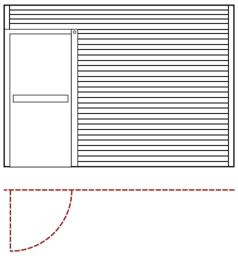




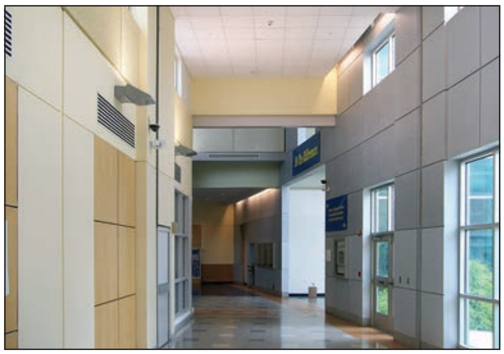
In this case study the intent is to add to an existing I-2 occupancy a 9,700 square foot Critical Care Suite. The existing building construction type is IIIA with 21,324 square feet and the desire is to have the new suite as open as possible to the existing hospital corridor system. The placement of a smoke barrier wall at this new addition connection is a specific code requirement in order to fall within the 22,500 square foot limitation. With the use of the McKEON wide-span labeled assembly approved for egress, the opening protective requirements are met without compromising the spacious clear open ambiance desired.

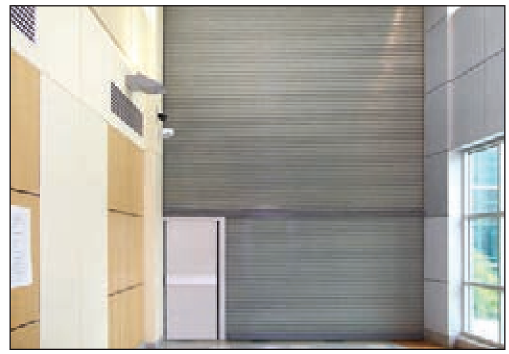
SMOKE COMPARTMENTATION

CASE 2: Vertical Coiling with Complying Swing Egress Door(s)

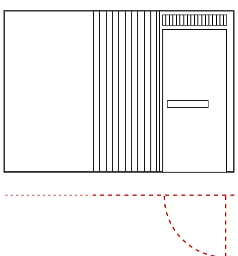


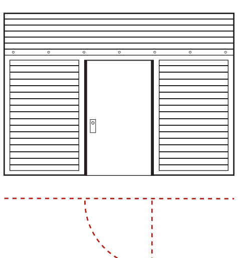
Regardless of the size of the space, smoke barriers must be maintained throughout the building. McKEON can easily protect these unusually large openings without compromising building ambiance.



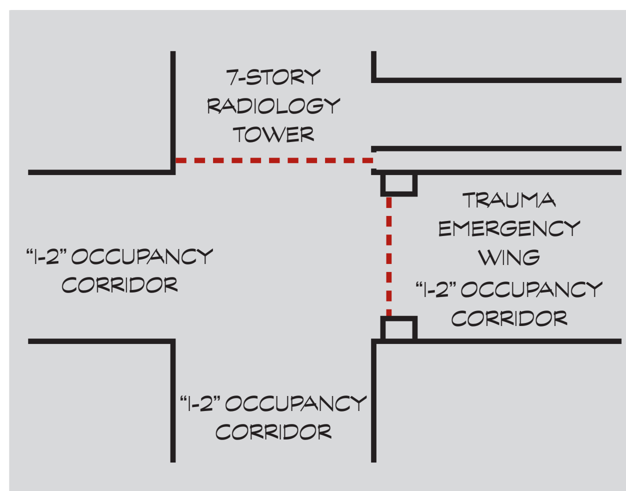


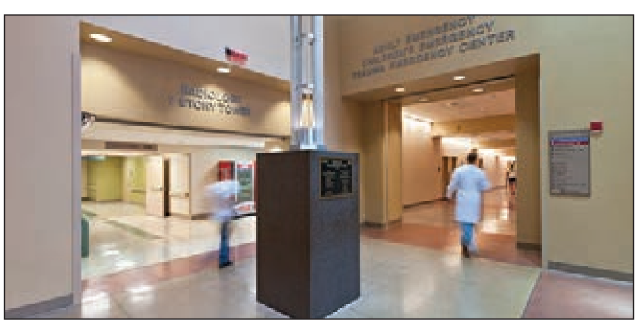
CASE 3: Side Acting with Conventional Egress Door(s) & Vertical Acting with Complying Swing Egress Door(s)

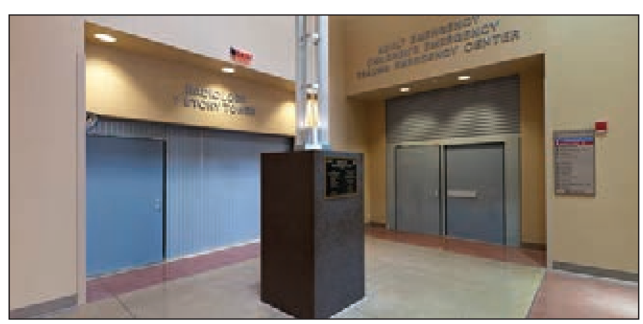




These two very different technologies converge on the inside corner of the structure to complete the smoke barrier separation creating separate refuge area compartments. Operating as duel function assemblies they are also located to separate the corridors from additional spaces.







Inquiry Discussion & Questions

In principle, smoke compartmentation and smoke barrier separation are the same with minor differences. Smoke barriers are created using 1-hour rated walls (Table 716.5) and the separations are incurred at a minimum of 22,500 square feet. Smoke compartments are created using non-rated smoke partitions and the separations are incurred at a minimum of 10,000 square feet in suites of sleeping rooms and 15,000 square feet in non-patient room areas. Smoke compartment applications occur in Group I-2 occupancies/hospitals and smoke barrier applications occur in Group I-2 and/or Group I-3 occupancies/prisons.

Helpful questions for smoke barrier applications can be found in the smoke compartmentation case study.

Notes:

McKEON®

8 Resilient Construction

Storm Shelters

Storm Shelters

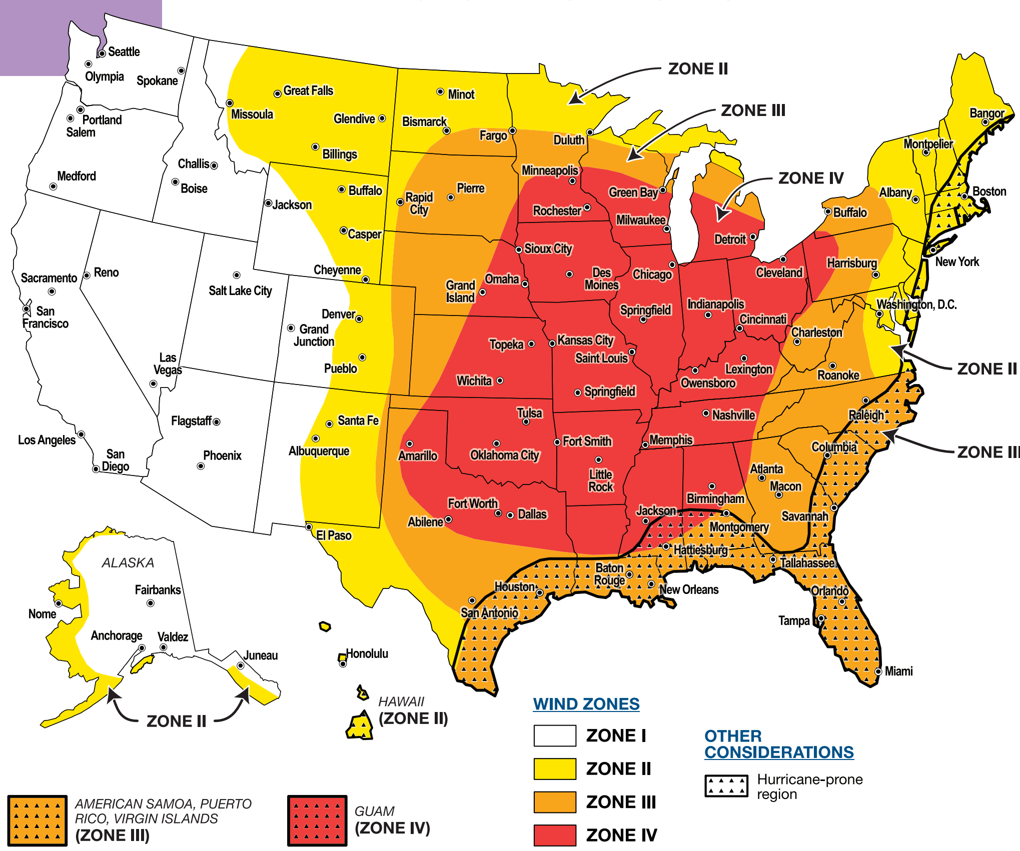
Section 423

Storm shelters can be constructed as separate detached buildings or as safe rooms within new or existing buildings. These types of structures are required to be designated hurricane shelters, tornado shelters or a combination thereof.

Fire & Life Safety Concerns

International Building Code committee staff worked closely with the Federal Emergency Management Agency (FEMA), in particular consulting the FEMA 361 Standard, when creating a formal ICC safety standard for buildings constructed in high-wind-load areas where tornadoes and hurricanes are a prevalent threat. The ICC 500 Standard has been adopted and incorporated into Section 423 of the code to provide safe areas of refuge from these storms.

WIND ZONES IN THE UNITED STATES*



* If you are uncertain of your location because of the level of detail and size of the map, or if you live on or near one of the delineation lines, use the highest adjacent wind zone.

Code Requirements

Section 423.3 Critical emergency operations. In areas where the shelter design wind speed for tornadoes in accordance with Figure 304.2(1) of ICC 500 is 250 MPH, 911 call stations, emergency operation center and fire, rescue, ambulance and police stations shall have a storm shelter constructed in accordance with ICC 500.

Exception: Buildings meeting the requirements for shelter design in ICC 500.

Section 423.4 Group E occupancies. In areas where the shelter design wind speed for tornadoes is 250 MPH in accordance with Figure 304.1(1) of ICC 500, all Group E occupancies with an aggregate occupant load of 50 or more shall have a storm shelter constructed in accordance with ICC 500. The shelter shall be capable of housing the total occupant load of the Group E occupancy.

Exceptions:

1. Group E day care facilities
2. Group E occupancies accessory to places of religious worship
3. Buildings meeting the requirements for shelter design in ICC 500

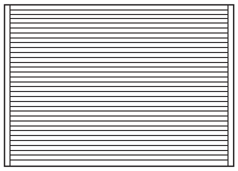
Design Solutions

In the case studies that follow the McKEON SafeSpace™ 500 is featured – an opening protective that complies with the stringent requirements of FEMA 361. Specifically passing the ASTM E1886 based missile impact test and withstanding wind pressures at 240 psf in accordance with ASTM E330, designers can now create large openings in exterior walls of ICC 500 compliant structures or compliant spaces within structures. Please note: When required the SafeSpace 500 can be labeled with a UL 10B 3-hour fire rating and UL 1784 smoke rating, the SafeSpace 500F model.

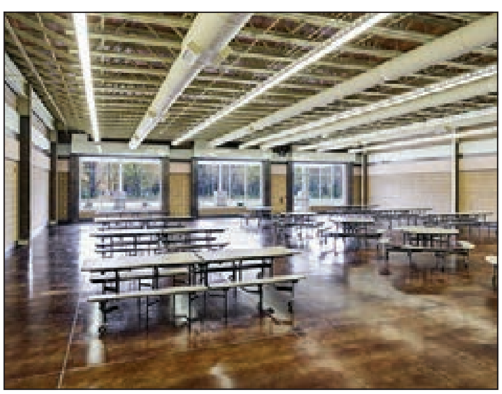
Missile impact test proves ability to withstand wind-borne debris from a hurricane or tornado.

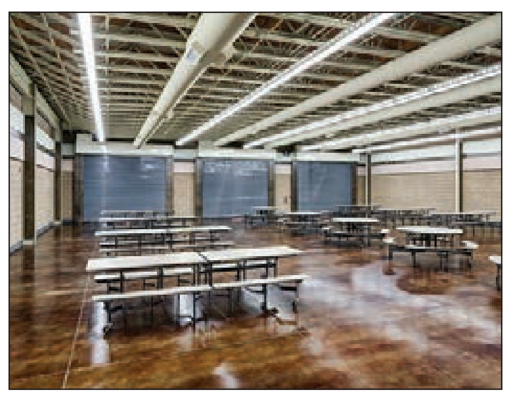
The SafeSpace 500 was subjected to both a positive and a negative 255 mph wind load.

CASE 1: Vertical Coiling without Egress

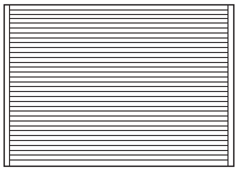


This elementary school cafeteria addition was required to comply with the FEMA 361/ICC 500 provisions. Without the SafeSpace™ 500 the three large window openings in the front of the structure would not have been possible. The cafeteria entrances would have been limited to small swing door openings and the space would have had to be artificially lit. The casual observer would not know this addition is tornado safe, it looks like a typical school multi-purpose cafeteria!

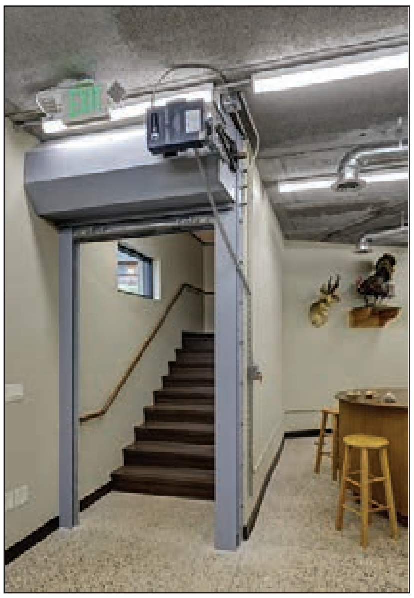




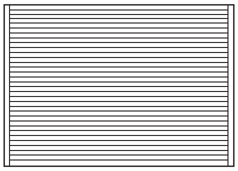
CASE 2: Vertical Coiling without Egress



Located within the 250 MPH wind zone, a two-story summer camp facility turned the lower level into a storm shelter. With SafeSpace™ 500 technology the structure is compliant without sacrificing natural light and appearance.



CASE 3: Vertical Coiling without Egress



Similar to the previous cases, this beautiful library in the Ida Freeman Elementary School is also a tornado shelter. Thanks to SafeSpace™ 500 technology large windows and storefront doors let in plenty of daylight. It is easy to imagine that this area is simply a spacious, inviting area for reading and learning.

Inquiry Discussion and Questions

Often design teams struggle with creating storm shelters because the code seems to allow openings no larger than the typical ICC 500 rated swing doors. Rolling steel assemblies that are FEMA 361/ICC 500 compliant offer design flexibility and allow the space to meet the requirements of a resilient structure. When incorporating a storm shelter into a typical non-FEMA rated structure this same design flexibility is available with the SafeSpace™ technology because in most cases the separation walls are required to be fire and smoke rated as well.

The following questions may be helpful:

- Are you concerned the structure under design will look like a "prison" when the requirements of ICC 500 or FEMA 361 are a part of your design?
- Did you know that if your jurisdiction is the recipient of FEMA funding, it is possible that associated construction may have to follow the FEMA 361 guidelines?
- Do you know if the area wherein you are designing an E occupancy or emergency operations facility structure is under the provisions of FEMA 361 or ICC 500?

Notes:

Appendix

Definitions

Resources

Fire Walls – Section 706

Definition

A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall. *(202)*

Fire Ratings: *(Table 706.4)*

2-hour

3-hour

4-hour

Opening Protection: *(706.8)*

Non-sprinklered buildings – Openings shall not exceed 156 square feet and the aggregate width of openings shall not exceed 25 percent of the length of the wall.

Sprinklered buildings – Openings may exceed 156 square feet but the aggregate width of all openings shall not exceed 25 percent of the length of the wall.

Design Notes

- Each portion of a building separated by one or more fire walls shall be considered a separate building. *(503.1)*
- Where a fire wall separates occupancies that are required to be separated by a fire barrier wall, the most restrictive requirements of each separation shall apply. *(706.1)*
- Regardless of the rating of the opening protective, fire walls cannot have openings that exceed 25 percent of the length of the wall. *(706.8)*
- Fire walls constructed as party walls shall NOT have openings. *(706.1.1)*

Applications

- Exceeding area allowances (*Tables 504.3, 504.4, 506.2)*
- Horizontal Exits *(1026)*

Fire Barriers – Section 707

Definition

A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained. *(202)*

Fire Ratings: *(Tables 716.5; 707.3.10)*

1-hour

2-hour

3-hour

4-hour

Opening Protection

Non-sprinklered Buildings – Openings shall be limited to a maximum aggregate width of 25 percent of the length of the wall, and the maximum area of any single opening shall not exceed 156 square feet. *(707.6)*

Sprinklered Buildings – Openings may exceed 156 square feet but must be limited to a maximum aggregate width of 25 percent of the length of the wall, unless the opening protective assembly has been tested in accordance with ASTM E119 and has a minimum fire-resistance rating not less than the fire-resistance rating of the wall. *(707.6 Exceptions #1 & #3)*

Design Notes

- A fire barrier may have an opening exceed the 25 percent rule if the building is sprinklered and the opening protective assembly is tested under the provisions of ASTM E-119. As seen below, most fire-rated walls used in building design will fall under Section 707, Fire Barrier Walls.

Applications

- Shaft Enclosures *(713.4)*
- Interior Exit Stairways *(1023.1)*
- Exit Passageways *(1024.3)*
- Horizontal Exits *(1026.1)*
- Atriums *(404.6)*
- Incidental Use Areas *(Table 509)*
- Control Areas *(414.2.4)*
- Separated Occupancies *(Table 508.4)*
- Fire Areas *(Table 707.3.10)*
- Enclosures for Exit Access Stairways *(713.4)*

Fire Partitions – Section 708

Definition

A vertical assembly of materials designed to restrict the spread of fire in which openings are protected. *(202)*

Fire Ratings *(708.3)*

1-hour

1/2-hour *(708.3, Exceptions #1 & #2)*

Opening Protection

Opening protectives in fire partitions shall have a minimum fire rating of 20 minutes and a maximum of 45 minutes *(Table 716.5)* and shall be smoke tested under UL 1784. *(716.53)*

Design Notes

- Most rated corridor walls fall into this category. *(708.1 and Table 1020.1)*
- Typically corridor walls are not required to be rated unless the structure is non-sprinklered. *(Table 1020.1)*

Applications

- Separation walls as required by Section 420.2 for Groups I-1, R-1, R-2 and R-3 *(708.1, Item #1)*
- Egress balconies as required by Section 1019.2 *(708.1, Item #5)*
- Walls separating tenant spaces in covered mall buildings as required by Section 402.4.2.1 *(708.1, Item #2)*
- Corridor walls as required by Section 1020.1 *(708.1, Item #3)*
- Elevator lobby separation as required by Section 3006.2 *(708.1, Item #4)*

Smoke Barriers – Section 709

Definition

A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly that is designed and constructed to restrict the movement of smoke. *(202)*

Fire Ratings *(709.3)*

1-hour

Opening Protection

Opening protectives in smoke barriers shall have a minimum 20 minute fire rating and UL 1784 smoke test rating. *(Table 716.5)*

Design Notes

- Door assemblies in cross-corridor smoke barriers of I-2 Occupancies (Hospitals) shall have vision panels. *(709.5.1)*
- Smoke barriers constructed of minimum 0.10-inch-thick steel in I-3 Occupancies (Jails & Prisons) are not required to be 1-hour rated. *(709.3)*

Applications

In I-2 Occupancies (Hospitals) smoke barriers are required to subdivide every story used by patients for sleeping or treatment. *(407.5)* As per the following:

- 50 or more persons / minimum 2 smoke compartments
- Each compartment cannot exceed 22,500 square feet
- Travel distance shall not exceed 200 feet to a smoke barrier door

In I-3 Occupancies (Jails & Prisons) smoke barriers are required to divide every story occupied by residents for sleeping. *(408.6)* As per the following:

- 50 or more persons / minimum 2 smoke compartments
- Maximum number of residents in any smoke compartment is 200
- Travel distance to any exit access component shall not exceed 150 feet
- Travel distance to any smoke barrier door shall not exceed 200 feet

Smoke Partitions – Section 710

Definition

A partition constructed to limit the transfer or passage of smoke. *(710.4)*

Fire Ratings *(710.3)*

Non-rated

Opening Protection

Door assemblies shall be UL 1784 tested and self closing by smoke detection. *(710.5.2)*

Design Notes

- Corridor walls in an I-2 Occupancy (Hospital) shall be constructed as Smoke Partitions. *(407.3 & 710)*

Applications

- Corridor walls of I-2 Occupancies (Hospitals) *(407.3)*
- Elevator Lobbies *(3006.3, Item #2)*
- Separation of care suites in Group I-2 Occupancies *(407.4.4.2)*

International Building Code, 2018

Means of Egress (AC8800 Series)

1010.1.2 Door Swing. Egress doors shall be side-hinged swinging.

Exceptions:

6. In other than Group H occupancies, horizontal sliding doors complying with Section 1010.1.4.3 are permitted in a means of egress.

1010.1.4.3 Special purpose horizontal sliding accordion or folding doors. In other than Group H occupancies, horizontal sliding doors permitted to be a component of a means of egress in accordance with Exception 6 to Section 1008.1.2 shall comply with all of the following criteria:

1. The doors shall be power operated and shall be capable of being operated manually in the event of power failure.
2. The door shall be openable by a simple method from both sides without special knowledge or effort.
3. The force required to operate the door shall not exceed 30 pounds (133 N) to set the door in motion and 15 pounds (67 N) to close the door or open it to the minimum required width.
4. The door shall be openable with a force not to exceed 15 pounds (67 N) when a force of 250 pounds (1100 N) is applied perpendicular to the door adjacent to the operating device.
5. The door assembly shall comply with the applicable fire protection rating and, where rated, shall be self-closing or automatic closing by smoke detection in accordance with Section 716.5.9.3 and shall be installed in accordance with NFPA 80 and shall comply with Section 716.
6. The door assembly shall have an integrated standby power supply.
7. The door assembly power supply shall be electrically supervised.
8. The door shall open to the minimum required width within 10 seconds after activation of the operating device.

NFPA 101 Life Safety Code, 2018

Means of Egress

7.2.1.4 Swing and Force to Open

7.2.1.4.1.4a, b, c Special-purpose horizontally sliding accordion or folding door assemblies complying with 7.2.1.14 shall be permitted.

7.2.1.14 Special-Purpose Horizontally Sliding Accordion or Folding Door Assemblies. Special-purpose horizontally sliding accordion or folding door assemblies shall be permitted in a means of egress, provided that the following criteria are met:

1. The door leaf is readily operable from either side without special knowledge or effort.
2. The force that, when applied to the operating device in the direction of egress, is required to operate the door leaf is not more than 15 lbf (67 N).
3. The force required to operate the door leaf in the direction of door travel is not more than 30 lbf (133 N) to set the leaf in motion and is not more than 15 lbf (67 N) to close the leaf or open it to the minimum required width.
4. The door leaf is operable using a force of not more than 50 lbf (222 N) when a force of 250 lbf (1100 N) is applied perpendicularly to the leaf adjacent to the operating device, unless the door is an existing special-purpose horizontally sliding accordion or folding exit access door assembly serving an area with an occupant load of fewer than 50.
5. The door assembly complies with the fire protection rating, if required, and, where rated, is self-closing or automatic-closing by means of smoke detection in accordance with 7.2.1.8 and is installed in accordance with *NFPA 80, Standard for Fire Doors and Fire Windows.*

INTERTEK Code Compliance Research Report

CCRR 1086

For access to this report:

- Download from the Intertek website: intertek.com/building/ccrr/
- Download from the McKEON website: mckeondoor.com

International Building Code, 2021

202 Definitions, 716 Opening Protectives, Referenced Standards

The development and final vote of the following code sections have been completed and will be published in the 2021 edition of the IBC:

Section 202 Definitions

FIRE PROTECTIVE CURTAIN ASSEMBLY. An assembly consisting of a fabric curtain, bottom bar, guides, coil, operating and closing system.

Section 716 Opening Protectives

716.4 Fire protective curtain assembly. Approved fire protective curtain assemblies shall be constructed of any materials or assembly of component materials tested without hose stream in accordance with UL 10D, and shall comply with Sections 716.4.1 through 716.4.3.

716.4.1 Label. Fire protective curtain assemblies used as opening protectives in fire rated walls and smoke partitions shall be labeled in accordance with 716.2.9.

716.4.2 Smoke and draft control. Fire protective curtain assemblies used to protect openings where smoke and draft control assemblies are required shall comply with Section 716.2.1.4.

716.4.3 Installation. Fire protective curtain assemblies shall be installed in accordance with NFPA 80.

Referenced Standards

UL 10D-17, Standard for Fire Tests of Fire Protective Curtain Assemblies (shown below)

4 FIRE TESTS OF FIRE-PROTECTIVE CURTAIN ASSEMBLIES - UL 10D SEPTEMBER 29, 2017

INTRODUCTION

1 Scope

1.1 These requirements cover the evaluation of fire-protective curtain assemblies intended to provide supplemental, passive fire protection as part of an engineered fire protection system. Fire-protective curtain assemblies are horizontally or vertically oriented. Horizontally or vertically oriented fire-protective curtain assemblies provide nonstructural separation only, and are not intended to be substituted for structural hourly rated partitions or opening protectives that have been tested for fire endurance and hose stream performance.

McKEON FireFighter® Egress Feature

All FireFighter models that incorporate the egress feature can be placed in a required path of egress. Compliance with the criteria detailed in IBC Chapter 10, Means of Egress means building occupants can easily exit through this unique curtain assembly regardless of its application in the building.

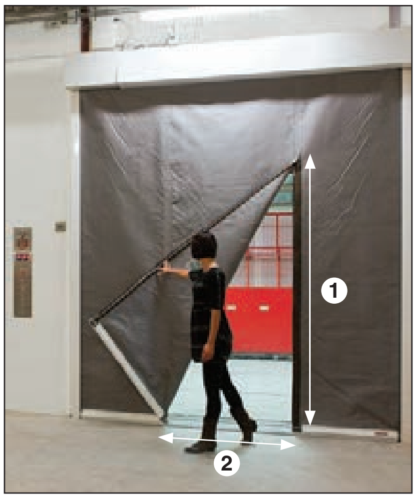
Code Requirements

Section 1010.1.2 Door Swing. Egress doors shall be of the pivoted or side-hinged swinging type.

The FireFighter egress door includes a hinged bottom bar located at 90 degrees to the fabric so that when the fabric is pushed to the open position both bottom bar and fabric easily swing providing complying egress width to allow building occupants to exit.

Section 1010.1.1 Size of doors. The required capacity of each door opening shall be sufficient for the occupant load thereof and shall provide a minimum clear opening width of 32 inches (813 mm) … The minimum clear opening height of doors shall be not less than 80 inches (2032 mm).

The following photo/dimensions and table will help you determine compliance with this code requirement.



Product	Opening Height from Floor	Opening (swing) Force (LBF)	Opening Dimensions
Fire & Smoke Curtain	18"	Less than 1/2 lbf	36"
Fire & Smoke Curtain	36"	Less than 1/2 lbf	22 1/2"
Fire & Smoke Curtain	54"	Less than 1/2 lbf	20"
Fire & Smoke Curtain	72"	Less than 1/2 lbf	12"
Fire & Smoke Curtain	84"	Less than 1/2 lbf	6"

Section 1010.1.3 Door opening force … the door latch shall release when subjected to a 15-pound (67 N) force. The door shall be set in motion when subjected to a 30-pound (133 N) force. The door shall swing to a full-open position when subjected to a 15-pound (67 N) force.

The following test data confirms that the FireFighter egress feature complies with these requirements.

Flexible Fabric Door Compliance Test	
Force A (LBF) Opening force to set egress in motion, hook & loop ripped open	26
Force B (LBF) Swing force to swing egress door to fully open position	0.5
Force C (LBF) Force required to hold egress door in the fully open 90 position	4
Height	34"

ADA Notes:

- Doors designated as fire doors must have the minimum opening force allowed by the local authority.
- Interior accessible doors should require no more than 5 lbs. of force to open.
- Threshold cannot be higher than 1/2 inch at accessible doors.

McKEON®

44 Sawgrass Drive
Bellport, NY 11713
Phone: 800-266-9392
Fax: 631-803-3030
Email: info@mckeondoor.com
www.McKeonDoor.com

File Attachments for Item:

ER-3 2018 IBC Fire and Life Safety Principles (International Code Council)

All certifications except ESI (4 hours)

Staff Notes: Recommend approval

Committee Recommendation:

APPLICATION

FOR

Continuing Education Course Approval

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

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

COURSE SUBMITTER:

Course Submitter: Laura Morris
(Contact Name)

Organization: International Code Council
(Organization/Company)

Address: 4051 Flossmoor Road
(Include Room Number, Suite, etc.)

City: Country Club Hills State: IL Zip: 60478

E-Mail: lmorris@iccsafe.org

Telephone: 888-422-7233 Ext: 4523 Fax: 708-799-2651

Course Sponsor: International Code Council

COURSE INFORMATION:

Course Title: 2018 IBC Fire and Life Safety Principles

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

Purpose and Objective: This seminar addresses the critical concepts of the 2018 IBC regarding fire and life safety issues. These concepts provide a basis for the correct use of the code in building planning, classification of buildings and occupancies, fire-resistance-rated construction, fire protection systems and means of egress.

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

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

Program Applicable for the Following Participants:

Building Official ■ Master Plans Examiner ■ Building Inspector ■ Fire Protection Inspector ■ Mechanical Inspector ■

Building Plans Exam. ✓
Plumbing Plans Exam. ■
Electrical Plans Exam. ■
Mechanical Plans Exam. ■
Fire Protect. Plans Exam. ✓

Plumbing Inspector ■
Non-Res IU Inspector ■

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

Electrical Safety Inspectors ☐
Location of ESI Course: ______ Date(s) of ESI Course(s): ______

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

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

2018 IBC® Fire and Life Safety Principles

Based on the 2018 International Building Code® (IBC®)

Length:	1/2 Day (0.4 Contact Hours)
Applicable Codes:	2018 IBC
Product Type/Status:	Seminar/Update
Level:	Intermediate

Project Team	
Instructional Designer	Denise Haas
Subject Matter Expert	Doug Thornburg
Technical Reviewer	TBA
Status of course	New Revision

(For in-house use only)

Course Information

Description

This seminar addresses the critical concepts of the 2018 IBC regarding fire and life safety issues. These concepts provide a basis for the correct use of the code in building planning, classification of buildings and occupancies, fire-resistance-rated construction, fire protection systems and means of egress. The content addresses issues that are necessary for many designs and plan review decisions.

During this training, participants will be listening to lecture and viewing examples, as well as discussing sections of the IBC that pertain to fire and life safety principles in building. They will participate in activities that involve a set of discussion, quizzes, questions and answers individually and in groups.

Goal

Upon completion of the course, students will be able to apply provisions of the 2018 *International Building Code*® for the design and plan review of buildings.

Objectives

Upon completion of this seminar, participants will be better able to:

- Classify uses into occupancy groups.
- Determine the type of construction of a proposed building.
- Calculate actual and allowable building height and floor area.
- Identify required fire-resistance-rated assemblies.
- Determine interior finish requirements.
- Identify any fire protection systems required.
- Determine means of egress design and component requirements

Target Audience

Building Officials, Architects, Building Inspectors, Contractors, Engineers, Fire Inspectors, Plans Examiners.

Prerequisites (Highlighted area pertains to this class)

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.

Timed Outline

Outline of Seminar (4 hours = 240 minutes)

I. Overview — **15 minutes**
   a. Course Introduction
   b. Objectives
   c. Participants Expectations
      i. Activity - Each participant will verbally indicate their expectations for this seminar. Instructor will write responses on top flip chart paper.

II. Module 1 – Chapter 1 Introduction — **10 minutes**
   a. Activity - Independently have participants answer the questions. Discuss answers with the group.

III. Module 2 – Chapter 3 Use and Occupancy Classification — **25 minutes**
   a. Activity - Participants will be split into 3-4 groups. As a group the participants will classify each building listed
   b. Activity - In the same groups, the participants will answer the questions. Instructor will review answer for both practices

IV. Module 3 – Chapter 6 Types of Construction — **25 minutes**
   a. Activity - Participants will be split into 3-4 groups. As a group the participants will complete the table. Instructor will review answers.

V. Module 4 – Chapter 4 Special Detailed Requirements Based on Use and Occupancy — **30 minutes**
   a. Activity - Instructor will read the questions and scribe answers on flip chart. Discussion.

VI. Module 5 – Chapter 5 General Building and Height Area — **30 minutes**
   a. Activity - Participants will complete the table. Instructors will Review Answers
   b. Activity - Participants will complete calculation. Instructors will Review Answers
   c. Activity - Participants will complete calculation. Instructors will Review Answers

d. Activity - Participants will complete calculation. Instructors will review answers

I. Module 6 – Chapter 7 Fire-Resistance-Rated Construction **35 minutes**

a. Activity - Participants will be split into 4 groups. Each group will be assigned one question to complete. As a group the participants will answer the questions. The group will report out the answer. Instructor will review answers provide discussion with the entire group.

II. Module 7 – Chapter 8 Interior Finishes **10 minutes**

a. Activity - Participants will complete table. Instructors will review answers

III. Module 8 – Chapter 9 Fire Protection System **30 minutes**

a. Activity Page - Participants will be split into 5 groups. Each group will be assigned one question to complete. As a group the participants will answer the questions. The group will report out the answer. Instructor will review answers, provide discussion with the entire group.

IV. Module 9 – Chapter 10 Mean of Egress (1455-206) **20 minutes**

a. Activity Page 225 - Participants will complete the questions. Instructors will review answers

V. Review of Day **10 minutes**

a. Review Expectations
b. Q & A
c. Evaluation

Please allow time for breaks at natural intervals.

INTERNATIONAL CODE COUNCIL®

BIO: Robert J. Schutz, P.E., P.S., CBO

Robert J. Schutz, P.E., P.S., CBO, has served as an Assistant Architect Administrator at the Ohio Board of Building Standards. While with the State of Ohio, he has oversight of the new Residential Code of Ohio program, including certification of local residential code departments and personnel. Previously, Bob served ICC as Manager of Instructors with responsibilities for the selection, oversight and quality of ICC's cadre of staff and contract instructors. his varied previous experiences include active military service during the 1980's as an Army Corps of Engineers (ACE) officer; building code enforcement for several central Ohio jurisdictions, including ten years as Chief Building Official (CBO) for the City of Powell where he also served as City Engineer and Director of Public Services; and Chief Engineer, for the Ohio Department of Health where he chaired the state's plumbing advisory board, was chief of plumbing and was a voting member on the Ohio Board of Building Standards. He is experienced in combat construction, facilities engineering and project management as well as having been a plumber, sheet metal worker and brick mason.

Mr. Schutz has a civil engineering degree from Ohio Northern University with post graduate studies at the University of Southern California and the Ohio State University in environmental law, land- use planning and public administration. He is a registered Professional Engineer and Professional Surveyor, certified Chief Building Official and holds Ohio certifications as Building Official, Plans Examiner and Inspector for Building, Plumbing, Electrical Safety and Residential. Bob instructs IBC structural and nonstructural seminars, all IRC subjects, mechanical, plumbing and fuel gas codes and administrative topics.

2018 IBC Fire and Life Safety Principles

Based on the 2018 International Building Code® (IBC®)

1

Goal

- The goal of this seminar is to provide participants with an understanding fire and life safety principles in the 2018 IBC.

2

Objectives

Upon completion, participants will be better able to:

1. Classify uses into occupancy groups.
2. Determine the type of construction of a proposed building.
3. Calculate actual and allowable building height and floor area.
4. Identify required fire-resistance-rated assemblies.
5. Determine interior finish requirements.
6. Identify any fire protection systems required.
7. Determine means of egress design and component requirements

3

Overview

- Application of the IBC
- Occupancy Classification and Use
- Types of Construction
- Special Detailed Requirements Based on Use and Occupancy
- General Building Heights and Area
- Fire and Smoke Protection Features
- Interior Finishes
- Fire Protection and Life Safety Systems
- Means of Egress

4

Module 1

Chapter 1 – Application of the IBC

5

5

Scope/Applicability Provisions

- 101.2 – Scope
- 101.3 – Intent
- 101.4 – Referenced codes
- 102.1 – General vs. specific application
- 102.4 – Referenced codes and standards
- 104.1 – Building official interpretive authority
- 104.8 – Liability
- 104.11 – Alternate materials, design and methods

IBC 2018 IBC Fire and Life Safety Principles 6 LEARNING center

6

Effective Use of the IBC

- The following procedure is suggested:
  - Building Classification
  - Fire Protection Systems
  - Means of Egress
  - Fire and Smoke Protection Features
  - Interior Finishes
  - Special Detailed Requirements Based on Use and Occupancy
  - Additional Applicable Provisions

IBC 2018 IBC Fire and Life Safety Principles 7 LEARNING center

7

ACTIVITY

Administration

1. When the board of appeals makes a decision inconsistent with that of the building official, whose decision is to be applied?

Section 113.2 indicates that the board of appeals has the authority to overrule the building official's decision, but that authority is limited to three areas of appeal. 1) interpretation of a provision, 2) applicability of the provision, or 3) equivalent or better construction.

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ACTIVITY

Administration

2. Does the building official have the authority to interpret the code in a way that waives the requirements specifically provided for in the IBC?

Section 104.1 states that an interpretation must not have the effect of waiving requirements of the code.

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Module 2

Chapter 3 – Occupancy Classification and Use

10

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Occupancy Classification

- Uses are grouped by occupancy based on similar:
  - Life safety characteristics
  - Combustible content
  - Fire hazards

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Occupancy Classification

To achieve equivalent safety in building design, each occupancy group and division varies by:

- Type of construction restrictions.
- Fire protection requirements.
- Location, area and height limitations.
- Means of egress elements.

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Occupancy Classification

Occupant-related Hazards

- Number of occupants.
- Density of the occupants.
- Age of the occupants.
- Mobility of the occupants.
- Awareness of the occupants.

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Occupancy Classification

Content-related Hazards

- Density of contents.
- Quantity of contents.
- Type of contents.
- Environment of contents.
- Flammability of contents.

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Occupancy Classification Section 302.1

- A — Assembly.
- B — Business.
- E — Educational.
- F — Factory and Industrial.
- H — Hazardous.
- I — Institutional.
- M — Mercantile.
- R — Residential.
- S — Storage.
- U — Utility and Miscellaneous.

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Occupancy Classification Sections 303-305

- 303.1 – Assembly Group A
  - Group A-1
  - Group A-2
  - Group A-3
  - Group A-4
  - Group A-5
- 304.1 – Business Group B
- 305.1 – Educational Group E

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Occupancy Classification Sections 306-307

- 306.1 – Factory Group F
  - Group F-1
  - Group F-2
- 307.1 – High-Hazard Group H
  - Group H-1
  - Group H-2
  - Group H-3
  - Group H-4
  - Group H-5

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Occupancy Classification Sections 308-309

- 308.1 - Institutional Group I
  - Group I-1 (Conditions 1 and 2)
  - Group I-2 (Conditions 1 and 2)
  - Group I-3
  - Group I-4
- 309.1 – Mercantile Group M

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Occupancy Classification Sections 310-312

- 310.1 – Residential Group R
  - Group R-1
  - Group R-2
  - Group R-3
  - Group R-4 (Conditions 1 and 2)
- 311.1 – Storage Group S
  - Group S-1
  - Group S-2
- 312.1 – Group U: Utility and Miscellaneous

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ACTIVITY

1. Cell Phone Tower

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ACTIVITY
2. Insurance Office
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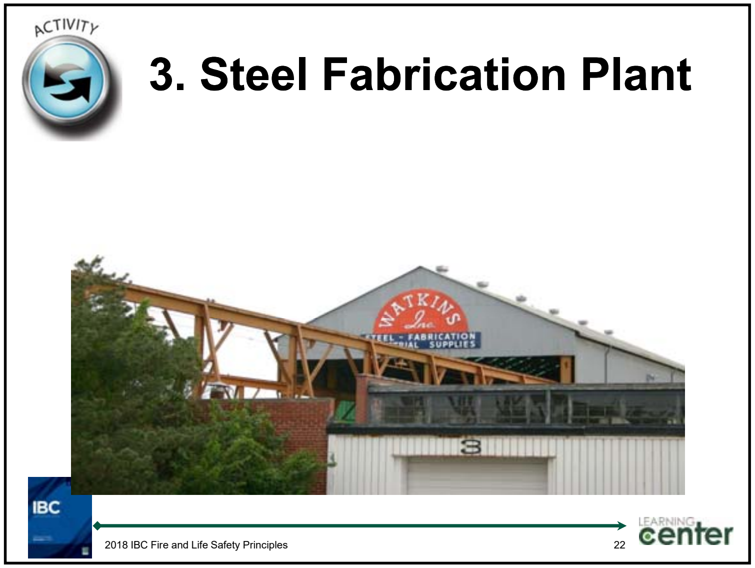
ACTIVITY
3. Steel Fabrication Plant
WATKINS Inc.
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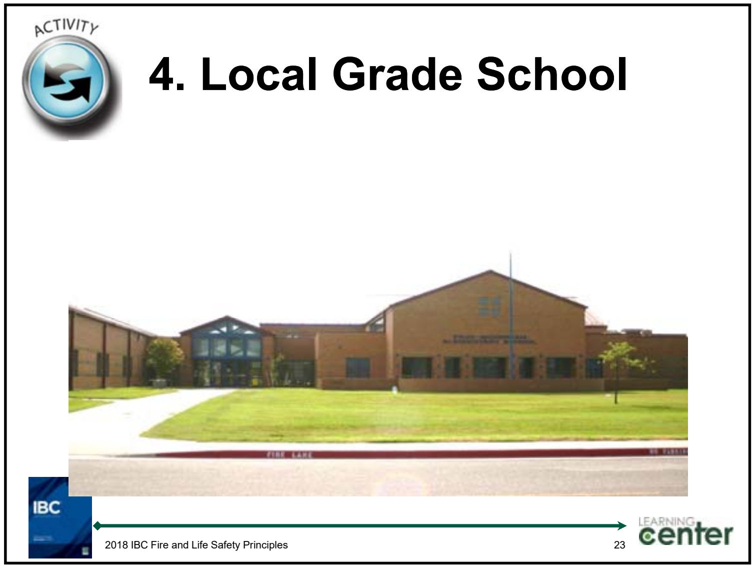
ACTIVITY
4. Local Grade School
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ACTIVITY
5. Hospital
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ACTIVITY

6. Bank

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ACTIVITY

7. Juvenile Detention Center

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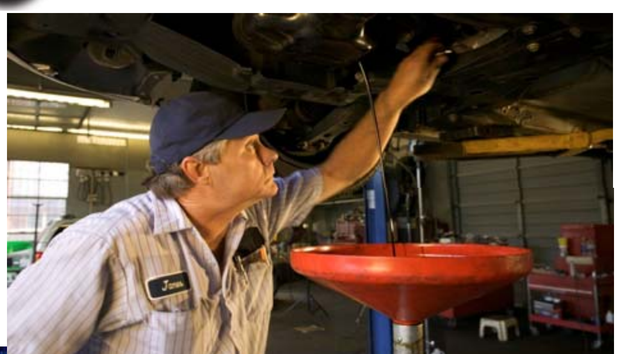
ACTIVITY

8. Oil and Lube Shop



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ACTIVITY

9. Convenience Store

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ACTIVITY

10. Multiplex Theater

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ACTIVITY

11. Canopy Over Pump Island

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ACTIVITY

12. Bleachers at Football Field

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ACTIVITY

13. Auto Body Shop

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ACTIVITY

14. Open Parking Garage

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ACTIVITY

What information is required to properly classify the following?

15. Kitchen Serving a Restaurant

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ACTIVITY

What information is required to properly classify the following?

16. Boarding House

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ACTIVITY

What information is required to properly classify the following?

17. Facility Used to Care for Children

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ACTIVITY

What information is required to properly classify the following?

18. Dance Studio for Children

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ACTIVITY

What information is required to properly classify the following?

19. Private Garages for Condominiums

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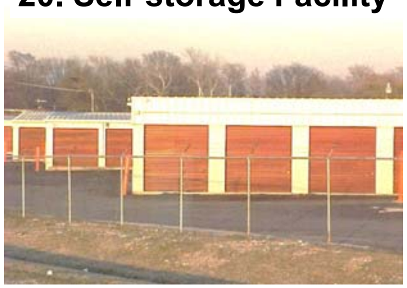
ACTIVITY

What information is required to properly classify the following?

20. Self-storage Facility



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ACTIVITY

What information is required to properly classify the following?

21. Dental Office

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ACTIVITY

What information is required to properly classify the following?

22. Casino Gaming Area

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ACTIVITY

What information is required to properly classify the following?

23. Fast Food Carry-out

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ACTIVITY

What information is required to properly classify the following?

24. Assisted Living Facility

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Chapter 6 – Types of Construction

Module 3

44

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Types of Construction

- 602.1 – Construction Classification
- 602.2 – Construction Types I and II
- 602.3 – Construction Type III
- 602.4 – Construction Type IV
- 602.5 – Construction Type V

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Types of Construction

Material	Structural Elements	Construction Types
Noncombustible	Exterior and interior (bearing or nonbearing) walls, floors, roofs, and structural elements to be of noncombustible materials	IBA IIA IIB
Combustible and/or noncombustible	Exterior walls to be of noncombustible materials	IIIA IIIB IV VA VB

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REFER TO CODE BOOK

2018 IBC
Table 601
Page 119

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	HT	A	B
Primary structural frame[f] (see Section 202)	3[a,b]	2[a,b]	1[b]	0	1[b]	0	HT	1[b]	0
Bearing walls Exterior[e,f] Interior	 3 3[a]	 2 2[a]	 1 1	 0 0	 2 1	 2 0	 2 1/HT	 1 1	 0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[d]	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	$1\frac{1}{2}$[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	HT	1[b,c]	0

For SI: 1 foot = 304.8 mm.
a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members in roof construction shall not be required, including protection of primary structural frame members, roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
c. In all occupancies, heavy timber complying with Section 2304.11 shall be allowed where a 1-hour or less fire-resistance rating is required.
d. Not less than the fire-resistance rating required by other sections of this code.
e. Not less than the fire-resistance rating based on fire separation distance (see Table 602).
f. Not less than the fire-resistance rating as referenced in Section 704.10.

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Table 601 Notes

a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of primary structural frame members, roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
c. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.
d. Not less than the fire-resistance rating required by other sections of this code.
e. Not less than the fire-resistance rating based on fire separation distance (see Table 602).
f. Not less than the fire-resistance rating as referenced in Section 704.10.

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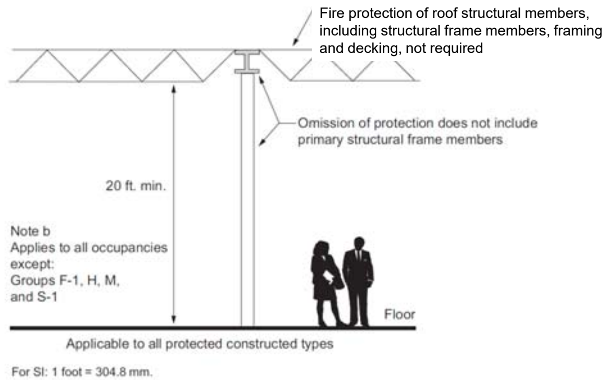
Types of Construction Table 601, Note b



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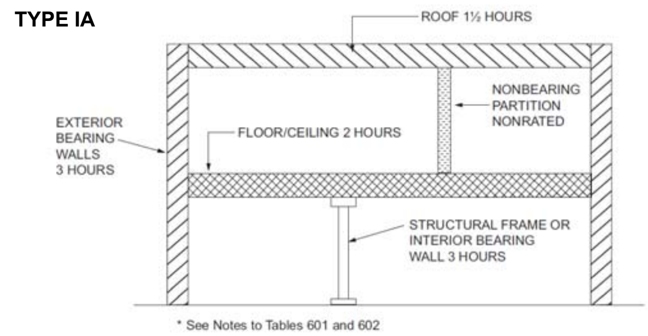
Type I Construction



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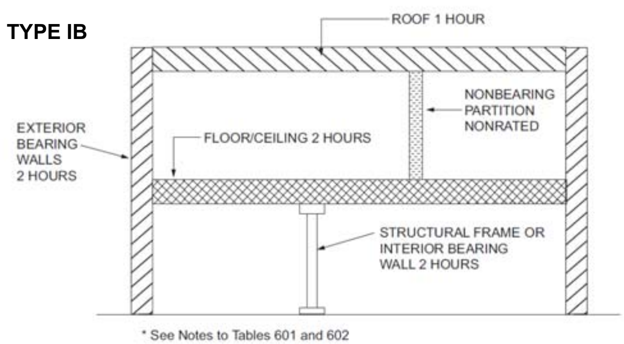
Type I Construction



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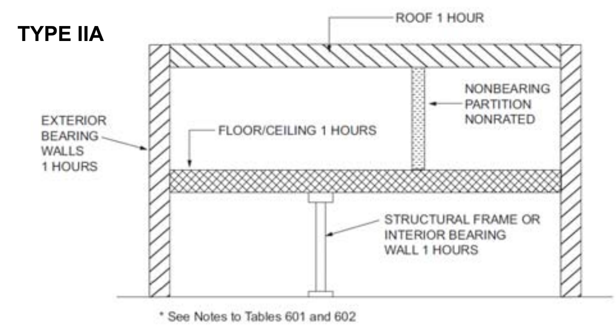
Type II Construction



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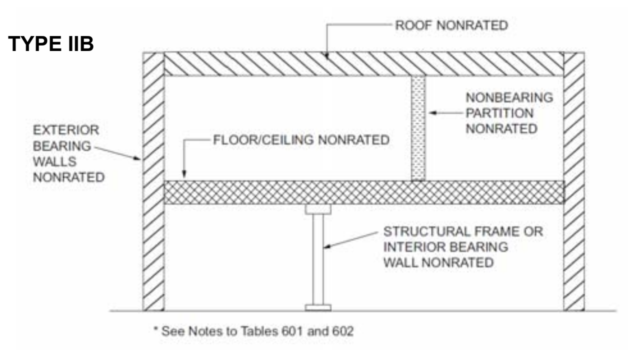
Type II Construction



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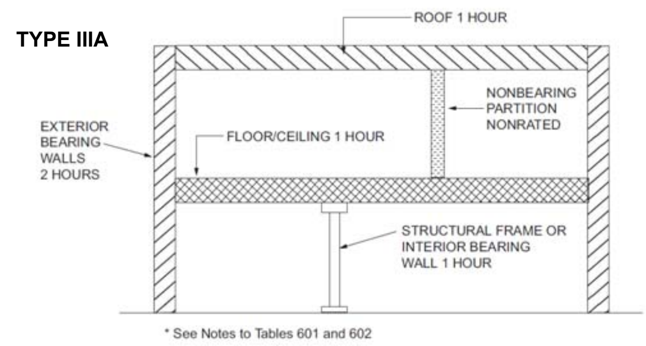
Types of Construction



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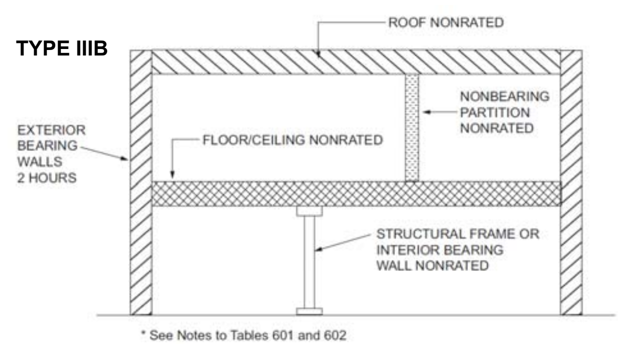
Type III Construction



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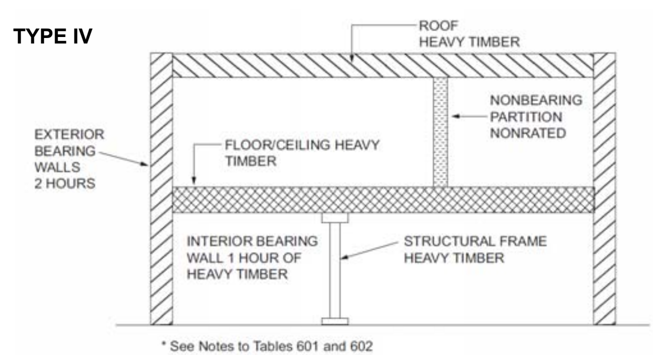
Type IV Construction



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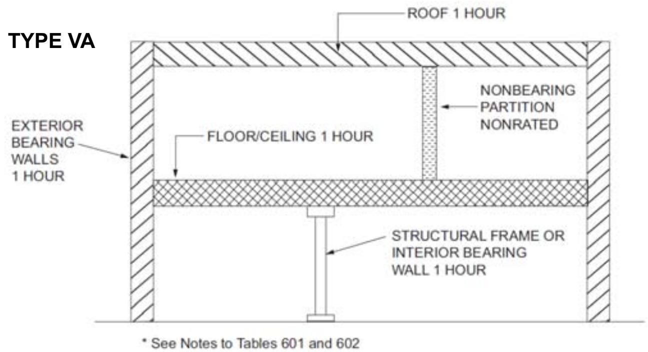
Type V Construction



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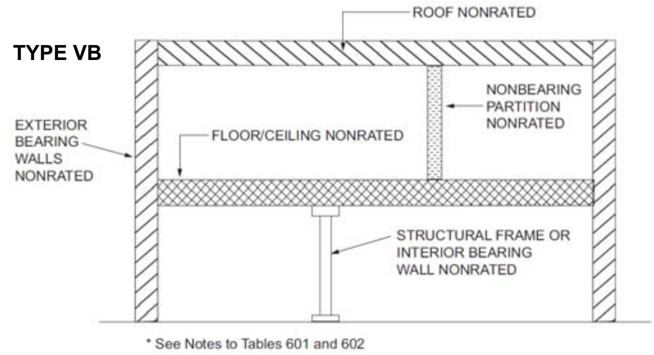
Type V Construction



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REFER TO CODE BOOK

Table 602

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Table 602
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TABLE 602
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
$5 \le X < 10$	IA Others	3 2	2 1	1 1
$10 \le X < 30$	IA, IB IIB, VB Others	2 1 1	1 0 1	1[c] 0 1[c]
$X \ge 30$	All	0	0	0

For SI: 1 foot = 304.8 mm.
a. Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.
b. See Section 706.1.1 for party walls.
c. Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.
d. The fire-resistance rating of an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.
e. For special requirements for Group H occupancies, see Section 415.6.
f. For special requirements for Group S aircraft hangars, see Section 412.3.1.
g. Where Table 705.8 permits nonbearing exterior walls with unlimited area of unprotected openings, the required fire-resistance rating for the exterior walls is 0 hours.
h. For a building containing only a Group U occupancy private garage or carport, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1523 mm) or greater.
i. For a Group R-3 building of Type II-B or Type V-B construction, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1523 mm) or greater.

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Section 603 – Combustible Material in Type I and Type II Construction

- Fire-retardant-treated (FRT) wood in:
  - Nonbearing partitions of 2 hours or less
  - Nonbearing exterior walls where rating not required
- Thermal and acoustical insulation with limited flame spread.
- Foam plastics in accordance with Chapter 26.
- A, B or C roof coverings.
- Interior floor finish, trim, millwork, doors, frames, etc.

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Section 603 – Combustible Material in Type I and Type II Construction

- Platforms in accordance with Section 410.
- Blocking for handrails, cabinets, fixtures, etc.
- Light-transmitting plastics in accordance with Chapter 26.
- Nailing or furring strips in accordance with Section 803.15.
- Heavy timber (HT) for specific components.
- Additional applications as specified.

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Module 4

Chapter 4 – Special Detailed Requirements Based On Occupancy and Use

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Special Detailed Requirements

- 402 – Covered mall and open mall buildings
- 403 – High-rise buildings
- 404 – Atriums
- 405 – Underground buildings
- 406 – Motor-vehicle-related occupancies
- 407 – Group I-2
- 408 – Group I-3

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Special Detailed Requirements

- 409 – Motion picture projection rooms
- 410 – Stages, platforms and technical production areas
- 411 – Special amusement buildings
- 412 – Aircraft-related occupancies
- 413 – Combustible storage
- 414 – Hazardous materials

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Special Detailed Requirements

- 415 – Groups H-1, H-2, H-3, H-4 and H-5
- 416 – Spray application of flammable finishes
- 417 – Drying rooms
- 418 – Organic coatings
- 419 – Live/work units
- 420 – Groups I-1, R-1, R-2, R-3 and R-4

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Special Detailed Requirements

- 421 – Hydrogen fuel gas rooms
- 422 – Ambulatory health care facilities
- 423 – Storm shelters
- 424 – Children's play structures
- 425 – Hyperbaric facilities
- 426 – Combustible dusts, grain processing and Storage
- 427 – Medical gas systems
- 428 – Higher education laboratories

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ACTIVITY

Special Detailed Requirements Based on Use and Occupancy

1. What is the purpose of a control area?

Sections 414.2 and 307.1. Control areas are used by the designer to permit additional quantities of hazardous materials in buildings not classified as Group H. Up to the maximum allowable quantities of hazardous materials may be located in each control area as limited by Table 414.2.2.

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ACTIVITY

Special Detailed Requirements Based on Use and Occupancy

2. How must individual dwelling units be separated from other areas of an apartment building?

Section 420. Dwelling units must be separated from each other and from other occupancies in the building through the use of fire partitions and/or horizontal assemblies.

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Module 5

Chapter 5 General Building Heights and Areas

69

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Allowable Area

- Essential ingredients in the determination of allowable areas include:
  - Type and amount of combustibles due to the use of the building.
  - Amount of combustibles contained in the construction of the building.
  - Features, such as automatic sprinkler systems, open yards and fire walls.

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Area Limitations

- The restrictions for maximum building area are intended to limit the size of the fire that potentially may develop.
- Primary concern is that of property damage and spread of fire to adjacent buildings.

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Area Limitations

- Life safety is considered because of the number of occupants.
- Fire fighting accessibility and protection of fire department personnel is a factor.

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Area Limitations

- To determine allowable building area of the structure:
  - Determine the allowable area factor based on the occupancy classification, type of construction and sprinkler protection as set forth in Table 506.2.
  - Determine any allowable increase based on the buildings location on the lot (Section 506.3).

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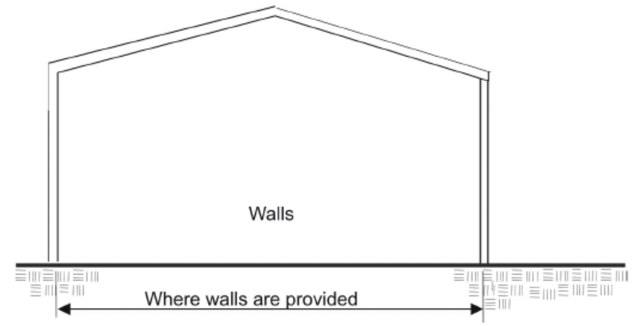
Section 503 – General Height and Area Limitations



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Section 503.1.2 – Buildings on the Same Lot

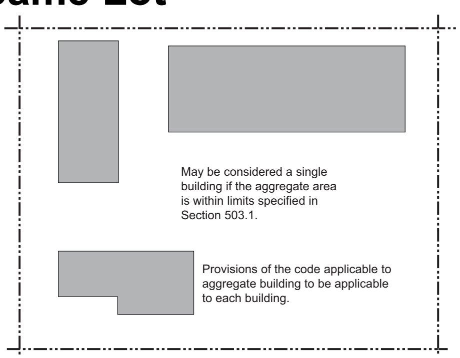

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Table 504.3 – Building Height

FOR EXAMPLE

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
H-1, H-2, H-3, H-5	NS[c, d] / S	UL	160	65	55	65	55	65	50	40
H-4	NS[c, d]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
I-1 Condition 1, I-3	NS[d, e]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
I-1 Condition 2, I-2	NS[d, e, f]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85						
I-4	NS[d, g]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
R[h]	NS[d]	UL	160	65	55	65	55	65	50	40
	S13D	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	85	70	60

For SI: 1 foot = 304.8 mm.

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FOR EXAMPLE

Table 504.3 – zoom to B

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE I A	TYPE I B	TYPE II A	TYPE II B	TYPE III A	TYPE III B	TYPE IV HT	TYPE V A	TYPE V B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60

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FOR EXAMPLE

Table 504.4 – Building Height in Stories Above Grade Plane

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE I A	TYPE I B	TYPE II A	TYPE II B	TYPE III A	TYPE III B	TYPE IV HT	TYPE V A	TYPE V B
A-1	NS	UL	5	3	2	3	2	3	2	1
	S	UL	6	4	3	4	3	4	3	2
A-2	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-3	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-4	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-5	NS	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	11	5	3	5	3	5	3	2
	S	UL	12	6	4	6	4	6	4	3
E	NS	UL	5	3	2	3	2	3	1	1
	S	UL	6	4	3	4	3	4	2	2
F-1	NS	UL	11	4	2	3	2	4	2	1
	S	UL	12	5	3	4	3	5	3	2
F-2	NS	UL	11	5	3	4	3	5	3	2

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FOR EXAMPLE

Table 504.4 – zoom into B

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE I A	TYPE I B	TYPE II A	TYPE II B	TYPE III A	TYPE III B	TYPE IV HT	TYPE V A	TYPE V B
B	NS	UL	11	5	3	5	3	5	3	2
	S	UL	12	6	4	6	4	6	4	3

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FOR EXAMPLE

Table 506.2

TABLE 506.2
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE I A	TYPE I B	TYPE II A	TYPE II B	TYPE III A	TYPE III B	TYPE IV HT	TYPE V A	TYPE V B
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	60,000	46,000	22,000
	SM	UL	UL	46,500	25,500	42,000	25,500	45,000	34,500	16,500
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-5	NS S1 SM	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	25,500	18,500	9,500
	S1	UL	UL	106,000	58,000	94,000	58,000	102,000	74,000	38,000

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FOR EXAMPLE

Table 506.2 zoom to B

TABLE 506.2
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
B	NS	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	108,000	54,000	27,000

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Section 505 – Mezzanines

- Not considered as an additional story.
- Not included in building area.
- Included in fire area.
- Regulated for means of egress under the general provisions of Chapter 10.
- The clear height above and below the mezzanine floor must not be less than 7 feet (2134 mm).

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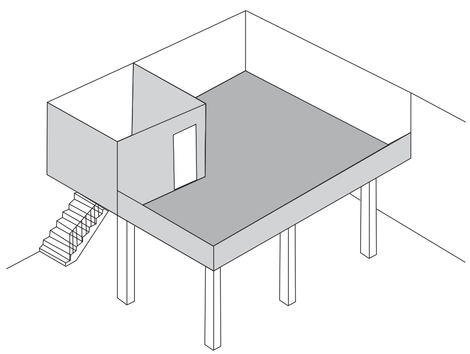
Section 505.2.3 – Mezzanine Openness



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Section 506 – Building Area

- A building's maximum allowable floor area is determined based on a variety of factors:
  - The building's type of construction.
  - The occupancy classification(s) housed in the building.
  - Whether or not there is a sprinkler system in the building.
  - If sprinklered, the type of sprinkler system installed (Group R.)
  - Amount of open space (frontage) at the building's perimeter.
  - The number of stories in the building.

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Table 506.2 – Allowable Area Factor

FOR EXAMPLE

TABLE 506.2
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	60,000	46,000	22,000
	SM	UL	UL	46,500	25,500	42,000	25,500	45,000	34,500	16,500
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	34,500	18,000
A-5	NS, S1, SM	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	25,500	18,500	9,500
	S1	UL	UL	106,000	58,000	94,000	58,000	102,000	74,000	38,000
	SM	UL	UL	79,500	43,500	70,500	43,500	76,500	55,500	28,500

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Section 506.2 – Allowable Area Determination

- For all of the following conditions, Table 506.2 establishes the allowable area factor that is the basis for determining the building's total allowable area:
  - Single-occupancy, one-story buildings.
  - Mixed-occupancy, one-story buildings.
  - Single-occupancy, multistory buildings.
  - Mixed-occupancy, multistory buildings.

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Section 506.3 – Frontage Increase

The following apply to an area increase for frontage:

- It is based on the percentage of open perimeter.
- There is no increase where the perimeter is no more than 25-percent open.
- There is typically a maximum increase of 75 percent where the entire perimeter is open.
- The open space must be at least 20 feet (6096 mm) wide to be considered open, with 30 feet (9144 mm) typically required to obtain the maximum increase.
- The open spaces are to be accessed from a street or a fire lane.

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Section 506.3 – Frontage Increase

- The following formula is to be used in determining the area increase due to frontage.

$$I_f = [F/P - 0.25]W/30$$

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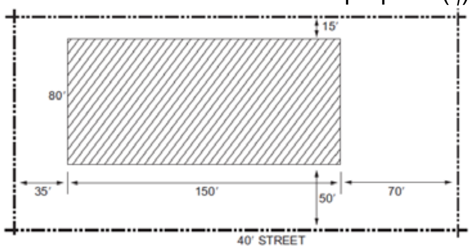
Section 506.3 – Frontage Increase

- **Example 1 of Area Increase for Frontage**
- **Given:** Yards as shown, 40-foot (12 192 mm) street
- **Determine:** Percent increase for area purpose (I_f)



For SI: 1 foot = 304.8 mm.

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Section 506.3 – Frontage Increase

$$\left[\frac{F}{P} - 0.25\right]\frac{W}{30}$$

$F = 310'$
$P = 460'$
$W = 35', 70', 90'$

$$\left[\frac{310}{460} - 0.25\right]\frac{30^*}{30}$$

[0.67 - 0.25] 1.0
[0.42] 1.0
$I_f = 0.42$

*[where W exceeds 30 feet (9144 mm), a value of 30 feet (9144 mm) is to be used]

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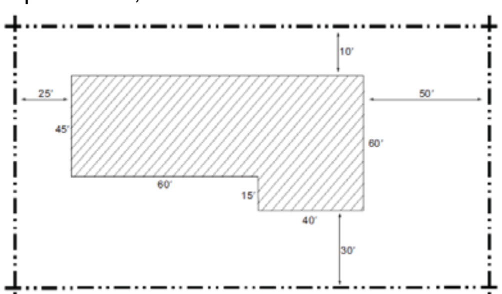
Allowable Area Calculation

- **Given:** Four-story office building, Type IIB construction
- Fully sprinklered, Yards and streets as shown



For SI: 1 foot = 304.8 mm.

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Allowable Area Activity

Determine: Maximum allowable area for the building (A_a)

$A_a = [A_t + (NS \times I_f)] \times S_a$

A_t = 69,000 square feet (6410 m²) (Table 506.2)

NS = 23,000 square feet (2137 m²)

$I_f = \left[\frac{220}{320} - 0.25\right]\frac{29^*}{30} = [0.69 - 0.25]0.96 = 0.42$ (*based on weighted average)

$S_a = 3$

A_a = 69,000 + [23,000(0.42)] × 3

= [69,000 + 9,660] × 3

= 78,660 square (7308 m²) feet per story × 3

= 235,980 square feet (21 923 m²) for building

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Section 507 – Unlimited Area Buildings

- The allowance of unlimited area permitted by Section 507 are commonly applied to the following buildings:
  - One-story nonsprinklered Group F-2 or S-2, surrounded by a minimum of 60- foot (18 288 mm) open space.
  - One-story sprinklered Groups A-4 (other than Type V construction), B, F, M or S surrounded by a minimum 60-foot (18 288 mm) open space (sprinklers may be omitted from participant areas of Group A-4 under specific conditions).
  - Two-story sprinklered Group B, F, M or S occupancies surrounded by a minimum 60-foot (18 288 mm) open space.

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REFER TO CODE BOOK

2018 IBC
Table 509
Page 116

Table 509 – Incidental Uses

[F] TABLE 509
INCIDENTAL USES

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
Incinerator rooms	2 hours and provide automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic sprinkler system
In Group E occupancies, laboratories and vocational shops not classified as Group H	1 hour or provide automatic sprinkler system
In Group I-2 occupancies, laboratories not classified as Group H	1 hour and provide automatic sprinkler system
In ambulatory care facilities, laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
In Group I-2, laundry rooms over 100 square feet	1 hour
Group I-3 cells and Group I-2 patient rooms equipped with padded surfaces	1 hour
In Group I-2, physical plant maintenance shops	1 hour
In ambulatory care facilities or Group I-2 occupancies, waste and linen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour
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 square feet	1 hour
Stationary storage battery systems having an energy capacity greater than the threshold quantity specified in Table 1206.2 of the *International Fire Code*	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
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.

For SI: 1 square foot = 0.0929 m^2, 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L, 1 cubic foot = 0.0283 m^3.

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Section 508 – Mixed Occupancies

- The designer must select one of the following methods to address each occupancy pairing that occurs:
  - Accessory occupancies.
  - Nonseparated occupancies.
  - Separated occupancies.

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Section 508.2 – Accessory Occupancies

- Compliance as accessory occupancy and separation of occupancies by fire barriers are not required where four conditions exist:
  - Occupancy under consideration is accessory to major occupancy.
  - Occupancy is not a Group H occupancy.
  - Occupancy does not exceed 10 percent of the area of the story where it is located.
  - Occupancy does not exceed the tabular allowable area values for nonsprinklered buildings found in Table 506.2.

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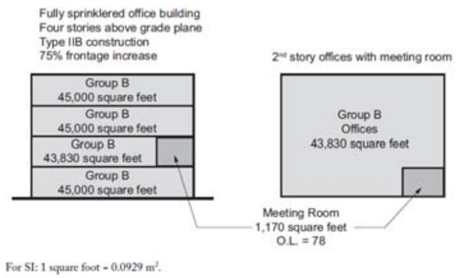
FOR EXAMPLE

Section 508.2 – Accessory Occupancies



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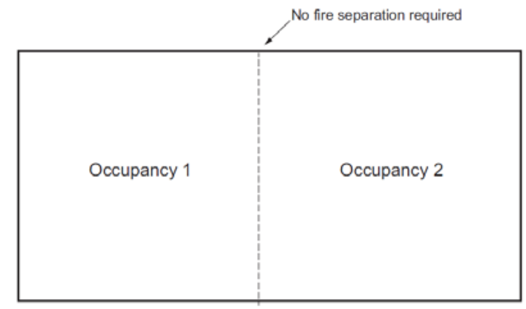
Section 508.3 – Nonseparated Occupancies



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FOR EXAMPLE

Nonseparated Occupancies

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FOR EXAMPLE

Solution: Nonseparated Occupancies

Occupancy	Allowable Height (stories)	Allowable Area (square feet)	Sprinkler System	Fire Alarm System
Group A-2	3	28,500	Yes	??
Group B	4	69,000	No	Yes
Group M	3	37,500	Yes	??

- The building does not exceed three stories in height, does not exceed 28,500 square feet per story, and is fully sprinklered. If it is provided with a manual fire alarm system throughout, it would comply as a nonseparated occupancy building.

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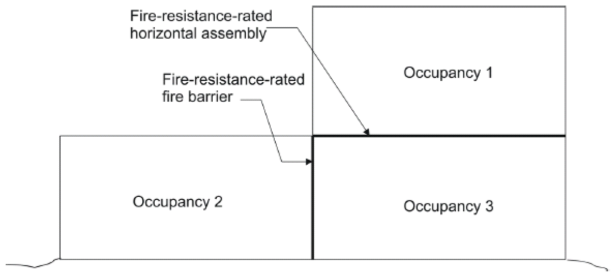
Section 508.4 – Separated Occupancies



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Separated Occupancies

FOR EXAMPLE

For SI: 1 square foot = 0.0929 m^2.

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ACTIVITY

Solution: Separated Occupancies

Solution: Apply the unity formula of Section 508.4.2 to determine compliance with allowable area.

Solution: Apply the unity formula of Section 508.4.2 to determine compliance with allowable area.

Occupancy	Tabular Area (square feet)	Frontage Increase (square feet)	Allowable Area (square feet)
Group A-2	38,000	2,375	40,375
Group B	92,000	5,750	97,750
Group M	50,000	3,125	53,125

6,000/40,375 + 46,000/97,750 + 26,000/53,125 $\leq$ 1.0 ???

0.15 + 0.47 + 0.49 $\leq$ 1.0 ???

1.11 > 1.0, therefore, building does not comply as a separated occupancies building.

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Section 510 Special Provisions

- Section 510.2 where minimum 3-hour horizontal assembly (podium) must be provided to 'separate' the buildings. Other conditions addressed in Section 510 include:
  - Section 510.3 for a Group S-2 enclosed parking garage with a Group S-2 open parking garage above.
  - Section 510.4 applicable to parking beneath a Group R occupancy.
  - Section 510.7 for an open parking garage beneath a Group A, I, B, M or R occupancy.
  - Section 510.8 where a Group B or M occupancy is located below a Group S-2 open parking garage.

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Module 6

Chapter 7 – Fire and Smoke Protection Features

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Chapter 7

This chapter contains provisions for building elements and protection features such as:

- Structural members.
- Exterior walls.
- Fire walls.
- Fire barriers.
- Fire partitions.
- Smoke barriers.
- Smoke partitions.
- Horizontal assemblies.
- Vertical openings.
- Shaft enclosures.
- Penetrations.
- Fire-resistant joints.
- Opening protectives.
- Ducts and air transfer openings.
- Concealed spaces.
- Fireblocking/draftstopping.
- Prescriptive and calculation methods for determining fire-resistance rating.

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Fire-Resistance Ratings and Fire Tests

The code distinguishes between two fundamental types of ratings for these assemblies:

- Fire resistance.
- Fire protection.

Collectively, they provide *fire-resistant construction*.

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Fire-Resistance Ratings and Fire Tests

For the specified hourly rating, the conditions of acceptance for walls ensure that the assemblies will at least:

- Withstand fire exposure based on a standard time-temperature curve without passage of flames or gases hot enough to ignite cotton waste on the unexposed side.
- Withstand thermal shock of a fire hose stream test on the exposed side after the fire test.
- Limit transmission of heat during the fire test to a maximum average of 250°F (121°C) above the initial temperature on the unexposed side.
- Sustain applied loads during the fire test at load-bearing assemblies, where applicable.

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Fire-Resistance Ratings and Fire Tests

- *Fire-protection rating* applies to opening protective assemblies (i.e., doors and windows). Fire tests are conducted in accordance with NFPA 252, UL 10B or UL 10C for doors, and NFPA 257 or UL 9 for windows, as applicable (Section 716.5 and 716.6).
- For the specified hourly rating, their conditions of acceptance all ensure that the assembly will at least withstand fire exposure and, typically, thermal shock, the same as specified for walls.

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Section 703.2 – Fire-resistance Ratings Section 703.3 – Methods for Determining Fire-resistance

- Fire tests in accordance with ASTM E119 or UL 263.
- The use of prescriptive (i.e., generic) designs contained in Section 721.
- The use of proprietary designs [i.e., testing by a Nationally Recognized Testing Laboratory (NRTL) per ASTM E119, UL 263, or equivalent].
- Calculations in accordance with Section 722.
- Engineering analysis based on a comparison of designs having a fire-resistance rating in accordance with ASTM E119 or UL 263.
- Fire-resistance designs certified by an approved agency.
- Alternative methods in accordance with Section 104.11 (alternative materials, design and methods of construction and equipment).

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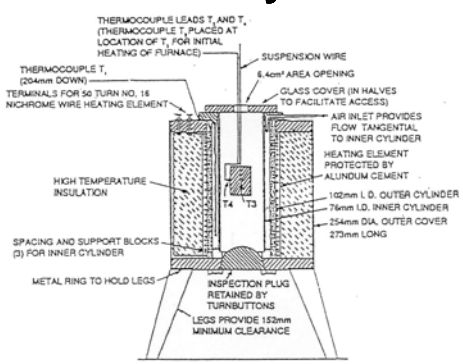
Section 703.5 – Noncombustibility Tests



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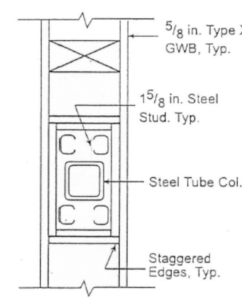
Fire and Smoke Protection Features

- 703.6 – Fire-resistance-rated glazing
- 703.7 – Marking and identification
- 704 – Structural members



TYPE VA

For SI: 1 inch = 25.4 mm

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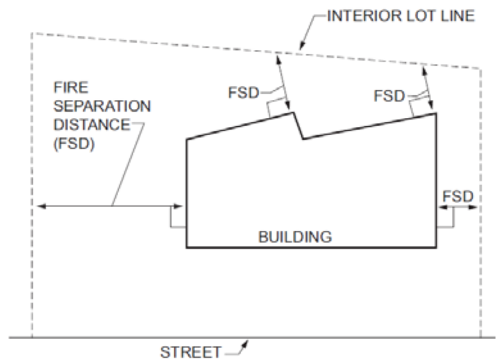
Section 705 – Exterior Walls



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Section 705.2 – Projections

REFER TO CODE BOOK

2018 IBC Table 705.2, page 126

TABLE 705.2
MINIMUM DISTANCE OF PROJECTION

FIRE SEPARATION DISTANCE-FSD (feet)	MINIMUM DISTANCE FROM LINE USED TO DETERMINE FSD
0 to less than 2	Projections not permitted
2 to less than 3	24 inches
3 to less than 5	24 inches plus 8 inches for every foot of FSD beyond 3 feet or fraction thereof
5 or greater	40 inches

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm.

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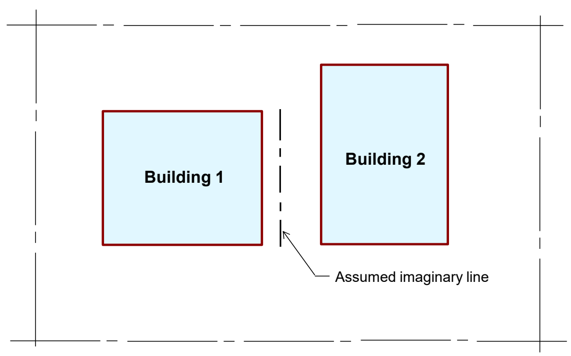
Section 705.3 – Buildings on the Same Lot



Buildings 1 and 2 regulated as two separate and distinct buildings

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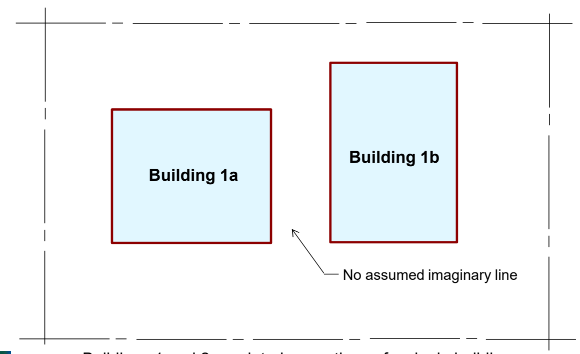
Section 705.3 – Buildings on the Same Lot



Buildings 1 and 2 regulated as portions of a single building

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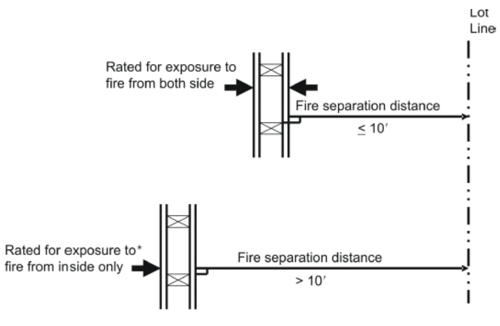
Section 705.5 – Fire-resistance Ratings



For SI: 1 foot = 304.8 mm.

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Section 705.8 Maximum Area of Exterior Wall Openings

TABLE 705.8
MAXIMUM AREA OF EXTERIOR WALL OPENINGS BASED ON FIRE SEPARATION DISTANCE AND DEGREE OF OPENING PROTECTION

FIRE SEPARATION DISTANCE (feet)	DEGREE OF OPENING PROTECTION	ALLOWABLE AREA[a]
0 to less than 3[b, c, k]	Unprotected, Nonsprinklered (UP, NS)	Not Permitted[k]
	Unprotected, Sprinklered (UP, S)[i]	Not Permitted[k]
	Protected (P)	Not Permitted[k]
3 to less than 5[d, e]	Unprotected, Nonsprinklered (UP, NS)	Not Permitted
	Unprotected, Sprinklered (UP, S)[i]	15%
	Protected (P)	15%
5 to less than 10[e, f, j]	Unprotected, Nonsprinklered (UP, NS)	10%[h]
	Unprotected, Sprinklered (UP, S)[i]	25%
	Protected (P)	25%
10 to less than 15[e, f, g, j]	Unprotected, Nonsprinklered (UP, NS)	15%[h]
	Unprotected, Sprinklered (UP, S)[i]	45%
	Protected (P)	45%

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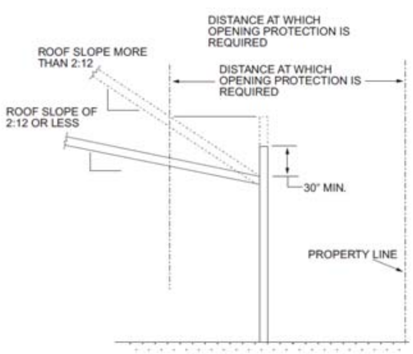
Section 705.11 – Parapets



For SI: 1 inch = 25.4 mm.
For SI: 1 inch = 25.4 mm.

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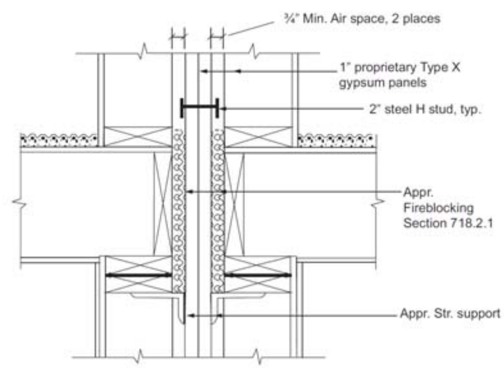
Section 706 – Fire Walls



For SI: 1 inch = 25.4 mm.

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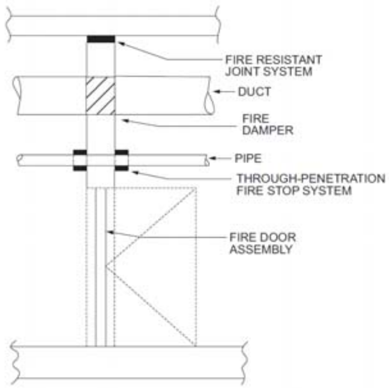
Section 707 – Fire Barriers



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Section 708 – Fire Partitions

It is limited in scope to the following required locations:

- Walls separating dwelling units from each other (Section 420.2).
- Walls separating sleeping units from each other (Section 420.2).
- Walls separating dwelling units and sleeping units from other occupancies in the same building (Section 420.2).
- Walls separating tenant spaces in covered and open mall buildings (Section 402.4.2.1).
- Corridor walls required to be fire-resistance rated (Section 1020.1).
- Elevator lobby separations (Section 3006.2).
- Egress balconies (Section 1021.2)

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Section 709 – Smoke Barriers

Smoke barriers are required at, intended for, or are a design option for the following:

- Compartmentation of underground buildings (Section 405.4).
- Compartmentation of Group I-2 (Section 407.5).
- Compartmentation of Group I-3 (Section 408.6).
- Compartmentation of Group I-1, Condition 2 (Section 420.6).
- Compartmentation of ambulatory care facilities (Section 422.3).
- Smoke control systems (Section 909.5).
- Areas of refuge (Section 1009.6.4).
- Fire service access elevator lobbies (Section 3007.6.2).
- Occupant evacuation elevator lobbies (Section 3008.6.2).

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Section 710 – Smoke Partitions

- The provisions of Section 710 are only applicable where other sections of the IBC specifically mandate the use of smoke partitions:
  - Section 407.3 addressing corridor walls in Group I-2 occupancies
  - Section 3006.3, Exception 2 dealing with elevator lobbies
- Smoke partitions are not required to have a fire-resistance rating unless required by some other provision of the code. Smoke partitions must be capable of resisting the passage of smoke.

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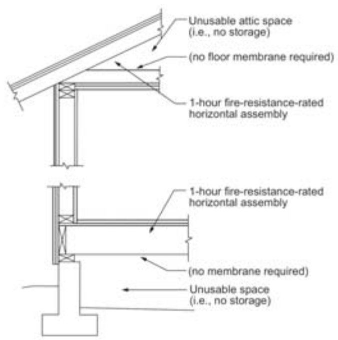
Section 711 – Horizontal Assemblies



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712 – Vertical Openings

A summary of the acceptable applications listed in Section 712 are:

- Openings contained entirely within a shaft enclosure complying with Section 713.
- Openings totally within an individual residential dwelling unit where connecting four stories or less.
- Escalator openings if protected appropriately and the building is provided with an automatic sprinkler system.
- Penetrations by pipes, tubes, conduits, etc., protected in accordance with Section 714.
- Joints protected in accordance with Section 715.
- Openings for ramps, elevators and mechanical exhaust or supply ducts, in parking garages.
- Penetrations by ducts protected in accordance with Section 717.6.

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Section 712 – Vertical Openings

A partial summary of the acceptable applications listed in Section 712 are:

- Shaft enclosures complying with Section 713.
- Penetrations by grease ducts protected in accordance with the IMC.
- Atriums complying with Section 404 (other than Group H).
- Floor openings connecting only two stories (with limitations).
- Automobile ramps in parking garages constructed in accordance with Section 406.5 or 406.6.
- Floor openings between a mezzanine and the floor below.
- Openings at exit access stairways and ramps in accordance with Section 1019.
- Horizontal fire door assemblies and access doors where tested and labeled.

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Section 713 – Shaft Enclosures

- Shaft enclosures are one of the multiple applications set forth in Section 712.1 to address openings and penetrations that occur in floor/ceiling and roof/ceiling assemblies of multistory buildings.
- Such enclosures are to be constructed through the use of fire barriers, or horizontal assemblies, or both.

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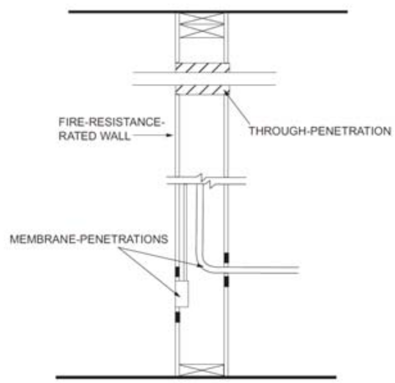
Section 714 – Penetrations

- Membrane penetration firestop systems are generally not tested, instead they consist of the portions of through-penetration firestop systems required to protect a penetration on only one side of an assembly.



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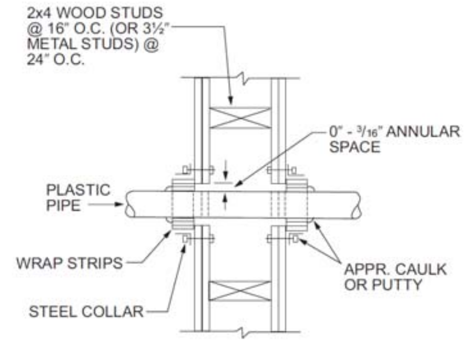
Section 714 – Penetrations



For SI: 1 inch = 25.4 mm.

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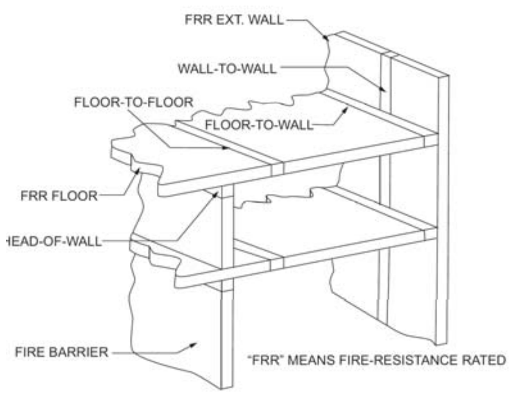
Section 715 – Joint Systems



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Section 716 – Opening Protectives

- Where opening protectives (fire doors, fire shutters and fire windows) are mandated by other provisions of the IBC, the provisions of Section 716 are applicable.
- As an option, fire-resistance-rated glazing tested as part of a wall assembly in accordance with ASTM E119 or UL 263 is permitted in fire windows and fire doors in accordance with their listings and not required to meet the provisions of Section 716.

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REFER TO CODE BOOK

Table 716.1(2) – Fire Door and Fire Shutter Assemblies

2018 IBC
Table 716.1(2)
Pages 146-147

TABLE 716.1(2)—continued
OPENING FIRE PROTECTION ASSEMBLIES, RATINGS AND MARKINGS

TYPE OF ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)	DOOR VISION PANEL SIZE[d]	FIRE-RATED GLAZING MARKING DOOR VISION PANEL[b, c]	MINIMUM SIDELIGHT/TRANSOM ASSEMBLY RATING (hours)		FIRE-RATED GLAZING MARKING SIDELIGHT/TRANSOM PANEL	
					Fire protection	Fire resistance	Fire protection	Fire resistance
Exterior walls	3	$1\frac{1}{2}$	100 sq. in.[a]	≤ 100 sq. in. = D-H-90 > 100 sq. in = D-H-W-90	Not Permitted	3	Not Permitted	W-180
	2	$1\frac{1}{2}$	Maximum size tested	D-H 90 or D-H-W-90	$1\frac{1}{2}$	2	D-H-OH-90	W-120
					Fire protection			
	1	$\frac{3}{4}$	Maximum size tested	D-H-45	$\frac{3}{4}$		D-H-45	
					Fire protection			
Smoke barriers	1	$\frac{1}{3}$	Maximum size tested	D-20	$\frac{3}{4}$		D-H-OH-45	

For SI: 1 square inch = 645.2 mm.
a. Two doors, each with a fire protection rating of $1\frac{1}{2}$ hours, installed on opposite sides of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one 3-hour fire door.
b. Fire-resistance-rated glazing tested to ASTM E119 in accordance with Section 716.1.2.3 shall be permitted, in the maximum size tested.
c. Under the column heading "Fire-rated glazing marking door vision panel," W refers to the fire-resistance rating of the glazing, not the frame.
d. See Section 716.2.5.1.2.1.
e. See Section 716.1.2.2.1 and Table 716.1(1) for additional permitted markings.

IBC

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REFER TO CODE BOOK

Table 716.1(3) – Fire-protection-rated Glazing

2018 IBC
Table 716.1(3)
Page 150

TABLE 716.1(3)
FIRE WINDOW ASSEMBLY FIRE PROTECTION RATINGS

TYPE OF WALL ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE WINDOW ASSEMBLY RATING (hours)	FIRE-RATED GLAZING MARKING
Interior walls			
Fire walls	All	NP[a]	W-XXX[b]
Fire barriers	>1 1	NP[a] NP[a]	W-XXX[b] W-XXX[b]
Atrium separations (Section 707.3.6), Incidental use areas (Section 707.3.7), Mixed occupancy separations (Section 707.3.9)	1	$\frac{3}{4}$	OH-45 or W-60
Fire partitions	1 0.5	$\frac{3}{4}$ $\frac{1}{3}$	OH-45 or W-60 OH-20 or W-30
Smoke barriers	1	$\frac{3}{4}$	OH-45 or W-60
Exterior walls	>1 1 0.5	$1\frac{1}{2}$ $\frac{3}{4}$ $\frac{1}{3}$	OH-90 or W-XXX[b] OH-45 or W-60 OH-20 or W-30
Party wall	All	NP	Not Applicable

NP = Not Permitted.
a. Not permitted except fire-resistance-rated glazing assemblies tested to ASTM E119 or UL 263, as specified in Section 716.1.2.3.
b. XXX = The fire rating duration period in minutes, which shall be equal to the fire-resistance rating required for the wall assembly.

IBC

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REFER TO CODE BOOK

Section 717 – Ducts and Air Transfer Openings

2018 IBC
Table 717.3.2.1
Page 151

TABLE 717.3.2.1
FIRE DAMPER RATING

TYPE OF PENETRATION	MINIMUM DAMPER RATING (hours)
Less than 3-hour fire-resistance-rated assemblies	1.5
3-hour or greater fire-resistance-rated assemblies	3

IBC

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ACTIVITY

Fire-resistance-rated construction

Wall assembly		Fire door assembly
D	1-hour interior exit stairway	A. No rating required
F	3-hour fire wall	B. 20 minutes
C	1-hour occupancy separation	C. 45 minutes
E	2-hour fire area separation	D. 1 hour
A	Smoke partition	E. 1 1/2 hours
B	Smoke barrier	F. 3 hours

IBC

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Module 7

Chapter 8 – Interior Finishes

137

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Section 803 – Wall and Ceiling Finishes

Wall and ceiling finishes have limits on flame spread and smoke development, except for:

- Materials less than 0.036-inches thick (0.914 mm) applied directly to the surface of walls or ceilings (Sec. 803.2)
- Exposed portions of heavy timber members, except in interior exit stairways and exit passageways (Sec. 803.3)
- Floor finishes having a limited critical radiant flux (Sec. 804)
- Trim and decorative materials that are regulated for flame resistance (Section 806).

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Section 803 – Wall and Ceiling Finishes

Wall and ceiling finishes are to be classified for fire performance and smoke development per:

- NFPA 286, which is considered to meet the Class A requirements (Sec. 803.1.1), or
- ASTM E84 or UL 723, which groups finishes into Class A, B and C classes (Sec. 803.1.2)
- Additional criteria for special conditions (Sec. 803.1.3 through 803.15, including provisions addressing:
  - Textile wall and ceiling coverings
  - Expanded vinyl wall and ceiling coverings
  - Site-fabricated stretch systems
  - Laminated products, facings and wood veneers

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Section 803.13 – Interior Finish Requirements Based on Groups

Table 803.11 specifies the minimum required classification for wall and ceiling finishes based on occupancy classification and automatic sprinkler protection for the following locations:

- Interior exit stairways, interior exit ramps and exit passageways,
- Corridors and enclosure for exit access stairways, or
- Rooms and enclosed spaces (i.e., not included in the first two items).

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Section 803.13 – Interior Finish Requirements Based on Groups

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		

(Footnotes a through m not shown)

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Section 804 – Interior Floor Finish Requirements

- Fibrous interior floor finishes in enclosures for stairways, exit passageways, corridors and rooms not separated from corridors by full-height partitions must also meet the following minimum classifications:
  - Class I for Groups I-1, I-2 and I-3 in a nonsprinklered building.
  - Class II for Groups I-1, I-2 and I-3 in a fully sprinklered building.
  - Class II for Groups A, B, E, H, I-4, M, R-1, R-2 and S in a nonsprinklered building.

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Module 8

Chapter 9 – Fire Protection and Life Safety Systems

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General Requirements for Fire Protection Systems

- Fire protection systems are to be installed, repaired, operated and maintained in accordance with the IBC and the IFC.
- Systems not required by the IBC are permitted to be installed for partial or complete protection, provided such systems meet the requirements of the IBC.
- Any system for which an exception to, or reduction in, the provisions of the IBC has been granted must be considered a required system.
- No person is permitted to remove or modify any system without the approval of the building official.
- All systems must be tested in accordance with the requirements of the IBC and IFC in the presence of the building official and at the expense of the owner or owner's representative.
- It is unlawful to occupy portions of a structure until the required fire protection systems within that portion have been tested and approved.

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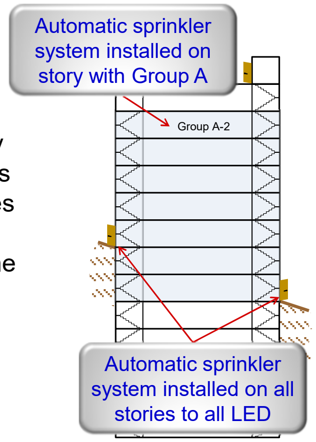
Fire Sprinklers in Group A

- Where fire sprinklers are required in a Group A occupancy located on a story other than LED, fire sprinklers must be installed on all stories leading to all levels of exit discharge that are used by the Group A occupancy



§903.2.1.1, 903.2.1.2, 903.2.1.3, 903.2.1.4.

145

Group A-1 §903.2.1.1

- Fire sprinklers required and throughout all stories from the Group A-1 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exists:
  - Fire area >12,000 ft²
  - Fire area has an OL ≥300
  - Fire area is located on a level other than LED
  - Fire area contains a multitheater complex

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Group A-2 §903.2.1.2

- Fire sprinklers required and throughout all stories from the Group A-2 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exists:
  - Fire area >5,000 ft²
  - Fire area has an OL ≥100
  - Fire area is located on a level other than LED

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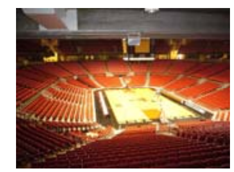
Group A-3 & A-4 §903.2.1.3, §903.2.1.4



- Fire sprinklers required and throughout all stories from the Group A-3, A-4 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exist:
  - Fire area >12,000 ft²
  - Fire area has OL ≥300
  - Fire area is located on a level other than LED

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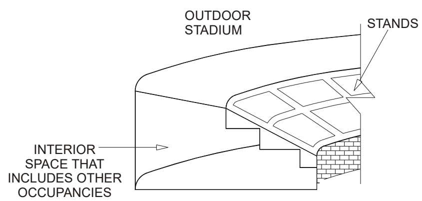
Group A-5 §903.2.1.5

- Fire sprinklers required in the following areas in excess of 1,000 ft² that are accessory to stadiums or arenas:
  - Concession areas
  - Retail areas
  - Press boxes



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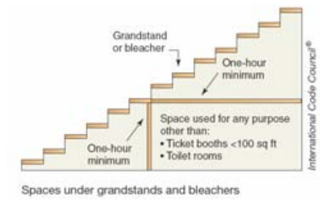
Group A-5 §903.2.1.5.1

- **903.2.1.5.1 Spaces under grandstands or bleachers.**
- Enclosed spaces under *grandstands* or *bleachers* shall be equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1 where either of the following exist:
- 1. The enclosed area is 1,000 square feet (93 m2) or less and is not constructed in accordance with Section 1029.1.1.1.
- 2. The enclosed area exceeds 1,000 square feet (93 m2).



Spaces under grandstands and bleachers

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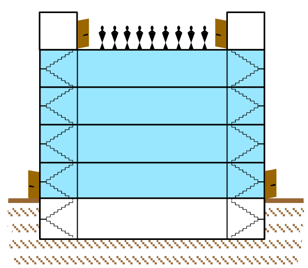
Assembly Occupancies on Roofs §903.2.1.6

- Fire sprinklers are required on all floors between an occupied roof and the LED discharge where assembly uses occur on the rooftop and:
  - OL >100 for Group A-2, or
  - OL >300 for other Group A occupancies



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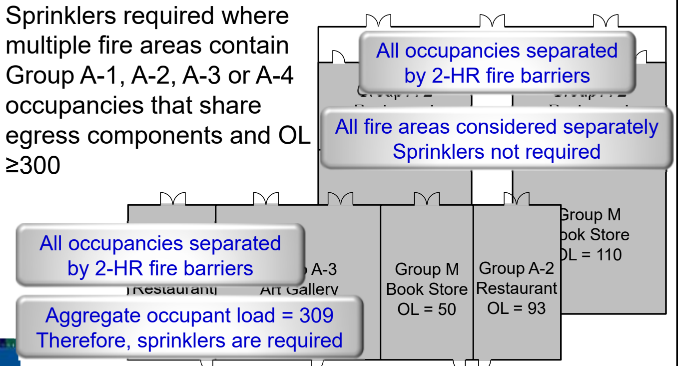
Multiple Group A Fire Areas §903.2.1.7

- Sprinklers required where multiple fire areas contain Group A-1, A-3 or A-4 occupancies that share egress components and OL ≥300



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Ambulatory Care Facilities §903.2.2

- Fire sprinklers required on floors with a Group B Ambulatory Care Facility when:
  - ≥4 care recipients incapable of self-preservation
  - ≥1 care recipients incapable of self-preservation on a floor other than LED

§903.3.2 requires the installation of QR or residential sprinklers throughout smoke compartments containing treatment rooms

How do you determine the number of care recipients?

Count the beds

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Ambulatory Care Facilities §903.2.2

- In buildings where ambulatory care is provided on levels other than the *level of exit discharge*, an *automatic sprinkler system* shall be installed throughout the entire floor as well as all floors below where such care is provided, and all floors between the level of ambulatory care and the nearest *level of exit discharge*, the *level of exit* discharge, and all floors below the *level of exit discharge*.
- **Exception:** Floors classified as an open parking garage are not required to be sprinklered.

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Group E §903.2.3

- Fire sprinklers required in the occupancy when one of the following conditions exist:
  1. Fire area >12,000 ft²
  2. All portions below LED
     - Sprinklers ***not*** required in areas below LED where each classroom has at least one exterior exit door at ground level
  3. The Group E fire area has an occupant load of ≥300

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Group F-1 §903.2.4

- Fire sprinklers required throughout the building where one of the following conditions exist:
  - Fire area >12,000 ft²
  - Fire area is >3 stories above grade
  - Aggregate fire areas >24,000 ft²
  - Used for manufacture of upholstered furniture or mattresses >2,500 ft²

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Woodworking Operations §903.2.4.1

- Fire sprinklers required throughout the building where ***both*** of the following conditions exist:
  - Fire area >2,500 ft²
  - The process generates finely divided waste or uses finely divided combustible materials

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Group H §903.2.5

- Fire sprinklers required in all Group H occupancies
- §5004.5 requires systems to meet Ordinary Hazard Group 2 criteria, at minimum with 3,000 ft² design area
  - 0.17 gpm/ft²
  - Many materials require more water

- Flammable & combustible liquids
- Flammable & pyrophoric gases
- Level 2 & 3 aerosols
- Organic peroxides
- Oxidizers

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Group H-5 §903.2.5.2

- Fire sprinklers required throughout the building
- IFC Table 903.2.5.2 establishes minimum design criteria for automatic sprinklers based on the location in the building

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Group I §903.2.6

- Fire sprinklers required throughout the building
- §903.2.6 allows the installation of NFPA 13R systems in Group I-1 Condition 1
- §903.3.2 requires the installation of QR or residential sprinklers in:
  - All areas of smoke compartments containing care recipient sleeping units in Group I-2
  - Sleeping units in Group I-1

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Group M
§903.2.7

- Fire sprinklers required throughout the building where one of the following conditions exist:
  - Fire area >12,000 ft²
  - Fire area >3 stories above grade
  - Aggregate fire areas >24,000 ft²
  - Used for display and sale of upholstered furniture or mattresses >5,000 ft²

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Group R
§903.2.8

- Fire sprinklers required throughout the building for all Group I occupancies
- NFPA 13D systems in Group R-3, R-4 Condition 1 and care facilities with ≤5 clients
- NFPA 13R systems in Group R-4 Condition 2
- §903.3.2 requires the installation of QR or residenti... and sleeping...

1- & 2-family dwellings and townhomes built under the IRC are sprinklered in accordance with the IRC or NFPA 13D

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Pedestal/Podium Construction
IBC §510.4

- Group R occupancies with parking beneath
- Depending on the construction and the building's height and area, the design of the sprinkler system may be based on NFPA 13, 13R or a combination of NFPA 13 and 13R

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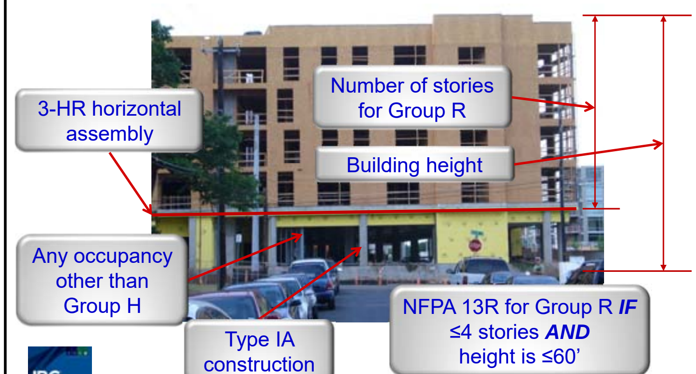
Pedestal/Podium Construction



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Pedestal/Podium Construction

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Group S-1 §903.2.9

- Fire sprinklers required throughout the building where one of the following conditions exist:
  - Fire area >12,000 ft²
  - Fire area is >3 stories above grade
  - Aggregate fire areas >24,000 ft²
  - Used for storage of upholstered furniture or mattresses >2,500 ft²
  - The storage of commercial trucks or buses when the fire area is >5,000 ft²

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Group S-1 Repair Garages §903.2.9.1

- Fire sprinklers required throughout the building when one of the following conditions exist:
  - Building is 1 story ***and*** fire area >12,000 ft²
  - Building is ≥ 2 stories ***and*** fire area >10,000 ft²
  - Repair garage is located in a basement
  - Repair garage for commercial trucks or buses and the fire area is >5,000 ft²

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Group S-1 Storage of Tires §903.2.9.2

- Fire sprinklers required when:
  - Fire area >20,000 cubic feet

Would this be considered high-piled combustible storage?

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Group S-2 Enclosed Parking Garage §903.2.10

- Fire sprinklers required when :
  - Fire area >12,000 ft²
  - Parking garage is located beneath another occupancy

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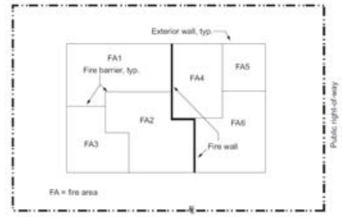
Section 901.7 – Fire Areas



Building Area No. 1 = FA1 + FA2 + FA3
Building Area No. 2 = FA4 + FA5 + FA6

TABLE 707.3.10
FIRE-RESISTANCE RATING REQUIREMENTS FOR FIRE BARRIERS, FIRE WALLS OR HORIZONTAL ASSEMBLIES BETWEEN FIRE AREAS

OCCUPANCY GROUP	FIRE-RESISTANCE RATING (hours)
H-1, H-2	4
F-1, H-3, S-1	3
A, B, E, F-2, H-4, H-5, I, M, R, S-2	2
U	1

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Section 903 – Automatic Sprinkler Systems

An automatic sprinkler system is required throughout all buildings containing the following occupancies:

- Group H-5
- Group I
- Group R

An automatic sprinkler system is required throughout the occupancy for the following occupancies:

- Groups H-1, H-2, H-3 and H-4

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Section 903 – Automatic Sprinkler Systems

An automatic sprinkler system is required throughout all buildings, containing the following occupancies:

- Groups F-1, M and S-1
  - Also required to and including the level of exit discharge
  - Required where:
    - Fire area exceeds 12,000 square feet, or
    - Combined area of all fire areas on all floors exceeds 24,000 square feet, or
    - Fire area located more than three stories above grade plane

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Section 903 – Automatic Sprinkler Systems

An automatic sprinkler system is required throughout all stories, containing the following occupancies:

- Groups A-1, A-2, A-3 and A-4
  - Also required to and including the level of exit discharge
  - Required where:
    - Fire area exceeds 12,000 square feet, or
    - Fire area has an occupant load of 300 or more (100 or more in Group A-2), or
    - Fire area located on a floor other than the level of exit discharge.

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Section 903 – Automatic Sprinkler Systems

An automatic sprinkler system is required throughout all fire areas, containing the following occupancy:

- Groups E
  - Required where:
    - Fire area exceeds 12,000 square feet, or
    - Fire area has an occupant load of 300 or more, or
    - Fire area located on a floor other than the level of exit discharge.

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Section 903 – Automatic Sprinkler Systems

An automatic sprinkler system is required:

- Group A-5: all enclosed accessory use areas exceeding 1,000 square feet
- Group B: ambulatory care facilities where:
  - Four or more care recipients incapable of self-preservation
  - One or more care recipients incapable of self-preservation are located at other than the level of exit discharge
- In numerous other applications, such as:
  - Assembly occupancies on roofs
  - High-piled storage areas
  - Repair garages
  - Enclosed parking garages

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Application Matrix of the NFPA Sprinkler Standards

NFPA Standard Design Consideration	NFPA Sprinkler Standard		
	NFPA 13	NFPA 13R	NFPA 13D (IRC P2904)
Extent of Protection	Throughout the building (IFC Section 903.3.1.1)	Occupied spaces (IFC Section 903.3.1.2)	Occupied spaces (IFC Section 903.3.1.3)
Design Intent	Life safety and property protection	Life safety	Life safety
Applicability	All IBC and NFPA occupancies	Group R occupancies to 4 stories	One- and two- family Dwellings and townhomes
Design Methods	Pipe schedule; control mode— discharge density/ design area; control mode— specific application; suppression mode	4-sprinklers/ compartments	2-sprinklers/ compartment (Designs using IRC P2904 are prescriptive)
Sprinklers	All listed and approved types	Listed residential	Listed residential
Minimum H_2O Supply Duration	30 to 120 minutes, depending on the design	30 minutes	10 minutes

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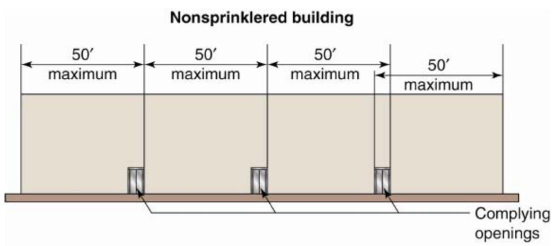
Section 903.2.11.1 – Automatic Sprinkler Systems



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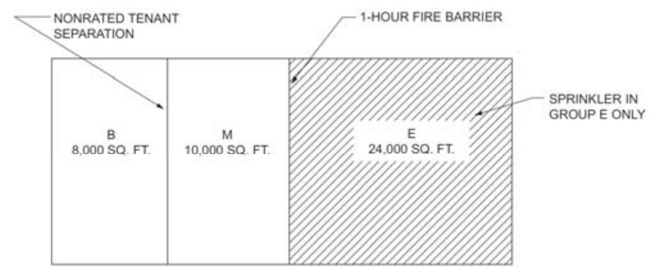
1. Fire Area Activity

ACTIVITY



For SI: 1 square foot = 0.0929 m^2.

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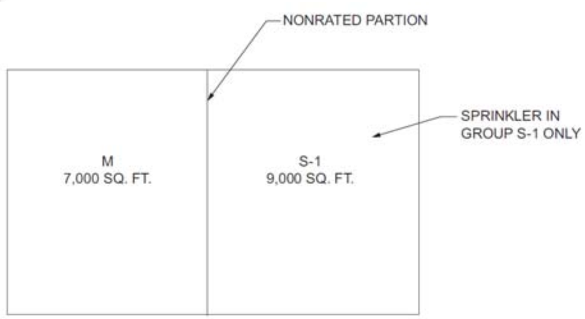
2. Fire Area Activity

ACTIVITY



For SI: 1 square foot = 0.0929 m^2.

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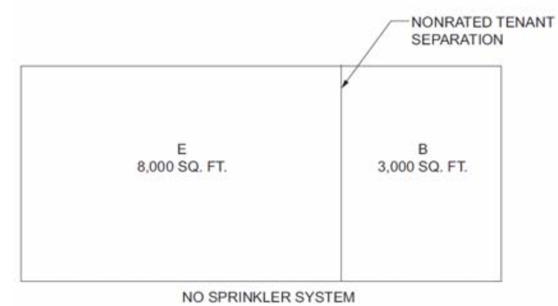
3. Fire Area Activity

ACTIVITY



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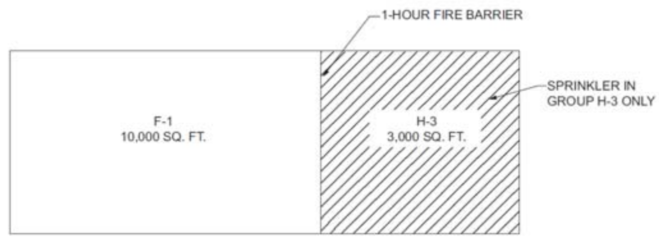
4. Fire Area Activity



For SI: 1 square foot = 0.0929m².

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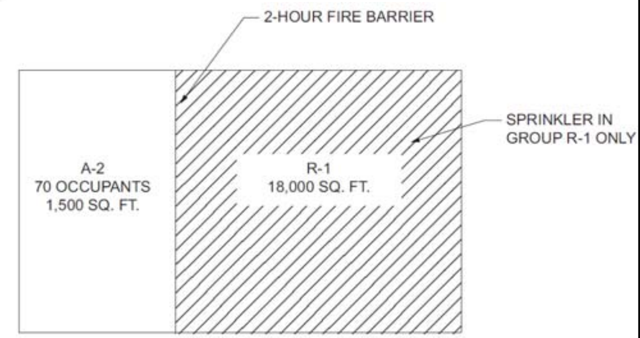
5. Fire Area Activity



For SI: 1 square foot = 0.0929m².

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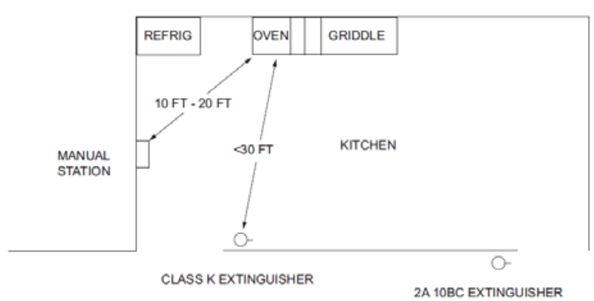
Section 904 – Alternative Automatic Fire-extinguishing Systems



For SI: 1 foot = 304.8 mm.

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Section 905 – Standpipe Systems

- There are 3 classes of standpipes:
  - Class I – 2½ -inch connections
  - Class II – 1½-inch connections
  - Class III – Both 1½-inch and 2½-inch connections

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REQUIRED STANDPIPE INSTALLATIONS		
LOCATION OR USE	NONSPRINKLERED BUILDING	SPRINKLERED BUILDING
Building of 4 or more stories or where highest story located more than 30 feet above LLFDVA	Class III [1,2,3,6]	Class I
Building of 4 or more stories or where lowest story located more than 30 feet above HLFDVA	Class III [1,2,3,6]	Class I
Group A occupancies with occupant load exceeding 1,000.	Class I[4]	No requirement
Covered mall buildings.		Class I
Stages more than 1,000 square feet (93 m^2).	Class III	Class III[5]
Underground buildings.		Class I

1. Class I standpipes permitted in basements equipped with automatic sprinkler system.
2. Class I manual dry standpipes permitted in open parking garages subject to freezing temperatures, provided hose connections located as for Class II systems.
3. Class I manual standpipes permitted in open parking garages where highest floor is less than 150 feet (45 720 mm) above the lowest level of fire department vehicle access.
4. Not required in open-air seating spaces without enclosed spaces.
5. Hose connections permitted to be supplied by sprinkler system.
6. Class I standpipes permitted in Group B and E occupancies, and where occupant-use hose lines will not be utilized by trained personnel or the fire department.

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Section 906 – Fire Extinguishers

CLASSIFICATION	TYPE OF FIRE
Class A	Fires involving ordinary combustibles such as paper, cloth, etc.
Class B	Fires involving combustible or flammable liquids and gases.
Class C	Fires involving energized electrical equipment—the extinguishing agent must be nonconductive.
Class D	Fires involving combustible metals such as titanium, magnesium.
Class K	Fires involving deep fat fryers.

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Section 907 – Fire Alarm and Detection Systems

OCCUPANCY	CONDITIONS	SYSTEM TYPE	EXCEPTIONS	SECTIONS
A	Occupant load $\geq$ 300, or > 100 above or below discharge level	Manual fire alarm system	1	907.2.1
	Occupant load $\geq$ 1,000	Emergency voice/alarm communications (EV/AC) system	2	907.2.1.1
B	Occupant load $\geq$ 500, or > 100 above or below discharge level	Manual fire alarm system	1	907.2.2
	Ambulatory care facilities	Electronically supervised automatic smoke detection system	15	907.2.2.1

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Section 907 – Fire Alarm and Detection Systems

OCCUPANCY	CONDITIONS	SYSTEM TYPE	EXCEPTIONS	SECTIONS
E	Occupant load > 50	Manual fire alarm system	1, 3	907.2.3
	Occupant load > 100	EV/AC system	None	
F	Two or more stories, and $\geq$ 500 above or below discharge level	Manual fire alarm system	1	907.2.4
H	H-5 and where organic coatings are manufactured	Manual fire alarm system	None	907.2.5
	Highly toxic gases, organic peroxides and oxidizers	Automatic smoke detection system		

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Section 907 – Fire Alarm and Detection Systems

OCCUPANCY	CONDITIONS	SYSTEM TYPE	EXCEPTIONS	SECTIONS
I	All Group I occupancies	Manual fire alarm system Automatic smoke detection system	4, 5	907.2.6
	Corridors in Group I-2 Condition 1 facilities and spaces open to corridors	Automatic smoke detection system	6	907.2.6.2
	Group I-3 occupancies	Manual fire alarm system	7	907.2.6.3
		Automatic smoke detection systems	8	907.2.6.3.3

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Section 907 – Fire Alarm and Detection Systems

M	Occupant load ≥ 500, or 100 above or below discharge level	Manual fire alarm system	1, 9	907.2.7
R	Group R-1	Manual fire alarm system	10, 11	907.2.8.1
		Automatic detection system	12	907.2.8.2
	Group R-2 with: 1. Any unit ≥ three stories above lowest discharge level, or 2. Any unit > one story below highest discharge level, or 3. > 16 dwelling units	Manual fire alarm system	1, 10, 12	907.2.9
	Group R-2 college and university buildings	Automatic smoke detection system	12	907.2.9.3

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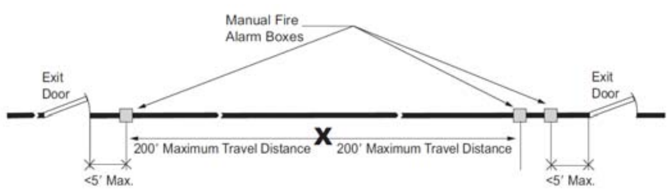
Section 907 – Fire Alarm and Detection Systems



For SI: 1 feet = 304.8 mm.

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Section 910 – Smoke and Heat Removal

- Approved smoke and heat vents or mechanical smoke removal system must be installed in roofs of one-story buildings, or portions thereof, occupied for the following uses:
  - Group F-1 or S-1 having more than 50,000 square feet (4645 m^2) in undivided area (exceptions for aircraft repair hangars, sprinklered frozen-food warehouses and areas of buildings equipped with early suppression, fast response (ESFR) sprinklers).
  - Any occupancy containing high-piled combustible stock or rack storage in accordance with Section 413 and the IFC.

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Section 911 – Fire Command Center

- Fire department communications unit.
- Fire detection and alarm system annunciator unit.
- Status indicators and controls for air-handling systems.
- Controls for unlocking stairway doors simultaneously.
- Emergency and standby power status indicators.

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Section 911 – Fire Command Center

- Fire pump status indicators.
- Schematic building plans.
- Manual start and transfer features.
- Elevator fire recall switch.
- Approved "Building Card Information"

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Module 9

Chapter 10 – Means of Egress

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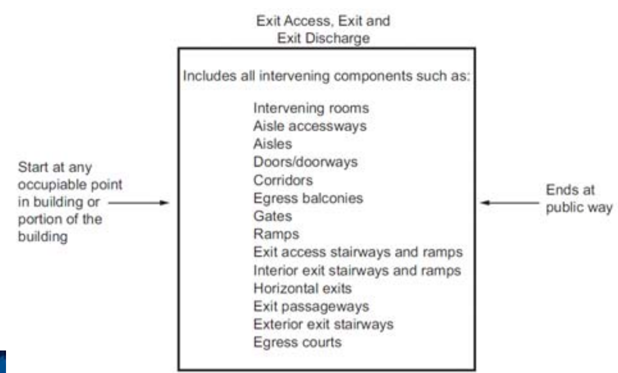
Chapter 10 – Means of Egress



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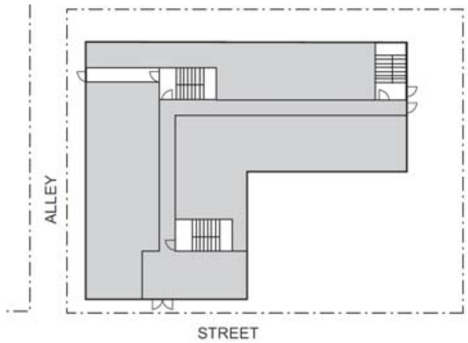
Exit Access



Shaded Area = Exit Access

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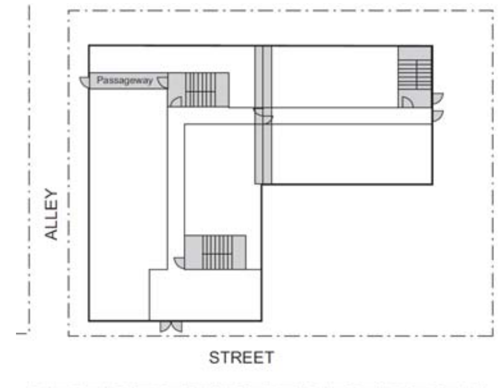
Exit



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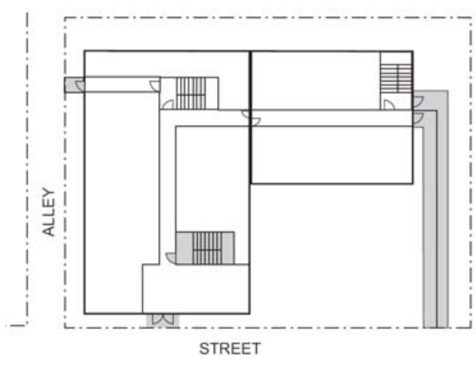
Exit Discharge



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ACTIVITY

Three-part means of egress systems

1. Interior exit stairway ___E___
2. Aisle accessway ___EA___
3. Egress court ___ED___
4. Fire-resistance-rated corridor ___EA___
5. Aisle ___EA___
6. Exit passageway ___E___
7. Exterior exit stairway ___E___
8. Intervening room ___EA___
9. Egress balcony ___EA___
10. Nonrated corridor ___EA___
11. Interior unenclosed stairway ___E___
12. Exterior exit door at grade ___E___
13. Horizontal exit ___E___

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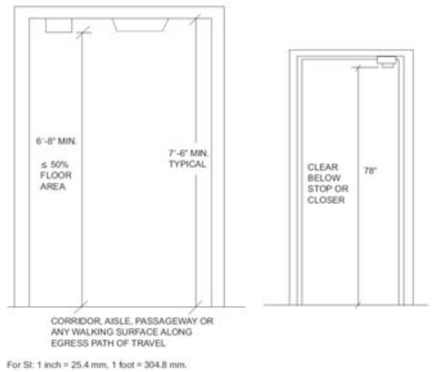
Section 1003 - General Means of Egress



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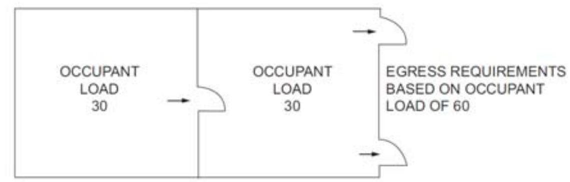
Section 1004.2 - Cumulative Occupant Loads



- Mezzanine occupant load to be added to room area or space below
- Occupant load from adjacent stories not to be added

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Section 1004.5 – Occupant Loads for Areas w/o Fixed Seating

TABLE 1004.5
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR[a]
Accessory storage areas, mechanical equipment room	300 gross
Agricultural building	300 gross
Aircraft hangars	500 gross
Airport terminal Baggage claim Baggage handling Concourse Waiting areas	 20 gross 300 gross 100 gross 15 gross
Assembly Gaming floors (keno, slots, etc.) Exhibit gallery and museum	 11 gross 30 net
Assembly with fixed seats	See Section 1004.6
Assembly without fixed seats Concentrated (chairs only—not fixed) Standing space Unconcentrated (tables and chairs)	 7 net 5 net 15 net
Bowling centers, allow 5 persons for each lane including 15 feet of runway, and for additional areas	7 net
Business areas Concentrated business use areas	150 gross See Section 1004.8
Courtrooms—other than fixed seating areas	40 net
Day care	35 net
Dormitories	50 gross
Educational Classroom area Shops and other vocational room areas	 20 net 50 net
Exercise rooms	50 gross
Group H-5 fabrication and manufacturing areas	200 gross
Industrial areas	100 gross
Institutional areas Inpatient treatment areas Outpatient areas Sleeping areas	 240 gross 100 gross 120 gross
Kitchens, commercial	200 gross
Library Reading rooms Stack area	 50 net 100 gross
Locker rooms	50 gross
Mall buildings—covered and open	See Section 402.8.2
Mercantile Storage, stock, shipping areas	60 gross 300 gross
Parking garages	200 gross
Residential	200 gross
Skating rinks, swimming pools Rink and pool Decks	 50 gross 15 gross
Stages and platforms	15 net
Warehouses	500 gross

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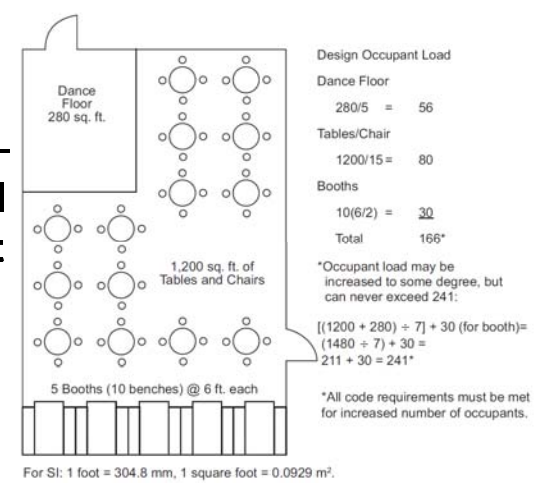
FOR EXAMPLE

1004.5.1 – Increased Occupant Load



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Section 1005.3 – Means of Egress Required Capacity

- The total width of the means of egress in inches (mm) must not be less than the total occupant load served by the means of egress multiplied by:
  - 0.3 inches (7.62 mm) per occupant for stairways (0.2 inches with sprinkler and EV/AC systems), and
  - 0.2 inches (5.08 mm) per occupant for other egress components (0.15 inches with sprinkler and EV/AC systems).

Occupant Load Served x Factor from Section 1005.3 = Minimum Available Width

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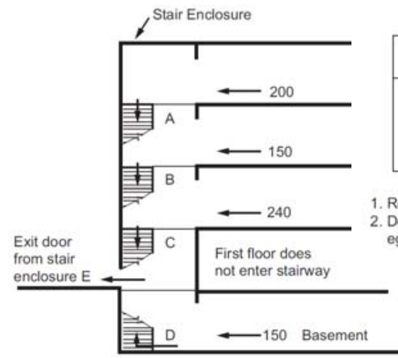
Exiting from Multiple Stories



Exit Element	Occupant Load Served	Required Width
Stair-Point A	200	60"
Stair-Point B	150	60"[1]
Stair-Point C	240	72"
Stair-Point D	150	45"
Door-Point E	390[2]	78"

1. Required width from above must be maintained
2. Door at point E serves occupants from C and D egress convergence per Section 1005.6

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Occupant Load

ACTIVITY

1. What is the occupant load for a place of worship seating area having 40 pews, each pew being 18 feet (5486 mm) in length?

18'/1.5' = 12 x 24 = 288 occupants
(Section 1004.6)

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Occupant Load

ACTIVITY

2. What is the minimum required egress width for a one-story sprinklered Group M occupancy having an occupant load of 878?

Without EV/AC system; Group M;
878 (0.2) = 175.6 inches (4460 mm)
With EV/AC system: Group M:
878 (0.15) = 131.7 inches (3345 mm)

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Occupant Load

3. What is the total required exit stairway width for a second floor office space having an occupant load of 330 in a nonsprinklered building?

Nonsprinklered; Group B;
330 (0.3) = 99.0 inches (2515 mm)

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Occupant Load

4. Determine the design occupant load:
   a. 32,000-square-foot (2973 m^2) factory
   32,000/100 = 320 occupants
   b. 2,400-square-foot (112 m^2) sales room (grade floor)
   2,400/30 = 40 occupants
   c. 1,200-square-foot (112 m^2) apartment unit
   1,200/200 = 6 occupants

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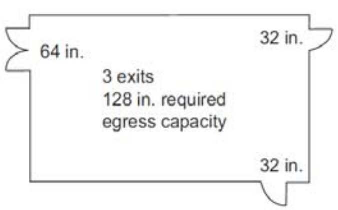
Section 1005.5 - Distribution of Egress Capacity



OK
The loss of any single exit will not result in less than ½ of the required capacity or width remaining

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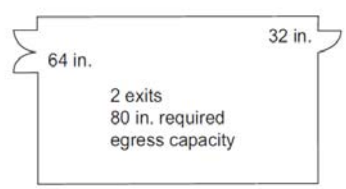
Section 1005.5 - Distribution of Egress Capacity



Not Permitted
Loss of single exit could result in less than ½ of the required capacity or width remaining

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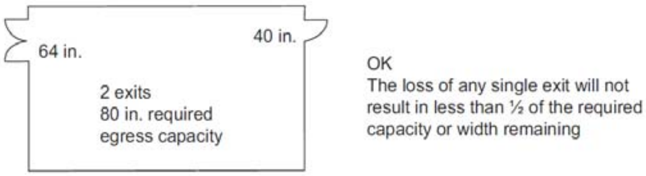
Section 1005.5 - Distribution of Egress Capacity



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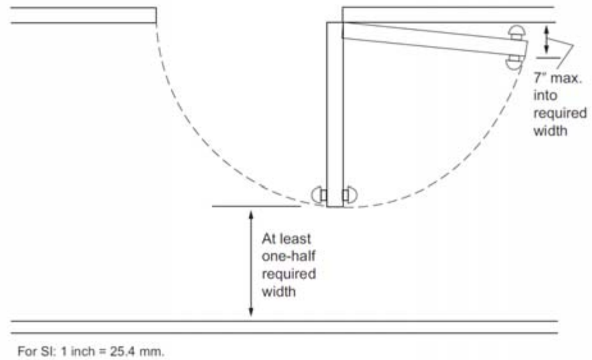
Section 1005.7.1 – Door Encroachment



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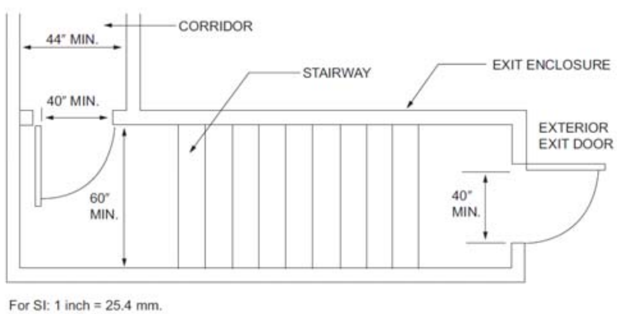
Application Example



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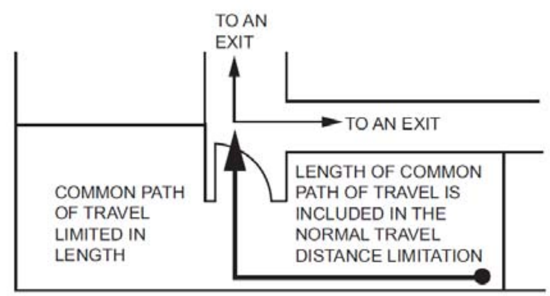
Section 202 – Common Path of Egress Travel



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REFER TO CODE BOOK

2018 IBC Table 1006.2.1 Page 262

1006.2.1 – Spaces with One Exit or Exit Access Doorway

TABLE 1006.2.1
SPACES WITH ONE EXIT OR EXIT ACCESS DOORWAY

OCCUPANCY	MAXIMUM OCCUPANT LOAD OF SPACE	MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE (feet)		
		Without Sprinkler System (feet) Occupant Load		With Sprinkler System (feet)
		OL ≤ 30	OL > 30	
A[c], E, M	49	75	75	75[a]
B	49	100	75	100[a]
F	49	75	75	100[a]
H-1, H-2, H-3	3	NP	NP	25[b]
H-4, H-5	10	NP	NP	75[b]
I-1, I-2[d], I-4	10	NP	NP	75[a]
I-3	10	NP	NP	100[a]
R-1	10	NP	NP	75[a]
R-2	20	NP	NP	125[a]
R-3[e]	20	NP	NP	125[a, g]
R-4[e]	20	NP	NP	125[a, g]
S[f]	29	100	75	100[a]
U	49	100	75	75[a]

For SI: 1 foot = 304.8 mm.
NP = Not Permitted.
a. Buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2. See Section 903 for occupancies where *automatic sprinkler systems* are permitted in accordance with Section 903.3.1.2.
b. Group H occupancies equipped throughout with an *automatic sprinkler system* in accordance with Section 903.2.5.
c. For a room or space used for assembly purposes having *fixed seating*, see Section 1029.8.
d. For the travel distance limitations in Group I-2, see Section 407.4.
e. The *common path of egress travel* distance shall only apply in a Group R-3 occupancy located in a mixed occupancy building.
f. The length of *common path of egress travel* distance in a Group S-2 *open parking garage* shall be not more than 100 feet.
g. For the travel distance limitations in Groups R-3 and R-4 equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.3, see Section 1006.2.2.6.

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Table 1006.3.3(1) – Stories with One Exit or Access to One Exit for Group R-2 Occupancies

TABLE 1006.3.3(1)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2 OCCUPANCIES

STORY	OCCUPANCY	MAXIMUM NUMBER OF DWELLING UNITS	MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE
Basement, first, second or third story above grade plane	R-2[a, b]	4 dwelling units	125 feet
Fourth story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 3048 mm.
NP = Not Permitted.
NA = Not Applicable.
a. Buildings classified as Group R-2 equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with *emergency escape and rescue openings* in accordance with Section 1030.
b. This table is used for R-2 occupancies consisting of *dwelling units*. For R-2 occupancies consisting of *sleeping units*, use Table 1006.3.3(2).

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Table 1006.3.3(2) – Stories with One Exit or Access to One Exit for Other Than Group R-2 Occupancies

TABLE 1006.3.3(2)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR OTHER OCCUPANCIES

STORY	OCCUPANCY	MAXIMUM OCCUPANT LOAD PER STORY	MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE (feet)
First story above or below grade plane	A, B[b], E F[b], M, U	49	75
	H-2, H-3	3	25
	H-4, H-5, I, R-1, R-2[a, c]	10	75
	S[b, d]	29	75
Second story above grade plane	B, F, M, S[d]	29	75
Third story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 304.8 mm.
NP = Not Permitted.
NA = Not Applicable.
a. Buildings classified as Group R-2 equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with *emergency escape and rescue openings* in accordance with Section 1030.
b. Group B, F and S occupancies in buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 shall have a maximum *exit access* travel distance of 100 feet.
c. This table is used for R-2 occupancies consisting of *sleeping units*. For R-2 occupancies consisting of *dwelling units*, use Table 1006.3.3(1).
d. The length of *exit access* travel distance in a Group S-2 *open parking garage* shall be not more than 100 feet.

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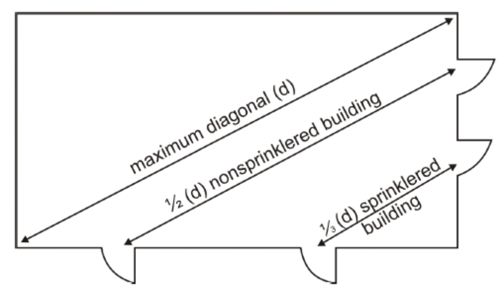
Section 1007 – Exit and Exit Access Configuration



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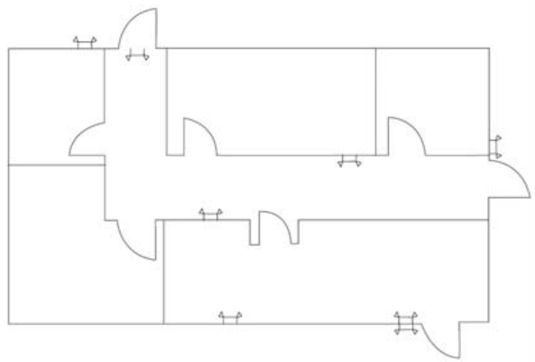
Section 1008 – Means of Egress Illumination



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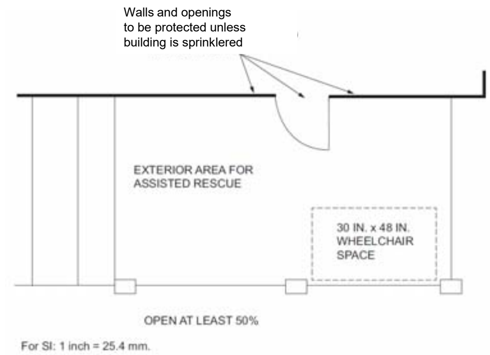
Section 1009 – Accessible Means of Egress



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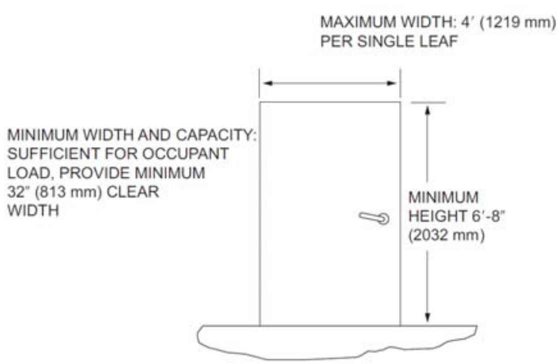
Section 1010.1.1 – Size of Doors



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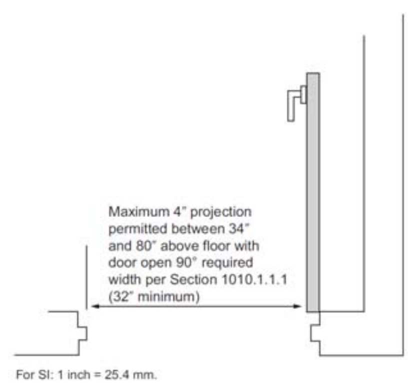
Section 1010.1.1 – Size of Doors



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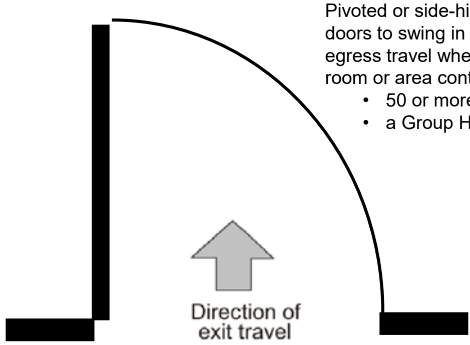
Section 1010.1.2 – Door Swing



Pivoted or side-hinged swinging doors to swing in direction of egress travel where serving a room or area containing:

- 50 or more persons, or
- a Group H occupancy

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Section 1010.1.4 – Special Doors

- Revolving doors
- Power-operated doors
- Horizontal sliding doors
- Locking arrangements in education occupancies
- Security grilles

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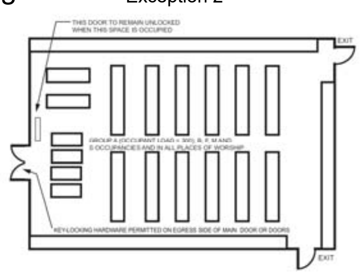
Section 1010.1.9 – Door Operations

- Egress doors should be readily openable from the egress side without the use of a key, special effort or knowledge.

Exception 2



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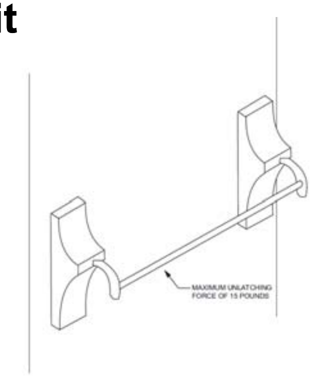
Section 1010.1.10 – Panic and Fire Exit Hardware

Swinging doors provided with a latch or lock shall be provided with panic hardware where serving:

- 50 or more persons in a Group A or E occupancy, or
- a Group H occupancy



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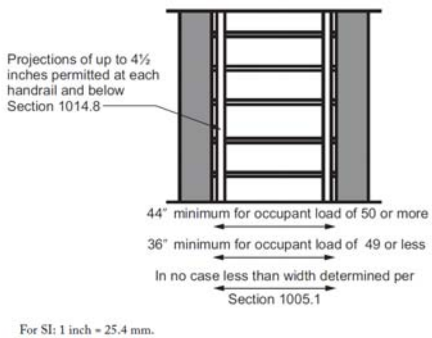
Section 1011.2– Stairway Width and Capacity



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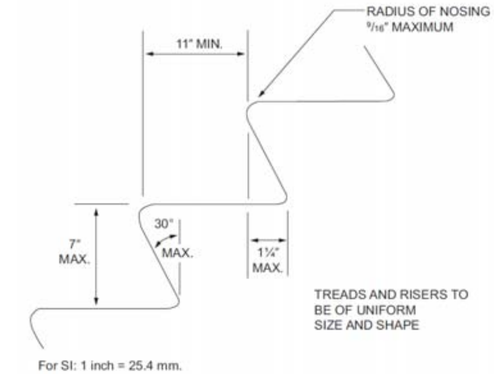
Section 1011.5 – Stair Treads and Risers



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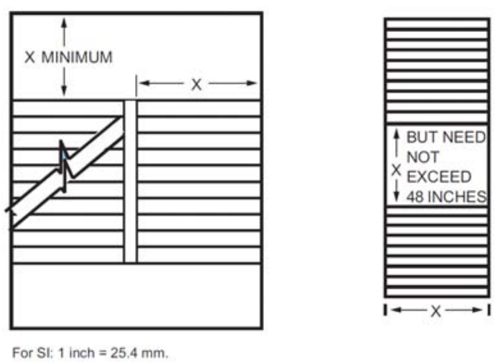
Section 1011.6 – Stairway Landings



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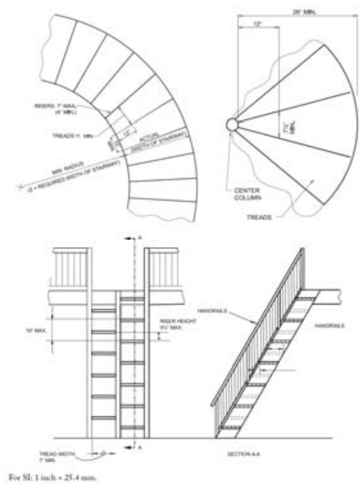
Sections 1011.9 through 1011.15– Alternate Stairways



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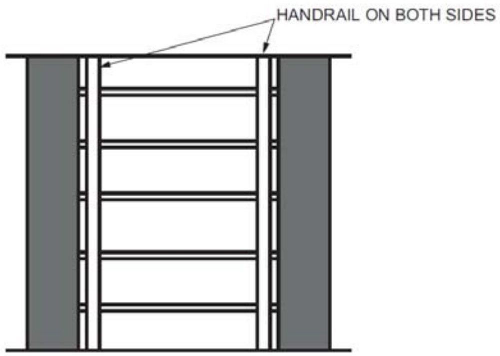
Section 1011.11 – Handrails



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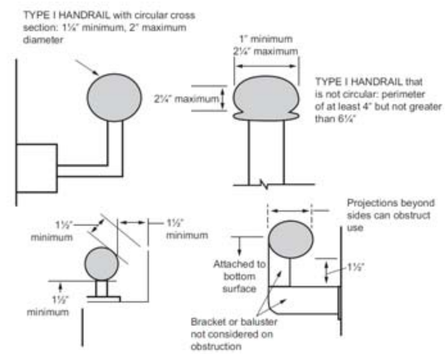
Section 1014.3 – Handrail Graspability



For SI: 1 inch = 25.4 mm.

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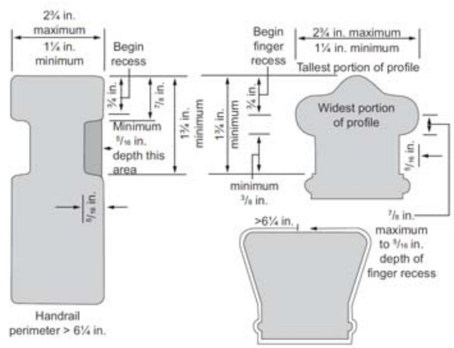
Section 1014.3 – Handrail Graspability



For SI: 1 inch = 25.4 mm.

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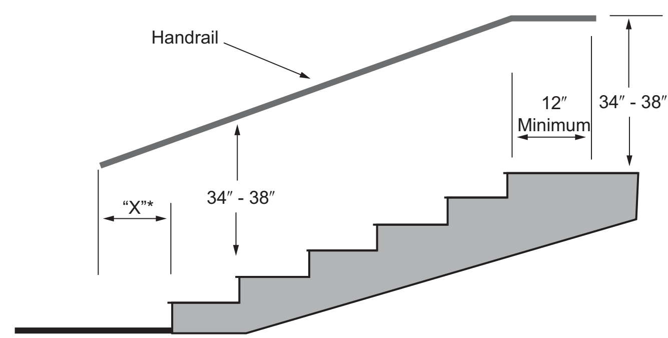
Section 1014.6 – Handrail Extensions



For SI: 1 inch = 25.4 mm.

* Extension "X" continues to slope for the depth of one tread beyond bottom riser

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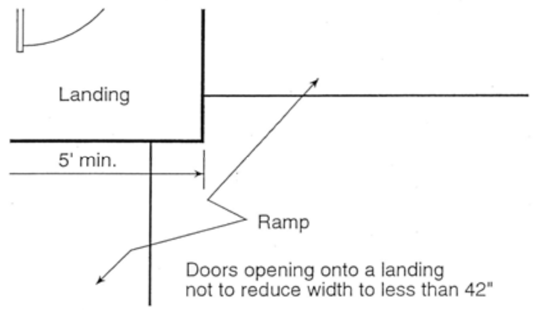
Section 1012 – Ramps



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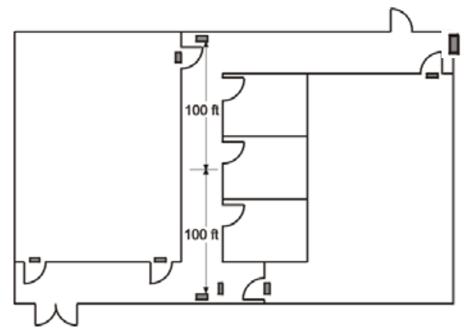
Section 1013 – Exit Signs



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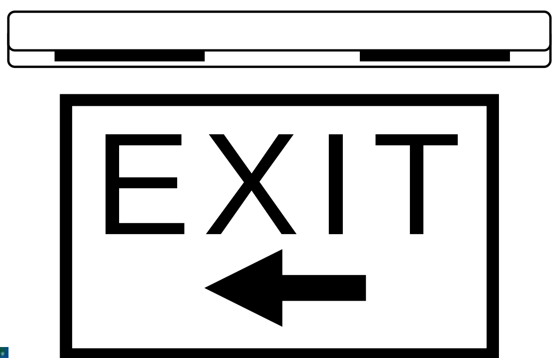
Section 1013.6.3 – Power Source



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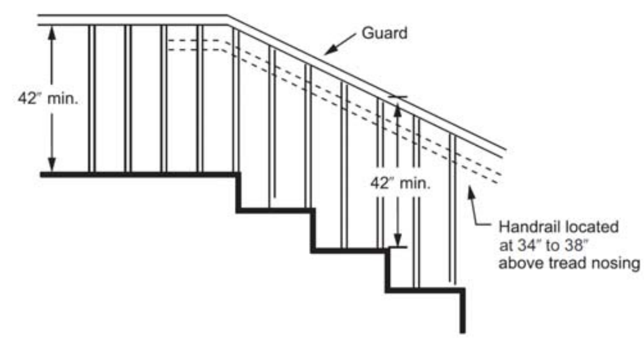
Section 1015 – Required Guards



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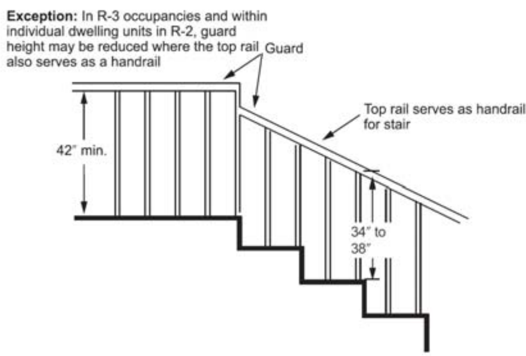
Section 1015.3 – Guard Height



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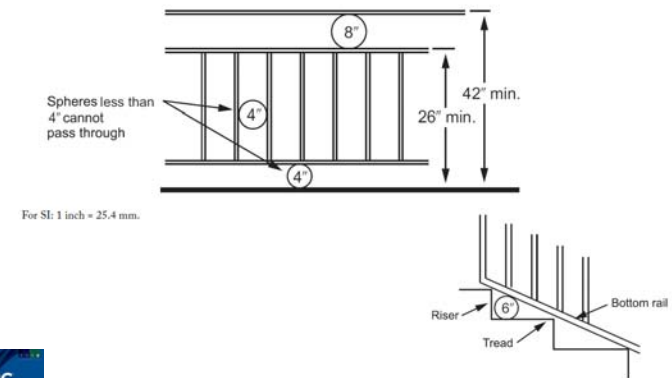
Section 1015.4 – Guard Opening Limitations



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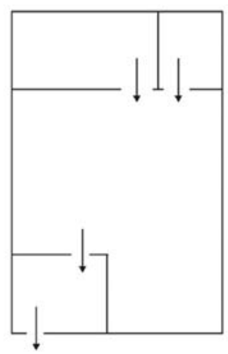
Section 1016.2 – Egress Through Intervening Spaces



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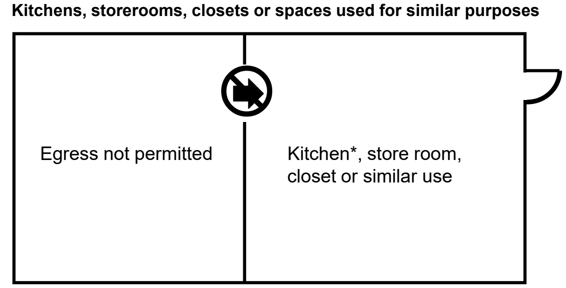
Section 1016.2 – Exit Through Intervening Spaces

Kitchens, storerooms, closets or spaces used for similar purposes



***Exception:**
Kitchen within same dwelling unit or guestroom.

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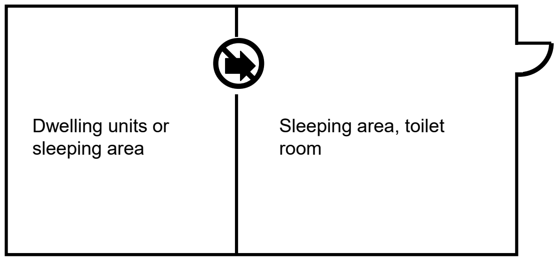
Section 1016.2 – Exit Through Intervening Spaces



Egress from dwelling units or sleeping areas shall not lead through other sleeping areas or toilet areas.

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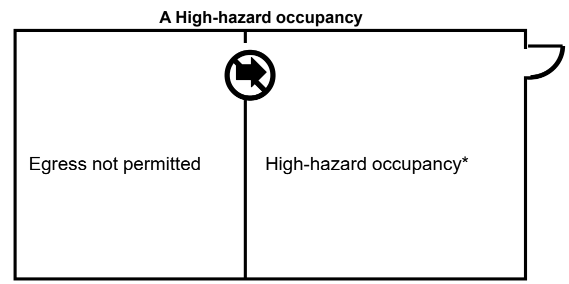
Section 1016.2 – Exit Through Intervening Spaces



***Exception**
When space to be entered is the same occupancy group.

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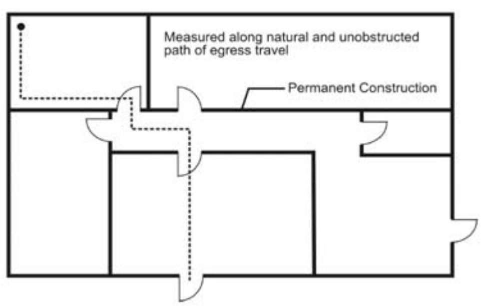
Section 1017 – Exit Access Travel Distance



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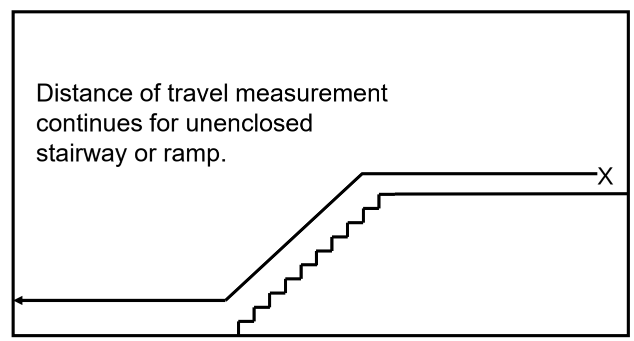
Section 1017 – Exit Access Travel Distance



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REFER TO CODE BOOK

2018 IBC Table 1017.2 Page 285

Table 1017.2 – Exit Access Travel Distance

TABLE 1017.2
EXIT ACCESS TRAVEL DISTANCE[a]

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (feet)	WITH SPRINKLER SYSTEM (feet)
A, E, F-1, M, R, S-1	200[e]	250[b]
I-1	Not Permitted	250[b]
B	200	300[c]
F-2, S-2, U	300	400[c]
H-1	Not Permitted	75[d]
H-2	Not Permitted	100[d]
H-3	Not Permitted	150[d]
H-4	Not Permitted	175[d]
H-5	Not Permitted	200[c]
I-2, I-3	Not Permitted	200[c]
I-4	150	200[c]

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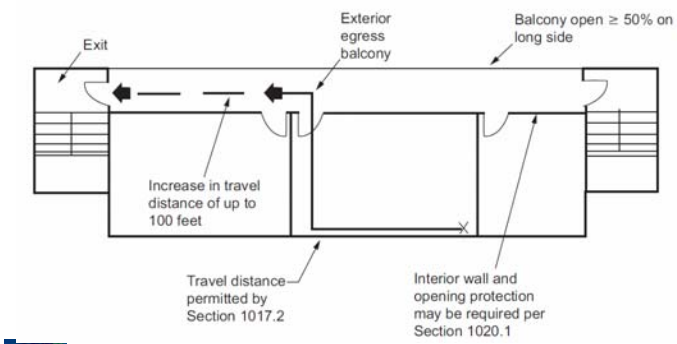
Section 1017.2.1 – Exterior Egress Balcony Increase



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REFER TO CODE BOOK

2018 IBC Table 1020.1 Page 287

Table 1020.1 – Corridor Fire-Resistance Rating

TABLE 1020.1
CORRIDOR FIRE-RESISTANCE RATING

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system[c]
H-1, H-2, H-3	All	Not Permitted	1
H-4, H-5	Greater than 30	Not Permitted	1
A, B, E, F, M, S, U	Greater than 30	1	0
R	Greater than 10	Not Permitted	0.5[c]/1[d]
I-2[a]	All	Not Permitted	0
I-1, I-3	All	Not Permitted	1[b]
I-4	All	1	0

a. For requirements for occupancies in Group I-2, see Sections 407.2 and 407.3.

b. For a reduction in the *fire-resistance rating* for occupancies in Group I-3, see Section 408.8.

c. Buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2 where allowed.

d. Group R-3 and R-4 buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.3. See Section 903.2.8 for occupancies where *automatic sprinkler systems* are permitted in accordance with Section 903.3.1.3.

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REFER TO CODE BOOK

2018 IBC Table 1020.2 Page 287

Table 1020.2 – Minimum Corridor Width

TABLE 1020.2
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facility not listed in this table	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a *dwelling unit*	36
In Group E with a *corridor* having an occupant load of 100 or more	72
In *corridors* and areas serving stretcher traffic in *ambulatory care facilities*	72
Group I-2 in areas where required for bed movement	96

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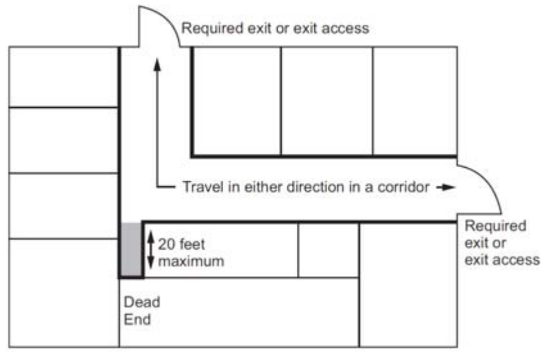
Section 1020.4 – Dead Ends



For SI: 1 foot = 304.8 mm.

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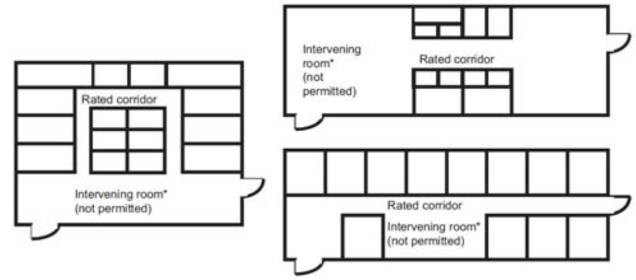
Section 1020.6 – Corridor Continuity



* Foyers, lobbies or reception rooms constructed as required for corridors not to be considered as intervening rooms.

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Section 1021 – Egress Balconies

Balconies considered as a portion of the means of egress must comply with the same requirements as corridors for:

- Width.
- Headroom.
- Dead ends.
- Projections.

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Section 1023 – Interior Exit Stairways and Ramps

- Interior exit stairways and ramps must be enclosed as specified in Section 1023.2.
- They shall lead directly to the exterior of the building or be extended to the building's exterior with an exit passageway.
- An interior exit stairway or ramp shall not be used for any purpose that interferes with its role as a means of egress.

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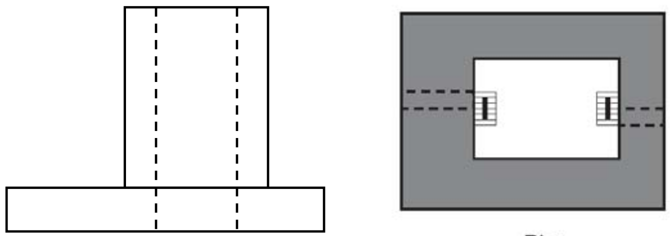
Section 1023.2 – Stairway Construction



Elevation

Plan

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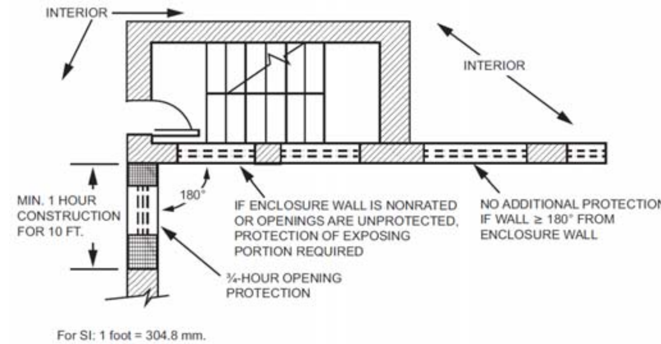
Section 1023.7– Interior Exit Stairway and Ramp Exterior Walls



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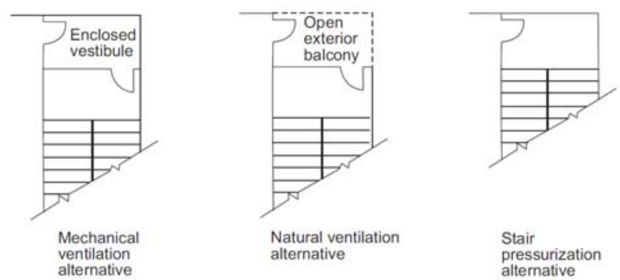
Section 1023.11 – Smokeproof Enclosures and Pressurized Stairways



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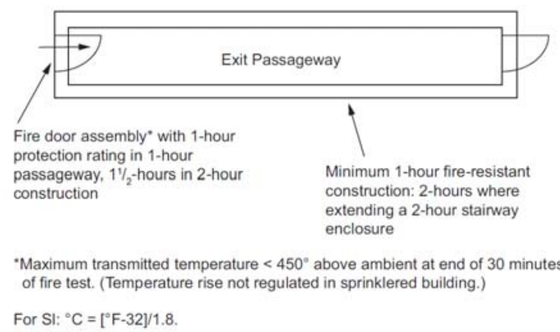
Section 1024 – Exit Passageways



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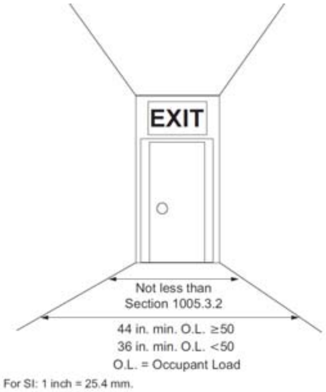
Section 1024 – Exit Passageways



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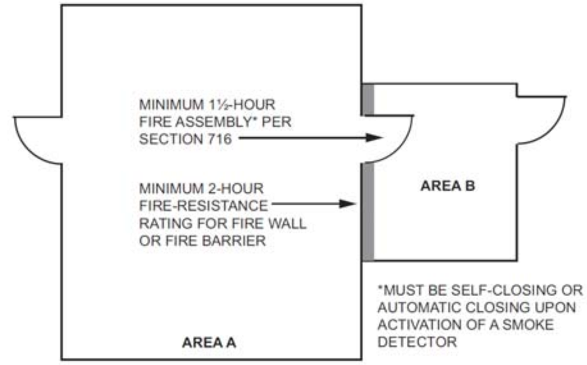
Section 1026 – Horizontal Exits



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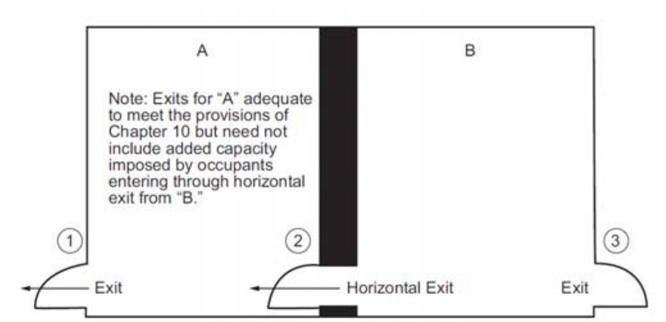
Section 1026.4 – Refuge Areas



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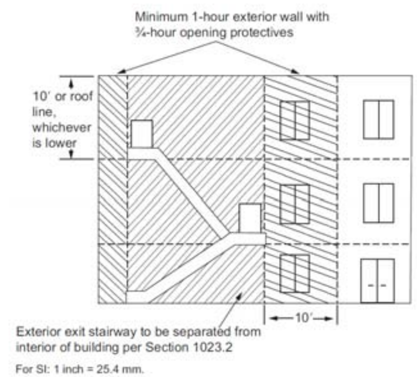
Section 1027 – Exterior Exit Ramps and Stairways



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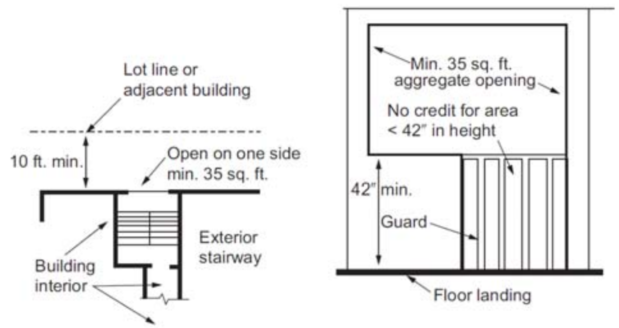
Section 1027 – Exterior Exit Ramps and Stairways



For SI: 1 inch - 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

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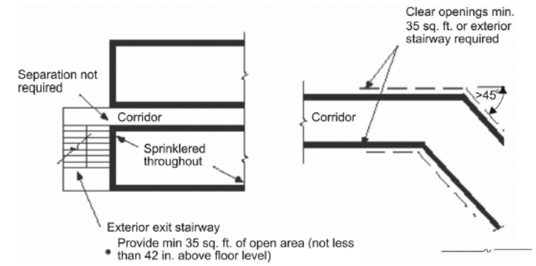
Section 1027.6 – Exterior Ramps and Stairway Protection



For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m^2.

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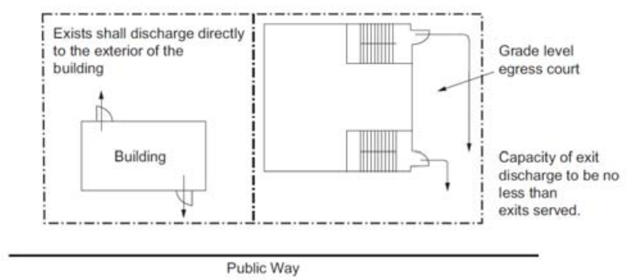
Section 1028 – Exit Discharge



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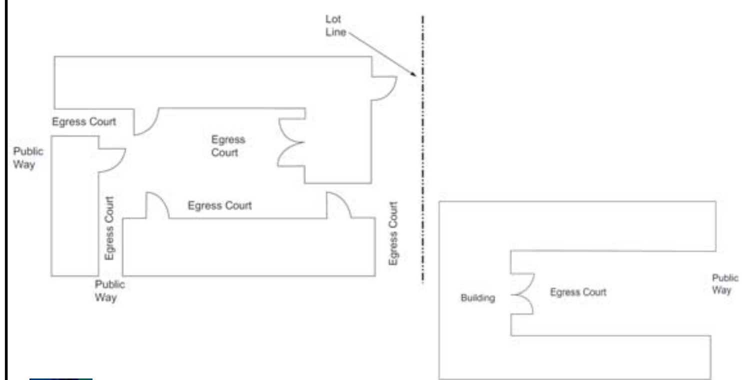
Section 1028.4 –Egress Courts



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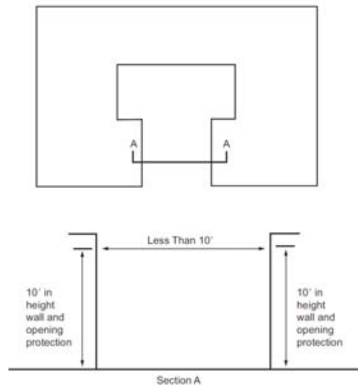
Section 1028.4.2 – Egress Court Construction



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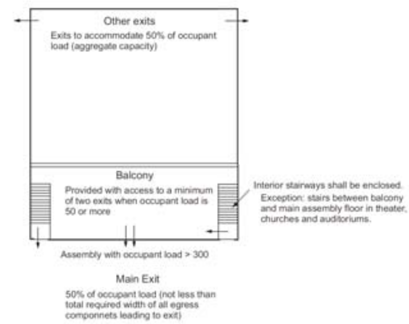
Section 1029 – Assembly Uses



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Section 1029.6 – Capacity of Aisles for Assembly Seating Areas

The minimum required capacity is determined from:

- Buildings without smoke-protected seating (Section 1029.6.1).
- Buildings with smoke-protected seating (Section 1029.6.2).
- Open-air assembly seating (Section 1029.6.3).

In no case must minimum clear widths of aisles be less than those stated in Section 1029.9.1.

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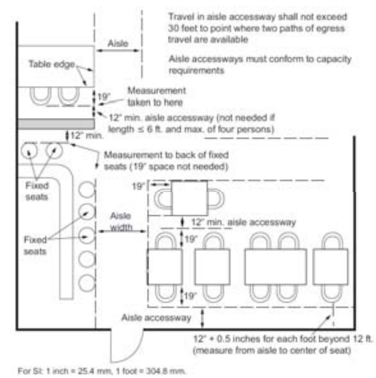
Section 1029.10.1 – Means of Egress for Seating at Tables



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Section 1030 – Emergency Escape and Rescue Openings

Exterior emergency escape and rescue openings must be provided in:

- Group R-2 occupancies located on stories with one exit per Tables 1006.3.3(1) and 1006.3.3(2).
- Group R-3 and R-4 occupancies.

Openings are to be provided in the following areas:

- Basements.
- Sleeping rooms below the fourth story.

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Table 1006.3.3(1) – Stories with One Exit or Access to One Exit for Group R-2 Occupancies

TABLE 1006.3.3(1)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2 OCCUPANCIES

STORY	OCCUPANCY	MAXIMUM NUMBER OF DWELLING UNITS	MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE
Basement, first, second or third story above grade plane	R-2[a, b]	4 dwelling units	125 feet
Fourth story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 3048 mm.
NP = Not Permitted.
NA = Not Applicable.
a. Buildings classified as Group R-2 equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with *emergency escape and rescue openings* in accordance with Section 1030.
b. This table is used for R-2 occupancies consisting of *dwelling units*. For R-2 occupancies consisting of *sleeping units*, use Table 1006.3.3(2).

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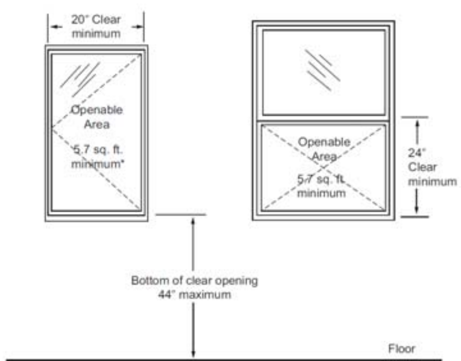
Table 1030.2 – Minimum Size



*Minimum net clear opening can be reduced to 5 square feet (0.28 m²) for grade floor openings
For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m²

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ACTIVITY

Means of Egress Activity

1. Access to at least three exits or exit access doorways is required from a room where the occupant load exceeds **500, Section 1006.2.1.1**.

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Means of Egress Activity

2. What is the minimum required corridor width:

a. For access to mechanical equipment **24 inches**

b. Within a dwelling unit **36 inches**

c. Serving 100 or more occupants in a Group E occupancy **72 inches**

d. For Group I-2 bed movement areas **96 inches**

e. Serving an occupant load less than 50 **36 inches**

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Means of Egress Activity

3. What is the maximum permitted travel distance, including exterior egress balcony travel, for a sprinklered Group R-1 occupancy?

350 feet (106 680 mm), based on 250' + 100' (76 200 mm + 30 480 mm) maximum balcony travel (Table 1017.2 and Section 1017.2.1)

4. How many intermediate rails are required for a 30-foot (9144 mm) wide stair that has a required width of 18 feet 9 inches (5738 mm)?

18' 9" = 225"/60 — four paths - three intermediate rails (Section 1014.9)

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Means of Egress Activity

5. How many means of egress are required from the following spaces, assuming the common path of travel is within the allowable limits?

a. 4,000-square-foot office **4,000/150 = 26 = 1**

b. 450-square-foot conference room **450/15 = 30 = 1**

c. 6,000-square-foot warehouse **6,000/500 = 12 = 1**

d. 2,400-square-foot apartment **2,400/200 = 12 = 1**

e. 1,800-square-foot sales room **1,800/60 = 30 = 1**

f. 900-square-foot café **900/15 = 60 = 2**

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Means of Egress Activity

6. What is the minimum required width of an egress court serving a Group M occupancy?

44 inches (1118 mm) (Section 1028.4.1)

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Conclusion

- Review
- Surveys
- Questions

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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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File Attachments for Item:

ER-4 2018 IBC Significant Changes (International Code Council)

All certifications except ESI (6 hours)

Staff Notes: Recommend approval.

Committee Recommendation:

APPLICATION

FOR

Continuing Education Course Approval

Board of Building Standards
6606 Tussing Road, P.O. Box 4009
Reynoldsburg, Ohio 43068-9009
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COURSE SUBMITTER:

Course Submitter: Laura Morris
(Contact Name)

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(Organization/Company)

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COURSE INFORMATION:

Course Title: 2018 IBC Significant Changes

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

Purpose and Objective: Overviews the changes from the 2015 to the 2018 IBC®. Identifies changes in organization and code requirements and the applicability of these requirements to design, plan review and inspection. This course uses the Significant Changes to the International Building Code 2018 Edition.

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

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

Program Applicable for the Following Participants:

Building Official ■ Master Plans Examiner ■ Building Inspector ■ Fire Protection Inspector ■ Mechanical Inspector ■

Building Plans Exam. ✔

Plumbing Plans Exam. ■

Electrical Plans Exam. ■

Mechanical Plans Exam. ■

Fire Protect. Plans Exam. ✔

Plumbing Inspector ■

Non-Res IU Inspector ■

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

Electrical Safety Inspectors ☐

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

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

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

Significant Changes to the International Building Code - 2018

Based on the 2018 International Building Code® (IBC®)
And Significant Changes to the International Building Code, 2018 Edition

Length:	1 Day (6 Contact Hours)
Applicable Codes:	2018 IBC
Product Type/Status:	Seminar/Update
Level:	Entry
2027SM18	7024S18

Background Information

Description

Overviews the changes from the 2015 to the 2018 IBC®. Identifies changes in organization and code requirements and the applicability of these requirements to design, plan review and inspection. This course uses the Significant Changes to the International Building Code 2018 Edition.

Goal

The goal of *Significant Changes to the International Building Code® 2018 Edition* is to familiarize building officials, fire officials, plans examiners, inspectors, design professionals, contractors, and others in the construction industry with many of the important changes in the 2018 International Building Code® (IBC®).

This publication is designed to assist those code users in identifying the specific code changes that have occurred and, more important, understanding the reason behind the change.

Objectives

Upon completion of this seminar, participants will be better able to:

- Identify the most significant differences between the 2015 IBC and the 2018 IBC.
- Explain the differences between the current and previous edition.
- Identify key changes in organization and code requirements.
- Identify the applicability of design, plan review and inspection requirements.

Target Audience

Building inspectors, building officials

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.

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.

learning for them to be incorporated into their memory. By interacting with others, there is a reinforcement of these concepts, and learning is enhanced further.

This approach may be a challenge for those instructors who are used to lecturing so the detail written into the Seminar at a Glance section should help instructors to prepare for the training and be used during these activities until it becomes second nature.

You will find the observation of learners starting to use what is presented in our training to be the most rewarding part of instruction. This learning will transfer back to their jobs.

New Slide Templates to enhance learning:

In addition, there is a new design of the slide templates for 2018 intended to make learning easier and provide the most realestate for graphics.

- An added emphasis of the content in the slides through more pictures.
- The slides are designed to hold the learner's attention and give them cues that will help them to process the information.
- Objective slides for the course are colored brighter than the supporting slides.
- There is less distraction on slides with images or drawings
- There is less type on slides and extensive type is now in the notes area for your use. This way you can elaborate on the key points without looking like you are reading from the slides.
- Animations on slides will draw learners' attention to information without overwhelming them. (Instructors must use Microsoft 2007 or higher for these animations to work).

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 Building Code
- Significant Changes to the International Building Code, 2018 Edition

Timed Outline

Outline of Seminar (6 hours = 360 minutes)

1) Course overview (20 minutes)
   a) Introductions (10)
   b) Objectives (5)
   c) Agenda (5)

2) Administration, Chapters 1 and 2 (40 minutes)
   a) Chapter 1: 101.2, 111.1 (5)
   b) Chapter 2: 202 (15)
   c) Activity (20)

3) Building Planning, Chapters 3 through 6 (70 minutes)
   a) Chapter 3: 304.1, 306.2, 308.3, 308.4, 310.5, 310.6, 311.11 (10)
   b) Chapter 4: 403.1, 404.5, 409.9, 406.3.1, 409.3.2, 407.2.5, 407.2.6, 407.5, 410.3.5, 412.7, 423.3, 423.4, (10)
   c) Chapter 5: 503, 504.3, 505.2.3, 506.2, 507.1, 507.9, 509, 510.2, 510.2 (20)
   d) Chapter 6: Table 610, Section, 602.4, 602.4.2, 603.1(10)
   e) Activity (20)

4) Fire Protection, Chapters 7 through 9 (70 minutes)
   a) Chapter 7: 704.4, 705.2, 705.2.3, 705.3, 705.6, 705.8.5, 706.2, 709.4, 711, 712, 714.4.2, 717.1.1, 717.3, 717.5 (20)
   b) Chapter 9: 903.2.1.6, 903.2.1.7, 903.2.8, 903.3.1.1.2, 903.3.8, 904.13, 907.2.3, 907.2.9.3, 907.2.11.3, 907.2.11.4, 909.21.1, 910, 915 (25)
   c) Activity (25)

5) Means of Egress, Chapter 10 (25 minutes)
   a) 1006, 1004.1.1, 1004.1.2, 1007, 1007.1, 1009.8, 1010.1.9, 1011.15, 1014.8, 1016.2, 1017.2.2, 1018.3, 1020.2, 1023.3.1, 1029.13.2.2.1 (15)
   b) Activity (10)

6) Accessibility, Chapter 11 (25 minutes)
   a) 1103.2.8, 1104.4, 1107.3, 1109.2, 1109.2.3, 1110, (15)
   b) Activity (10)

7) Building Envelope, Structural Systems and Construction, Chapters 12 through 26 (60 minutes)
   a) 1405.3, 1602.1, 1603, 1603.1.7, 1603.1.8, 1604.3, 1604.5, 1607.5, 1607.9, 1607.10.2, 1607.12, 1607.12.5, 1609.1.1, 1613.3.1, 1613.5, 1613.6, 1704.5, 1705.2, 1705.2.3, 1705.3, 1705.11, 1705.12, 1708.3.2, 1709.5, 1711, 1803.5, 1804.1, 1808.3, 1810.2.5, 1810.3, 1901.3, 1901.4, 1904, 1905.1.3, 1905.1.8, 2101.2, 2103, 2104, 2105, 2111, 2210, 2211, 2303.1.4, 2303.1.13, 2304.6, 2304.10.6, 2304.12, 2308, 2308.2.5, 2308.7, 2309, 2406.4.7, Chapter 25, 2612 (50)
   b) Activity (10)

8) Building Services, Special Devices, and Special Conditions, Chapters 27 through 34 (20 minutes)
   a) 2902.3, 3004, 3006, Chapter 34 (10)
   b) Activity (10)

9) Summary and Wrap-up (30 minutes)

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

John is the Technical Manager/ Education and an Instructor for the International Code Council (ICC). A certified Master Code Professional and Certified Fire Marshal; he has forty- five (45) other certifications, including thirty-six (36) 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, permit technician, property maintenance, zoning, green building, fire, wildland/urban interface, energy courses, and is a contract instructor at the Dept. of Homeland Security, United States Fire Administration, National Fire Academy, Emmitsburg, MD. He received the ICC Educator of the Year award in 2010.

2018 IBC Significant Changes

Based on the
2015 and 2018 editions of the
International Building Code®, (IBC®)

LEARNING center

1

Identify changes between
the 2015 and 2018 IBC

Apply code requirements to design, plan submittals and/or inspection.

2018 IBC Significant Changes 2

2

OBJECTIVES

- Identify the differences between 2015 IBC and 2018 codes.
- Determine if the change is an addition, deletion, modification or clarification.
- Identify changes in format and technical requirements.
- Explain the intent and application of the changes.

2018 IBC Significant Changes 3

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Tips

Guide to a successful class:

- Slides contain some text and iconic images to help you learn.
- Text and commentary is in the handout.
- Follow along in the course handout.
- Ask Questions, ask questions, ASK QUESTIONS!!!!

2018 IBC Significant Changes 4

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Course Icons

Addition Deletion Modification Clarification

2018 IBC Significant Changes 5

5

Chapter 2

Definitions

6

6

202 Definition of Greenhouse

- Structure of thermally-isolated area of building that maintains a specialized sunlit environment
- Focus is on the cultivation, protection and maintenance of plants rather than the structure itself or the presence of plants

2018 IBC Significant Changes 7

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202 Definition of Repair Garage

- Motor vehicle:
  - Servicing, or
  - Repair

2018 IBC Significant Changes 8

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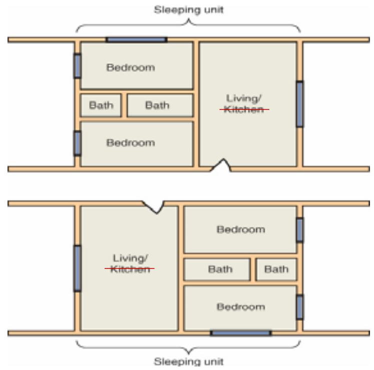
202 Definition of Sleeping Unit

- Clarifies bedrooms within residential unit not to be considered as sleeping units
- Consistent with dwelling unit provisions



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Chapter 2 Removal of Definition References

- References throughout code to Chapter 2 for specific definitions have been removed

~~**502.1 Definitions.** The following terms are defined in Chapter 2:~~

~~**AREA, BUILDING.**~~

~~**BASEMENT.**~~

~~**EQUIPMENT PLATFORM.**~~

~~**HEIGHT, BUILDING.**~~

~~**MEZZANINE.**~~

2018 IBC Significant Changes 10

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Chapter 3

Use and Occupancy

11

11

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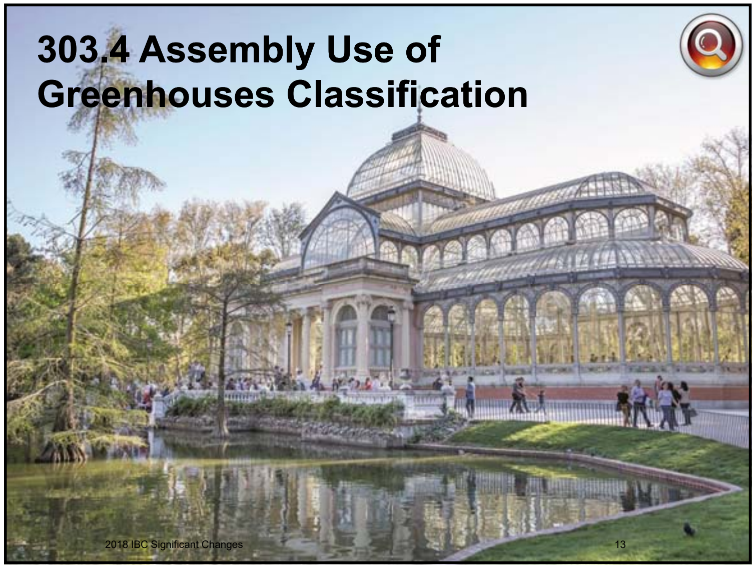

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310.3, 310.4 Classification of Congregate Living Facilities

- All nontransient congregate living facilities with 16 or fewer occupants to be classified as Group R-3, including:
  - Dormitories
  - Fraternity and sorority houses
  - Convents
- Group R-3 lodging houses to now have 10 or fewer occupants

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310.4.4 Owner-Occupied Lodging Houses

- Owner-occupied lodging houses permitted to comply with IRC where:
  - 5 or fewer guest rooms, <u>and</u>
  - <u>10 or fewer total occupants</u>

2018 IBC Significant Changes 16

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311.1.1 Classification of Accessory Storage Rooms

- Room or space used for storage accessory to another occupancy to be classified as part of that occupancy

2018 IBC Significant Changes 17

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311.2 Classification of Self-Service Storage Facilities

2018 IBC Significant Changes 18

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312.1 Classification of Communication Equipment Structures

- Group U classification applies where floor area less than 1,500 sf

2018 IBC Significant Changes 19

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312.1.1 Classification of Agricultural Greenhouses

- Group U classification applies where greenhouse not classified as another occupancy

2018 IBC Significant Changes 20

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Chapter 4

Special Requirements for Use and Occupancy

21

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403.2.1.1 Type of Construction in High-Rise Buildings

- Type IB high-rise buildings containing Group H-2, H-3 or H-5 occupancy not permitted to be regulated as Type IIA for fire-resistance ratings

2018 IBC Significant Changes 22

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404.6 Enclosure of Atriums

- Separation between atrium and adjoining spaces not required where smoke control system not required

2018 IBC Significant Changes 23

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406.1 Motor Vehicle-Related Occupancies

- Reorganization includes grouping of requirements that apply to all motor-vehicle-related uses

2018 IBC Significant Changes 24

24

406.3 Regulation of Private Garages

- Private garages now permitted to comply with public parking garage provisions

2018 IBC Significant Changes 25

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406.6.2 Ventilation of Enclosed Parking Garages

- Chapters 4 and 5 of IMC now specifically addressed for ventilation and exhaust requirements
- Although limited in application, exception for one- and two-family dwellings has also been established

2018 IBC Significant Changes 26

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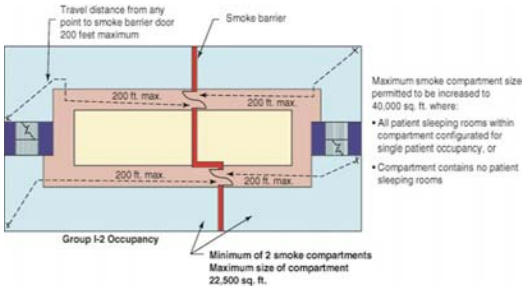
407.5 Maximum Smoke Compartment Size

- Applicable to Group I-2, Condition 2 occupancies



2018 IBC Significant Changes 27

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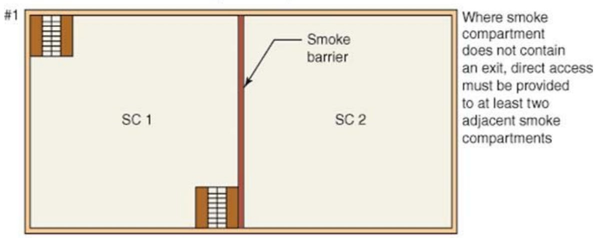
407.5.4 Required Egress from Smoke Compartments

NONCOMPLIANT EXAMPLE



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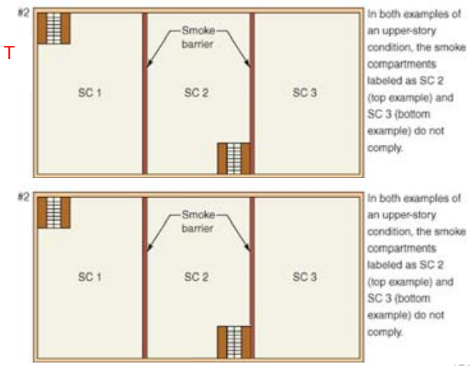
407.5.4 Required Egress from Smoke Compartments

NONCOMPLIANT EXAMPLE

COMPLIANT EXAMPLE



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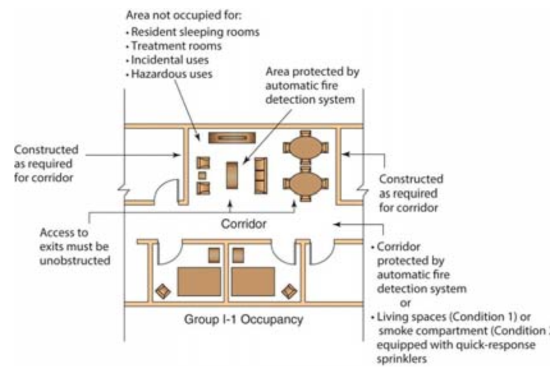
420.7 Corridor Protection in Assisted Living Units



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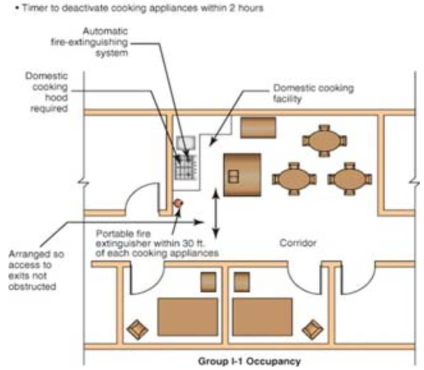
420.8 Group I-1 Cooking Facilities

- Appliances limited to ovens, cooktops, ranges, warmers and microwaves
- Fuel and electrical supply to cooking equipment be provided with shut-off accessible only to staff
- Timer to deactivate cooking appliances within 2 hours



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420.10 Dormitory Cooking Facilities

- Domestic cooking appliances for resident use now regulated
- Cooktops, ranges and ovens not permitted in sleeping rooms

32

422.6 Electrical Systems in Ambulatory Care Facilities

- New references identified for essential electrical systems in ambulatory care facilities:
  - IBC Section 2702: Emergency and Standby Power Systems
  - NFPA 99: *Health Care Facilities Code*

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424.1 Children's Play Structures

- Play structures regulated where:
  - Over 10 feet in height, <u>or</u>
  - 150 sf in area

2018 IBC Significant Changes 34

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427 Medical Gas Systems

- IFC construction-related provisions for medical gas systems now replicated in IBC

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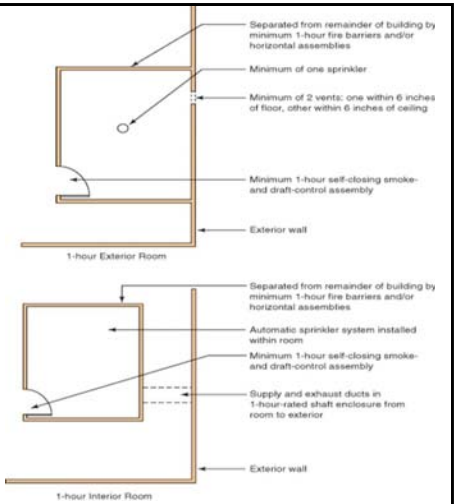
427 Medical Gas Systems



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428 Higher Education Laboratories

- Special allowances and provisions for Group B laboratories in college and university buildings
- Similar to 'control area' concept

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428 Higher Education Laboratories

TABLE 428.3 Design and Number of Laboratory Suites Per Floor

Floor Level		Percentage of the Maximum Allowable Quantity Per Lab Suite (a)	Number of Lab Suites Per Floor	Fire-Resistance Rating for Fire Barriers in Hours (b)
Above Grade Plane	21+	Not Allowed	Not Permitted	Not Permitted
	16-20	25	1	2c
	11-15	50	1	2c
	7-15	50	2	2c
	4-6	75	4	1
	3	100	4	1
	1-2	100	6	1
Below Grade Plane	1	75	4	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 307.1(1) and 307.1(2), with all increases allowed in the footnotes to those tables.
b. Fire barriers shall include walls, floors and ceilings necessary to provide separation from other portions of the building.
c. Vertical fire barriers separating laboratory suites from other spaces on the same floor shall be permitted to be 1-hour fire-resistance rated.

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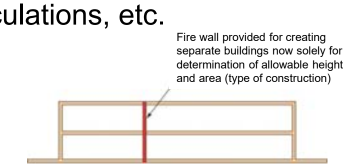
Chapter 5

Allowable Building Heights and Areas

39

503.1, 706.1 Scope of Fire Wall Use

- Use of fire wall to create separate buildings now limited to only the determination of permissible types of construction, based upon allowable building height and area
- Fire walls to continue to be used for horizontal exits, fire area separations, fire-flow calculations, etc.



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503.1.4 Allowable Height and Area of Occupied Roofs

- Allowable area and height of occupied roofs now addressed
  - Area not to be included in building area
  - Height (in stories) regulated based on uppermost story (unless exception applied)
- Enclosures of occupied roofs limited to 48 inches in height above roof deck, except for:
  - Penthouses, towers, spires, etc.

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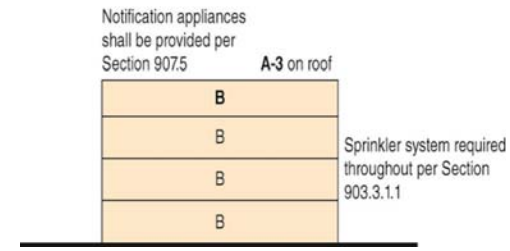
503.1.4 Allowable Height and Area of Occupied Roofs

Example:
If building of Type VA construction,
Group B: 4 stories max. (S)
Group A-3: 3 stories max. (S)



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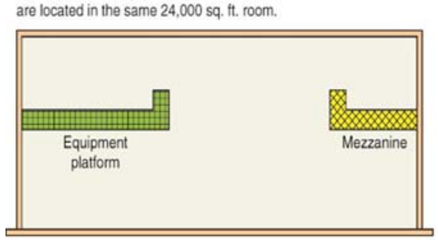
505.2.1.1 Mezzanine and Equipment Platform Area Limitations

Example:
Assume both an equipment platform and a mezzanine are located in the same 24,000 sq. ft. room.



Permitted aggregate size of equipment platform and mezzanine limited to 16,000 sq. ft. (based on ⅔ limitation)

Permitted size of mezzanine limited to 8,000 sq. ft. (based on ⅓ limitation)

2018 IBC Significant Changes 43

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Table 506.2, Note i Allowable Area of Type VB Greenhouses

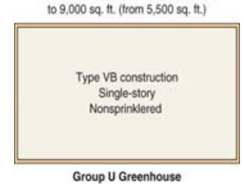
TABLE 506.2 Allowable Area Factor

Occupancy Classification	See Footnotes	Type I		Type II		Type III		Type IV	Type V	
		A	B	A	B	A	B	HT	A	B
U	NS[i]	UL	35,500	19,000	8,500	14,000	8,500	18,000	9,000	5,500
	S1	UL	142,000	76,000	34,000	56,000	34,000	72,000	36,000	22,000
	SM	UL	106,500	57,000	25,500	42,000	25,500	54,000	27,000	16,500

Note:
i. The maximum allowable area for a single-story nonsprinklered Group U greenhouse is permitted to be 9,000 square feet, or the allowable area shall be permitted to comply with Table C102.1 of Appendix C.

(No changes to other portions of table and notes.)

Maximum allowable area increased to 9,000 sq. ft. (from 5,500 sq. ft.)



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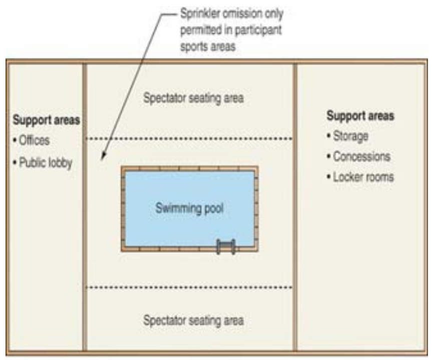
507.4 Sprinklers in Unlimited Area Group A-4 Buildings



Unlimited Area Group A-4 Occupancy

45

508.3.1.2 Group I-2, Condition 2 Nonseparated Occupancies

- Where nonseparated occupancies method used in mixed-occupancy condition, applicable within fire area to most restrictive provisions of:
  - Sec. 407 Group I-2
  - Sec. 509 Incidental uses
  - Sec. 712 Vertical openings
- Most restrictive means of egress provisions to apply

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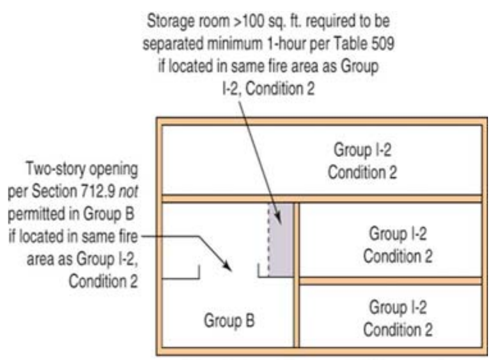
508.3.1.2 Group I-2, Condition 2 Nonseparated Occupancies



Regulated as Nonseparated Occupancies

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508.4.1, Table 508.4 Separated Occupancies vs. Fire Area Separations

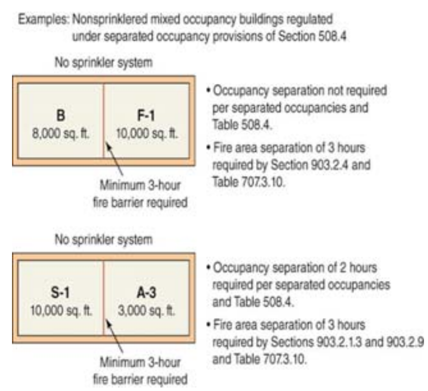

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Table 509 Incidental Uses

- Limits of stationary storage battery systems now based on energy capacities set forth in IFC
- Reference now made to specific sections in NEC for protection and separation of electrical installations and transformers

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Table 509 Incidental Uses

TABLE 509 Incidental Uses

Room or Area	Separation and/or Protection
Stationary storage battery systems having ~~a liquid electrolyte capacity of more than 50 gallons for flooded lead-acid, nickel cadmium or VRLA, or more than 1,000 pounds for lithium-ion and lithium metal polymer~~ an energy capacity greater than the threshold quantity specified in Table 1206.2 of the *International Fire Code*	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies
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

(No changes to other portions of Table 509.)

2018 IBC Significant Changes 50

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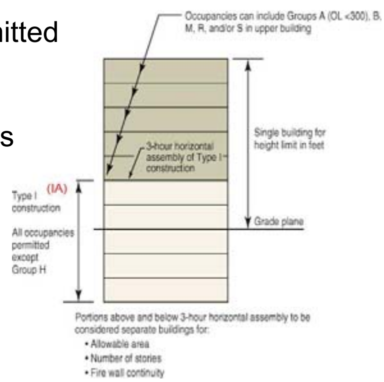
510.2 Horizontal Building Separation

- Vertical offsets permitted where offset and supporting structure rated at least 3 hours



2018 IBC Significant Changes 51

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Chapter 6

Types of Construction

52

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Table 601 Fire Protection of Structural Roof Members

TABLE 601 Fire-Resistance Rating Requirements for Building Elements

	Type I		Type II		Type III		Type IV	Type V	
Building Element	A	B	A	B	A	B	HT	A	B
Primary structural frame [f]	$3^{a,b}$	$2^{a,b}$	1^{b}	0	1^{b}	0	HT	1^{b}	0
Roof construction and associated secondary members	$1\frac{1}{2}^{b}$	$1^{b,c}$	$1^{b,c}$	0^{c}	$1^{b,c}$	0	HT	$1^{b,c}$	0

b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members in roof construction shall not be required, including protection of primary structural frame members, roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.

(No changes to other portions of Table 601 and notes.)

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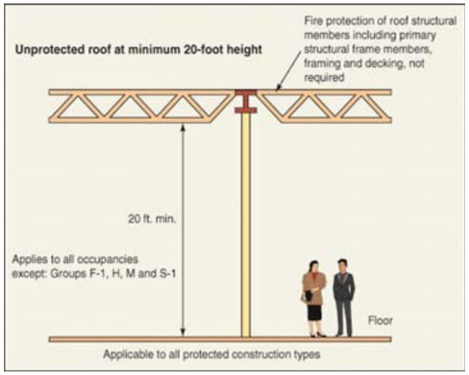
Table 601 Fire Protection of Structural Roof Members



2018 IBC Significant Changes 54

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Table 602, Note i Group R-3 Fire Separation Distance

TABLE 602 Fire-Resistance Rating Requirements for Exterior Walls Based on Fire Separation Distance

Fire Separation Distance	Type of Construction	Occupancy Group H	Occupancy Group F-1, M, S-1	Occupancy Group A, B, E, F-2, I, R[i], S-2, U
X < 5	All	3	2	1
5 ≤ X < 10	IA	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, IB	2	1	1
	IIB, VB	1	0	0
	Others	1	1	1
X ≥ 30	All	0	0	0

i. For a Group R-3 building of Type IIB or Type VB construction, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1523 mm) or greater.

(No changes to other portions of Table 602 and notes.)

2018 IBC Significant Changes 55

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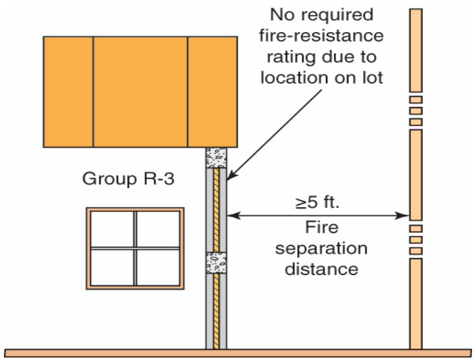
Table 602, Note i Group R-3 Fire Separation Distance



2018 IBC Significant Changes 56

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602.3, 602.4.1 FRT Wood Sheathing in Exterior Wall Assemblies

- Fire-retardant-treated wood framing and sheathing permitted within exterior walls of Type III and IV construction
  - Minimum of 6 inches in thickness
  - 2-hour rating or less

2018 IBC Significant Changes 57

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Chapter 7

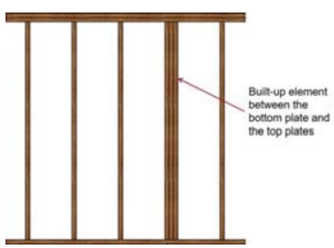
Fire and Smoke Protection Features

58

58

704.2, 704.4.1 Column Protection in Light-Frame Construction

- Required fire-resistance rating permitted to be provided with membrane protection



2018 IBC Significant Changes 59

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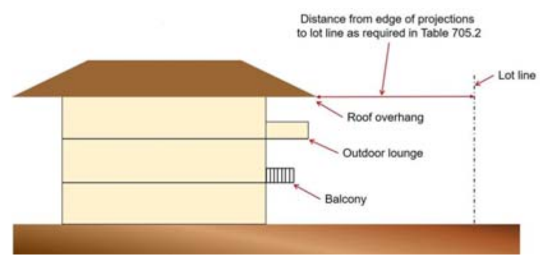
Table 705.2 Extent of Projections

- Minimum clearance measured to line used to determine fire separation distance has been revised to be consistent with 2012 IBC



2018 IBC Significant Changes 60

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Table 705.2 Extent of Projections

TABLE 705.2 Minimum Distance of Projection

Fire Separation Distance – FSD ~~(FSD)~~ (feet)	Minimum Distance from Line Used to Determine FSD
0 ~~feet~~ to less than 2 ~~feet~~	Projections not permitted
~~Greater than~~ 2 ~~feet~~ to less than 3 ~~feet~~	24 inches
~~Greater than~~ 3 ~~feet~~ to less than ~~30~~ 5 feet	24 inches plus 8 inches for every foot of FSD beyond 3 feet or fraction thereof
~~30 feet~~ 5 or greater	~~20 feet~~ 40 inches

For SI: 1 foot 5 304.8 mm; 1 inch 5 25.4 mm.

61

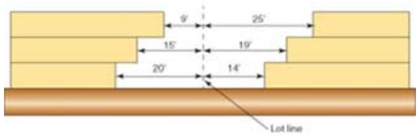
705.2.3, 705.2.3.1, 705.2.4 Combustible Balconies, Projections, and Bay Windows

- Provisions relocated from Section 1406 (Combustible Materials on the Exterior Side of Exterior Walls)
- Plastic composites now permitted to be installed in guard components where untreated wood allowed

62

705.8.1 Measurement of Fire Separation Distance for Opening Protection

- Where addressing allowable area of exterior openings, fire separation distance to be measured in same manner as when determining exterior wall rating
- Fire separation distance is measured on a story-by-story basis



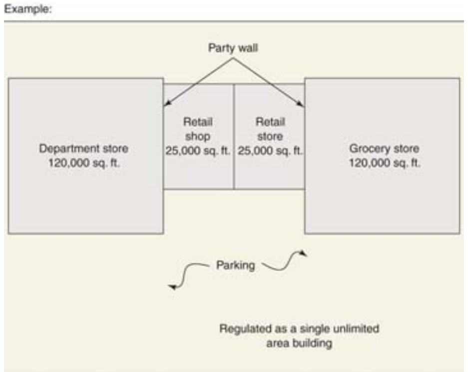
63

706.1.1 Party Walls Not Constructed as Fire Walls

- Fire walls not required on lot lines dividing a building for ownership purposes where:
  - Aggregate height and area do not exceed maximum requirements
  - Dedicated access easements and contractual agreements are provide to allow access for purposes of maintaining fire and life safety systems necessary for building operation
    - Subject to review and approval by building official

64

706.1.1 Party Walls Not Constructed as Fire Walls



2018 IBC Significant Changes 65

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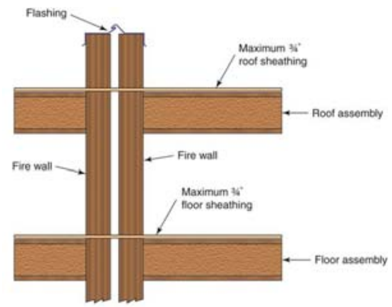
706.2 Structural Continuity of Double Fire Walls

- Applicable only in SDCs D, E and F
- Allows for continuous diaphragm for floor and/or roof assembly
- Also stabilizes double fire walls to resist impact during seismic event

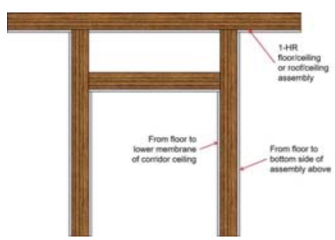


2018 IBC Significant Changes 66

66

708.4 Continuity of Fire Partitions

- Reformatted into 3 distinct areas:
  - Continuity in regard to enclosure limits
  - Supporting construction components
  - Fireblocking and draftstopping



2018 IBC Significant Changes 67

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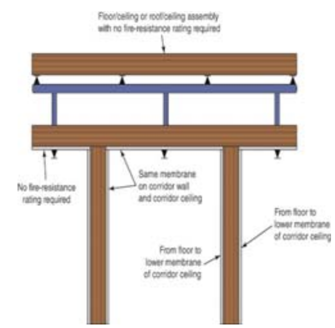
708.4 Continuity of Fire Partitions

- Additional enclosure continuity method for corridor walls that do not extend above lower membrane of corridor ceiling:
  - Applicable to sprinklered buildings where sprinklers installed in concealed space



2018 IBC Significant Changes 68

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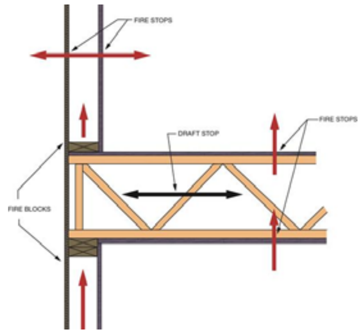
708.4.2 Fireblocking and Draftstopping at Fire Partitions

- General reorganization and consolidation effort
- Now only applicable in Group R-2 with four or more dwelling units and Group R-3 with more than two dwelling units



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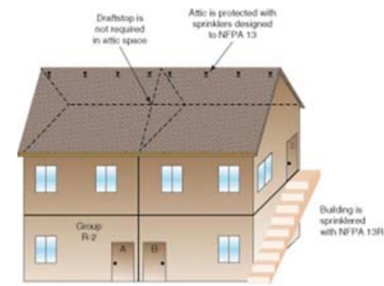
708.4.2 Fireblocking and Draftstopping at Fire Partitions

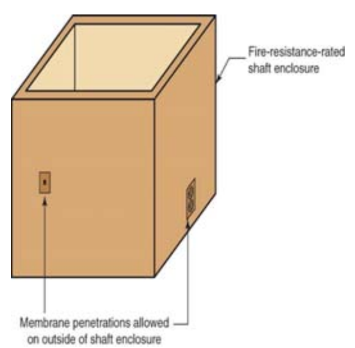
- Clarifies that where building has NFPA 13R sprinkler system, attic protection to be based on NFPA 13 system in order to eliminate required fireblocking/ draftstopping



70

713.8.1 Membrane Penetrations of Shaft Enclosures

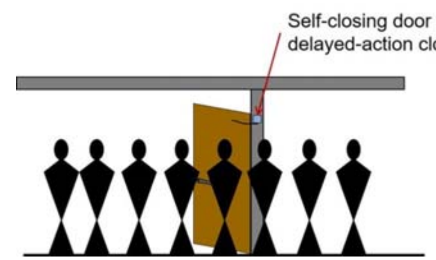
- Consistent with allowance for interior exit stairway membrane penetrations when protected per Section 714.4.2



71

716.2.6.5 Delayed-Action Self-Closing Doors

- Delay-action closers permitted where automatic-closing not required
- Defined as mechanical devices with an adjustable delay
- Time delay not specifically addressed



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Chapter 8

Interior Finishes

73

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803.1.1, 803.1.2 Interior Wall and Ceiling Finish Testing

- Criteria reorganized by:
  - Initially addressing allowance for compliance with NFPA 286 for all applications
  - Followed by testing under ASTM E84 and UL 723
  - Then other methods identified for special conditions such as textile coverings

2018 IBC Significant Changes 74

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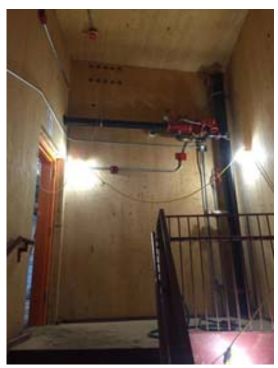
803.3 Interior Finish Requirements for Heavy Timber Members

- Now applicable to interior exit stairways, interior exit ramps and exit passageways



2018 IBC Significant Changes 75

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803.12 Flame Spread Testing of Laminates and Veneers

- Addresses flame spread testing for:
  - Factory-produced laminated products over a wood substrate
  - Facings and wood veneers applied over a wood substrate on site

2018 IBC Significant Changes 76

76

Chapter 9

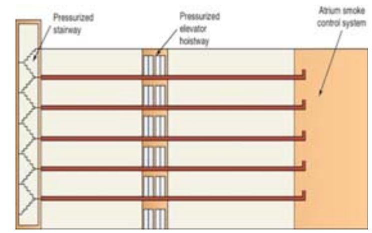
Fire Protection Systems

77

77

901.6.2 Integrated Fire Protection System Testing

- Where two or more fire protection or life safety systems are interconnected, the acceptance process and testing must evaluate all systems as a whole
- Reference is made to NFPA 4
- Integrated testing required for:
  - High-rise buildings
  - Smoke control systems



2018 IBC Significant Changes 78

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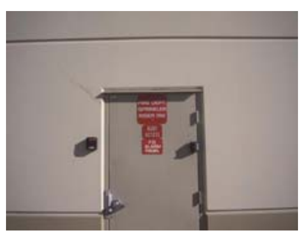
902.8 Fire Pump and Fire Sprinkler Riser Rooms

- Prescriptive provisions added for:
  - Access
  - Marking on access doors
  - Environment
  - Lighting



2018 IBC Significant Changes 79

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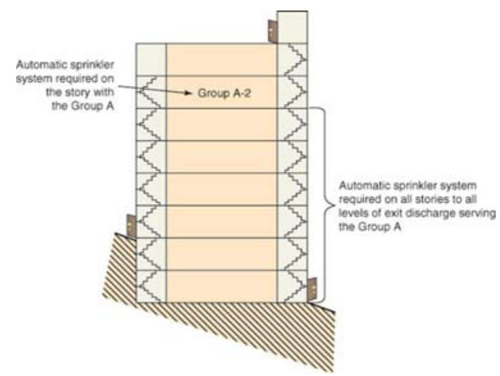
903.2.1 Sprinklers Required in Group A Occupancies



2018 IBC Significant Changes 80

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903.2.3 Sprinklers in Group E Occupancies

- Sprinkler protection now also required for Group E fire areas where fire area:
  - Located on a floor other than the level of exit discharge, or
  - Has an occupant load of 300 or more

2018 IBC Significant Changes 81

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903.3.1.1.2 Omission of Sprinklers in Group R-4 Bathrooms

- Group R-4 now included with other residential occupancies where sprinkler protection not required in small bathrooms

2018 IBC Significant Changes 82

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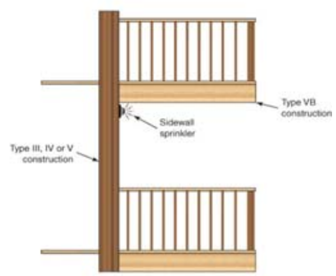
903.3.1.2.1 Sprinkler Protection at Balconies and Decks

- Allowance previously in Section 1406.3 for extension of sprinkler protection to exterior balconies in order to be of nonrated Type V construction has been relocated



2018 IBC Significant Changes 83

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903.3.1.2.3 Protection of Attics in Group R Occupancies

- Additional sprinkler protection or acceptable alternative methods now required for attics in multi-family occupancies equipped with an NFPA 13R system
- Applicable where roof assembly more than 55 feet above LLFDA
- Method of determining height of roof assembly established as greatest of:
  - Eave of highest pitched roof
  - Intersection of highest roof to exterior wall
  - Top of highest parapet

2018 IBC Significant Changes 84

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903.3.1.2.3 Protection of Attics in Group R Occupancies

- Methods of protection include:
  - Provide sprinkler protection
  - Construct attic of noncombustible materials
  - Construct attic of FRT wood
  - Fill attic with noncombustible insulation

2018 IBC Significant Changes 85

85

904.12 Commercial Cooking Operations

- Automatic fire-extinguishing system for commercial cooking systems to now be installed in accordance with NFPA 96
- Where automatic water mist systems are used, they shall comply with NFPA 750

2018 IBC Significant Changes 86

86

904.13 Domestic Cooking Protection in Institutional and Residential Occupancies

- Automatic fire-extinguishing system now required at required hood over any domestic cooktop or range in:
  - Group I-1 occupancies
  - Group R-2 college dormitories
- Previously only required in Group I-2, Condition 1 occupancies

2018 IBC Significant Changes 87

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904.14 Aerosol Fire Extinguishing Systems

- IFC and NFPA 2010 now referenced for installation, inspection, testing and maintenance of aerosol fire-extinguishing systems
- Previously recognized in ICC-ES Acceptance Criteria and resulting evaluation report

2018 IBC Significant Changes 88

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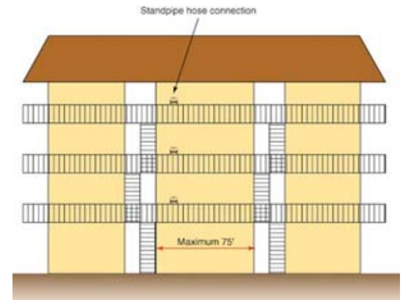
905.3.1 Class III Standpipes

- Class III standpipe system required where four or more stories above or below grade plane
- Class I standpipes now allowed:
  - In Group B occupancies
  - In Group E occupancies
  - Where occupant-use hose lines will not be utilized by trained personnel or fire department

89

905.4 Class I Standpipe Connection Locations

- Single hose connection permitted in open corridor or open breezeway between open stairs



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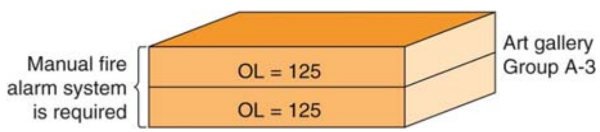
907.2.1 Fire Alarms in Group A Occupancies

- Manual fire alarm system required where Group A occupant load exceeds 100 above or below the lowest level of exit discharge



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907.2.10 Group R-4 Fire Alarm Systems

- Installation of manual fire alarm system and automatic smoke detection system no longer required in Group R-4 occupancies

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Chapter 10

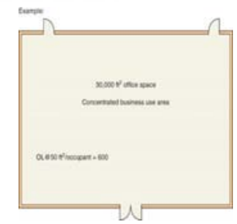
Means of Egress

Table 1004.5, 1004.8 Occupant Load Calculation in Business Use Areas

TABLE ~~1004.1.2~~ 1004.5 Maximum Floor Area Allowances Per Occupant

Function of Space	Occupant Load Factor[a]
Business areas	~~100~~150 gross
Concentrated business use areas	See Section 1004.8

(No changes to other portions of table.)



1006.2.1, Table 1006.2.1 Group R Spaces with One Exit or Exit Access Doorway

- Single exit Group R-4 spaces now allow for a maximum occupant load of 20

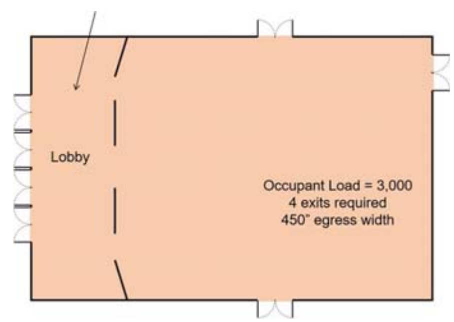
TABLE 1006.2.1 Spaces With One Exit or Exit Access Doorway

Occupancy	Maximum Occupant Load of Space	Maximum Common Path of Egress Travel Distance (feet): Without Sprinkler System (feet), Occupant Load: OL ≤ 30	Without Sprinkler System (feet), Occupant Load: OL > 30	With Sprinkler System (feet)
R-2	~~10~~ 20	NP	NP	125[a]
R-3[e]	~~10~~ 20	NP	NP	125[a,g]
R-4[e]	~~10~~ 20	~~75~~ NP	~~75~~ NP	125[a,g]

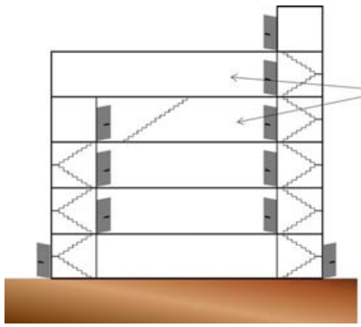
(Portions of table not shown are unchanged.)

a. *No change*
b. *No change*
c. *No change*
d. *No change*
e. The ~~length of~~ common path of egress travel distance shall only apply in a Group R-3 occupancy located in a mixed occupancy building.
f. *No change*
g. For the travel distance limitations in Groups R-3 and R-4 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.3, see Section 1006.2.2.6.

1006.2.1, Table 1006.2.1 Group R Spaces with One Exit or Exit Access Doorway



1006.3 Egress Through Adjacent Stories



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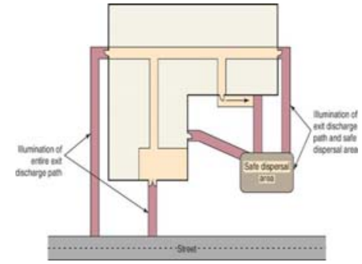
1008.2.3 Illumination of the Exit Discharge

- Where safe dispersal area is utilized, illumination required along exit discharge path as well as in dispersal area



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1008.3.5, 1008.2.2 Emergency Illumination in Group I-2

- Emergency lighting required in Group I-2 occupancies such that failure of single lamp in a luminaire maintains minimum 1 foot-candle illumination level
- Previously based on failure of single lighting unit

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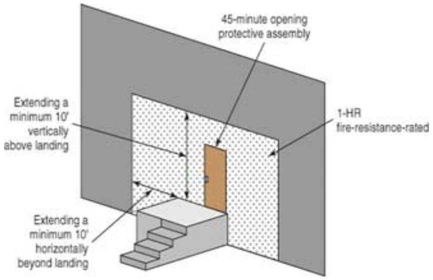
1009.7.2 Protection of Exterior Area of Assisted Rescue

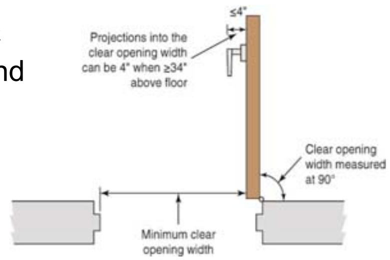
- Wall rating and opening protectives not required where building fully sprinklered



100

1010.1.1 Size of Doors

- Door width provisions reorganized and revised to correlate with technical requirements of ICC A117.1, ADA, IFC and IPC



101

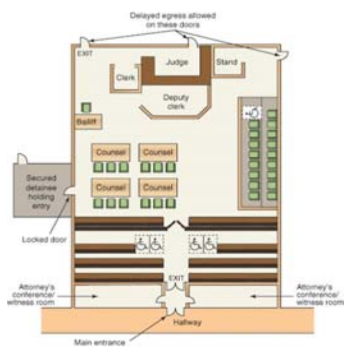
1010.1.4.4 Locking Arrangements in Educational Occupancies

- Applicable to both Groups E and B
- Addresses locking devices designed to keep intruders from entering room
- Conditions include:
  - Allows for outside unlocking
  - Openable from within room
  - Modifications to door hardware or closers not permitted

102

1010.1.9.8 Use of Delayed Egress Locking Systems in Group E Classrooms

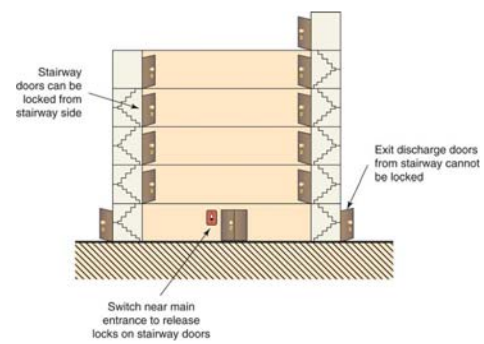
- Delayed egress locking devices now permitted on Group E classrooms with an occupant load < 50
- Also permitted on courtroom means of egress doors other than main door(s) where building is sprinklered



103

1010.1.9.12 Locks on Stairway Doors

- Allowance for locking of stairway doors no longer limited to stairways serving four stories or less



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1010.3.2 Security Access Turnstiles

- Allows for use as component of means of egress system where:
  - Building fully sprinklered
  - Minimum clear passage of 22 inches
  - Barrier automatically retracts to open position under each of 5 conditions
- Egress capacity limit to 50 persons where < 32 inches clear

2018 IBC Significant Changes 105

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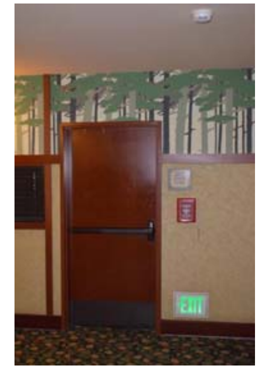
1013.2 Floor Level Exit Sign Location

- Bottom of 'low-level' exit signs now limited to maximum 18 inches above floor level



2018 IBC Significant Changes 106

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1015.6, 1015.7 Fall Arrest for Rooftop Equipment

- Prescriptive provisions for placement of personal fall arrest/restraint anchorage connector devices deleted with reference to ANSI/ASSE Z 359.1
- Now standard provides guidance on actual roof system and equipment location

2018 IBC Significant Changes 107

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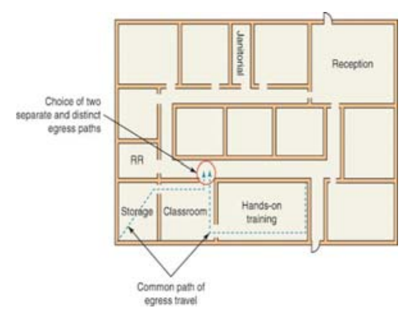
1017.3, 202 Measurement of Egress Travel

- Common path measurement applicable to every room, area or space



2018 IBC Significant Changes 108

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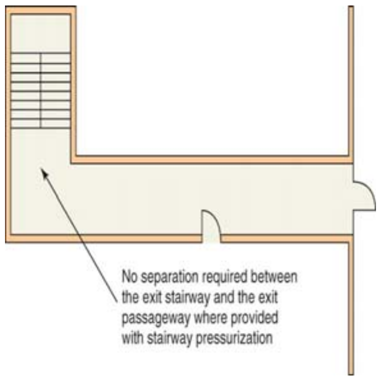
1023.3.1 Stairway Extensions



109

1023.5, 1024.6 Exit Stairway and Exit Passageway Penetrations

- Allowable penetrations into or through interior exit stairways/ramps and exit passageways now include:
  - Security systems
  - Two-way communication systems

110

1025.1 Luminous Egress Path Marking in Group I-1 Occupancies

- Luminous egress path markings no longer required in high-rise buildings classified as Group I-2, I-3 or I-4 occupancies

111

1026.4 Refuge Areas for Horizontal Exits

- Refuge area to accommodate:
  - Original occupant load of refuge area, plus
  - Occupant load anticipated from adjoining compartment
- Anticipated occupant load to be based on:
  - Capacity of horizontal exit doors entering the refuge area, or
  - <u>Total occupant load of adjoining compartment, whichever is less</u>
- Floor area/occupant now references Chapter 4

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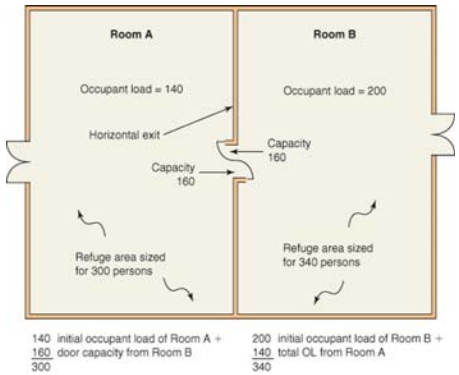
1026.4 Refuge Areas for Horizontal Exits



2018 IBC Significant Changes 113

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1029.6, 1029.6.3, 202 Open-Air Assembly Seating

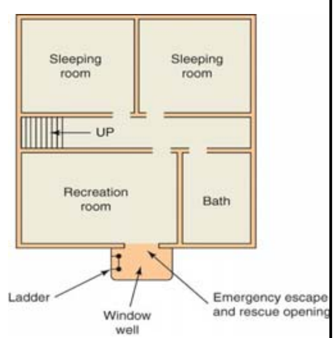
- Outdoor smoke-protected assembly seating now referred to as "open-air assembly seating"
- New definition recognizing seating served by means of egress not subject to smoke accumulation within or under a structure and open to atmosphere

2018 IBC Significant Changes 114

114

1030.1 Required Emergency Escape and Rescue Openings

- Clarified scope of provisions regarding single-exit stories
- Group R-4 now specifically addressed
- In sprinklered buildings, basement sleeping rooms not required to have EEROs where:
  - One MOE and one EERO, or
  - Two MOEs



2018 IBC Significant Changes 115

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Chapter 11

Accessibility

116

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1103.2.14 Access to Walk-In Coolers and Freezers

- Walk-in cooler and freezer equipment exempted from accessibility provisions where accessed only from work areas

2018 IBC Significant Changes 117

117

1109.2.1.2 Fixtures in Family or Assisted-Use Toilet Rooms

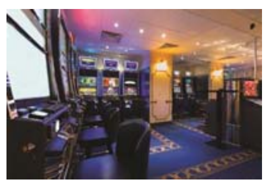
- Additional fixtures permitted in a family or assist-use toilet room now include:
  - Child-height water closet
  - Child-height lavatory
- Provides additional accommodation on an optional basis

2018 IBC Significant Changes 118

118

1109.15 Access to Gaming Machines and Gaming Tables

- Access to gaming areas in casinos and similar facilities now regulated separately for:
  - Gaming machine type
  - Gaming table type
- Requirement for front approach at gaming machines deleted



2018 IBC Significant Changes 119

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1110.4.13 Access to Play Areas for Children

- Play areas containing children's play components to be located on accessible route

2018 IBC Significant Changes 120

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Chapter 12

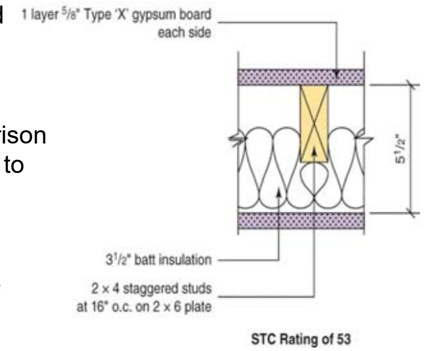
Interior Environment

121

121

1206.2, 1207.3 Engineering Analysis of Sound Transmission

- Performance-based approach to sound transmission compliance
- Based on a comparison with designs tested to ASTM E90
- Applies to both:
  - Air-borne sound
  - Structural-borne sound



2018 IBC Significant Changes 122

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Chapter 14

Exterior Walls

123

123

Table 1404.2 Weather Covering Minimum Thickness

TABLE ~~1405.2~~ 1404.2 Minimum Thickness of Weather Coverings

Covering Type	Minimum Thickness (inches)
Adhered masonry veneer	~~0.25~~
• Architectural cast stone	0.75
• Other	0.25
Anchored masonry veneer	~~2.625~~
• Stone (natural)	2.0
• Architectural cast stone	1.25
• Other	2.625
~~Stone (cast artificial, anchored)~~	~~1.5~~
~~Stone (natural)~~	~~2.0~~

(Portions of table and footnotes not shown remain unchanged.)

2018 IBC Significant Changes 124

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1404.18 Polypropylene Siding

- Polypropylene siding now permitted for use on exterior walls of all types of construction
- Previously limited to Type VB construction

2018 IBC Significant Changes 125

125

Chapter 15

Roof Assemblies and Rooftop Structures

126

126

1504.3.3 Metal Roof Shingles

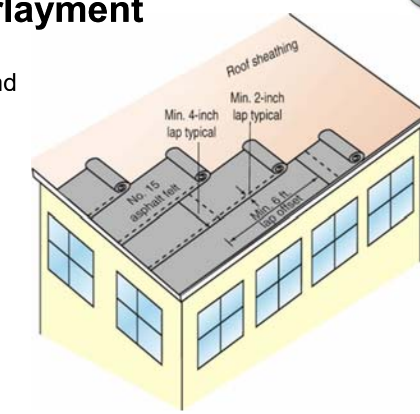
- Metal roof shingles now addressed independent from other metal panel roof systems
- Reference made to applicable standards for:
  - Labeling
  - Testing for wind resistance

2018 IBC Significant Changes 127

127

1507.1 Underlayment

- Underlayment and ice barrier requirements relocated to a single location in code to address:
  - Type
  - Attachment
  - Application



2018 IBC Significant Changes 128

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1507.1 Underlayment

TABLE 1507.1.1(2) Underlayment Application

Roof Covering	Section	Maximum Basic Design Wind Speed, $V < 140$ mph	Maximum Basic Design Wind Speed, $V \geq 140$ mph
Asphalt shingles	1507.2	For roof slopes from two units vertical in 12 units horizontal (2:12), up to four units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied as follows: Apply a 19-inch (483 mm) strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment, overlapping successive sheets 19 inches (483 mm). End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm). Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of four units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied as follows: Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (51 mm). Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm).	Same as Maximum Basic Design Wind Speed, $V < 140$ mph except all laps shall be not less than 4 inches (102 mm).

2018 IBC Significant Changes 129

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1507.18 Building Integrated Photovoltaic Panels

- Roof covering requirements established for BIPV panel systems
  - Deck requirements
  - Deck slope
  - Underlayment
  - Material standards
  - Attachment
  - Wind resistance

2018 IBC Significant Changes 130

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Chapter 16

Structural Design

131

131

1603.1 Construction Documents

- Additional loads to be identified for conventional light-frame construction:
  - Floor and roof dead loads
  - Rain load data
- Slope factor to now be included in roof snow load data
- Rain intensity to be shown regardless of whether rain loads govern the design

2018 IBC Significant Changes 132

132

1604.3.7 Deflection of Glass Framing

- Deflection of framing members supporting glass now addressed based on length of member span
- When subjected to 0.6 times the component and cladding wind loads, deflection limited to:
  - 1/175 of span length not more than 13 feet 6 inches
  - 1/240 + ¼ inch for members with greater lengths

2018 IBC Significant Changes 133

133

1604.5.1 Multiple Occupancies

- Where assigning a risk category to a building with a storm shelter, the normal occupancy of building shall apply

2018 IBC Significant Changes 134

134

1604.10 Storm Shelters

- ICC 500 standard now referenced for load determinations of storm shelters
  - Provides wind speeds for tornado and hurricane shelter design using ASCE 7 load combinations

2018 IBC Significant Changes 135

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Table 1607.1 Deck Live Load

TABLE 1607.1 Minimum Uniformly Distributed Live Loads, L_o, and Minimum Concentrated Live Loads

Occupancy or Use	Uniform (psf)	Concentrated (pounds)
5. Balconies and decks[h]	1.5 times the live load for the area served, not required to exceed 100 ~~Same as occupancy served~~	—

h. See Section 1604.8.3 for decks attached to exterior walls.

2018 IBC Significant Changes 136

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Table 1607.1 Live Load Reduction

- Table 1607.1 now clarified as to where heavy live loads of 100 psf or greater may be reduced
- Three conditions addressed by footnotes:
  - “m” Not permitted
  - “n” Only per Section 1607.11.1.2 or Item 1 of Section 1607.11.2
  - “o” Only per Section 1607.11.1.3 or Item 2 of Section 1607.11.2

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Table 1607.1 Live Load Reduction

Occupancy or Use	Uniform (psf)	Concentrated (pounds)
26. Roofs		
Occupiable roofs:		
Roof gardens	100	
Assembly areas	100[m]	
All other similar areas	Note l	Note l
29. Sidewalks, vehicular driveways and yards, subject to trucking	250[d, m]	8,000[e]

(Footnotes a-k not included for brevity.)

l. Areas of occupiable roofs, other than roof gardens and assembly areas, shall be designed for appropriate loads as approved by the building official. Unoccupied landscaped areas of roofs shall be designed in accordance with Section ~~1607.12.3~~ 1607.13.3.

m. Live load reduction is not permitted ~~unless specific exceptions of Section 1607.10 apply~~.

n. Live load reduction is only permitted in accordance with Section 1607.11.1.2 or Item 1 of Section 1607.11.2.

o. Live load reduction is only permitted in accordance with Section 1607.11.1.3 or Item 2 of Section 1607.11.2.

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1607.14.2 Minimum Fire Load for Fire Walls

- Minimum lateral loading required for fire walls now established at 5 psf
- Based on assumption that structure on one side of wall has collapsed
- Consistent with fire walls designed in accordance with NFPA 221

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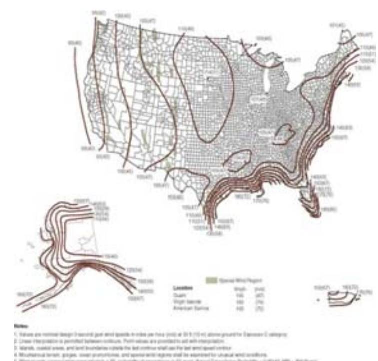
1609 Wind Loads

- Updated wind speed maps
- Terminology changed from “ultimate design” to “basic design”



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1613 Earthquake Loads

- Values of site coefficients now in alignment with newest generation of ground motion attenuation equations
- Modifications made for both short period and 1-second period parameters
- Previous coefficients based on soil studies performed in early 1990s

2018 IBC Significant Changes 141

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1613 Earthquake Loads

TABLE ~~1613.3.3(1)~~ 1613.2.3(1) Values of Site Coefficient F_a[a]

Site Class	Mapped Risk Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameter at short period					
	$S_s \le 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	S_s ~~≥~~ = 1.25	$S_s \ge 1.5$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	0.9~~1.0~~	0.9~~1.0~~	0.9~~1.0~~	0.9~~1.0~~	0.9~~1.0~~	0.9
C	1.3~~1.2~~	1.3~~1.2~~	1.2~~1.1~~	1.2~~1.0~~	1.2~~1.0~~	1.2
D	1.6	1.4	1.2	1.1	1.0	1.0
E	2.4~~2.5~~	1.7	1.3~~1.2~~	Note b~~0.9~~	Note b~~0.9~~	Note b
F	Note b	Note b	Note b	Note b	Note b	Note b

a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at short period, S_s.
b. Values shall be determined in accordance with Section ~~11.4.7~~ 11.4.8 of ASCE 7.

TABLE ~~1613.3.3(2)~~ 1613.2.3(2) Values of Site Coefficient F_v[a]

Site Class	Mapped Risk Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameter at 1-second period					
	$S_1 \le 0.1$	$S_1 = 0.2$	$S_1 = 0.3$	$S_1 = 0.4$	S_1 ~~≥~~ = 0.5	$S_1 \ge 0.6$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	0.8 ~~1.0~~	0.8 ~~1.0~~	0.8 ~~1.0~~	0.8 ~~1.0~~	0.8 ~~1.0~~	0.8
C	1.5 ~~1.7~~	1.5 ~~1.6~~	1.5	1.5 ~~1.4~~	1.5 ~~1.3~~	1.4
D	2.4	2.2[c] ~~2.0~~	2.0[c] ~~1.8~~	1.9[c] ~~1.6~~	1.8[c] ~~1.5~~	1.7[c]
E	4.2 ~~3.5~~	3.3[c] ~~3.2~~	2.8[c]	2.4[c]	2.2[c] ~~2.4~~	2.0[c]
F	Note b	Note b	Note b	Note b	Note b	Note b

a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at 1-second period, S_1.
b. Values shall be determined in accordance with Section ~~11.4.7~~ 11.4.8 of ASCE 7.
c. See requirements for site-specific ground motions in Section ~~11.4.7~~ 11.4.8 of ASCE 7.

2018 IBC Significant Changes 142

142

1613.2.1 Seismic Maps

- Seismic maps updated to match new maps in
  - 2015 NEHRP
  - 2016 ASCE 7

2018 IBC Significant Changes 143

143

1615 Tsunami Loads

- New section and definitions address tsunami-resistant design of critical infrastructure and essential facilities
- Applicable to Risk Category III and IV structures located in Tsunami Design Zones

2018 IBC Significant Changes 144

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Chapter 17

Special Inspections and Tests

145

145

1704.6 Structural Observation

- Structural observation now required in <u>all</u> buildings classified as:
  - High-rise
  - Risk Category IV

2018 IBC Significant Changes 146

146

1705.5.2 Metal-plate-connected Wood Trusses

- Special inspection of wood trusses required where:
  - Clear span exceeds 60 feet, <u>or</u>
  - <u>Overall height is 60 inches or greater</u>

2018 IBC Significant Changes 147

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1705.12.1, 1705.13.1 Seismic Force-Resisting Systems

- Exceptions for special inspection of structural steel in seismic force-resisting systems have been clarified for structures in moderate and high-seismic regions
  - Applicable to all SDCs except A

2018 IBC Significant Changes 148

148

1705.12.6 Fire Sprinkler Clearance

- Provisions added for periodic special inspection of minimum clearance of fire sprinkler components to mechanical, electrical and plumbing systems
  - Not required where flexible sprinkler hose fittings are used

2018 IBC Significant Changes 149

149

Chapter 18

Soils and Foundations

150

150

1804.4 Site Grading

- Impervious surfaces now permitted to slope less than 2% where surface is a door landing or ramp required to comply with egress provisions
- General provisions require minimum 2% slope to allow for water drainage away from building

2018 IBC Significant Changes 151

151

1807.2 Retaining Walls

- Presence of a keyway in a retaining wall no longer recognized in the sliding analysis of the wall
- Keyway may still be used when designed using the principles of soil mechanics and accepted engineering practice

2018 IBC Significant Changes 152

152

1810.3.8.3 Precast Prestressed Piles

- Equations addressing precast prestressed piles have been updated

2018 IBC Significant Changes 153

153

Chapter 19

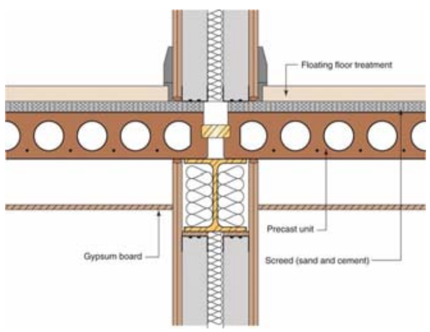
Concrete

154

154

1901.2 Seismic Loads for Precast Concrete Diaphragms

- In the design of precast concrete diaphragms used in buildings located in high seismic regions, applicable provisions of ASCE 7 to be used



2018 IBC Significant Changes 155

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Chapter 22

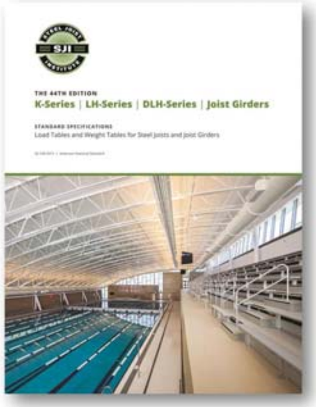
Steel

156

156

2207.1 SJI Standard

- 2015 edition of combined SJI1-100 standard now referenced for steel joists



2018 IBC Significant Changes 157

157

2209.2 Cantilevered Steel Storage Racks

- Reference is now made to RMI standard for cantilevered steel storage racks

2018 IBC Significant Changes 158

158

2211 Cold-Formed Light-Frame Construction

- 2015 editions of AISI standards for cold-formed steel now referenced

2018 IBC Significant Changes 159

159

Chapter 23

Wood

160

160

2303.2.2 Fire-Retardant-Treated Wood

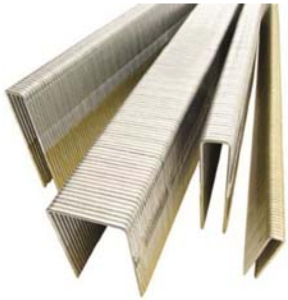
- Engineered lumber of FRT wood to be impregnated with chemicals
- Paints, coating, stains and other surface treatments not an approved method

2018 IBC Significant Changes 161

161

2303.6 Nails and Staples

- Nails and staples to also comply with Supplement 1 of ASTM F 1667
- Minimum average bending moment values have been added for staples



2018 IBC Significant Changes 162

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Table 2304.9.3.2 Mechanically Laminated Decking

- New alternative fastener schedule for construction of mechanically laminated decking
- Provides for equivalency where power-driven fasteners are used instead of 30 penny nails

2018 IBC Significant Changes 163

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Table 2304.9.3.2 Mechanically Laminated Decking

TABLE 2304.9.3.2 Fastening Schedule for Mechanically Laminated Decking Using Laminations of 2-inch Nominal Thickness

Minimum Nail Size (Length × Diameter) (inches)	Maximum Spacing Between Face Nails[a,b] (inches)		Number of Toenails into Supports[c]
	Decking Supports ≤ 48 inches o.c.	Decking Supports > 48 inches o.c.	
4 × 0.192	30	18	1
4 × 0.162	24	14	2
4 × 0.148	22	13	2
3½ × 0.162	20	12	2
3½ × 0.148	19	11	2
3½ × 0.135	17	10	2
3 × 0.148	11	7	2
3 × 0.128	9	5	2
2¾ × 0.148	10	6	2
2¾ × 0.131	9	6	3
2¾ × 0.120	8	5	3

For SI: 1 inch = 25.4 mm

a. Nails shall be driven perpendicular to the lamination face, alternating between top and bottom edges.

b. Where nails penetrate through two laminations and into the third, they shall be staggered one-third of the spacing in adjacent laminations. Otherwise, nails shall be staggered one-half of the spacing in adjacent laminations.

c. Where supports are 48 inches (1219 mm) on center or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches (1219 mm) on center, alternate laminations shall be toenailed to every support.

2018 IBC Significant Changes 164

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Table 2304.10.1 Ring Shank Nails

- 8-penny common or ring shank nails now addressed for fastening of roof sheathing when nailing 6 inches or 12 inches on center
- Provides for alignment of 2018 IBC and IRC

2018 IBC Significant Changes 165

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Table 2304.10.1 Ring Shank Nails

TABLE 2304.10.1 Fastening Schedule, roof requirements

Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing		Spacing and Location	
Building Element	Number and Type of Fastener	Edges (inches)	Intermediate supports (inches)
~~31.~~ 30. 3/8" - 1/2"	8d ~~box~~ common or deformed (2½" × ~~0.113~~ 0.131") (roof), or RSRS-01 (2 3/8" × 0.113") nail (roof)[d]	6	12
	2 3/8" × 0.113" nail (roof)	4	8
	1-3/4" 16 gage staple, 7/16" crown (roof)	3	6
~~32.~~ 31. 19/32" - 3/4"	8d common or deformed (2½" × 0.131") (roof), or RSRS-01 (2 3/8" × 0.113") nail (roof)[d]	6	12
	2 3/8" × 0.113" nail; or 2" 16 gage staple, 7/16" crown	4	8
~~33.~~ 32. 7/8" - 1¼"	10d common (3" × 0.148"); or 8d deformed (2½" × 0.131")	6	12

For SI: 1 inch = 25.4 mm.
d. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F 1667.
(No changes to footnotes a–c.)

2018 IBC Significant Changes 166

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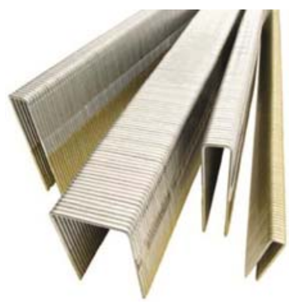
2304.10.5 Fasteners in Treated Wood

- Staples used in preservative-treated wood and fire-retardant-treated wood now required to be made of stainless steel



2018 IBC Significant Changes 167

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2304.11 Heavy-Timber Construction

- Heavy timber provisions of Chapter 23 have been reorganized
- Table on engineered lumber dimensional equivalencies relocated from Section 602.4

2018 IBC Significant Changes 168

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2304.11 Heavy-Timber Construction

TABLE ~~602.4~~TABLE 2304.11 ~~Wood Member Size Equivalencies~~ Minimum Dimensions of Heavy Timber Structural Members

Supporting	Heavy Timber Structural Elements	Minimum Nominal Solid Sawn Size Width, inch	Minimum Nominal Solid Sawn Size Depth, inch	Minimum Glued-laminated Net Size Width, inch	Minimum Glued-laminated Net Size Depth, inch	Minimum Structural Composite Lumber Net Size Width, inch	Minimum Structural Composite Lumber Net Size Depth, inch
Floor loads only or combined floor and roof loads	• Columns; • Framed sawn or glue-laminated timber arches which spring from the floor line; • Framed timber trusses	8	8	6¾	8¼	7	7½
	• Wood beams and girders	6	10	5	10½	5¼	9½
Roof loads only	• Columns (roof and ceiling loads); • Lower half of wood-frame or glue-laminated arches which spring from the floor line or from grade	6	8	5	8¼	5¼	7½
	• Upper half of wood-frame or glue-laminated arches which spring from the floor line or from grade	6	6	5	6	5¼	5½
	• Framed timber trusses and other roof framing[a]; • Framed or glue-laminated arches that spring from the top of walls or wall abutments	4[b]	6	3[b]	6⅞	3½[b]	5½

For SI: 1 inch = 25.4 mm.

a. Spaced members shall be permitted to be composed of two or more pieces not less than 3 inches (76 mm) nominal in thickness where blocked solidly throughout their intervening spaces or where spaces are tightly closed by a continuous wood cover plate of not less than 2 inches (51 mm) nominal in thickness secured to the underside of the members. Splice plates shall be not less than 3 inches (76 mm) nominal in thickness.

b. Where protected by approved automatic sprinklers under the roof deck, framing members shall be not less than 3 inches (76 mm) nominal in width.

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2304.12.2.5, 2304.12.2.6 Supporting Members for Permeable Floors and Roofs

- Where an impervious moisture barrier system is used to protect the wood structure supporting floors, positive drainage shall be provided for water that infiltrates the moisture-permeable floor topping

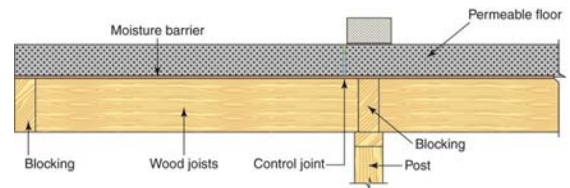

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Table 2308.4.1.1 (1) Header and Girder Spans – Exterior Walls

TABLE 2308.4.1.1(1) Header and Girder Spans[a,b] for Exterior Bearing Walls

Headers and Girders Supporting	Size	Ground Snow Load (psf)[e] 30, Building Width[c] (feet) 12 Span[f]	NJ[d]	30, 24 Span[f]	NJ[d]	30, 36 Span[f]	NJ[d]	50, 12 Span[f]	NJ[d]
Roof and Ceiling	1-2 × 6	4 - 0	1	3 - 1	2	2 - 7	2	3 - 5	1
	1-2 × 8	5 - 1	2	3 - 11	2	3 - 3	2	4 - 4	2
	1-2 × 10	6 - 0	2	4 - 8	2	3 - 11	2	5 - 2	2
	1-2 × 12	7 - 1	2	5 - 5	2	4 - 7	3	6 - 1	2
	2-2 × 4	4 - 0	1	3 - 1	1	2 - 7	1	3 - 5	1
	2-2 × 6	6 - 0	1	4 - 7	1	3 - 10	1	5 - 1	1
	2-2 × 8	7 - 7	1	5 - 9	1	4 - 10	2	6 - 5	1
	2-2 × 10	9 - 0	1	6 - 10	2	5 - 9	2	7 - 8	2
	2-2 × 12	10 - 7	2	8 - 1	2	6 - 10	2	9 - 0	2
	3-2 × 8	9 - 5	1	7 - 3	1	6 - 1	1	8 - 1	1
	3-2 × 10	11 - 3	1	8 - 7	1	7 - 3	2	9 - 7	1
	3-2 × 12	13 - 2	1	10 - 1	2	8 - 6	2	11 - 3	2
	4-2 × 8	10 - 11	1	8 - 4	1	7 - 0	1	9 - 4	1
	4-2 × 10	12 - 11	1	9 - 11	1	8 - 4	1	11 - 1	1
	4-2 × 12	15 - 3	1	11 - 8	1	9 - 10	2	13 - 0	1
Roof, ceiling and one center-bearing floor	1-2 × 6	3 - 3	1	2 - 7	2	2 - 2	2	3 - 0	2
	1-2 × 8	4 - 1	2	3 - 3	2	2 - 9	2	3 - 9	2
	1-2 × 10	4 - 11	2	3 - 10	2	3 - 3	3	4 - 6	2

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are given in feet and inches.

b. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir. ~~No. 1 or better grade lumber shall be used for Southern Pine.~~

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

e. Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.

f. Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2x8, 2x10, or 2x12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.

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Table 2308.4.1.1 (2) Header and Girder Spans – Interior Walls

TABLE 2308.4.1.1(2) Header and Girder Spans[a,b] for Interior Bearing Walls

Headers and Girders Supporting	Size	Building Width[c] (feet) 12 Span[e]	NJ[d]	24 Span[e]	NJ[d]	36 Span[e]	NJ[d]
One floor only	2-2 × 4	4 - 1	1	2 - 10	1	2 - 4	1
	2-2 × 6	6 - 1	1	4 - 4	1	3 - 6	1
	2-2 × 8	7 - 9	1	5 - 5	1	4 - 5	2
	2-2 × 10	9 - 2	1	6 - 6	2	5 - 3	2
	2-2 × 12	10 - 9	1	7 - 7	2	6 - 3	2
	3-2 × 8	9 - 8	1	6 - 10	1	5 - 7	1
	3-2 × 10	11 - 5	1	8 - 1	1	6 - 7	2
	3-2 × 12	13 - 6	1	9 - 6	2	7 - 9	2
	4-2 × 8	11 - 2	1	7 - 11	1	6 - 5	1
	4-2 × 10	13 - 3	1	9 - 4	1	7 - 8	1
	4-2 × 12	15 - 7	1	11 - 0	1	9 - 0	2
Two floors	2-2 × 4	2 - 7	1	1 - 11	1	1 - 7	1
	2-2 × 6	3 - 11	1	2 - 11	2	2 - 5	2
	2-2 × 8	5 - 0	1	3 - 8	2	3 - 1	2
	2-2 × 10	5 - 11	2	4 - 4	2	3 - 7	2
	2-2 × 12	6 - 11	2	5 - 2	2	4 - 3	3
	3-2 × 8	6 - 3	1	4 - 7	2	3 - 10	2
	3-2 × 10	7 - 5	1	5 - 6	2	4 - 6	2
	3-2 × 12	8 - 8	2	6 - 5	2	5 - 4	2
	4-2 × 8	7 - 2	1	5 - 4	1	4 - 5	2
	4-2 × 10	8 - 6	1	6 - 4	2	5 - 3	2
	4-2 × 12	10 - 1	1	7 - 5	2	6 - 2	2

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are given in feet and inches.

b. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir. ~~No. 1 or better grade lumber shall be used for Southern Pine.~~

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

e. Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2x8, 2x10, or 2x12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.

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2308.5.5.1 Openings in Exterior Bearing Walls

- Single member headers now permitted under conventional light-frame construction provisions of Section 2308
- Typically limited to spans of two to four feet as set forth in Table 2308.4.1.1(1)
- Increases energy efficiency by allowing for a greater thickness of cavity insulation

2018 IBC Significant Changes 173

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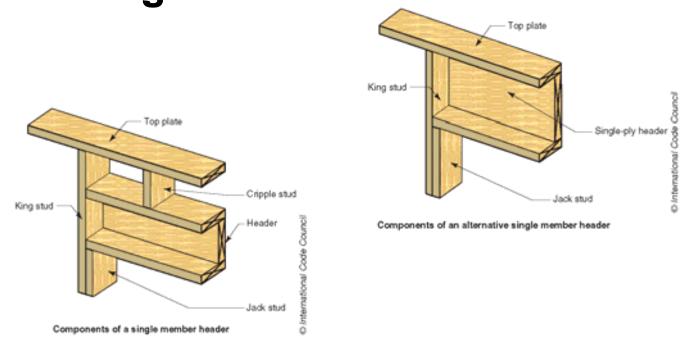
2308.5.5.1 Openings in Exterior Bearing Walls



2018 IBC Significant Changes 174

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Chapter 24

Glass and Glazing

175

175

2407.1 Structural Glass Baluster Panels

- Guards with structural glass baluster panels to be installed with an attached top rail <u>or handrail</u>

2018 IBC Significant Changes 176

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Chapter 25

Gypsum Board, Gypsum Panel Products and Plaster

177

177

2510.6 Water-Resistive Barrier

- Where a water-resistive barrier is applied over wood based sheathing, a ventilated air space shall be provided between the stucco and water-resistive barrier
  - Applicable in Climate Zones 1A, 2A or 3A
- Provides a means to mitigate the potential for moisture migration into the wall assembly

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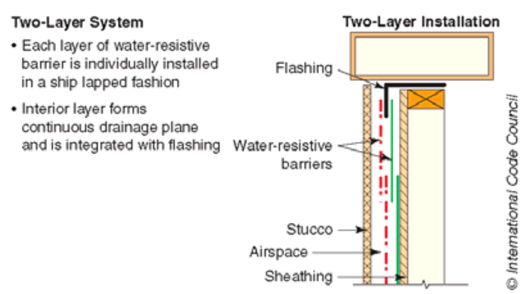
2510.6 Water-Resistive Barrier



Water-resistive barrier

2018 IBC Significant Changes 179

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Chapter 26

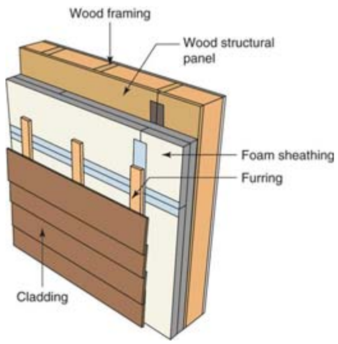
Plastic

180

180

2603.13 Cladding Attachment over Foam Sheathing to Wood Framing

- IBC now consistent with IRC regarding cladding over foam sheathing and wood framing
- New provisions added addressing both direct attachment and furred cladding attachment



181

2603.13 Cladding Attachment over Foam Sheathing to Wood Framing

TABLE 2603.13.1 Cladding Minimum Fastening Requirements for Direct Attachment over Foam Plastic Sheathing to Support Cladding Weight[a]

Cladding Fastener Through Foam Sheathing into:	Cladding Fastener - Type and Minimum Size[b]	Cladding Fastener Vertical Spacing (inches)	Maximum Thickness of Foam Sheathing[c] (inches): 16" o.c. Fastener Horizontal Spacing, Cladding Weight: 3 psf	16" o.c.: 11 psf	16" o.c.: 18 psf	16" o.c.: 25 psf	24" o.c. Fastener Horizontal Spacing, Cladding Weight: 3 psf	24" o.c.: 11 psf	24" o.c.: 18 psf	24" o.c.: 25 psf
Wood Framing (minimum 1¼-inch penetration)	0.113" diameter nail	6	2.00	1.45	0.75	DR	2.00	0.85	DR	DR
		8	2.00	1.00	DR	DR	2.00	0.55	DR	DR
		12	2.00	0.55	DR	DR	1.85	DR	DR	DR
	0.120" diameter nail	6	3.00	1.70	0.90	0.55	3.00	1.05	0.50	DR
		8	3.00	1.20	0.60	DR	3.00	0.70	DR	DR
		12	3.00	0.70	DR	DR	2.15	DR	DR	DR
	0.131" diameter nail	6	4.00	2.15	1.20	0.75	4.00	1.35	0.70	DR
		8	4.00	1.55	0.80	DR	4.00	0.90	DR	DR
		12	4.00	0.90	DR	DR	2.70	0.50	DR	DR
	0.162" diameter nail	6	4.00	3.55	2.05	1.40	4.00	2.25	1.25	0.80
		8	4.00	2.55	1.45	0.95	4.00	1.60	0.85	0.50
		12	4.00	1.60	0.85	0.50	4.00	0.95	DR	DR

For SI: 1 inch = 25.4 mm; 1 pound per square foot (psf) = 0.0479 kPa
DR = design required
o.c. = on center

a. Wood framing shall be spruce-pine-fir or any wood species with a specific gravity of 0.42 or greater in accordance with ANSI/AWC NDS.
b. Nail fasteners shall comply with ASTM F 1667, except nail length shall be permitted to exceed ASTM F 1667 standard lengths.
c. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C 578 or ASTM C 1289.

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2603.13 Cladding Attachment over Foam Sheathing to Wood Framing

TABLE 2603.13.2 Furring Minimum Fastening Requirements for Application over Foam Plastic Sheathing to Support Cladding Weight[a,b]

Furring Material	Framing Member	Fastener Type and Minimum Size	Minimum Penetration into Wall Framing (inches)	Fastener Spacing in Furring (inches)	Maximum Thickness of Foam Sheathing[d] (inches): 16" o.c. Furring[e], Siding Weight: 3 psf	16" o.c.: 11 psf	16" o.c.: 18 psf	16" o.c.: 25 psf	24" o.c. Furring[e], Siding Weight: 3 psf	24" o.c.: 11 psf	24" o.c.: 18 psf	24" o.c.: 25 psf
Minimum 1x Wood Furring[c]	Minimum 2x Wood Stud	0.131" diameter nail	1¼	8	4.00	2.45	1.45	0.95	4.00	1.60	0.85	DR
				12	4.00	1.60	0.85	DR	4.00	0.95	DR	DR
				16	4.00	1.10	DR	DR	3.05	0.60	DR	DR
		0.162" diameter nail	1¼	8	4.00	4.00	2.45	1.60	4.00	2.75	1.45	0.85
				12	4.00	2.75	1.45	0.85	4.00	1.65	0.75	DR
				16	4.00	1.90	0.95	DR	4.00	1.05	DR	DR
		No. 10 wood screw	1	12	4.00	2.30	1.20	0.70	4.00	1.40	0.60	DR
				16	4.00	1.65	0.75	DR	4.00	0.90	DR	DR
				24	4.00	0.90	DR	DR	2.85	DR	DR	DR
		¼" lag screw	1½	12	4.00	2.65	1.50	0.90	4.00	1.65	0.80	DR
				16	4.00	1.95	0.95	0.50	4.00	1.10	DR	DR
				24	4.00	1.10	DR	DR	3.25	0.50	DR	DR

For SI: 1 inch = 25.4 mm; 1 pound per square foot (psf) = 0.0479 kPa
DR = design required
o.c. = on center

a. Wood framing and furring shall be spruce-pine-fir or any wood species with a specific gravity of 0.42 or greater in accordance with ANSI/AWC NDS.
b. Nail fasteners shall comply with ASTM F 1667, except nail length shall be permitted to exceed ASTM F 1667 standard lengths.
c. Where the required cladding fastener penetration into wood material exceeds ¾ inch (19 mm) and is not more than 1½ inches (38 mm), a minimum 2x wood furring or an approved design shall be used.
d. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C 578 or ASTM C 1289.
e. Furring shall be spaced not greater than 24 inches (610 mm) on center in a vertical or horizontal orientation. In a vertical orientation, furring shall be located over wall studs and attached with the required fastener spacing. In a horizontal orientation, the indicated 8-inch (203 mm) and 12-inch (305 mm) fastener spacing in furring shall be achieved by use of two fasteners into studs at 16 inches (406 mm) and 24 inches (610 mm) on center, respectively.

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Chapter 30

Elevators and Conveying Systems

184

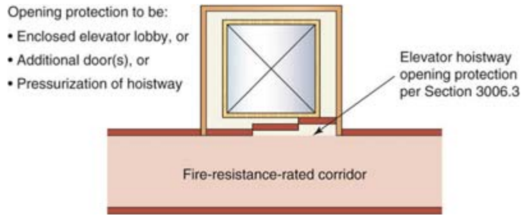
3001.2 Emergency Elevator Communication Systems

- Two-way communication system to be visual text-based, video-based and live interactive
- Accessible to individuals who are deaf, hard of hearing and speech impaired

185

3006.2.1 Corridors Adjacent to Elevator Hoistway Openings

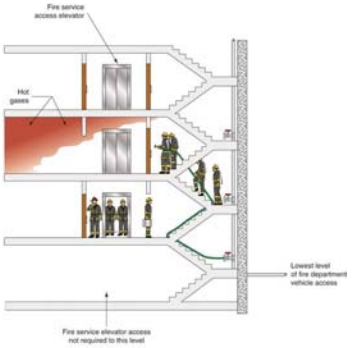
- Hoistway openings to be protected where corridors to be fire-resistance-rated per Section 1020.1



186

3007.1 Extent of Fire Service Access Elevator Travel

- Only floors at and above lowest level of fire department vehicle access need to served by fire service access elevators
- Not required for elevators that only serve parking garage and lobby levels



187

3008.1.1 Required Number of Occupant Evacuation Elevators

- Minimum number of required occupant evacuation elevators based on one of two egress scenarios
  - Full building evacuation in less than 1 hour, or
  - Evacuation of 5 consecutive floors with highest accumulated occupant load in less than 15 minutes

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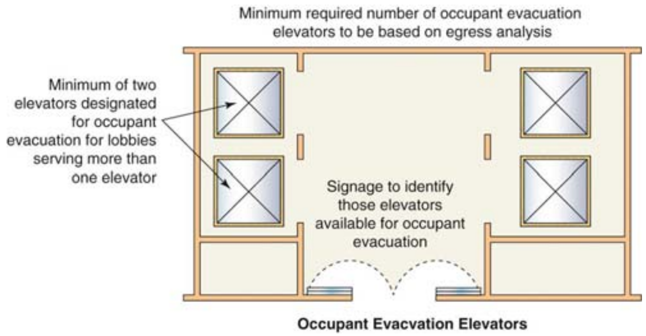
3008.1.1 Required Number of Occupant Evacuation Elevators



2018 IBC Significant Changes 189

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Chapter 31

Special Construction

190

190

3112 Relocatable Buildings

- Compliance required as for new construction
- Provisions address:
  - Supplemental information
  - Manufacturer’s data plate
  - Inspection agencies

2018 IBC Significant Changes 191

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Chapter 33

Safeguards During Construction

192

192

3310.1 Stairways in Buildings under Construction

- Stairway to be provided where building construction exceeds 40 feet above lowest level of fire department vehicle access
- As construction progresses, stairway to extend within one floor of highest point with secured decking/flooring

2018 IBC Significant Changes 193

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3314 Fire Watch During Construction

- Fire watch can be required by fire code official
  - Provided during non-business hours
  - Applicable where construction exceeds 40 feet above lowest adjacent grade

2018 IBC Significant Changes 194

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Appendix G

Flood-Resistant Construction

195

195

G103.6 Watercourse Alteration

- Applicant to notify all "adjacent" government jurisdictions rather than just those 'affected'
- Now consistent with NFIP regulations

2018 IBC Significant Changes 196

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Appendix N

Replicable Buildings

197

197

Appendix N Guidelines for Replicable Buildings

- Based on ICC Guideline G1
- Benefits include:
  - More uniform review process
  - Elimination of repetitive reviews
  - Reduces time between permit submittal and construction mobilization

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Discussion Activity

2018 IBC Significant Changes 199

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Final Reflection

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?

2018 IBC Significant Changes 200

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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.

201

Copyright Materials

202

Thank you for participating

To schedule a seminar, contact:

The ICC Training & Education Department
1-888-ICC-SAFE (422-7233) Ext. 33818
or
E-mail: Learn@iccafe.org

2018 IBC Significant Changes 203

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File Attachments for Item:

ER-5 2018 IPC, IMC, IFGC Significant Changes (International Code Council)

All certifications except ESI (6 hours)

Staff Notes: Recommend approval.

Committee Recommendation:

APPLICATION

FOR

Continuing Education Course Approval

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

BOARD OF BUILDING STANDARDS · STATE OF OHIO

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

COURSE SUBMITTER:

Course Submitter: Laura Morris
(Contact Name)

Organization: International Code Council
(Organization/Company)

Address: 4051 Flossmoor Road
(Include Room Number, Suite, etc.)

City: Country Club Hills State: IL Zip: 60478

E-Mail: lmorris@iccsafe.org

Telephone: 888-422-7233 Ext: 4523 Fax: 708-799-2651

Course Sponsor: International Code Council

COURSE INFORMATION:

Course Title: 2018 IPC, IMC, IFGC Significant Changes

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

Purpose and Objective: This seminar introduces participants to the major changes from the 2015 IPC, IMC and IFGC to the 2018 IPC, IMC and IFGC
Participants will discuss the changes, reasons for the changes, and take part in knowledge review activities.

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

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

Program Applicable for the Following Participants:

Building Official ■ Master Plans Examiner ■ Building Inspector ■ Fire Protection Inspector ■ Mechanical Inspector ■

Building Plans Exam. ✓ Plumbing Inspector ■

Plumbing Plans Exam. ■ Non-Res IU Inspector ■

Electrical Plans Exam. ■

Mechanical Plans Exam. ■

Fire Protect. Plans Exam. ✓

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

Electrical Safety Inspectors ☐
Location of ESI Course: ______ Date(s) of ESI Course(s): ______

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

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

2018 IPC, IMC, IFGC® Significant Changes

Based on the 2018 International Plumbing Code® (IPC®)

Based on the 2018 International Mechanical Code® (IMC®)

Based on the 2018 International Fuel Gas Code® (IFGC®)

SKU #	Product #

Length:	1 Day (6 Contact Hours)
Applicable Codes:	2018 IPC
Product Type/Status:	Seminar - Update
Level:	Entry

Background Information

Description

This seminar introduces participants to the major changes from the 2015 IPC, IMC and IFGC to the 2018 IPC, IMC and IFGC. Participants will discuss the changes, reasons for the changes, and take part in knowledge review activities. Information presented will allow participants to apply these new code requirements to design, plan review, and/or inspection.

Goal

Participants will be able to use this document to identify changes from the 2015 IPC, IMC and IFGC to the 2018 IPC, IMC and IFGC, allowing them to apply these code requirements to the design, plan and/or inspection.

Objectives

Upon completion of this seminar, participants will be better able to:

- Identify the most significant differences between the 2015 IPC, IMC and IFGC and the 2018 IPC, IMC and IFGC.
- Explain the differences between the current and previous edition.
- Identify changes in organization and code requirements.
- Identify the applicability of design, plan review and inspection requirements

Target Audience

Building Officials, Architects, Building Inspectors, Contractors, Engineers, Plans Examiners, Plumbing Inspectors

Prerequisites

Participants will be at the beginning level, which means they should be able to do or know the following before they participate in this training:

- Be familiar with the IPC
- Know basic construction terminology, techniques, methods and materials
- Reads basic construction document.

Timed Outline

Outline of Seminar (6 hours = 360 minutes)

I. Introduction (25 minutes)
   - **A. Icebreaker (10)**
   - **B.** Scope and introduction (5)
   - **C.** Definitions (10)

II. IPC Significant Changes part 1 (25 minutes)
   - **A.** Chapter 3: 303.5, 305.1, 305.6, 308.6, 308.10 (5)
   - **B.** Chapter4: 403.1, 403.1.2, 403.1.3, 403.2, 403.3, 405.3.1, 405.3.5, 405.5, 409.1, 409.4, 411.3, 412.7, 422(10)
   - **C.** Activity (10)

III. IPC Significant Changes part 2a (25 minutes)
   - **A.** Chapter 5: 502.1, 504.6, 504.7 (5)
   - **B.** Chapter 6: 602.3.1, 605.13.7, 607.3, 608.3, 608.11, 608.16.1.1, 608.16.1.2, 608.16.10, 609.1, 611.1 (5)

IV. IPC Significant Changes part 2b (25 minutes)
   - **A.** Chapter 7: 701.2, 701.8, 702.3, 704.2, 705.16.4, 709.3, 712.3.2, 712.4.2, 713, 716 (5)
   - **B.** Activity (10)

V. IPC Significant Changes part 3 (25 minutes)
   - **A.** Chapter 8: 802.1, 802.4.3.1 **and** Chapter 9: 918.8 (5)
   - **B.** Chapter 10: 1003.3.2, 1003.3.3 and Chapter 11: 1102.4, 1106.5, And Chapter 13: 1301.1.1, 1302.7.2, 1303.15.8, 1303.15.9, (10)
   - **C.** Activity (10)

VI. IMC Significant Changes part 1 (25 minutes)
   - **A.** Chapter 2 Commercial cooking appliance (5)
   - **B.** Chapter-4: 403.3.2.4, 404.1 (5)
   - **C.** Chapter 5: 504.4, 504.4.1, 504.8.2, 506.3.13.2, 506.3.13.3, 506.5.2, 507.2.6 (5)
   - **D.** Activity (10)

VII. IMC Significant Changes part 2 (25 minutes)

- **A.** Chapter 6 603.5.2, 603.8.2, 603.9, 607.3.1 (5)
- **B.** Chapter 9: 929 (5)
- **C.** Chapter 11: 1105.6.3, 1107.2 and Chapter 14 (5)
- **D.** Activity (10)

VIII. IFGC Significant Changes (25 minutes)

- **A.** Chapter 3: 303.3, 310.2, 310.3, 310.2.3 (5)
- **B.** Chapter 4: 403.4.2, 403.10 404.11.1-4, 404.14, 409.7(5)
- **C.** Chapter 5: 503.4.1, 503.4.1.1, 503.4.2, 503.8, and Chapter 6, 602.2
- **D.** Activity (10)

IX. Summary and Q&A (5 minutes)

Please allow time for breaks at natural intervals.

INTERNATIONAL CODE COUNCIL®

BIO: Robert J. Schutz, P.E., P.S., CBO

Robert J. Schutz, P.E., P.S., CBO, has served as an Assistant Architect Administrator at the Ohio Board of Building Standards. While with the State of Ohio, he has oversight of the new Residential Code of Ohio program, including certification of local residential code departments and personnel. Previously, Bob served ICC as Manager of Instructors with responsibilities for the selection, oversight and quality of ICC's cadre of staff and contract instructors. his varied previous experiences include active military service during the 1980's as an Army Corps of Engineers (ACE) officer; building code enforcement for several central Ohio jurisdictions, including ten years as Chief Building Official (CBO) for the City of Powell where he also served as City Engineer and Director of Public Services; and Chief Engineer, for the Ohio Department of Health where he chaired the state's plumbing advisory board, was chief of plumbing and was a voting member on the Ohio Board of Building Standards. He is experienced in combat construction, facilities engineering and project management as well as having been a plumber, sheet metal worker and brick mason.

Mr. Schutz has a civil engineering degree from Ohio Northern University with post graduate studies at the University of Southern California and the Ohio State University in environmental law, land- use planning and public administration. He is a registered Professional Engineer and Professional Surveyor, certified Chief Building Official and holds Ohio certifications as Building Official, Plans Examiner and Inspector for Building, Plumbing, Electrical Safety and Residential. Bob instructs IBC structural and nonstructural seminars, all IRC subjects, mechanical, plumbing and fuel gas codes and administrative topics.

2018 IPC, IMC, IFGC Significant Changes

Based on the
2018 International Plumbing Code®, (IPC®)
2018 International Mechanical Code®, (IMC®)
2018 International Fuel Gas Code®, (IFGC®)

ICC LEARNING center

1

Identify significant changes between the 2015 and 2018 IPC, IMC and IFGC

Apply code requirements to design, plan submittals and/or inspection.

2018 IPC, IMC, IFGC Significant Changes 2

2

OBJECTIVES

- Identify the differences between 2015 and 2018 IPC, IMC and IFGC codes.
- Explain differences between current and previous code years.
- Identify changes in organization and code requirements.
- Identify design, plan review and inspection requirements.

2018 IPC, IMC, IFGC Significant Changes 3

3

Tips

Guide to a successful class:

1. Slides contain some text and iconic images to help you learn.
2. Text and commentary is in the handout.
3. Follow along in the course handout.
4. Ask Questions, ask questions, ASK QUESTIONS!!!!

2018 IPC, IMC, IFGC Significant Changes 4

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Course Icons

Addition Deletion Modification Clarification

2018 IPC, IMC, IFGC Significant Changes 5

5

Chapter 2

Definitions

6

6

Section 202

- **ACCESSIBLE.**

2018 IPC, IMC, IFGC Significant Changes 7

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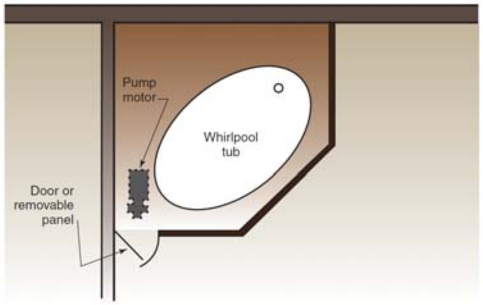
Section 202

- **ACCESSIBLE.**



Access to whirlpool tub pump

2018 IPC, IMC, IFGC Significant Changes 8

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Section 202

- ACCESSIBLE.

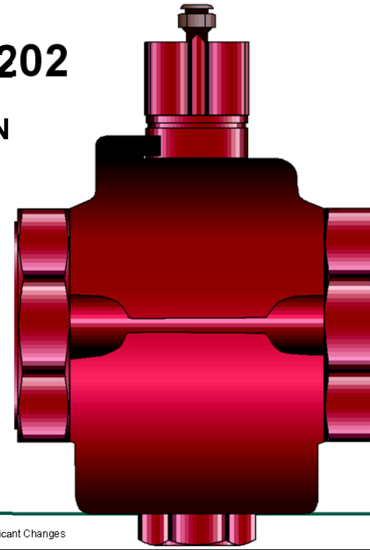
2018 IPC, IMC, IFGC Significant Changes 9

9

Section 202

- FULL-OPEN VALVE.

Plug valve with rectangular port in closure member



2018 IPC, IMC, IFGC Significant Changes 10

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Section 202

Press-connect copper fitting

- PRESS-CONNECT JOINT.

2018 IPC, IMC, IFGC Significant Changes 11

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12

13


Section 202
SWIMMING POOL.
2018 IPC, IMC, IFGC Significant Changes
14

14

15

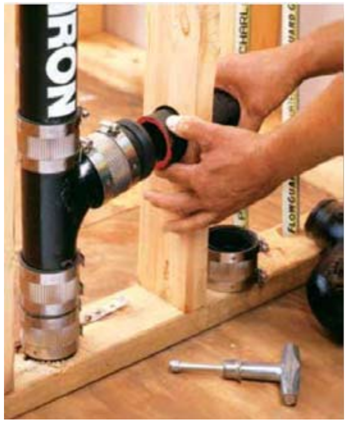
16

Chapter 3

General Regulations

17

17



303.5 Cast Iron Soil Pipe

IPC

2018 IPC, IMC, IFGC Significant Changes 18

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IPC

2018 IPC, IMC, IFGC Significant Changes 19

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305.1 Protection Against Contact

Metallic piping in plastic sheathing

IPC

2018 IPC, IMC, IFGC Significant Changes 20

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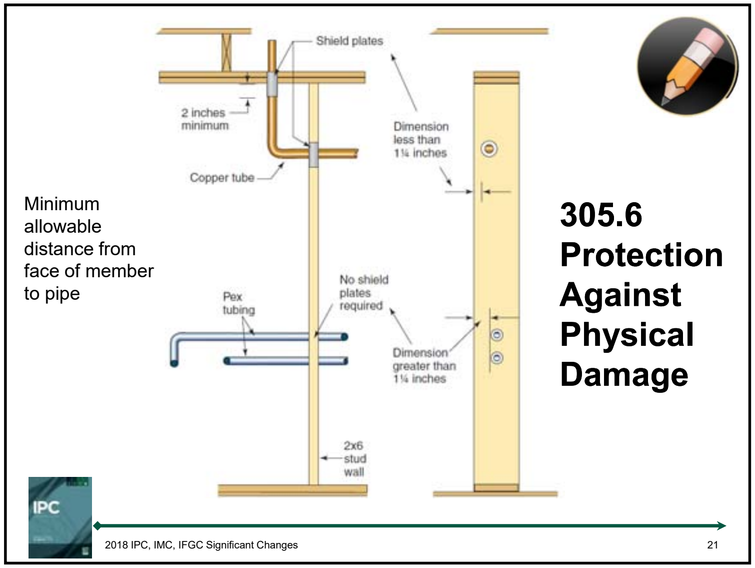
Shield plates
2 inches minimum
Dimension less than 1¼ inches
Copper tube
Minimum allowable distance from face of member to pipe
Pex tubing
No shield plates required
Dimension greater than 1¼ inches
2x6 stud wall
305.6 Protection Against Physical Damage
IPC
2018 IPC, IMC, IFGC Significant Changes
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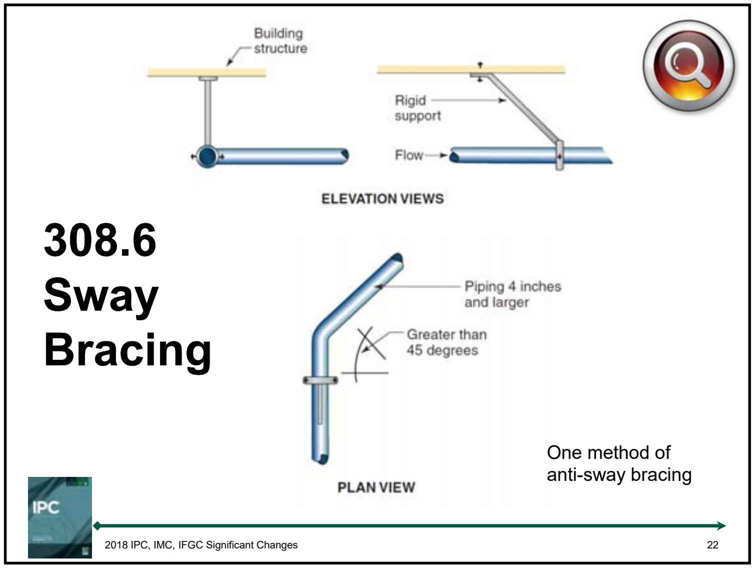
21


Building structure
Rigid support
Flow
ELEVATION VIEWS
308.6 Sway Bracing
Piping 4 inches and larger
Greater than 45 degrees
PLAN VIEW
One method of anti-sway bracing
IPC
2018 IPC, IMC, IFGC Significant Changes
22

22


308.10 Thermal Expansion Tanks
2018 IPC, IMC, IFGC Significant Changes
23

23


Photo courtesy of Holdrite-Hubbard Enterprises
IPC
One method of independent tank support
2018 IPC, IMC, IFGC Significant Changes
24

24

Chapter 4

Fixtures, Faucets and Fixture Fittings

25

25

Table 403.1 Minimum Number of Required Plumbing Fixtures

IPC

2018 IPC, IMC, IFGC Significant Changes 26

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TABLE 403.1 Minimum Number of Required Plumbing Fixtures[a]
(See Sections 403.1.1 and 403.2)

Classification	Description	Water Closets (Urinals: See Section 419.2) Male	Water Closets (Urinals: See Section 419.2) Female	Lavatories Male	Lavatories Female	Bathtubs/ Showers	Drinking Foundation	Other
Assembly	Gaming areas	1 per 100 for the first 400 and 1 per 250 for the remainder exceeding 400	1 per 50 for the first 400 and 1 per 150 for the remainder exceeding 400	1 per 250 for the first 750 and 1 per 500 for the remainder exceeding 750		—	1 per 1,000	1 service sink

IPC

2018 IPC, IMC, IFGC Significant Changes 27

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Table 403.1 Minimum Number of Required Plumbing Fixtures

TABLE 403.1 Minimum Number of Required Plumbing Fixtures[a]
(See Sections 403.1.1 and 403.2)

Classification	Description	~~Occupancy~~	Water Closets Male	Water Closets Female	Lavatories Male	Lavatories Female	Bathtubs/ Showers	Drinking Foundation	Other

Photo courtesy of iStock.com

Small business occupancy

IPC

2018 IPC, IMC, IFGC Significant Changes 28

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TABLE 403.1 Minimum Number of Required Plumbing Fixtures[a]
(See Sections 403.1.1 and 403.2)

Classification	Description	Water Closets Male	Water Closets Female	Lavatories Male	Lavatories Female	Bathtubs/ Showers	Drinking Foundation	Other
	Stadiums, amusement parks, bleachers and grandstands for outdoor sporting events and activities[f]							

Notes a through e are unchanged.

f. The required number and type of plumbing fixtures for outdoor public swimming pools shall be in accordance with Section 609 of the *International Swimming Pool and Spa Code.*

29

Table 403.1

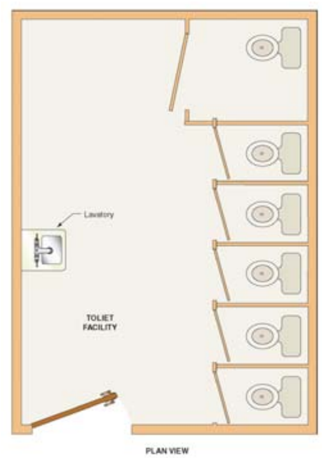
- Note "f" in Table 403.1 points the reader to Section 609 of the *International Swimming Pool and Spa Code* for determining the required number of plumbing fixtures

Plumbing fixtures for outdoor public swimming pools are determined by the ISPSC.

30

403.1.2 Single-user Toilet Facility and Bathing Room Fixtures

31



403.1.3 Lavatory Distribution

32

403.2 Separate Facilities

- Separate facilities not required in businesses which have a max. occupant load of 25 or fewer.

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403.3 Employee and Public Toilet Facilities

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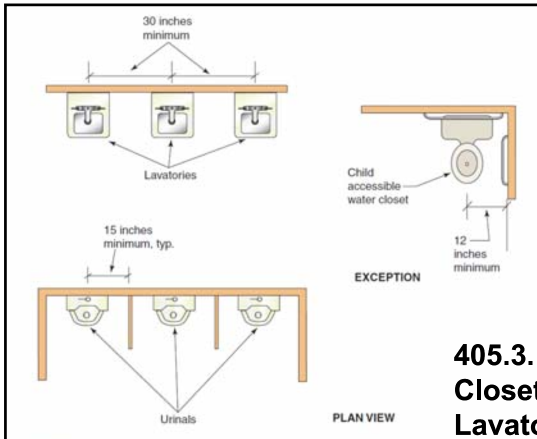

Minimum fixture clearances

405.3.1 Water Closets, Urinals, Lavatories and Bidets

2018 IPC, IMC, IFGC Significant Changes 35

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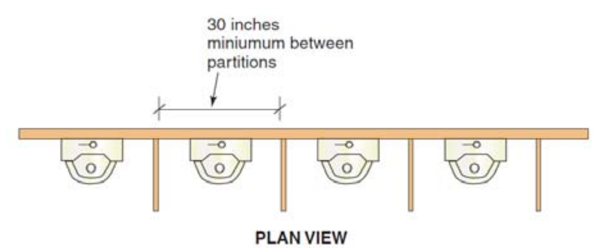
405.3.5 Urinals Partitions



Minimum clearance between urinal partitions

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405.5 Plumbing Fixtures With Pumped Waste Arrangement

Photo Courtesy of SFA Saniflo

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405.5 Plumbing Fixtures With a Pumped Waste Arrangement

Pumped waste fixture

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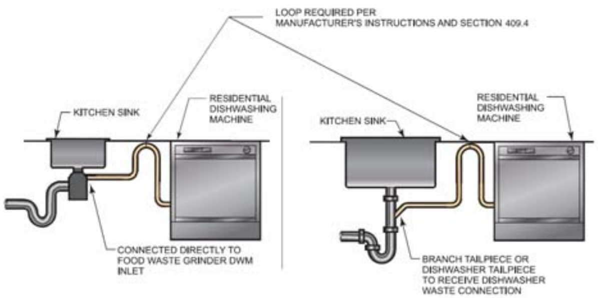
409.1 Approval

39

409.4 Residential Dishwasher Waste Connection



Residential dishwasher waste connnection

40

409.4 Residential Dishwasher Waste Connection

IPC

2018 IPC, IMC, IFGC Significant Changes 41

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411.3 Water Supply

Emergency eyewash

Emergency shower and eyewash station

IPC

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412.7 Temperature-actuated, Flow Reduction Valves Devices for Individual Fixture Fittings

Temperature-actuated flow reduction device

IPC

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Section 422

- Health Care Fixtures and Equipment

IPC

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Chapter 5

Water Heaters

45

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502.1 General

- Solar thermal water heating systems shall conform to the requirements of the International Mechanical Code and ICC 900/SRCC 300.

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Solar Water Heating System Standard

Photo courtesy of iStock.com

Solar thermal collector

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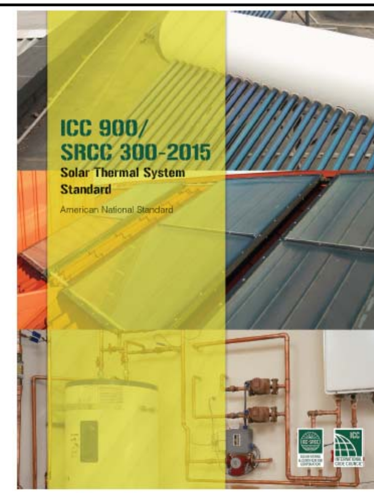
Solar Water Heating System Standard



International Code Council®

Solar thermal water heating systems must conform to ICC 900/SRCC 300.

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504.6 Requirements for Discharge Piping


Photo courtesy of ExtremeHowTo

Insert fitting for piping

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504.7 Required Pan


Photo courtesy of Lowe's

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Discussion Activity

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Chapter 6

Water and Supply Distribution

52

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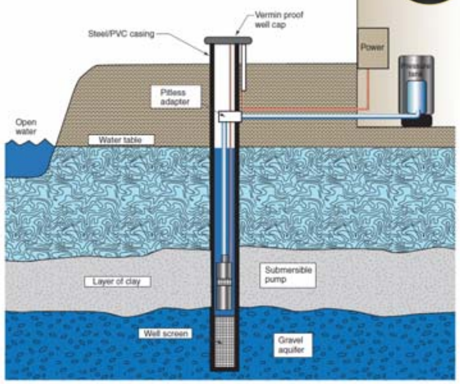
602.3.1 Sources



Water well

53

605.13.7, 605.14.4 & 605.16.3 Push-fit Joints

TABLE 605.5 Pipe Fittings

Material	Standard
Fittings for polyethylene of raised temperature (PE-RT) plastic tubing	ASSE 1061; ASTM F1807; ASTM F2098; ASTM F2159; ASTM F2735

Photo courtesy of Sharkbite.com

Push-fit fitting

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607.3 Thermal Expansion Control

Thermal expansion control device

55

608.3 Devices, Appurtenances, Appliances and Apparatus

56

608.4 Potable Water Handling and Treatment Equipment

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608.12 Painting of Potable Water Tanks

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608.17.1.1 Carbonated Beverage Dispensers

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608.17.1.2 Coffee Machines and Noncarbonated Drink Dispensers

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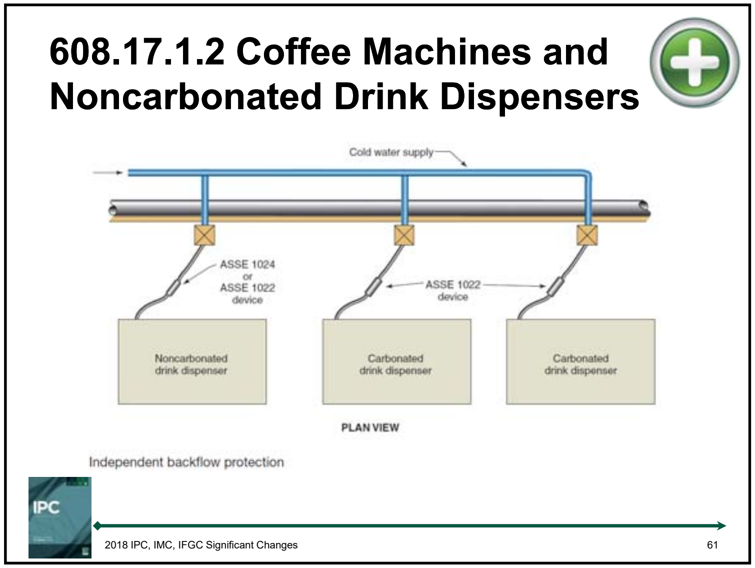
608.17.1.2 Coffee Machines and Noncarbonated Drink Dispensers
Cold water supply
ASSE 1024 or ASSE 1022 device
ASSE 1022 device
Noncarbonated drink dispenser
Carbonated drink dispenser
Carbonated drink dispenser
PLAN VIEW
Independent backflow protection
IPC
2018 IPC, IMC, IFGC Significant Changes
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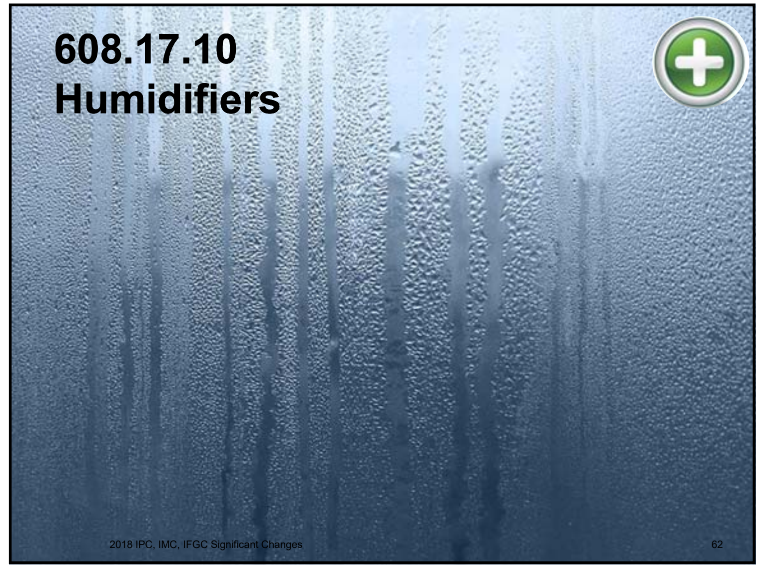
608.17.10
Humidifiers
2018 IPC, IMC, IFGC Significant Changes
62

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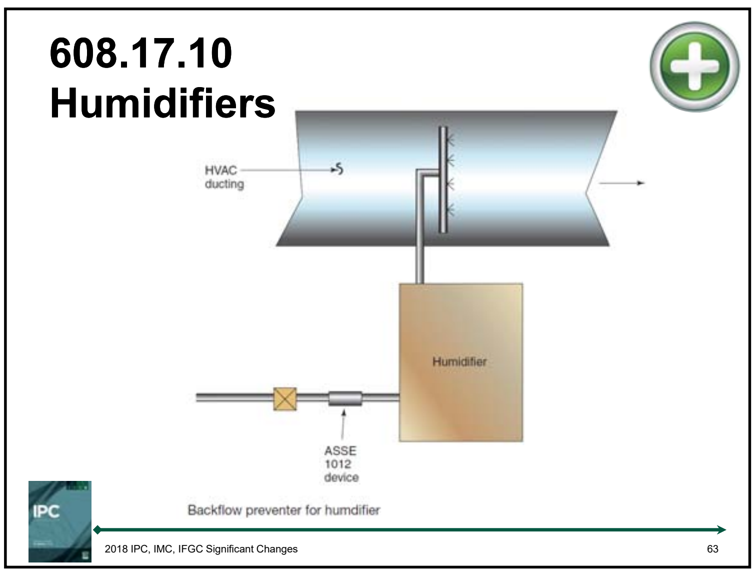
608.17.10
Humidifiers
HVAC ducting
Humidifier
ASSE 1012 device
Backflow preventer for humidifier
IPC
2018 IPC, IMC, IFGC Significant Changes
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609.1
Scope
IPC
2018 IPC, IMC, IFGC Significant Changes
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609.1 Scope

Photo courtesy of iStock.com

Group I-1 Assited living facility

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611.1 Design

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Chapter 7

Sanitary Drainage

67

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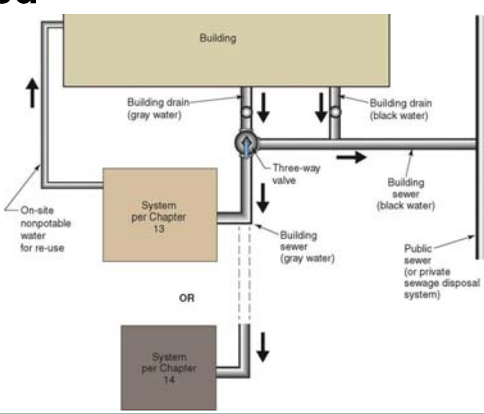
701.2 Connection to Sewer Required

Where state requirements do not exist, private sewage disposal systems must comply with the IPSDC.



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701.8 Drainage Piping in Food Service Areas

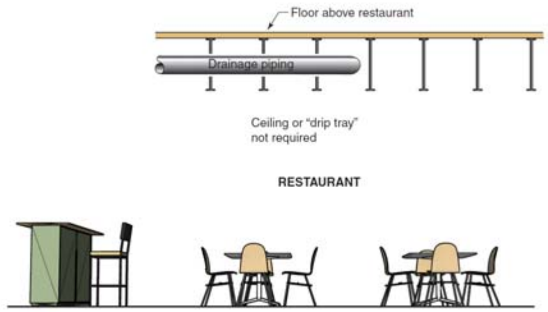

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Table 702.3

BUILDING SEWER PIPE

MATERIAL	STANDARD
Polypropylene (PP) Plastic Pipe	ASTM F2736; ASTM F2764; CSA B182.13

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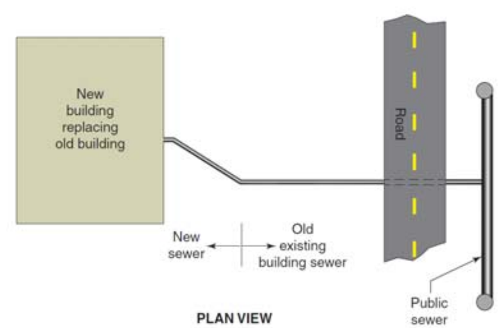
Table 702.3

Smooth inner wall polypropylene piping for sewer service

71

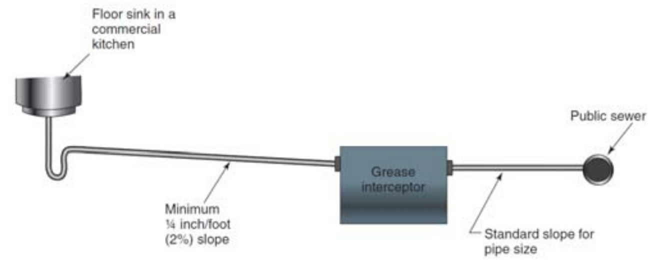
703.4 Existing Building Sewers and Building Drains



Old existing building sewer need not be replaced

72

704.1 Slope of Horizontal Drainage Piping



Drainage piping slope to grease interceptor

73

704.2 Reduction in Pipe Size

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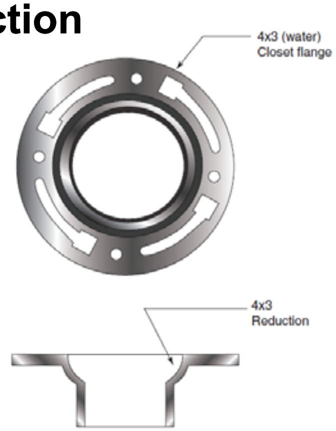
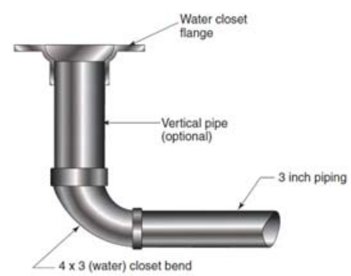
704.2 Reduction in Pipe Size



Water closet flange

75

704.2 Reduction in Pipe Size



4 x 3 water closet bend

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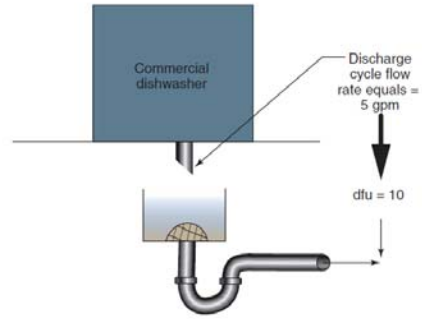
705.16.4 Plastic Pipe or Tubing to Other Piping Material

77

709.3 Conversion of gpm Flow to dfu Values



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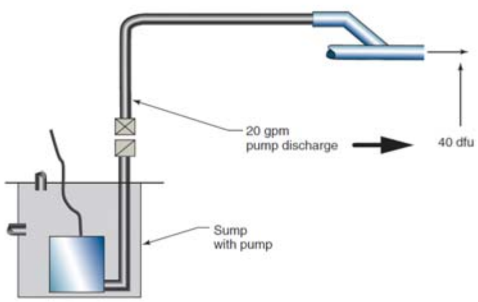
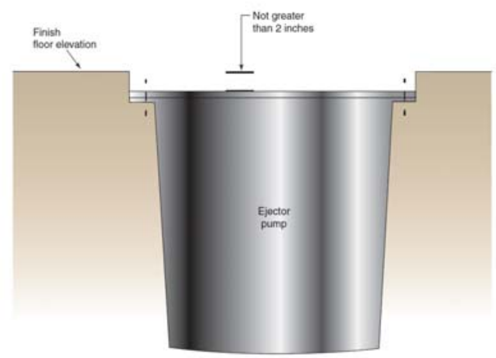
709.3 Conversion of gpm Flow to dfu Values



Conversion from gpm to dfu

79

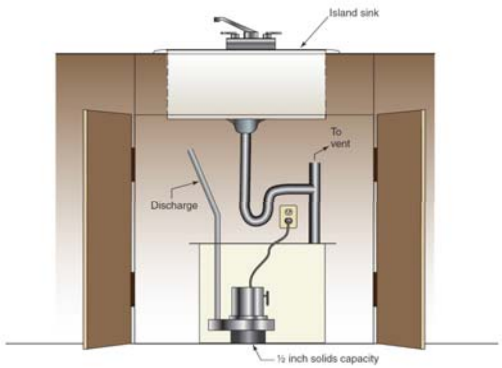
712.3.2 Sump Pit



Elevation of floor with respect to sump cover

80

712.4.2 Capacity



Sink pump system

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Section 713 Health Care Plumbing

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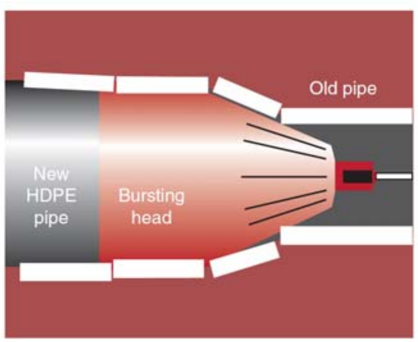
Section 716 Replacement of Underground Building Sewers and Building Drains by Pipe Bursting Methods



Pipe bursting building drainage piping

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Chapter 8

Indirect/Special Waste

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802.1 Protection

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802.4.3.1 Connection of Laundry Tray to Standpipe

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Chapter 9

Vents

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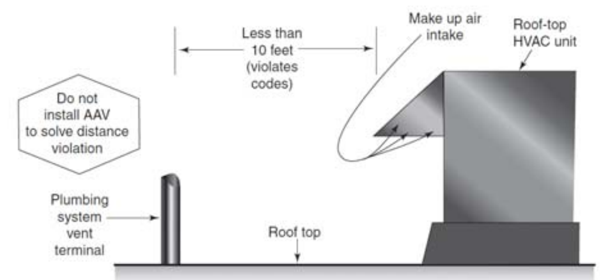
918.8 Prohibited Installations



Improper use of AAV

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Chapter 10

Traps Interceptors and Separators

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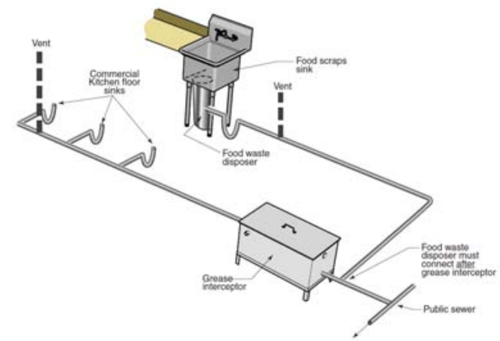
1003.3.2 Food Waste Disposers Restriction



Food waste disposer must connect after grease interceptor

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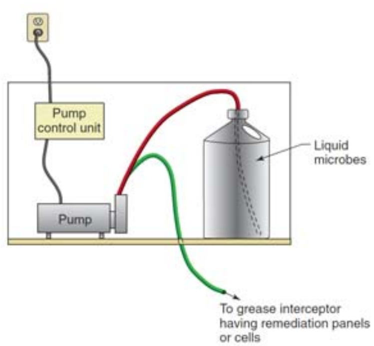
1003.3.3 Additives to Grease Interceptors



Aerobic bioremediation additives

2018 IPC, IMC, IFGC Significant Changes 91

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Chapter 11

Storm Drainage

92

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Table 1102.4 Building Storm 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 D 2751;~~ ASTM F628; ASTM F1488; CSA B181.1; CSA B182.1
Polyethylene (PE) plastic pipe	ASTM F667; ASTM F2306/F2306M; ASTM F2648/F2648M
Polypropylene (PP) Pipe	ASTM F2881; CSA B182.13;
Polyvinyl chloride (PVC) plastic pipe (Type DWV, SDR26, SDR35, SDR41, PS50 or PS100) 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 D3034; ASTM F891; ASTM F1488; CSA B182.4; CSA B181.2; CSA B182.2

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1106.5 Parapet Wall Scuppers

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Chapter 13

Nonpotable Water Systems

95

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1302.7.2 Design and Construction

Gray water storage tank

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1303.1.1 Fire Protection Systems

97

1303.15.8 Rainwater Quality Test

TABLE 1303.15.8 ~~Rainwater Quality~~

Parameter	Value
pH	~~6.0-7.0~~
~~BOD~~	~~Not greater than 10 mg/L~~
~~NTU~~	~~Not greater than 2~~
~~Fecal coliform~~	~~No detectable fecal coli in 100 mL~~
~~Sodium~~	~~No detectable sodium in 100 mL~~
~~Chlorine~~	~~No detectable chlorine in 100 mL~~
~~Enteroviruses~~	~~No detectable enteroviruses in 100 mL~~

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1303.15.9 Collected Raw Rainwater Quality

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Discussion Activity

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2018 International Mechanical Code®, IMC®

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Chapter 2

Definitions

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Chapter 4

Ventilation

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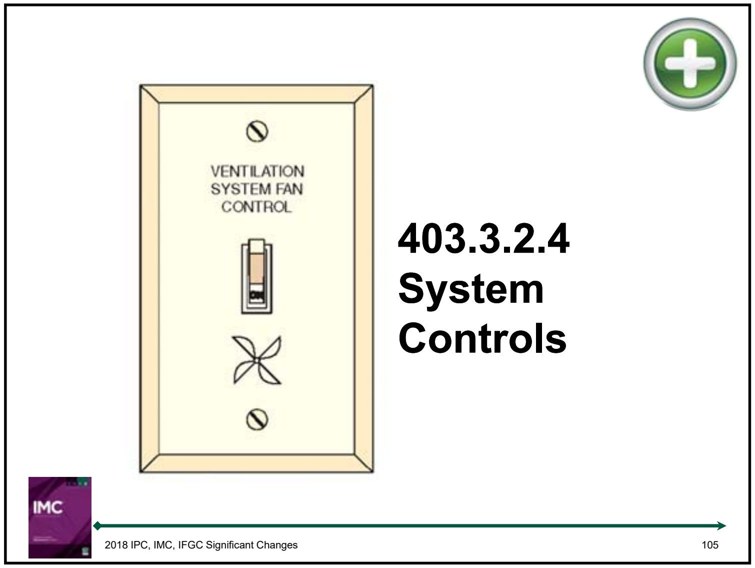

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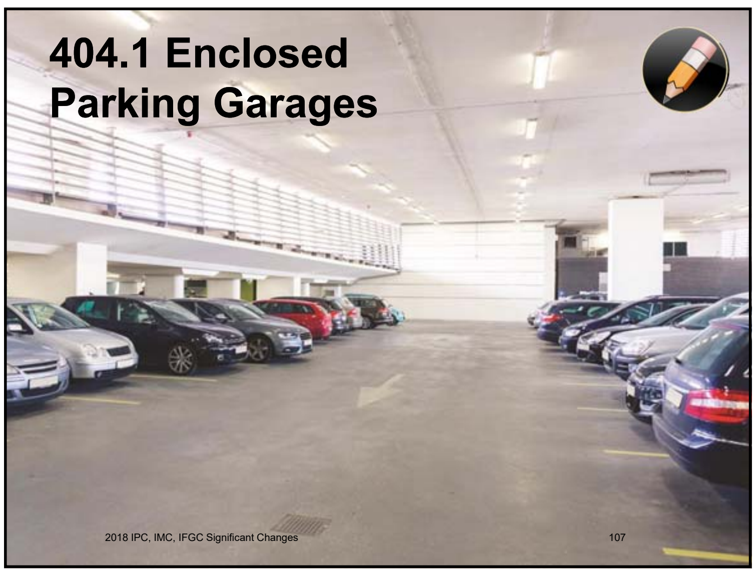
106



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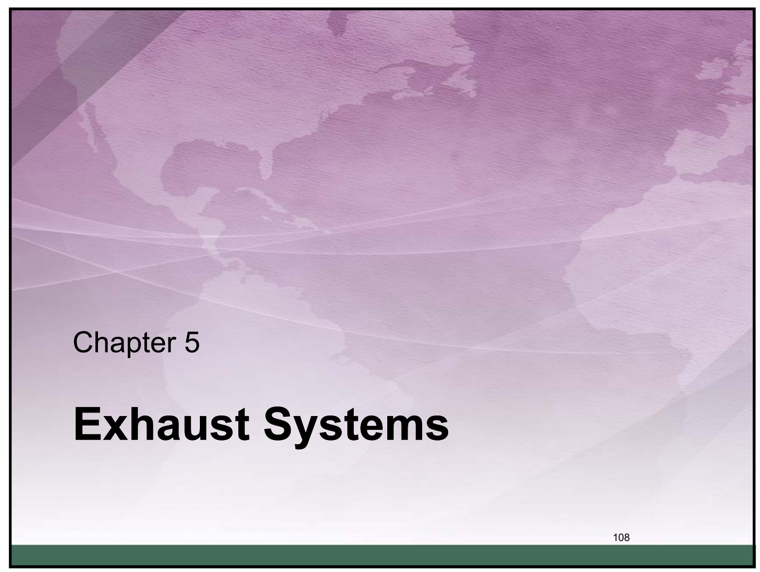

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504.4 Exhaust Installation

Joints in dryer exahust duct must be sealed.

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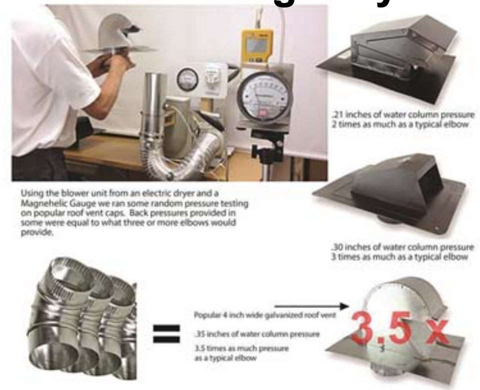
504.4.1 Exhaust Termination Outlet and Passageway Size



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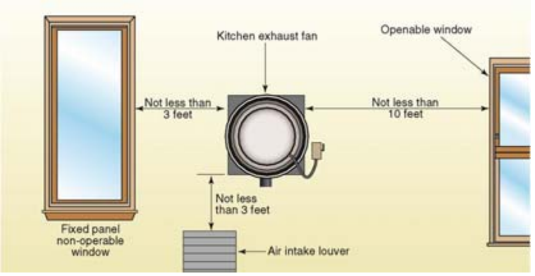
504.8.2 Duct Installation

Examples of "mechanical walls" showing the abundance of utilities in this wall, demonstrating the need to provide more than 3.5"

111

506.3.13 Termination Through an Exterior Wall, Termination Location



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506.5.2 Pollution-Control Units

IMC

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507.2.6 Clearances for Type I Hood

IMC

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Chapter 6

Duct Systems

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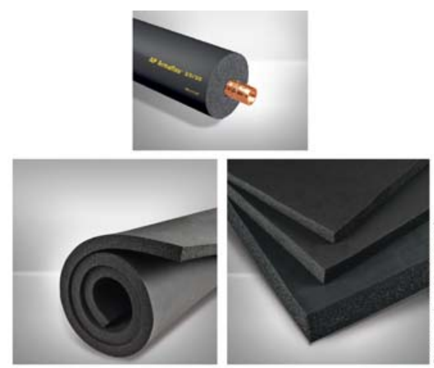
602.2.1.8 Pipe and Duct Insulation with Plenums



Photos courtesy of Armacell, LLC

Pipe and duct insulation for use in plenums must meet the limitations and conditions specified in Section 602.2.1.8.

IMC

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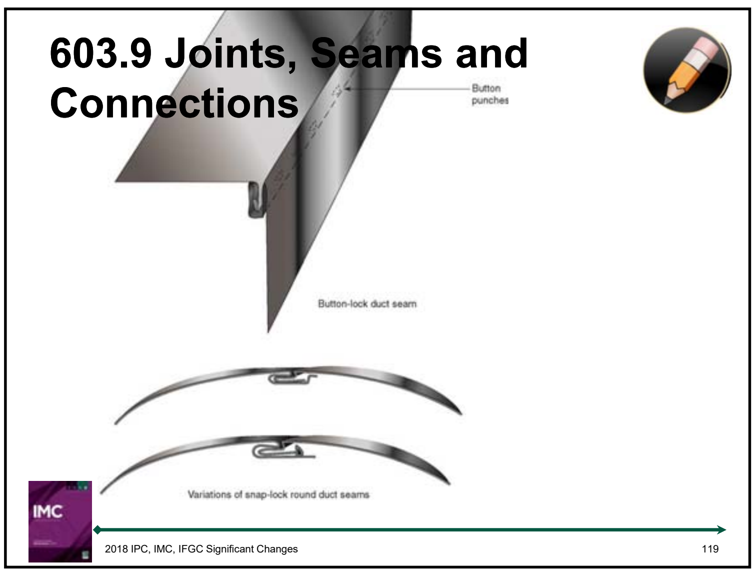

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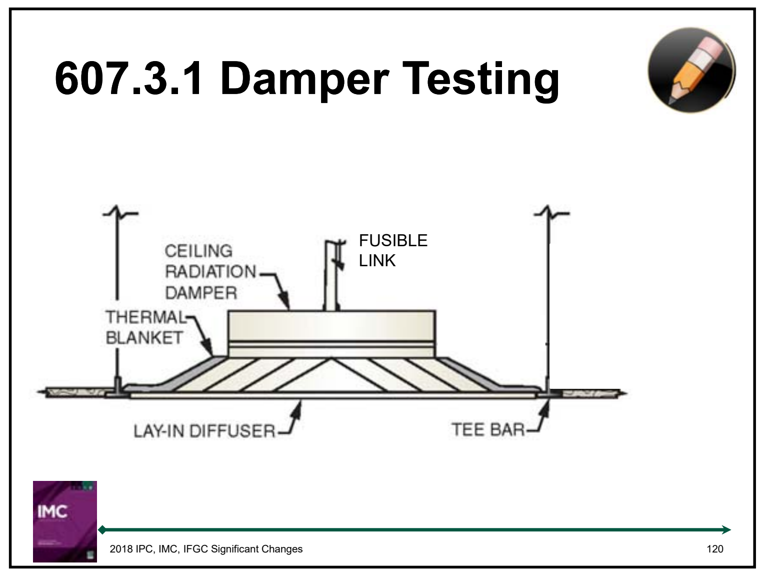

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Chapter 9

Specific Appliances, Fireplaces and Solid-Fuel-burning Equipment

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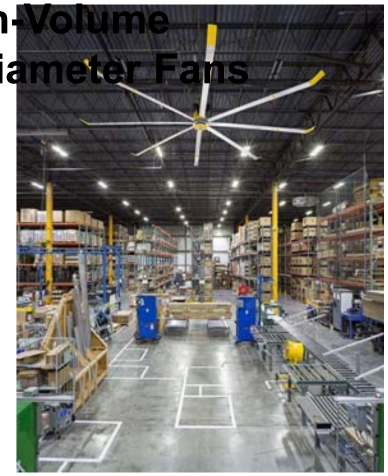
929 High-Volume Large-Diameter Fans



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Chapter 11

Refrigeration

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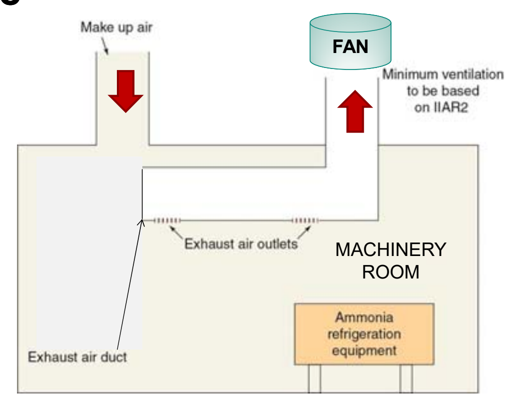
1105.6.3 Ventilation Rate



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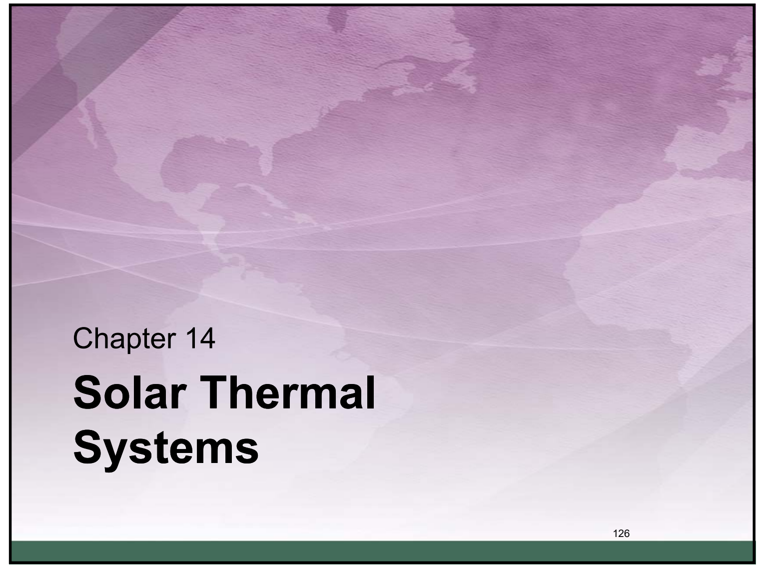

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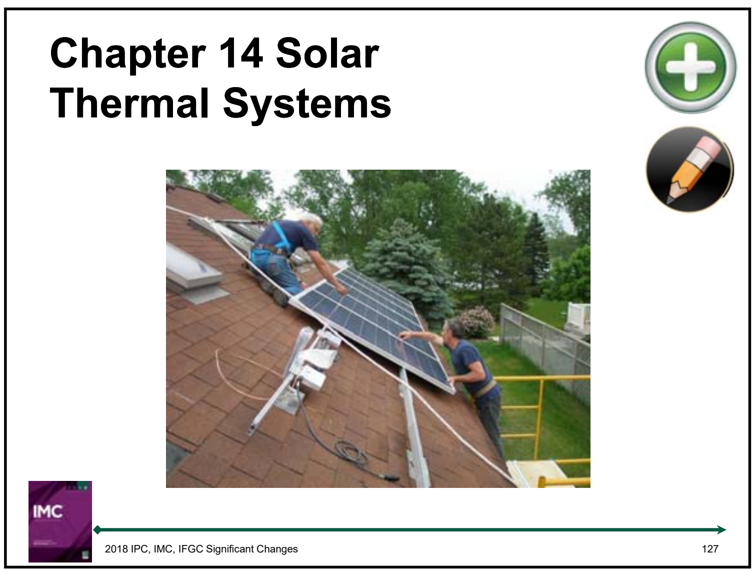

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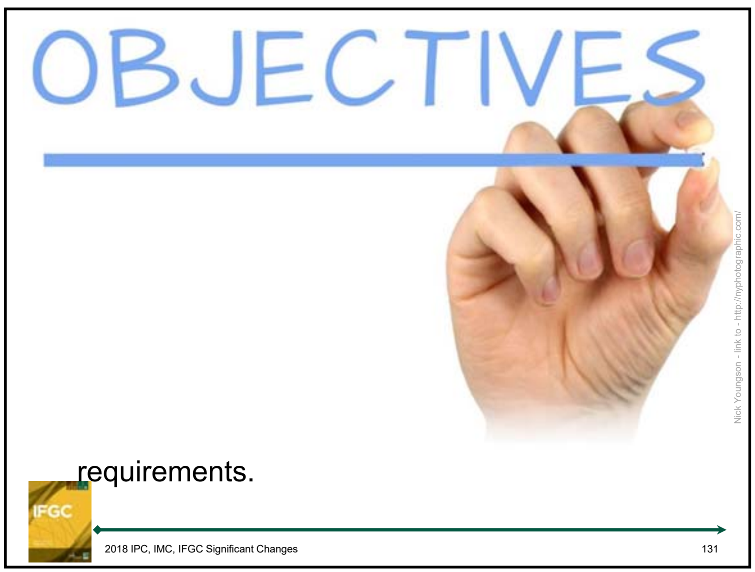
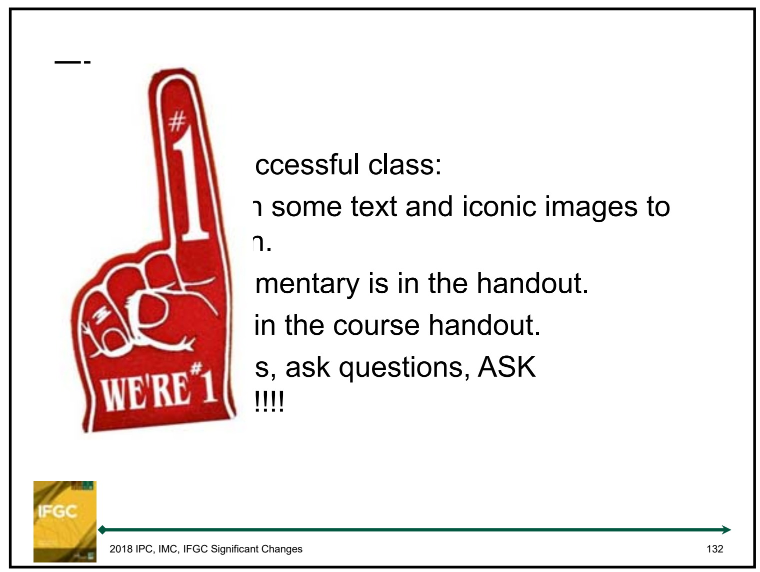


131



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Course Icons

Addition

Deletion

Modification

Clarification

2018 IPC, IMC, IFGC Significant Changes 133

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Chapter 3

General Regulations

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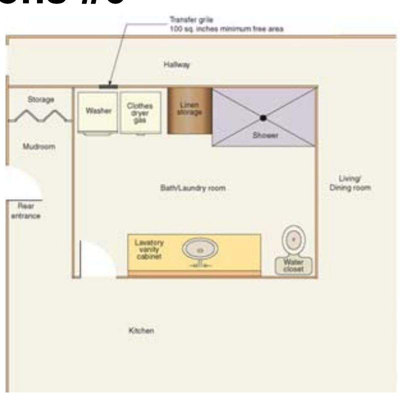
303.3 Prohibited Locations #6



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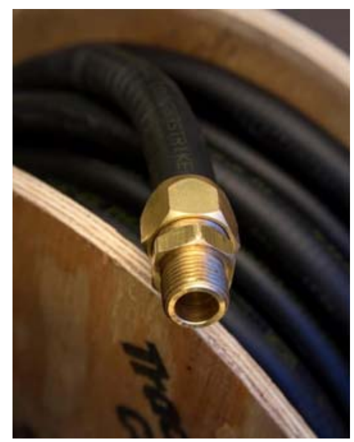
310.2 CSST



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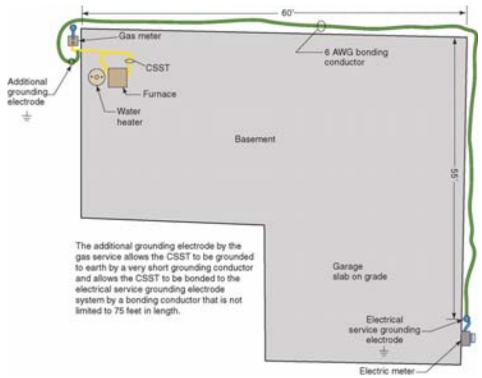
310.2.3 Bonding Jumper Length



The additional grounding electrode by the gas service allows the CSST to be grounded to earth by a very short grounding conductor and allows the CSST to be bonded to the electrical service grounding electrode system by a bonding conductor that is not limited to 75 feet in length.

2018 IPC, IMC, IFGC Significant Changes 137

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310.3 Arc-resistant CSST

2018 IPC, IMC, IFGC Significant Changes 138

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Chapter 4

Gas Piping Installations

139

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403.4.2 Steel and 403.10 Pipe Joints

Press-connect fittings use gaskets and special equipment to join steel gas piping

2018 IPC, IMC, IFGC Significant Changes 140

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Section 404.11.1-4 Protection Against Corrosion

2018 IPC, IMC, IFGC Significant Changes 141

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404.14 Piping Underground Beneath Buildings

2018 IPC, IMC, IFGC Significant Changes 142

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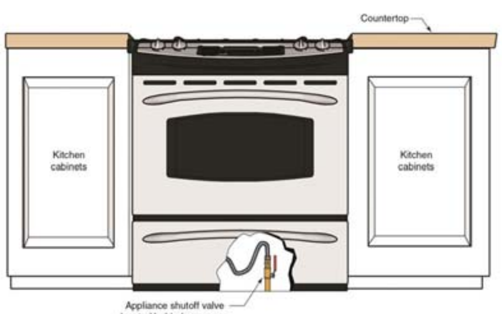
409.5.1 Located within same room



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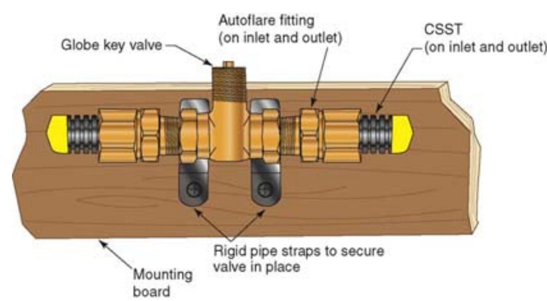
409.7 Shutoff Valves in Tubing Systems



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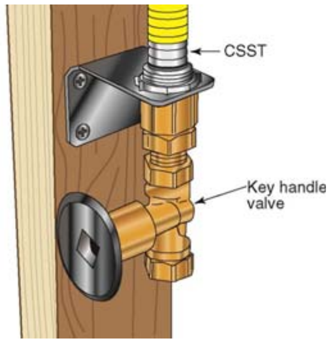
409.7 Shutoff Valves in Tubing Systems



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Chapter 5

Chimney and Vents

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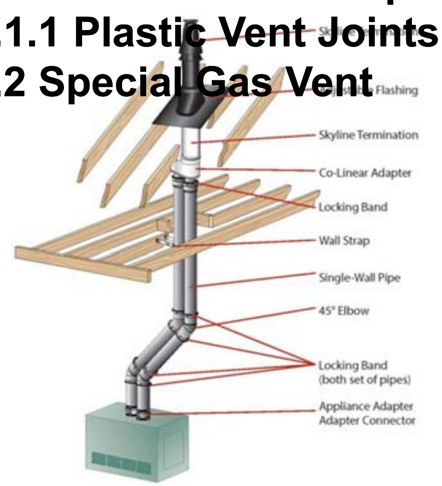
503.4.1.1 Plastic Vent Joints ar
503.4.2 Special Gas Vent



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503.8 #2 and #3 and Table 503.8

TABLE 503.8
THROUGH-THE-WALL, DIRECT-VENT TERMINATION CLEARANCES

DIRECT-VENT APPLIANCE INPUT RATING (Btu/hr)	THROUGH-THE-WALL VENT TERMINAL CLEARANCE FROM ANY AIR OPENING INTO THE BUILDING (inches)
< 10,000	6
≥ 10,000 ≤ 50,000	9
> 50,000 ≤ 150,000	12
> 150,000	In accordance with the appliance manufacturer's instructions and not less than the clearances specified in Section 503.8, Item 2

For SI: 1 inch = 25.4 mm, 1 Btu/h = 0.2931 W.

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Discussion Activity

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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?

2018 IPC, IMC, IFGC Significant Changes 150

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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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Thank you for participating

To schedule a seminar, contact:

The ICC Training & Education Department
1-888-ICC-SAFE (422-7233) Ext. 33821
or
E-mail: Learn@iccsafe.org

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File Attachments for Item:

ER-6 Grounding and Bonding Electrical Services (Ohio Certificate Renewal)

ESI, BO, MPE, BPE, EPE, BI, FPI, NRIUI, RBO, RPE, RBI, RIUI (4 hours)

Staff Notes: Recommend approval with usual required language.

ESIAC Recommendation: Recommend approval.

Committee Recommendation:

APPLICATION
FOR
Continuing Education Course Approval

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

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

COURSE SUBMITTER: OHIO CERTIFICATE RENEWAL (OCR)

Course Submitter: HAROLD PLANT (by MAYDA SANCHEZ SHINGLER)
(Contact Name)
Organization: OHIO CERTIFICATE RENEWAL (aka OCR)
(Organization/Company)
Address: P. O. BOX 211102
(Include Room Number, Suite, etc.)
City: COLUMBUS State: OHIO Zip: 43221-1102
E-Mail: halplant2112@outlook.com / mayda@ohiocertificate.com
Telephone: (614)451-9003 Fax: ALT MOBILE 614.395.9689
Course Sponsor: OHIO CERTIFICATE RENEWAL

COURSE INFORMATION:

Course Title: Grounding & Bonding Electrical Services (4)

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

Purpose and Objective: INSTRUCTOR (J.D. WHITE / ALT - R J SCHUTZ / ALT Sam Cronk) DIRECTED SEMINAR UTILIZING POWER POINT EITHER FROM CLASSROOM PLATFORM FOR ON-SITE PARTICIPANTS OR REMOTE INSTRUCTION VIA INTERNET E-LEARNING PLATFORM RELATING ELECTRICAL SYSTEMS DESIGN, INSTALLATION AND INSPECTION PRACTICES BY DIRECT REFERENCE TO THE LATEST EDITIONS OF THE OHIO BUILDING CODE (OBC) AND NFPA STANDARD 70 - NATIONAL ELECTRICAL CODE (NEC - 2020). Enable participants to better understand the correct methods of Grounding & Bonding of Electrical Services.

Number of Instructional Contact Hours that can be obtained upon completion: 4.0

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

Program Applicable for the Following Participants:

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

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

Electrical Safety Inspectors ☐
Location of ESI Course: OCR Classroom / Interactive Webinar Date(s) of ESI Course(s): 09/17/2021

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

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

Ohio Certificate Renewal
(614) 451-9003
Ohio Certificate Renewal
P.O. P.O. Box 211102
Columbus, Ohio 43221-1102
www.OhioCertificate.com

Ohio Certificate Renewal
"Since 1994"

Grounding & Bonding Electrical Services

Outline Presented by Ohio Certificate Renewal

Course Hours: 4.0 Four 50-minute segments / Interactive Webinar or Classroom

Course Description: This course will instruct learners regarding NEC requirements for Utility Supplied and Separately Derived Service Equipment. Detailed guidance will be given to establishing a connection to Earth, requirements of Electrical System Grounding, and the Establishment of an effective Ground Fault Path. Learners will be instructed regarding the Practical Components required and used to create a safe and reliable electrical service.

Course Objective: Enable the class participant to better understand the correct methods of Grounding & Bonding of Electrical Services.

Outline:

I.	Introduction to Grounding & Bonding (Definitions of Each)	7:30 AM	50 Minutes
II.	Grounding Electrode System		
III.	Electrical System Grounding		50 Minutes
IV.	Understanding the Service Riser		
V.	G&B Sizing Requirements		50 Minutes
VI.	Bonding of Electrical Equipment		
VII.	Equipment Grounding Requirements		50 Minutes
VIII.	Intentional Ground Fault Paths		
IX.	Q & A	11:20 AM	

JD White

6048 Astor Avenue 614-546-7884
Columbus, OH 43232 jd.white2000@gmail.com

Objective:

To provide timely and informative teaching relative to Electrical Theory/Fundamentals, Electrical Practices, and National Electric Code Compliance. Most teaching is geared for licensed contractors, architects, engineers, electrical inspectors, and electrician apprentices. I also provide Electrical Design and Drafting of small to moderate sized projects, using AutoCAD.

Teaching Experience:

06/2007 - Present
Columbus State Community College
Title: Skilled Trades Apprenticeship Supervisor
Supervisor: Doug House, 614-287-2576

06/2007 - Present
Columbus State Community College
Title: Adjunct Faculty Teaching:
Electrical Courses, National Electric Code, Employability, Construction Overview, Construction Estimating, Manual Drafting, and AutoCAD
Supervisor: Doug House, 614-287-2576

09/1999 – Present
Electrician Apprenticeship Instructor
Title: Year 1 – Year 4 Lead Instructor
OCILB Instructor, as needed
IEC Central Ohio 614-473-1050

10/2001 – Present
OCILB Instructor, 1-2 seminars per year
Ohio Contractor Training 614-203-1531

12/2008 – Present
OCILB Instructor, 4 seminars per year
Rebecca Warren Training 614-402-6551

11/2017 – Present
OCILB Instructor, 2-6 seminars per year
HalfMoon Education Services 715-835-5900

06/2020 – Present
OCILB, BBS, 8 seminars per year
Ohio Certificate Renewal 614-451-9003

JD White

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Columbus, OH 43232 | jd.white2000@gmail.com

Trade & Other Experience:

01/2006 – Present
Voltaire Electric Company, Inc. – Columbus, OH
Electrical System Design and Drafting
Title: Consultant 614-546-7884

10/2005 - 08/2006
MG Abbott Electric Company – Columbus, OH
Title: Commercial Electrician, Estimator, and ITS Coordinator
Supervisor: Joe Abbott-President, 614-837-3614

07/1995 - 08/2005
Just Dandy Electric Systems, Inc. – Columbus, OH
Title: Owner, Electrician, Estimator, Project Designer...

08/1989 - 07/1995
Safeway Electric Company, Inc. – Columbus, OH
Title: Commercial Electrician, Commercial Division Manager
Supervisor: Andy Untch, 614-443-7672

07/1976 - 09/1982
MG Abbott Electric Company – Columbus, OH
Title: Electrician, Field Supervisor
Supervisor: Gene Abbott-Owner

09/1982 - 08/1989
Delphos Wesleyan Church – Delphos, OH
Mansfield Wesleyan Church – Mansfield, OH
Title: Senior Pastor

07/1972 - 06/1974
US Navy – Quonset Point-RI
Title: ADJ (Aviation Machinist Mate Jet)
Supervisor: Various

JD White

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Columbus, OH 43232

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Licensure:

Electrical
11/1990
Cities of: Columbus, Elyria, Springfield, Youngstown, Toledo, Dayton, and others
07/1992

Electrical State of Ohio
02/1996
State of Ohio #EL 14058

Fire Alarm Installer
02/2003
State of Ohio #54.25.3708

Education:

06/2005 – 05/2015
Columbus State Community College – Columbus, OH
ATS Electrical System Architecture Designer

09/1982 - 05/1987
Indiana Wesleyan University – Marion, IN
Christian Ministries & Biblical Literature

06/1981 - 05/1982
Columbus Technical Institute – Columbus, OH
General Education Studies

06/1973
GED Central High School, Columbus, OH

07/1972 - 08/1973
Naval Aviation Technical Training Center
Aviation A School Jet Engines – Memphis, TN
Naval Aviation Technical Training Center
Aviation B School Helicopters – Quonset Pt, RI
Rating: Aviation Machinist Mate Jet

References:

Joe Abbott - Previous Employer: 614-837-3614
Barb Tipton – Present Employer: 614-473-1050
Dr. Andy Rezin – Previous Supervisor: 614-551-8378
Doug House – Present Supervisor: 614-287-2576
Other References Available Upon Request

Sam Cronk

Sam Cronk has extensive knowledge and experience with the interpretation and application of the National Electrical Code. Sam has been involved in all aspects of the residential, commercial, and industrial electrical industry since 1985. His previous employment includes work as an electrical foreman, project manager, and estimator. He has held numerous certifications and licenses including electrical journeyman by the State of South Carolina, journeyman wireman with the International Brotherhood of Electrical Workers (I.B.E.W.), and electrical contractor with the State of Ohio. Sam currently holds certifications as an Electrical Safety Inspector and Electrical Plans Examiner.

Sam has instructed a variety of adult education and professional continuing education classes, including with Columbus Public Schools, NECA-IBEW Joint Apprenticeship Training Committee (J.A.T.C.), International Association of Electrical Inspectors (I.A.E.I.), and the International Code Council (I.C.C.).

Robert J. Schutz, P.E.

Robert J. Schutz, P.E. is the retired Chief Building Official of the City of Powell (OH) and is currently a Consulting Engineer serving as the contract Plans Examiner and Inspector for several municipalities in central Ohio. He is a civil engineering graduate of the Ohio Northern University with post-graduate studies at the Ohio State University and the University of Southern California.

Bob is a registered Professional Engineer and Professional Surveyor in the State of Ohio; where is also certified as a Building Official, Plans Examiner, Mechanical Inspector, Plumbing Inspector and Electrical Safety Inspector. Bob previously served as the Chief Engineer with the State of Ohio Health Department where he supervised the Plumbing Inspection program, was the Chairman of the Plumbing Advisory Board and was a member of the Ohio Board of Building Standards. Bob instructs nationally and internationally for the International Code Council (ICC), as well as for OCR on Mechanical, Fuel Gas, Plumbing and Building codes.

Grounding and Bonding Service Equipment Requirements

OCR

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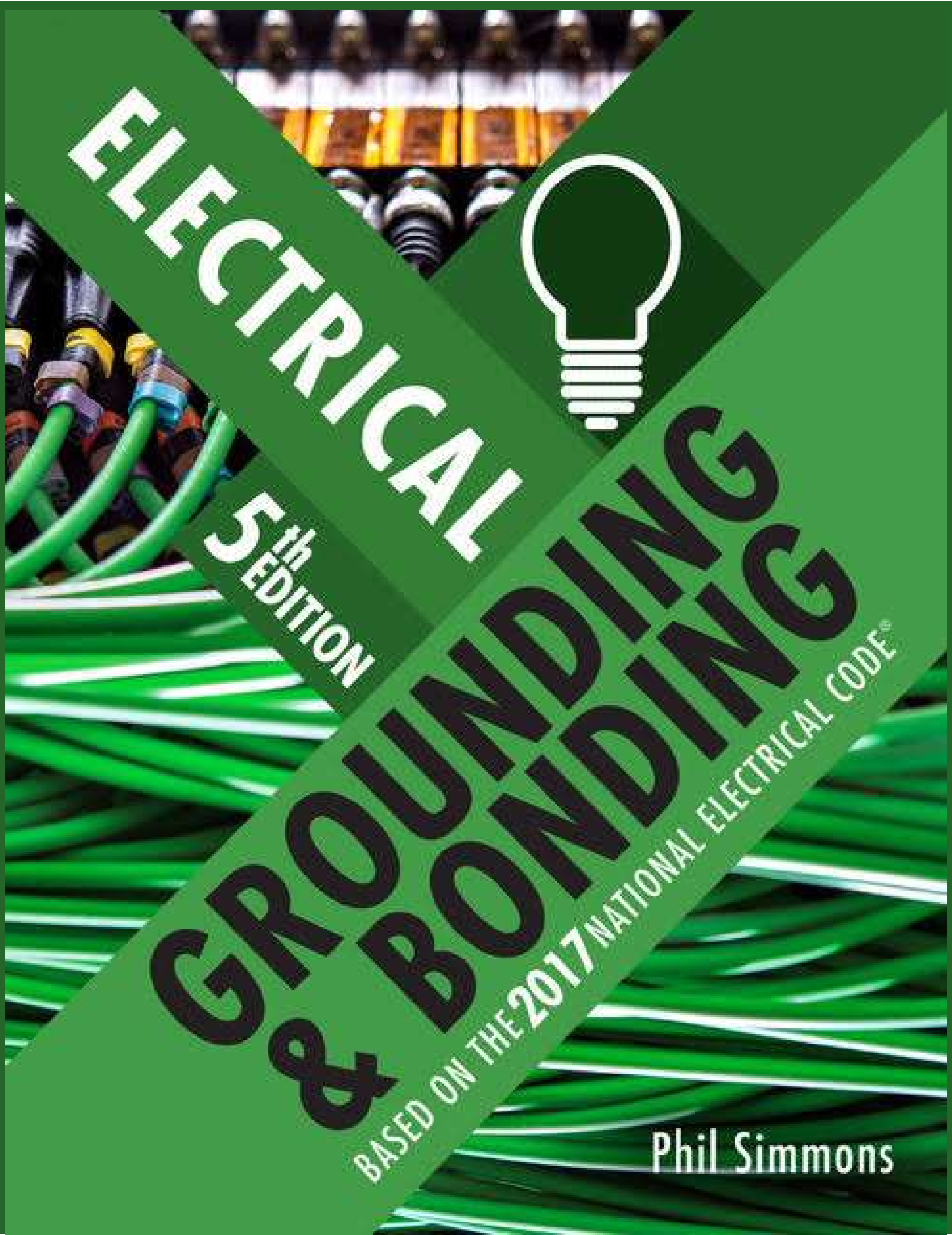
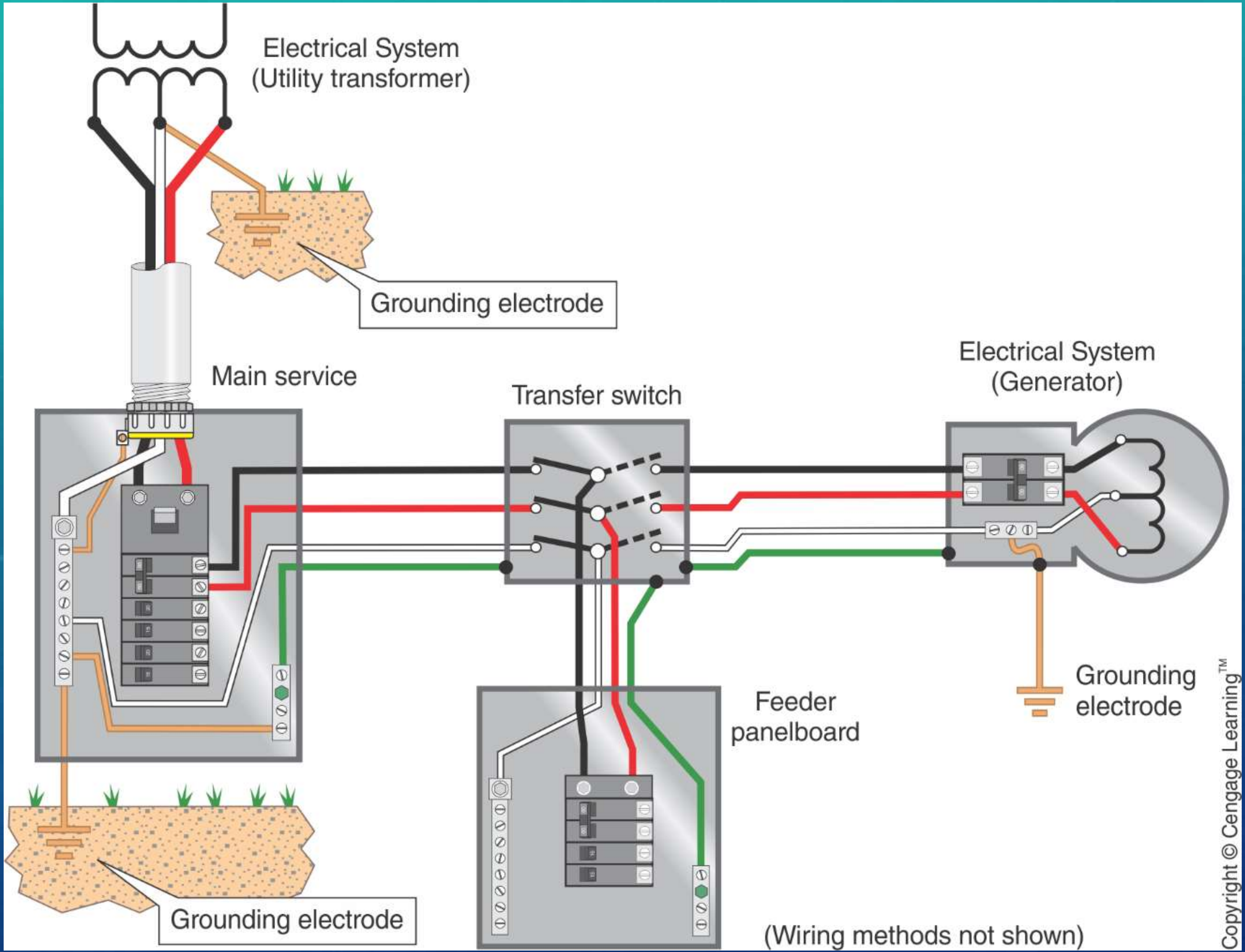

ELECTRICAL
5th EDITION
GROUNDING & BONDING
BASED ON THE 2017 NATIONAL ELECTRICAL CODE®
Phil Simmons

Ideas to Explore

- The importance of using accepted definitions of terms applicable to grounding and bonding
- The importance of providing a low-impedance path of proper capacity to ensure the operation of overcurrent protective devices
- The various components of the grounding and bonding system

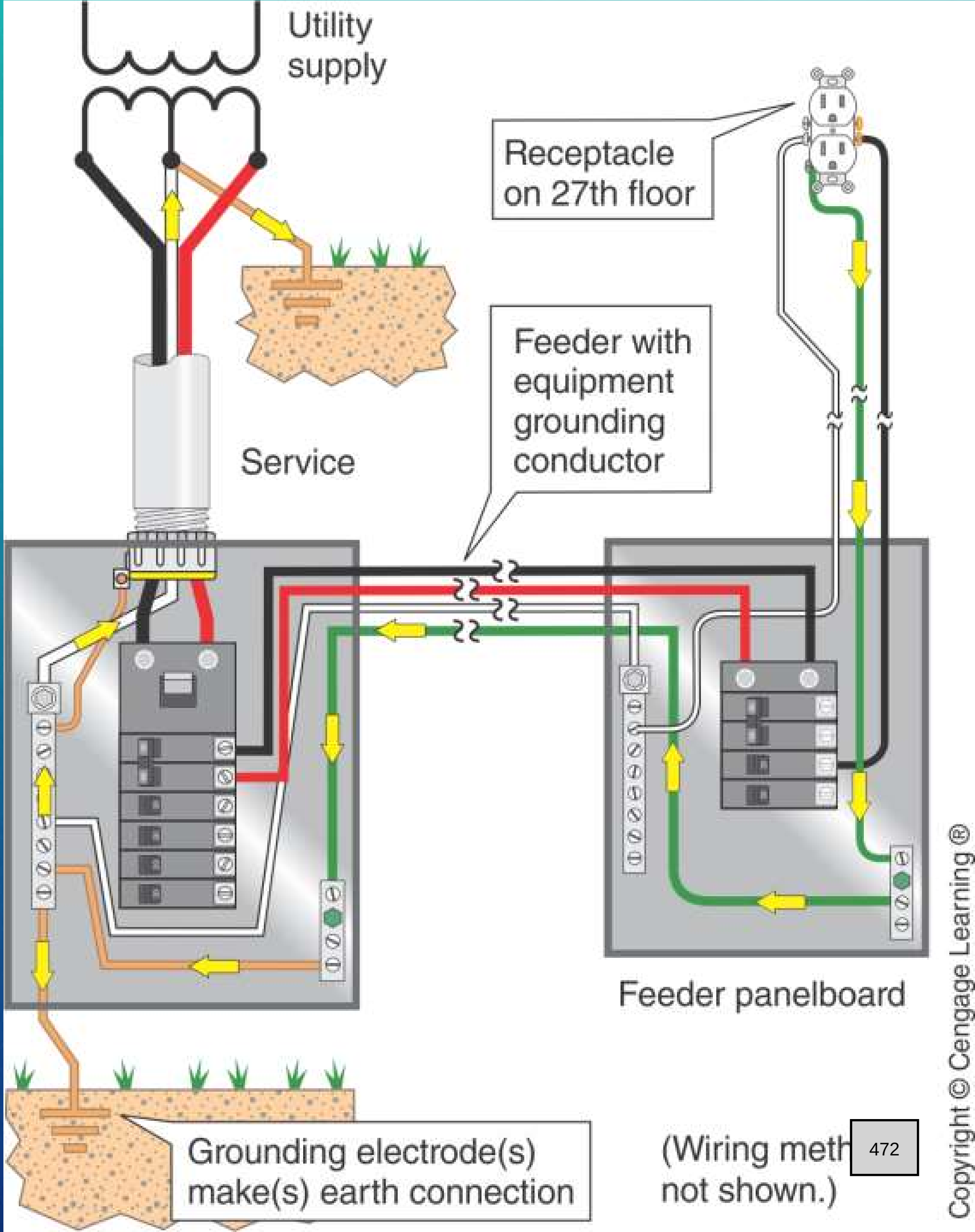
Grounding of Electrical Systems



Grounded (Grounding) (*Article 100*)

- "Connected (connecting) to ground or to a conductive body that extends the ground connection"
  - Connection to ground is accomplished by means of a recognized grounding electrode (system).
  - It is vital to provide an effective ground-fault current path defined and described in *Article 250*
- Grounded objects such as metal conduit, cables with metallic sheaths and structural metal may "extend the earth connection"
- Grounding Electrode conductors "extend the earth connection"
  - Structural metal often extends many stories above the point where it makes an earth connection or is connected to a grounding electrode system
  - Metal water pipes are recognized in certain occupancies for connection purposes throughout a building or structure

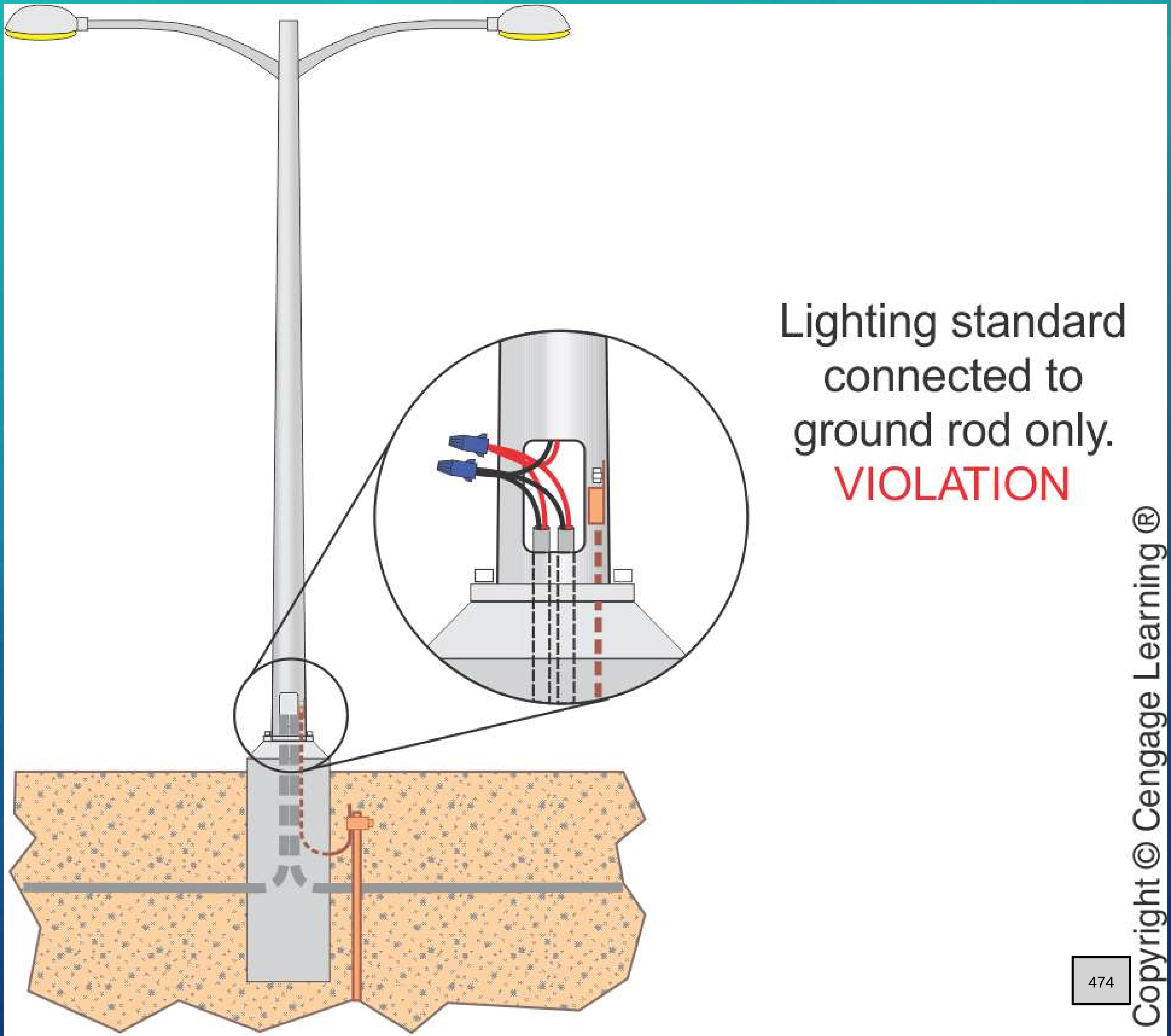
Grounded by Conductive Body



Grounded, Improperly

- Equipment can be "grounded" and not be in compliance with *NEC*®
- Equipment grounding must be in compliance with the "Effective ground fault path rules" in *250.4(A)(5)* and *250.4(B)(4)*

Grounded, improperly

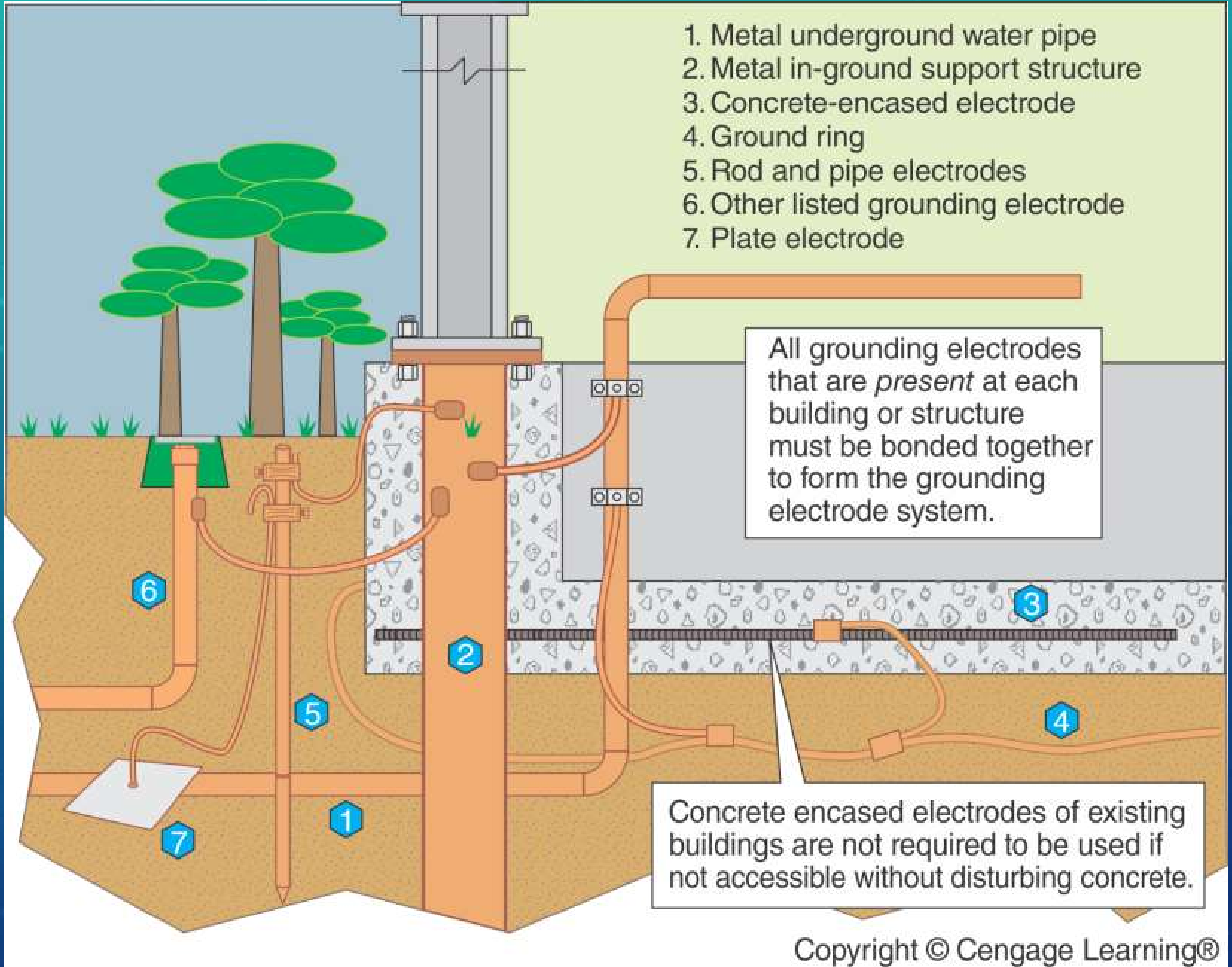


250.50 Grounding Electrode System

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

- *Exception: Concrete-encased electrodes of existing buildings or structures are not required to be part of the grounding electrode system if the steel reinforcing bars or rods are not accessible for use without disturbing the concrete*

Grounding electrode system, *250.50.*

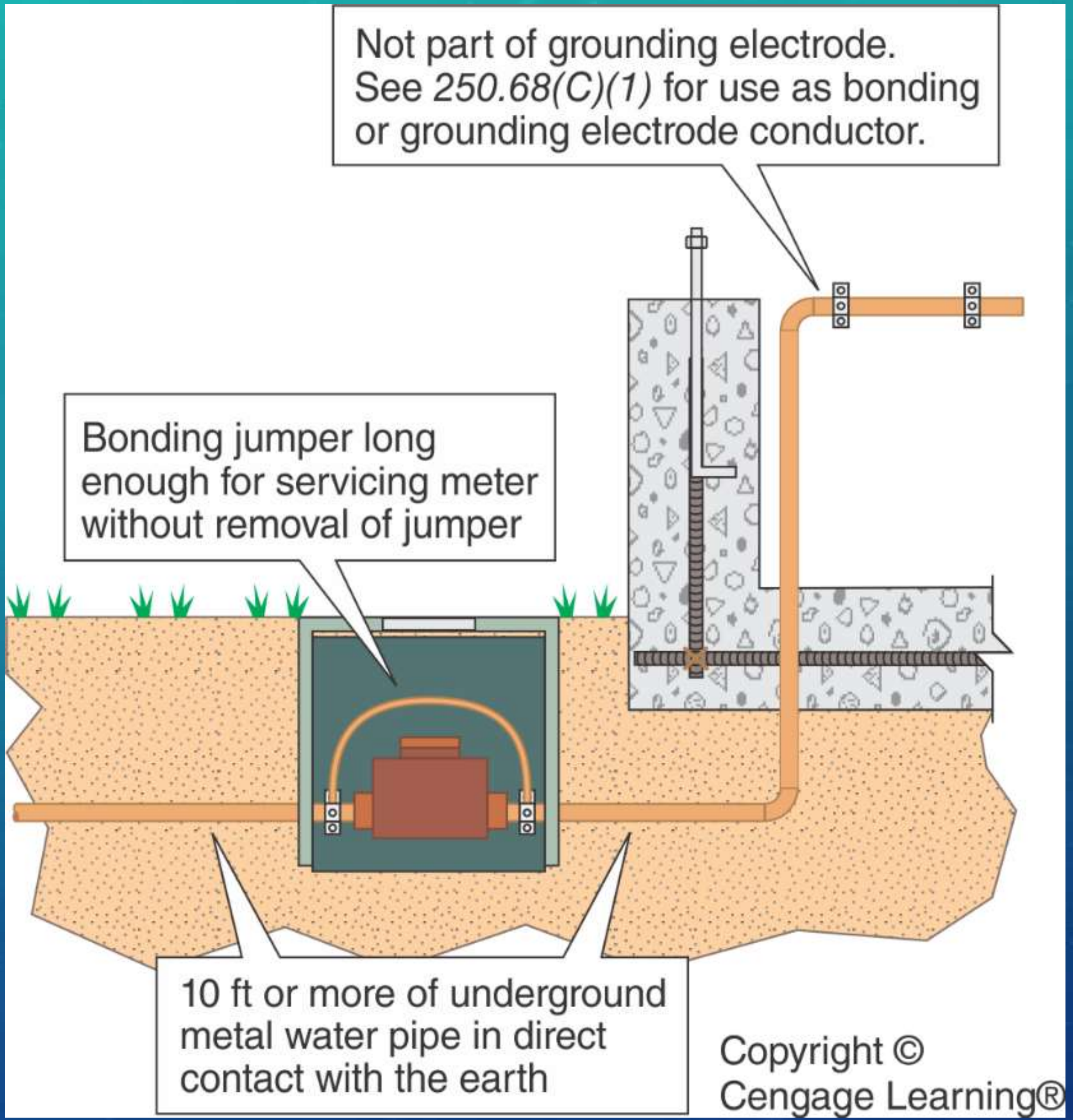


250.52(A) Electrodes Permitted For Grounding

- Use of the grounding electrodes in this section becomes mandatory due to the requirement in *250.50*
- Some electrodes are traditionally installed by other trades
  - Electrodes in *(A)(4)* through *(A)(8)* are often installed by electricians
  - Some installation requirements are contained in the description of the grounding electrodes

250.52(A)(1) Metal Underground Water Pipe

- Required to be used if 10 ft. or more is in direct contact with the earth
- Interior metal water pipe located more than 5 ft. from point of entrance not permitted to be used for connection purposes



Metal underground water pipe grounding electrode, *250.52(A)(1)*.

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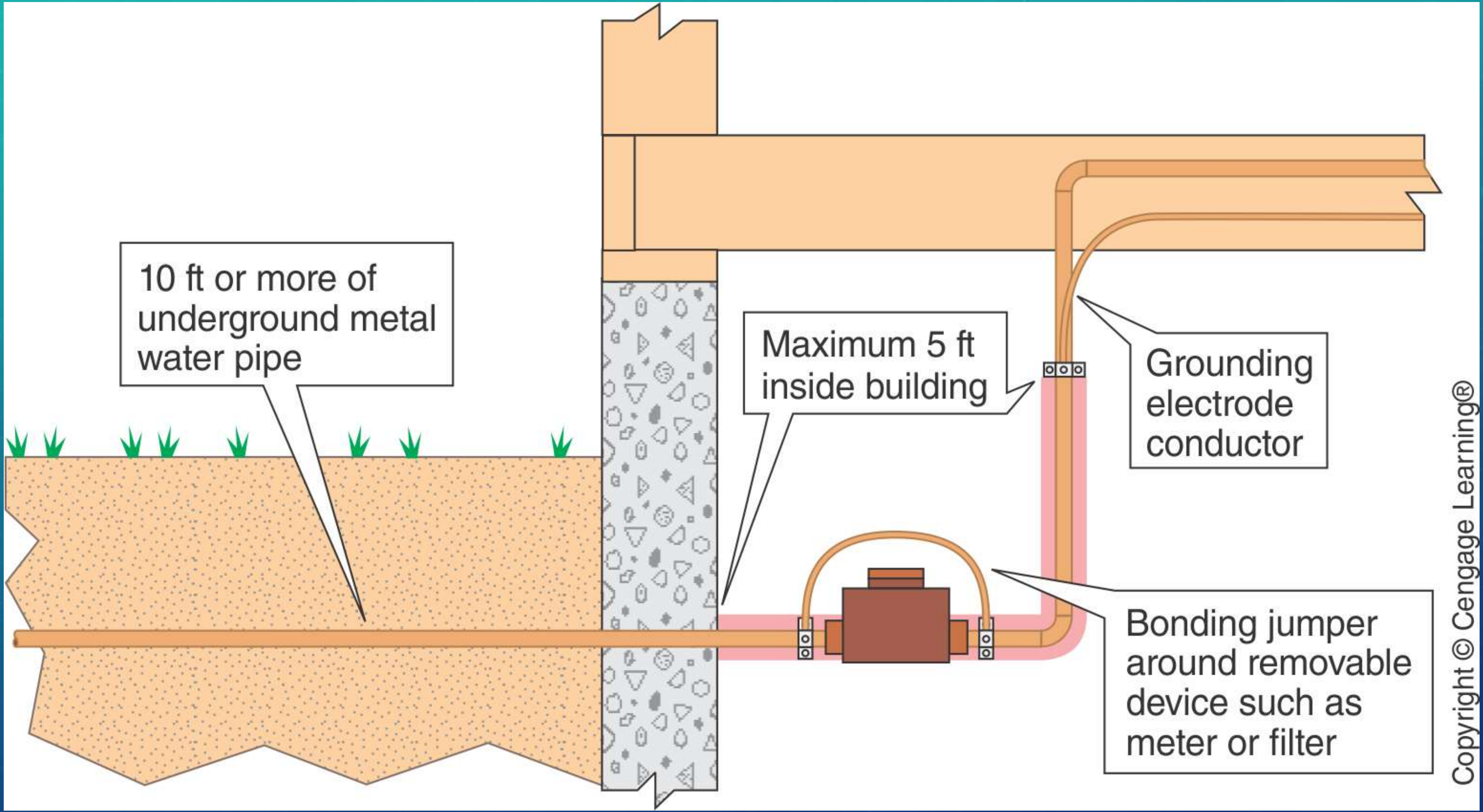
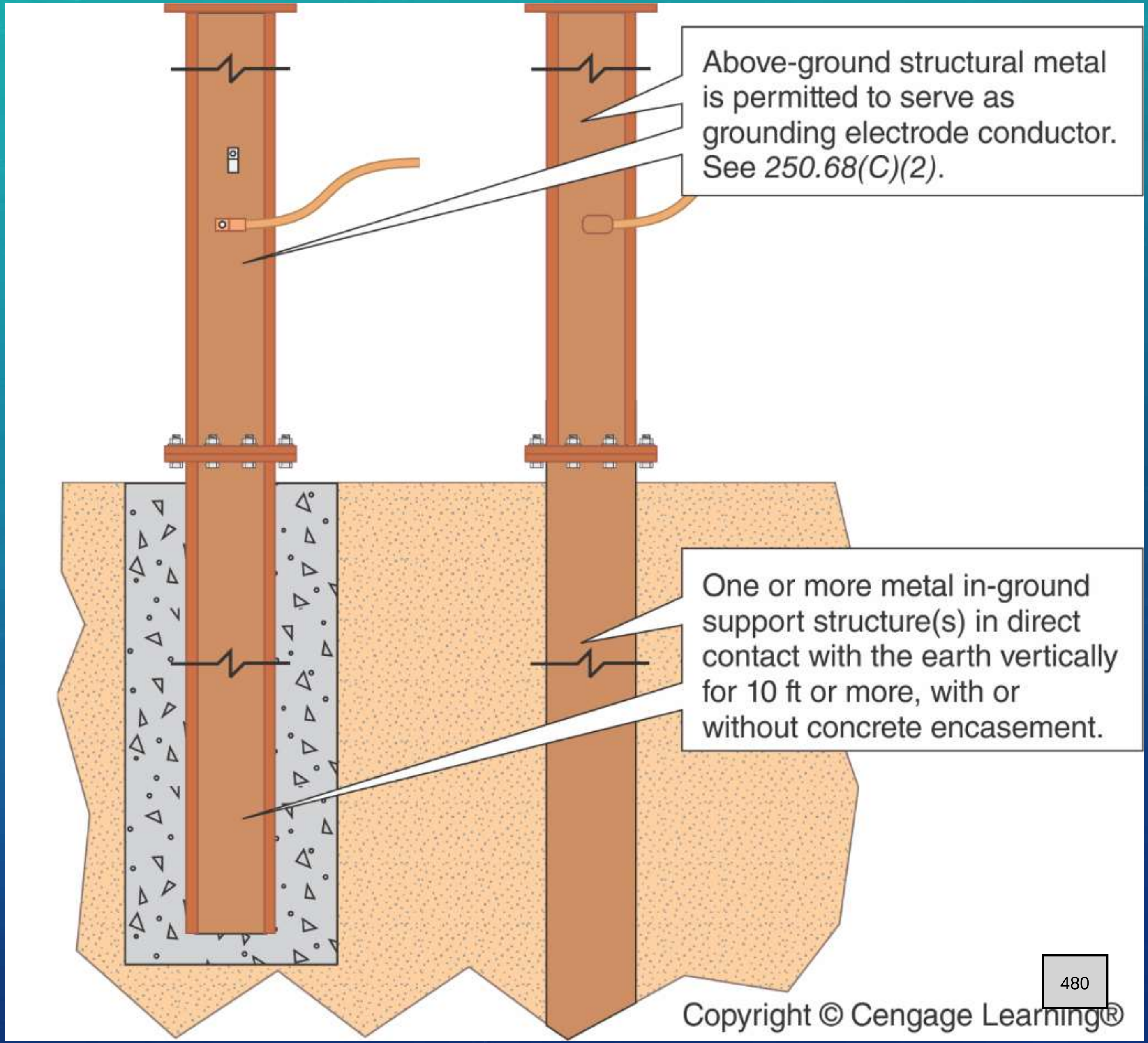
Continuity of Water Pipe Grounding Electrode



Metal underground water pipe grounding electrode: continuity, *250.53(D)(1)*.

Metal In-ground Support Structure

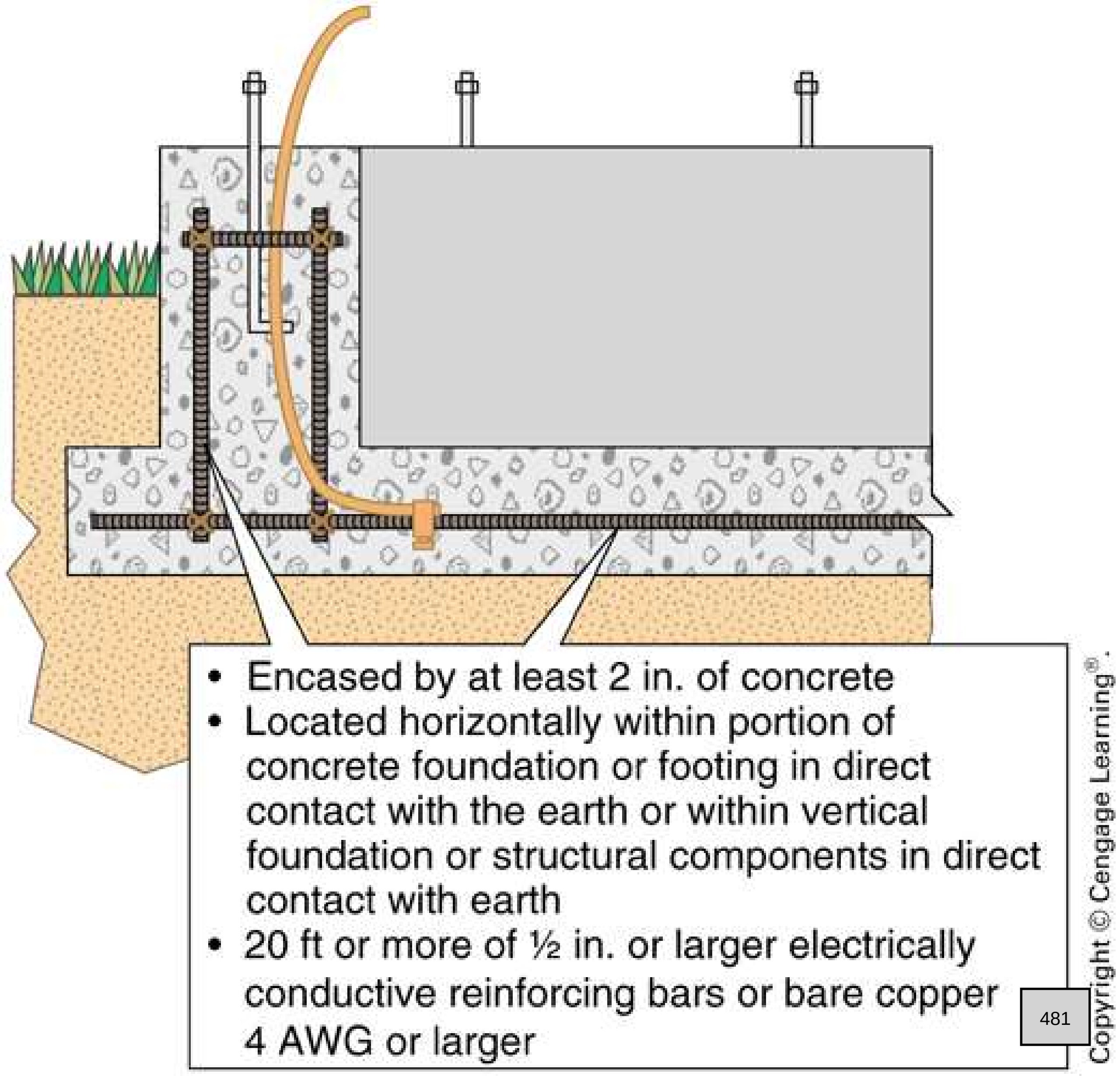
Metal in-ground support structure grounding electrode, *250.52(A)(2)*.



250.52(A)(3) Concrete-Encased Electrode

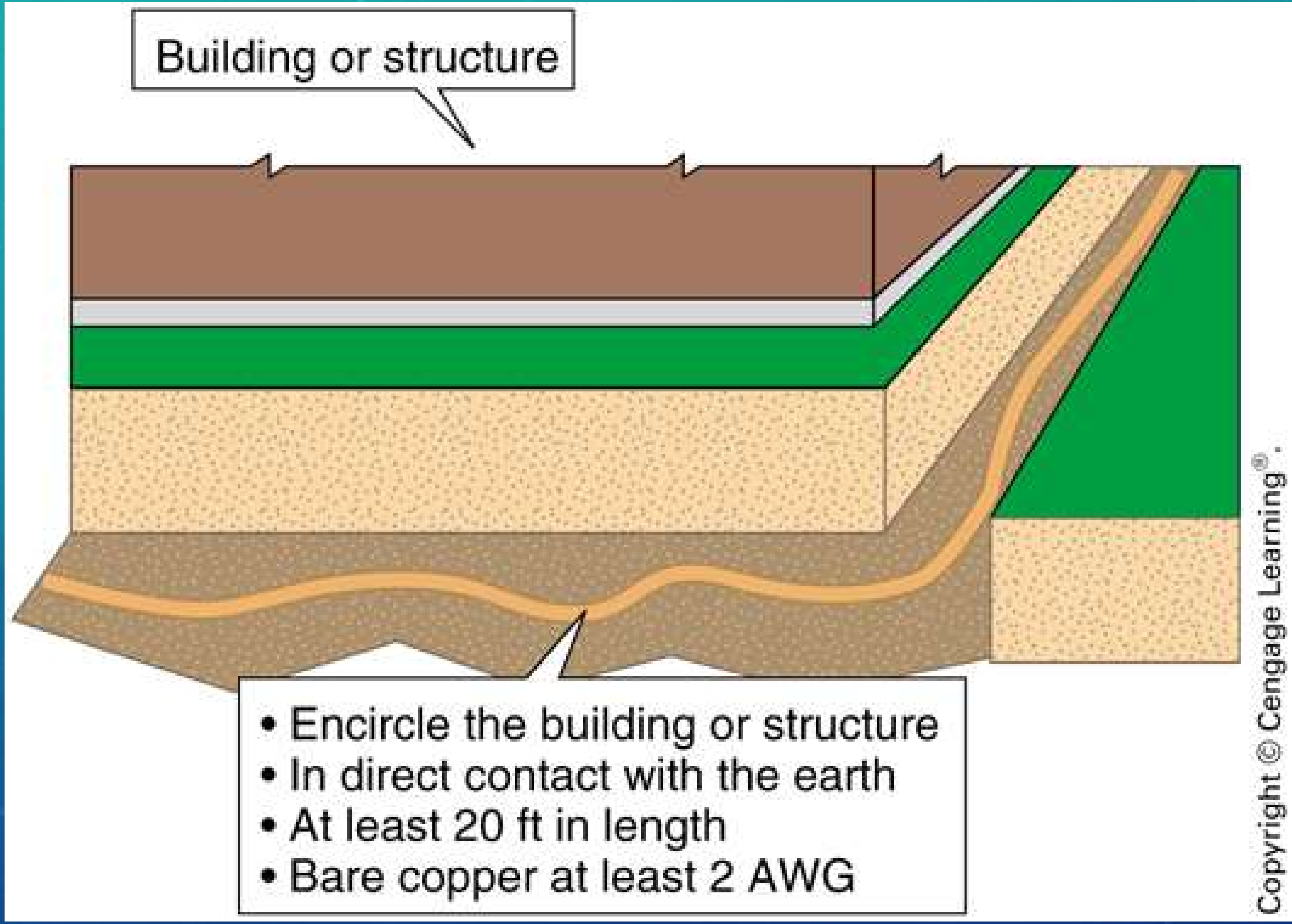
- Required to be used where present at the building or structure served

- Use of these electrodes pioneered in the early 1940s for the US Army in arid climates



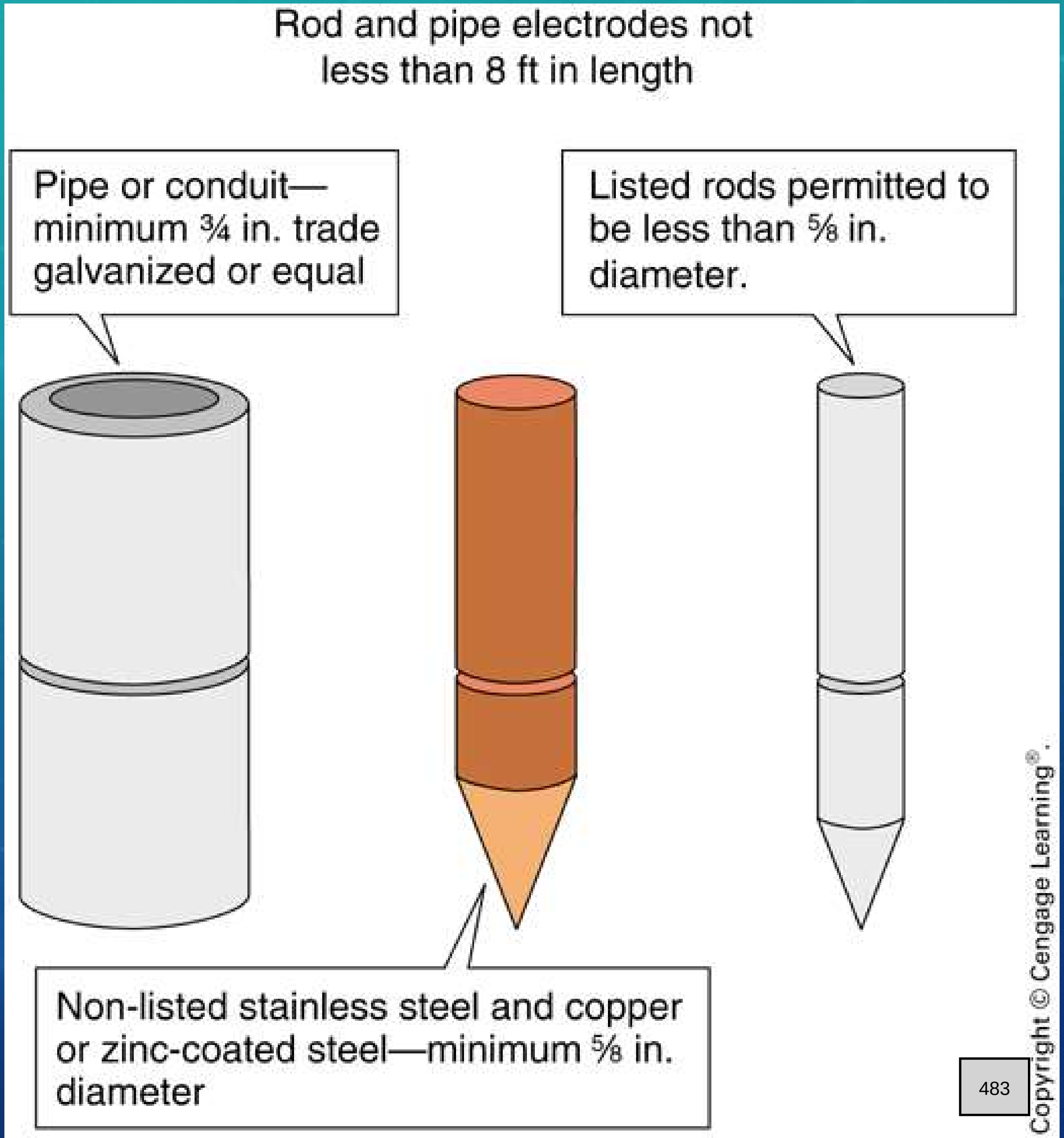
250.52(A)(4) Ground Ring

- To encircle the building or structure
- Be in direct contact with the earth
- Consist of at least 20 ft. of bare copper conductor not smaller than 2 AWG
- Burial depth is not less than 2½ ft. [250.53(F)]

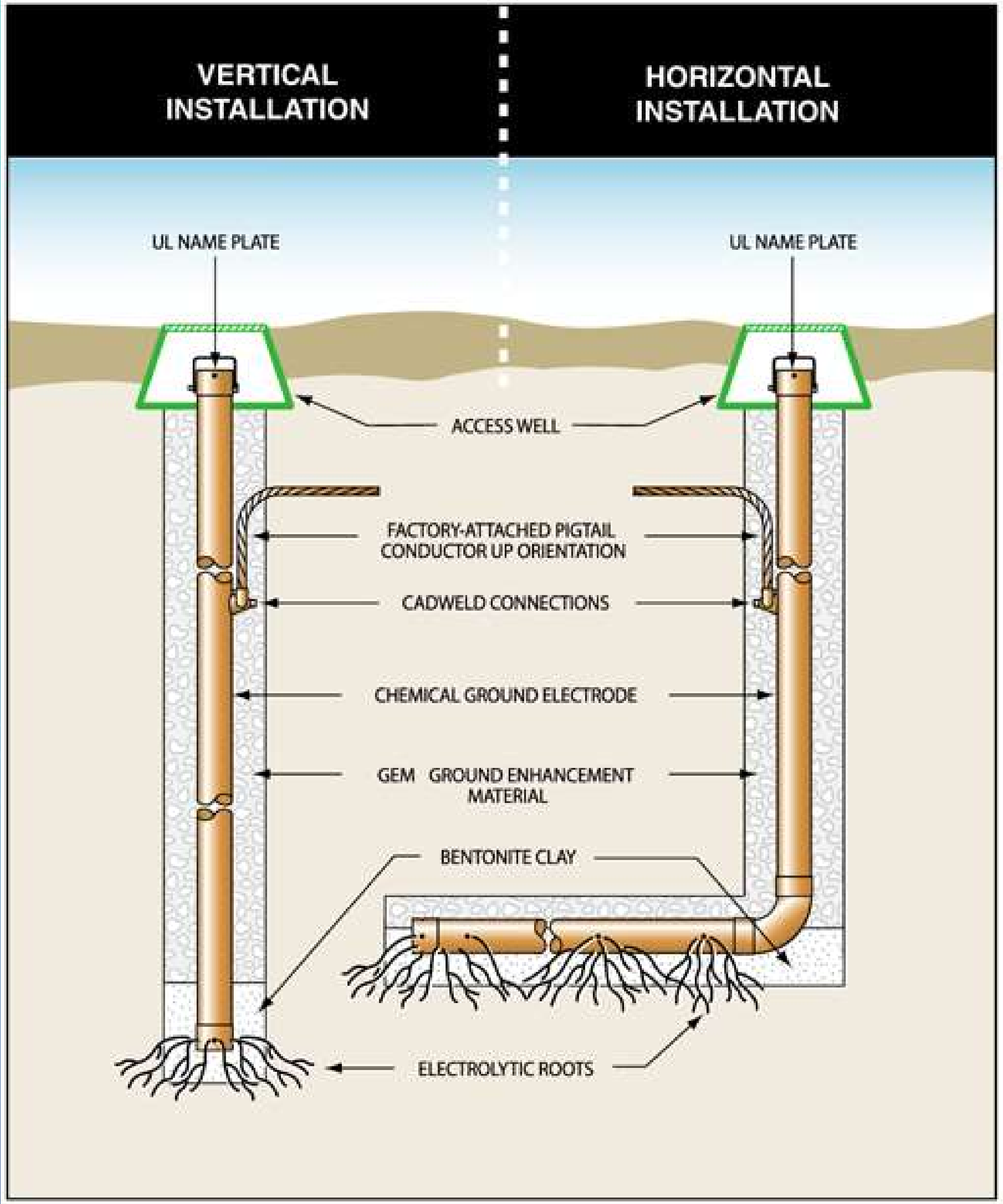


250.52(A)(5) Rod and Pipe Electrodes

- Ideally, installed below permanent moisture level
- Specifications may require thicker or longer electrodes and installation in specific configurations



250.52(A)(6) Other Electrodes



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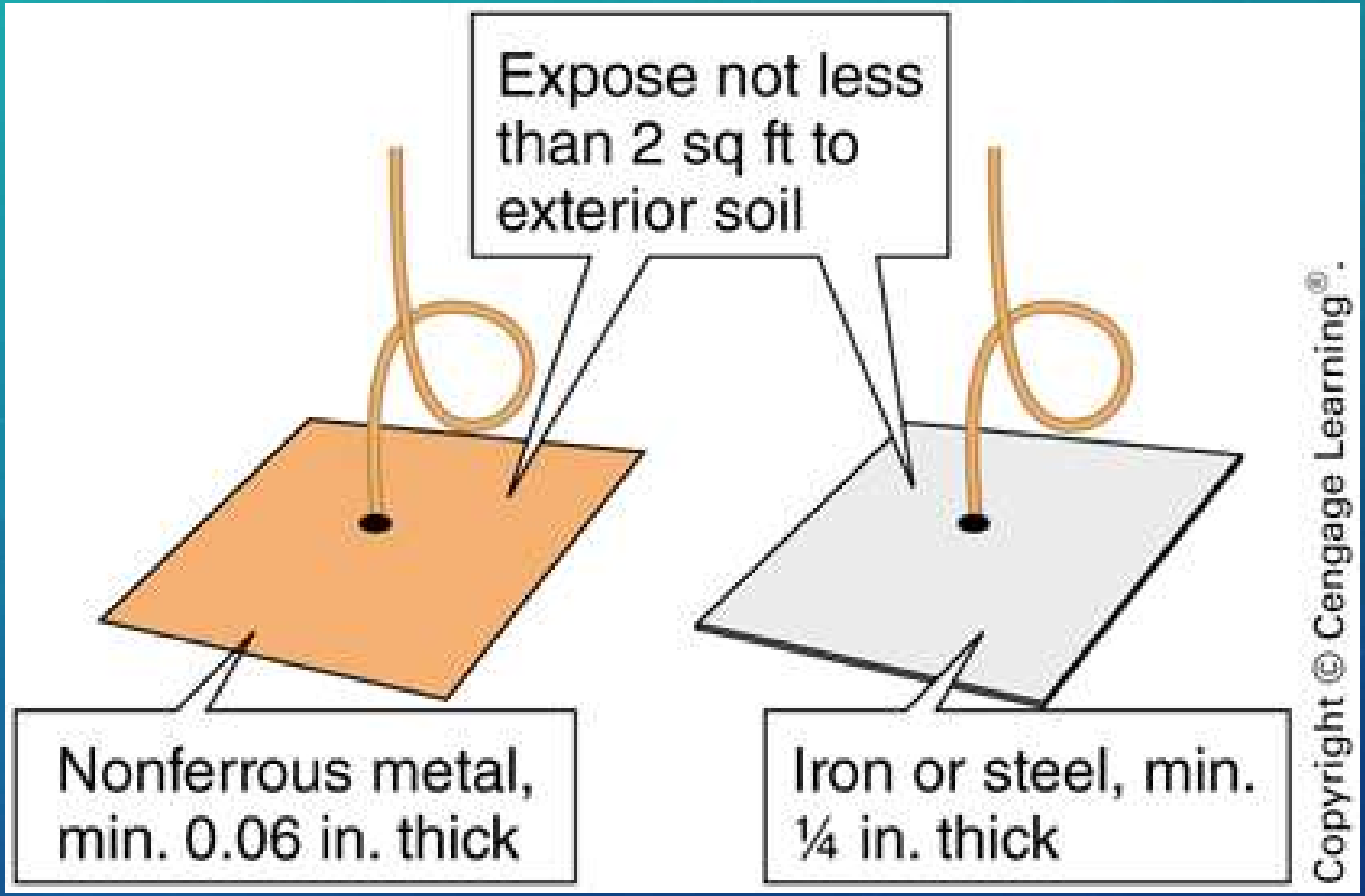
250.52(A)(7) Plate Electrodes

- Each plate electrode required to expose not less than 2 sq. ft. to exterior soil
- 1.5’ by 1.5’
- Some interpret rule as permitting a 12 in. square plate (verify)
- Installation rules are at *250.53(A)*, *(B)*, *(E)*, and *(H)*



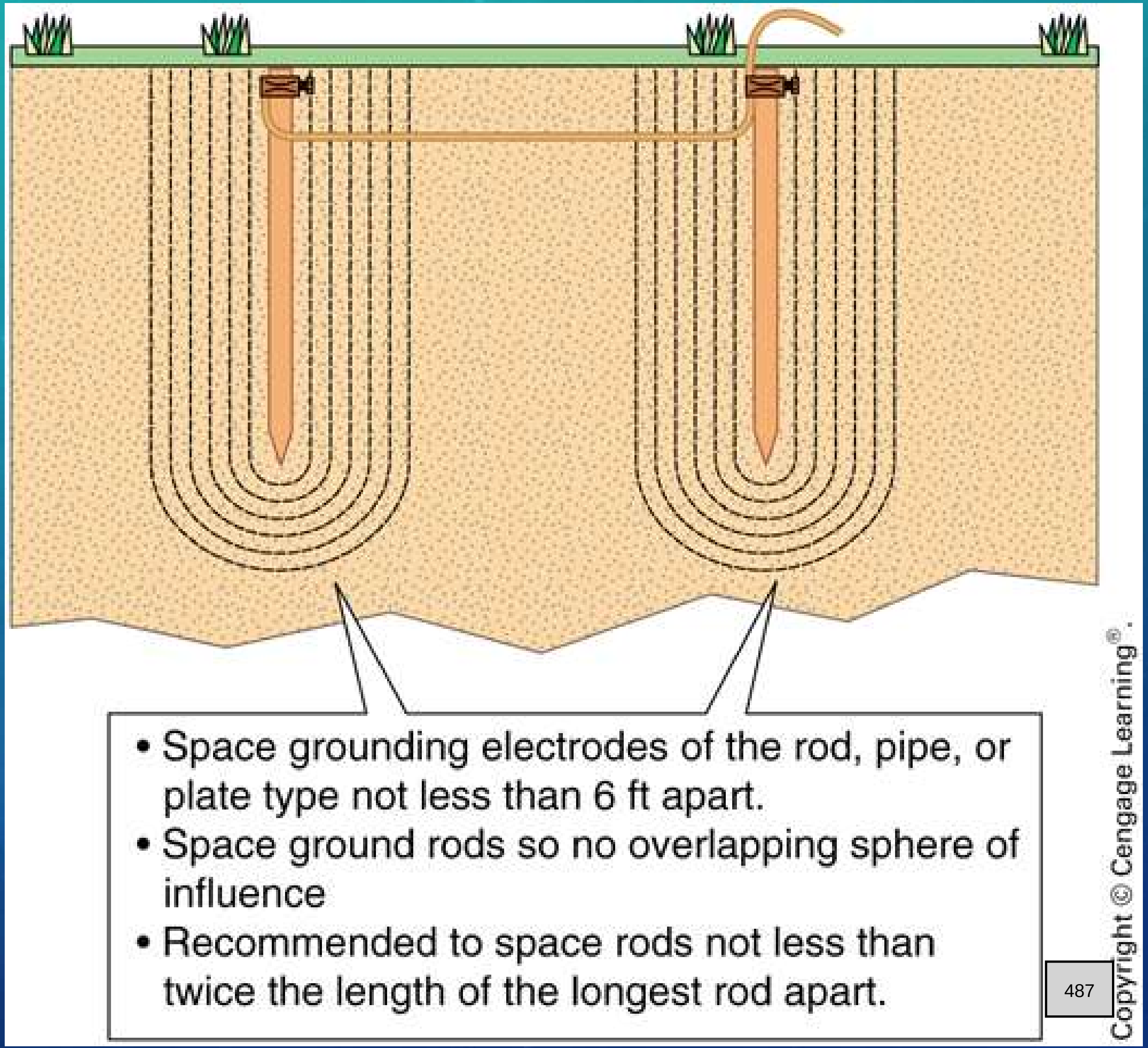
250.53(A)(2) Supplemental Electrode Required

Single rod, pipe, or plate electrode must be supplemented by an electrode of a type specified in *250.52(A)(2)* through *(A)(8)*

- The supplemental electrode is permitted to be bonded to one of the following:
  - Rod, pipe, or plate electrode
  - Grounding electrode conductor
  - Grounded service-entrance conductor
  - Nonflexible grounded service raceway
  - Any grounded service enclosure
  - If the resistance of single rod, pipe or plate is 25 ohms or less, a supplemental grounding electrode is not required

250.53(A)(3) Multiple Rods, Pipes or Plates

- Space not less than 6 ft. apart
- Avoid overlapping "sphere of influence"
- Installation of additional electrodes not required to obtain 25 ohms resistance



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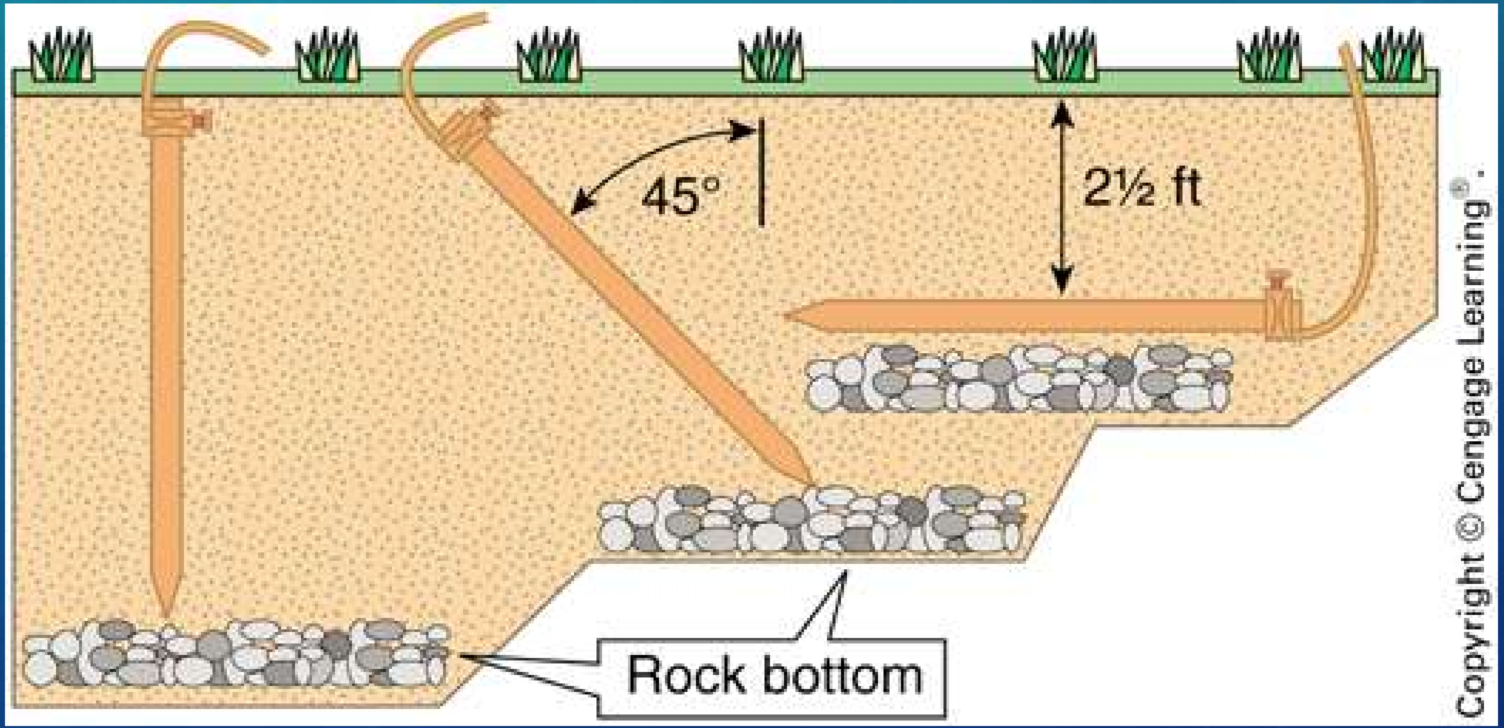
I – Note, Spacing of Rods

- The paralleling efficiency of ground rods is increased by spacing them twice the length of the longest rod
- This spacing may be required in manufacturer's installation requirements and if so stated, must be followed to comply with *110.3(B)*

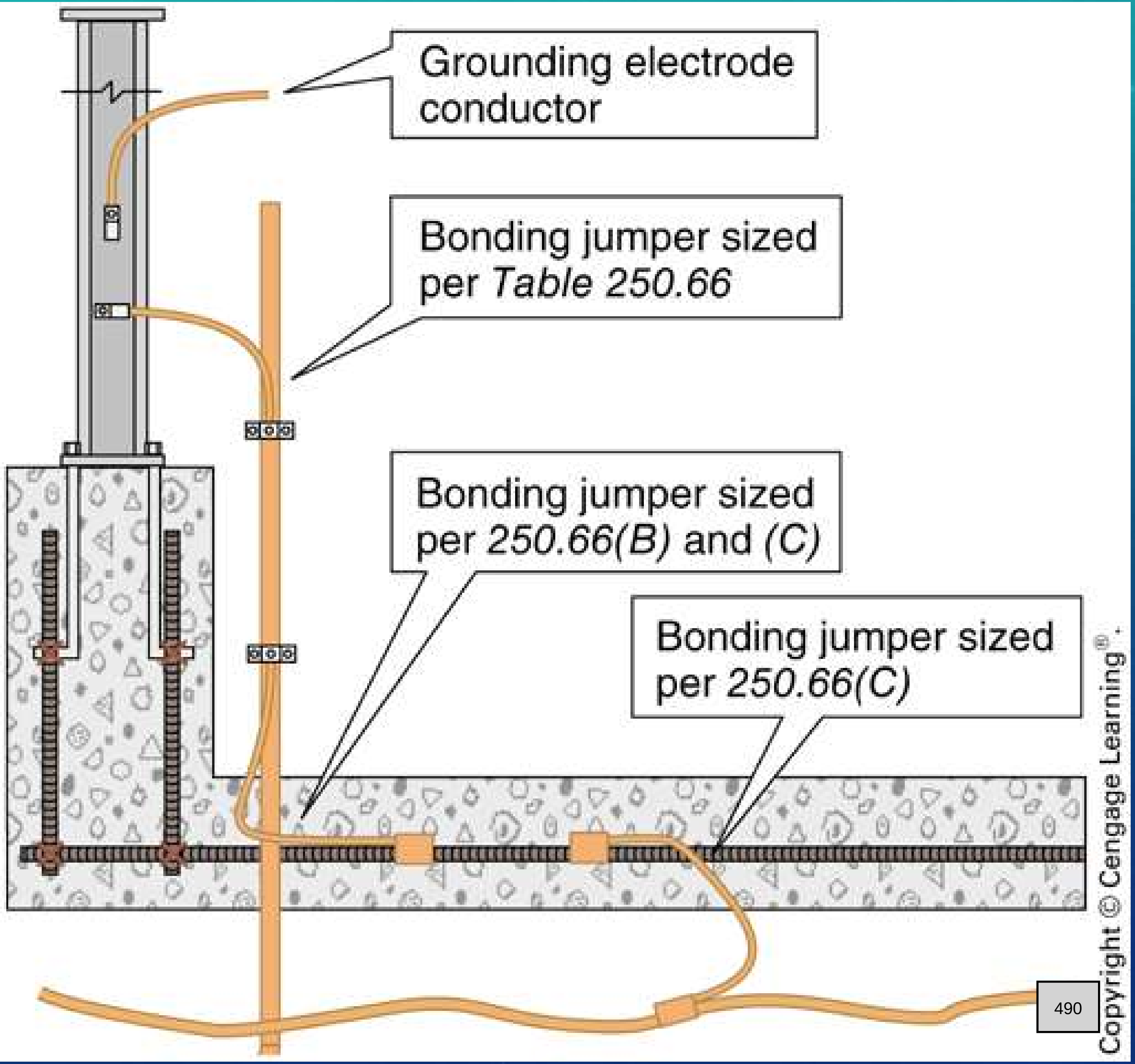
250.53(G) Rod and Pipe Electrodes

- At least 8 ft. in contact with the soil
- If rock bottom is encountered, install at maximum 45°angle
- If rock bottom is then encountered, burial in trench 2½ ft. deep is permitted



250.53(C) Bonding Jumper

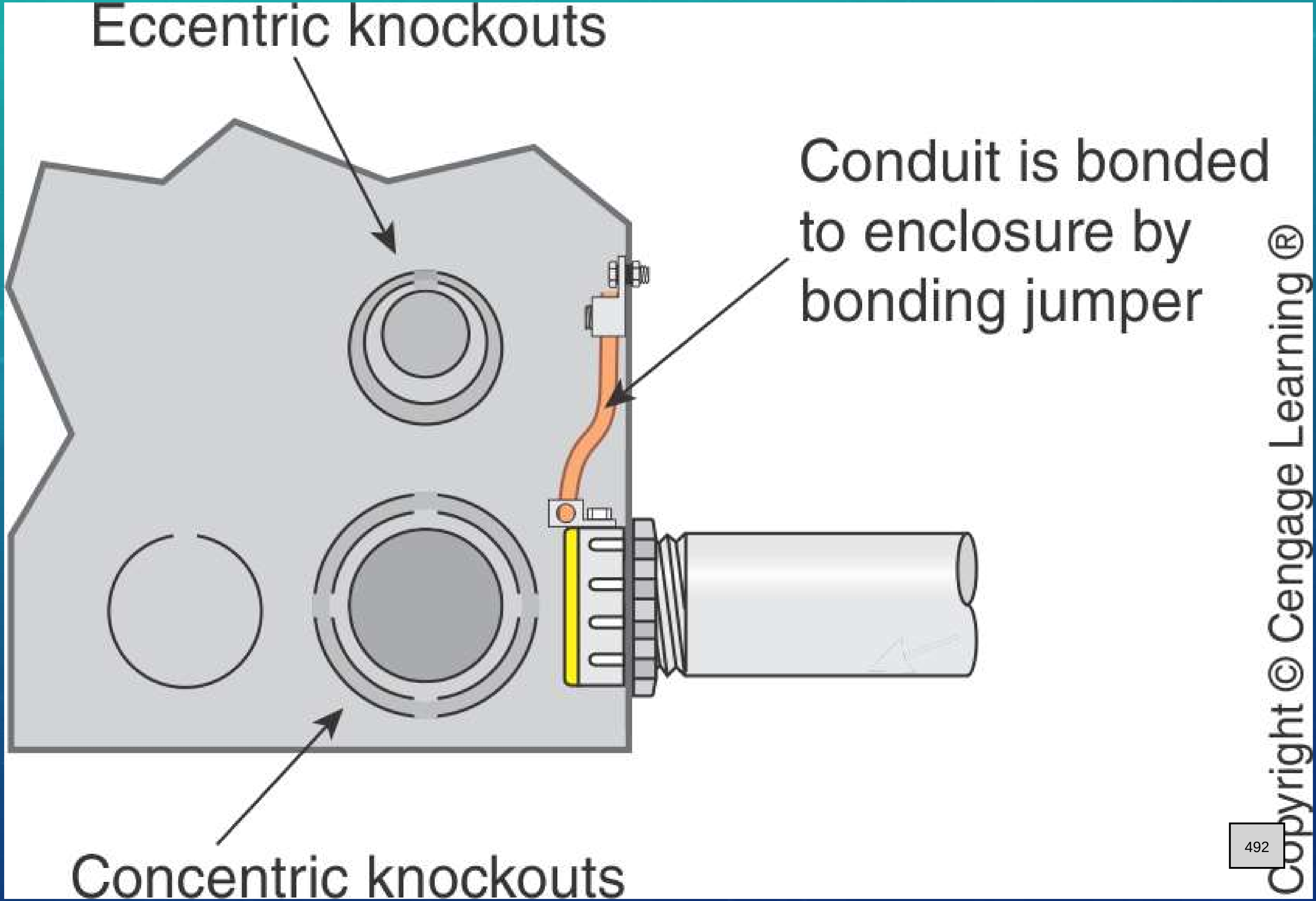
- Bonding jumper is used to connect grounding electrodes together
- Install per 250.64(A), (B) and (E)
- Size per 250.66
- Connect per 250.70



Bonded (Bonding) (*NEC® Article 100*)

- "Connected to establish electrical continuity and conductivity"
- In its simplest form, the definition means the conductor and connections to connect equipment together and to provide a complete path for current to flow
- Bonding ensures conductivity around suspect connections
- Conduit or equipment grounding conductor in Type MC or other wiring method are permitted to be used to bond (connect) enclosures together.
- The function of equipment grounding and bonding become inseparable

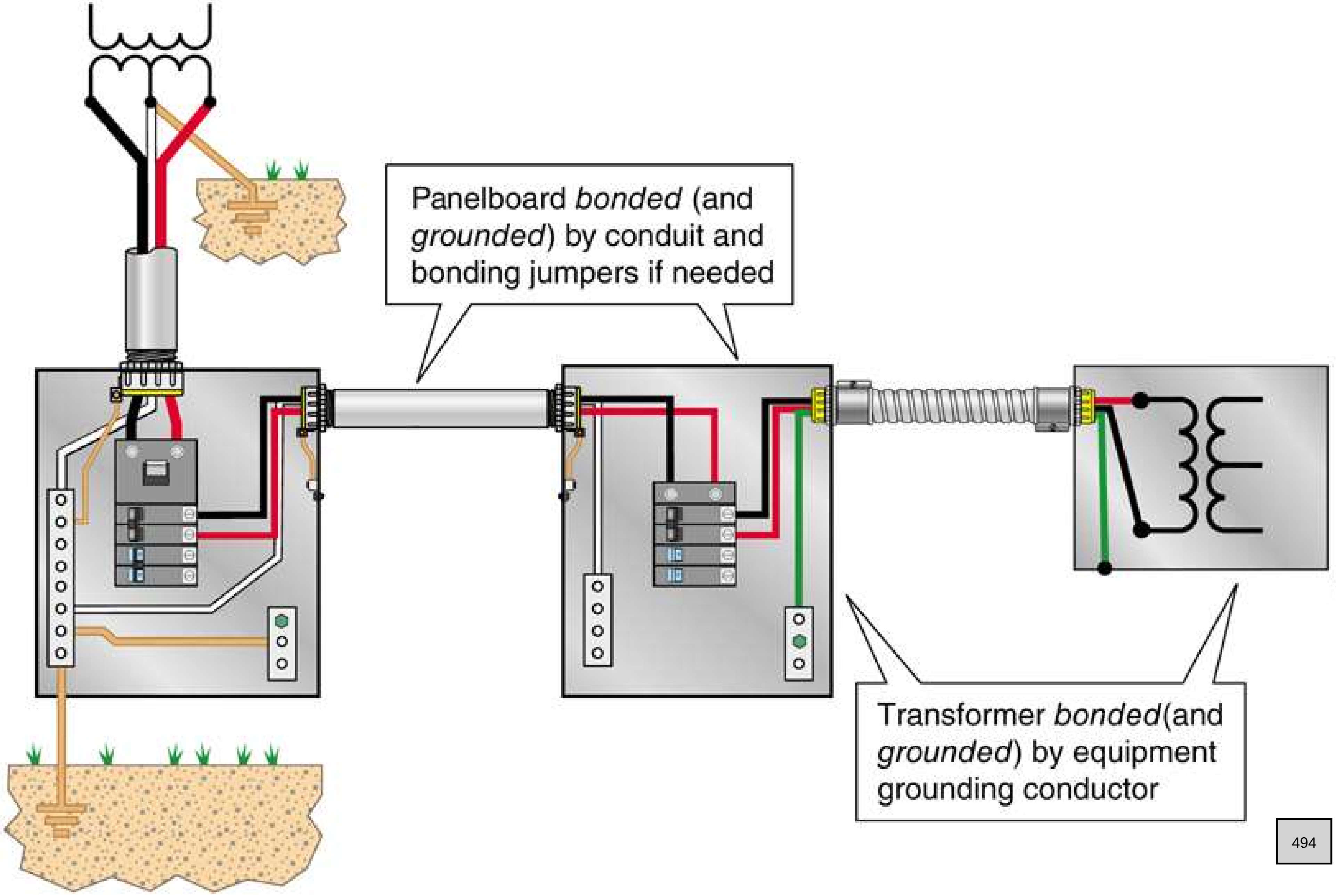
Bonded


Eccentric knockouts
Conduit is bonded to enclosure by bonding jumper
Concentric knockouts
Copyright © Cengage Learning®

Bonding Conductor or Jumper (*NEC*® *Article 100*)

- “A conductor to ensure the required electrical conductivity between metal parts required to be electrically connected.”
- Usually a wire-type conductor used to connect parts that are required to be electrically continuous
- Specific sizes are given for application

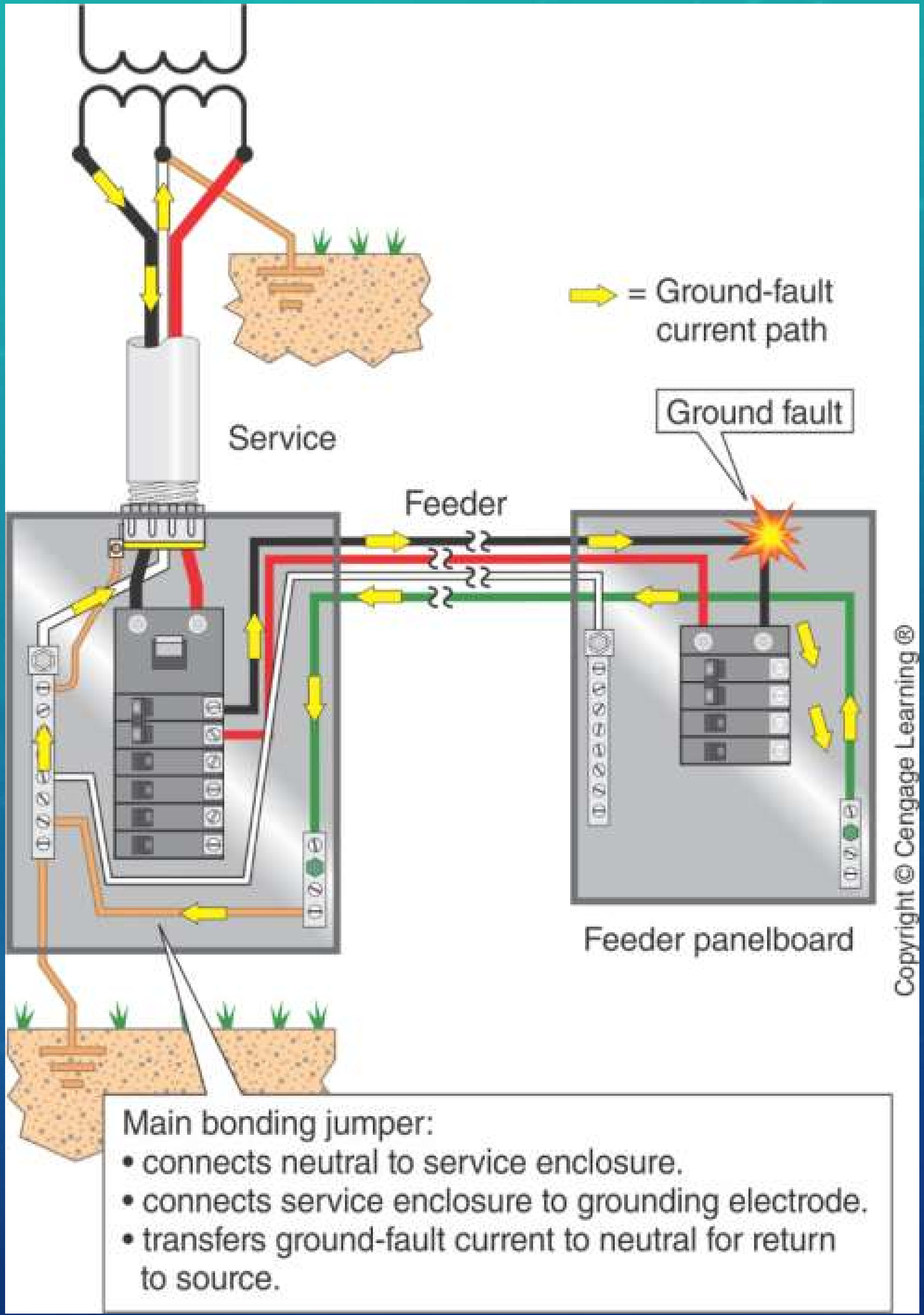
Bonding with Wiring Methods



Main Bonding Jumper (*NEC*® *Article 100*)

- Must be large enough so it does not melt while carrying fault current
- Permitted to be a wire, a bus, or a screw
- Identical in function to “system bonding jumper”
- Provides return path for fault current
- Many rules on the Main Bonding Jumper are in *250.28*
- *Sized per 250.66 and 250.102*

100: Main Bonding Jumper



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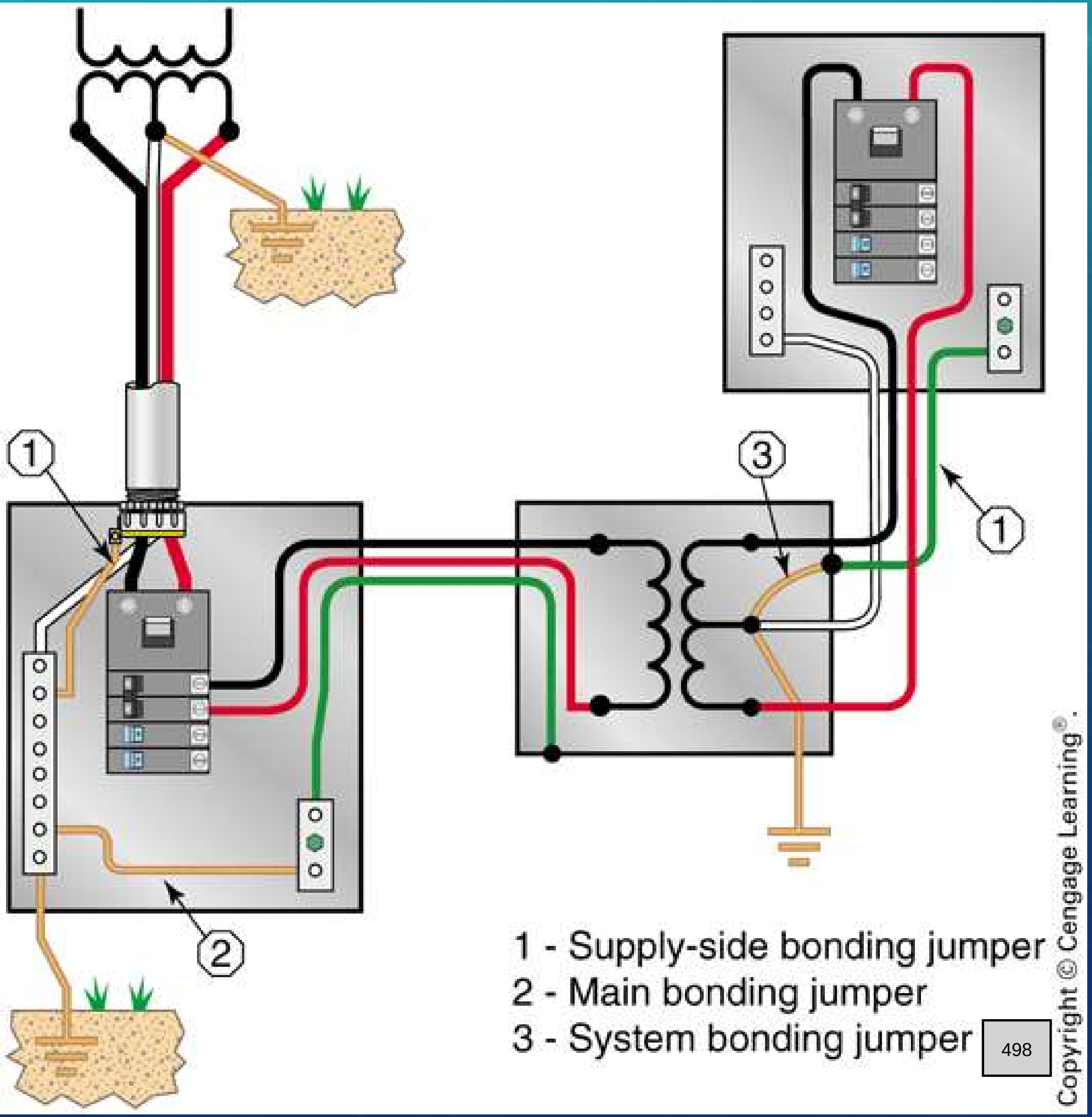
Ohio Certificate Renewal
"Since 1994"

Supply-Side Bonding Jumper (*NEC® Article 100*)

- Used for bonding raceways, and enclosures containing service conductors
- Also used to ensure bonding for metal enclosures for separately derived systems
- Bonding jumper sized from *Table 250.102(C)(1)* on the size of the ungrounded service conductor or the derived ungrounded conductor of separately derived system

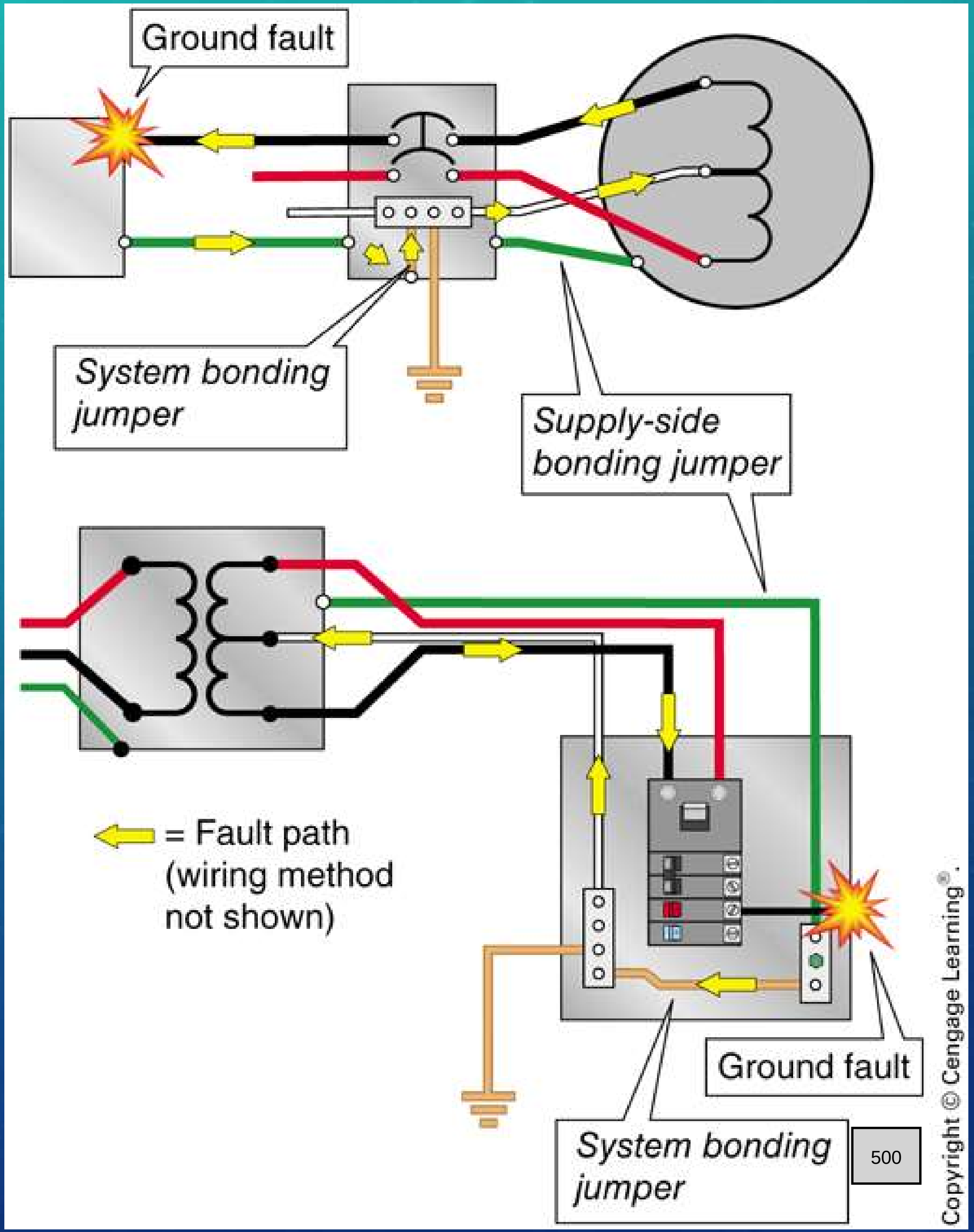
Supply-Side Bonding Jumper (*NEC*® *Article 100*)



System Bonding Jumper (*NEC*® *Article 100*)

- "The connection between the grounded-circuit conductor and the supply-side bonding jumper or the equipment grounding conductor, or both, at a separately derived system." (*Article 100*)
- Identical in function to "main bonding jumper" for service
  - Must be large enough so it does not melt while carrying fault current
  - Permitted to be a wire, a bus, or a screw
  - Provides return path for fault current

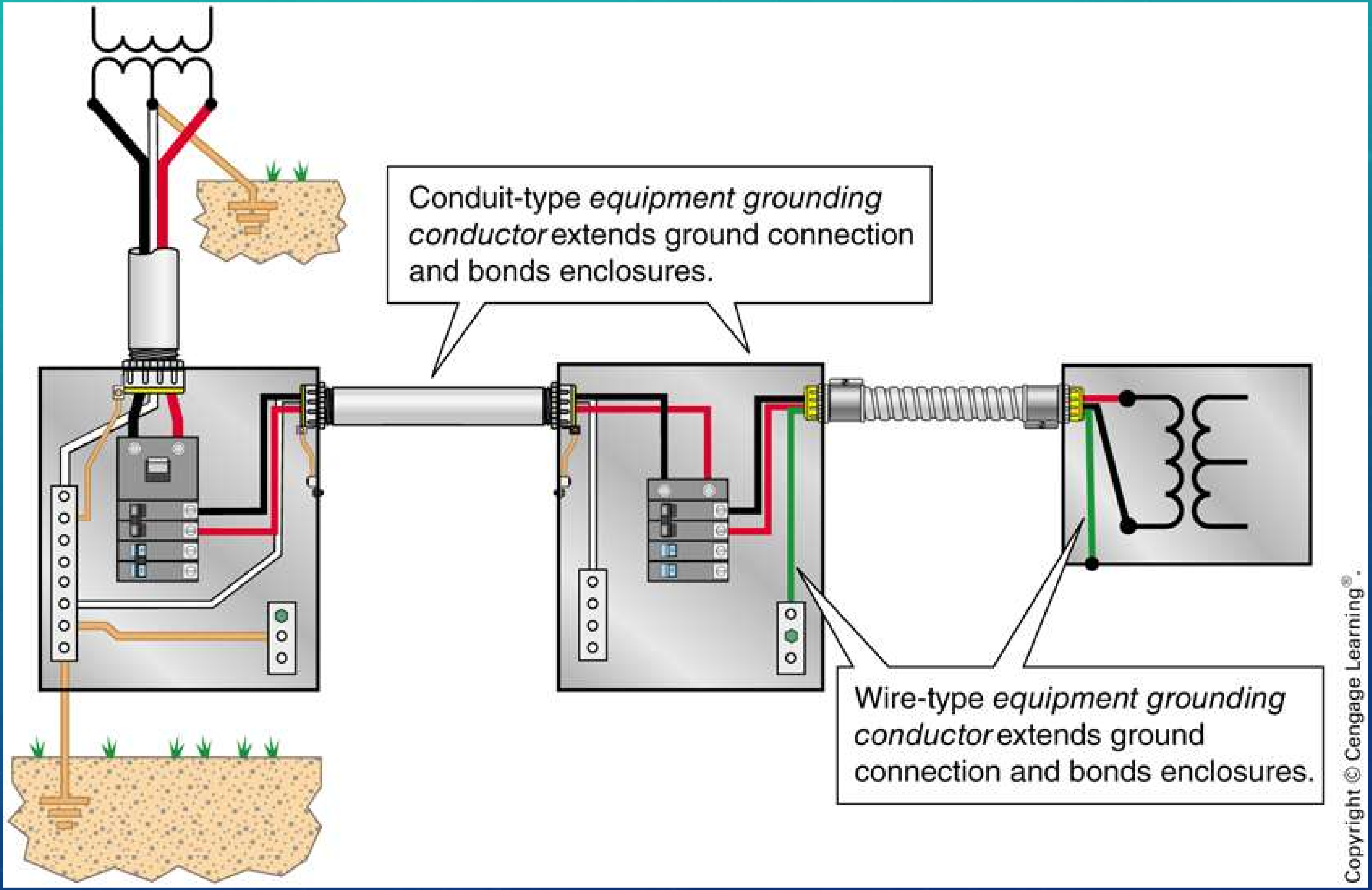
System Bonding Jumper (*NEC*® *Article 100*)



Equipment Grounding Conductor (EGC) (*NEC® Article 100*)

- "The conductive path(s) that provides a ground-fault current path and connects normally non–current-carrying metal parts of equipment together and to the system grounded conductor or to the grounding electrode conductor, or both."
- Conductive ground-fault current path is provided by the EGC
  - Paths recognized include a wire or bus, metallic raceways and metallic cable sheaths
- "Normally non-current-carrying metal parts of equipment …"
  - Equipment grounding conductors do not normally carry current
  - Neutral conductors carry current under normal conditions

Equipment Grounding Conductor (EGC) (*NEC® Article 100*)



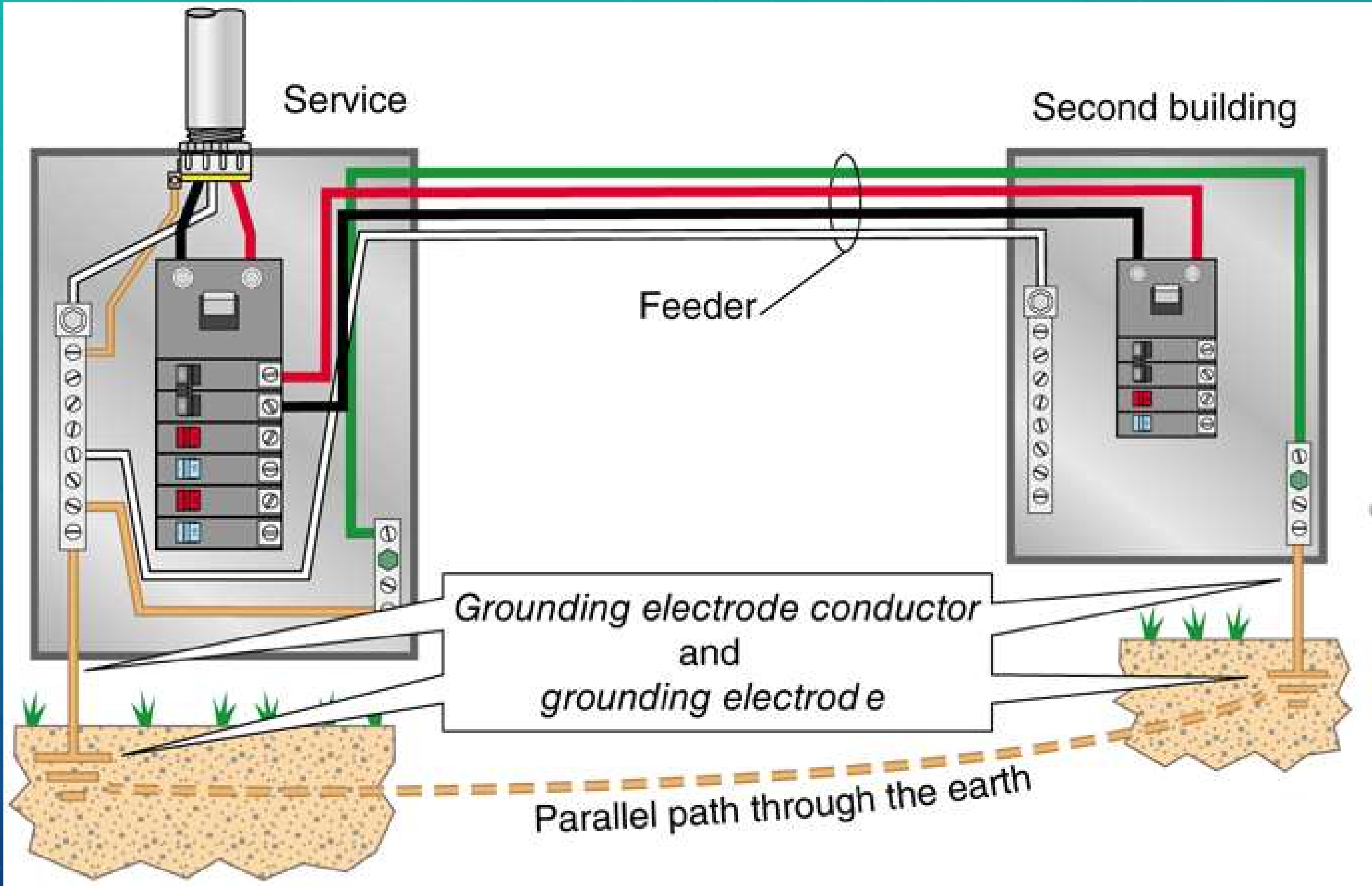
Grounding Electrode (*NEC® Article 100*)

- New definition in 2005 *NEC®*
  - Revised in 2008 *NEC®*
- Descriptions of grounding electrodes required to be used are in *250.52(A)*
- Grounding electrodes are never used to provide a fault-current path
- Used to make an earth connection
- See Appendix C of this text for testing methods of grounding electrodes

Grounding Electrode Conductor (*NEC*® *Article 100*)

- "A conductor used to connect the system grounded conductor or the equipment to a grounding electrode or to a point on the grounding electrode system."
- Specific rules are provided in *Article 250* for the sizing and installation of grounding electrode conductors, as well as where they are required to be connected to the electrical system or equipment
  - In some cases, specific requirements; in others, considerable flexibility on installation methods

Grounding Electrode



Intersystem Bonding Termination (*NEC*® *Article 100*)

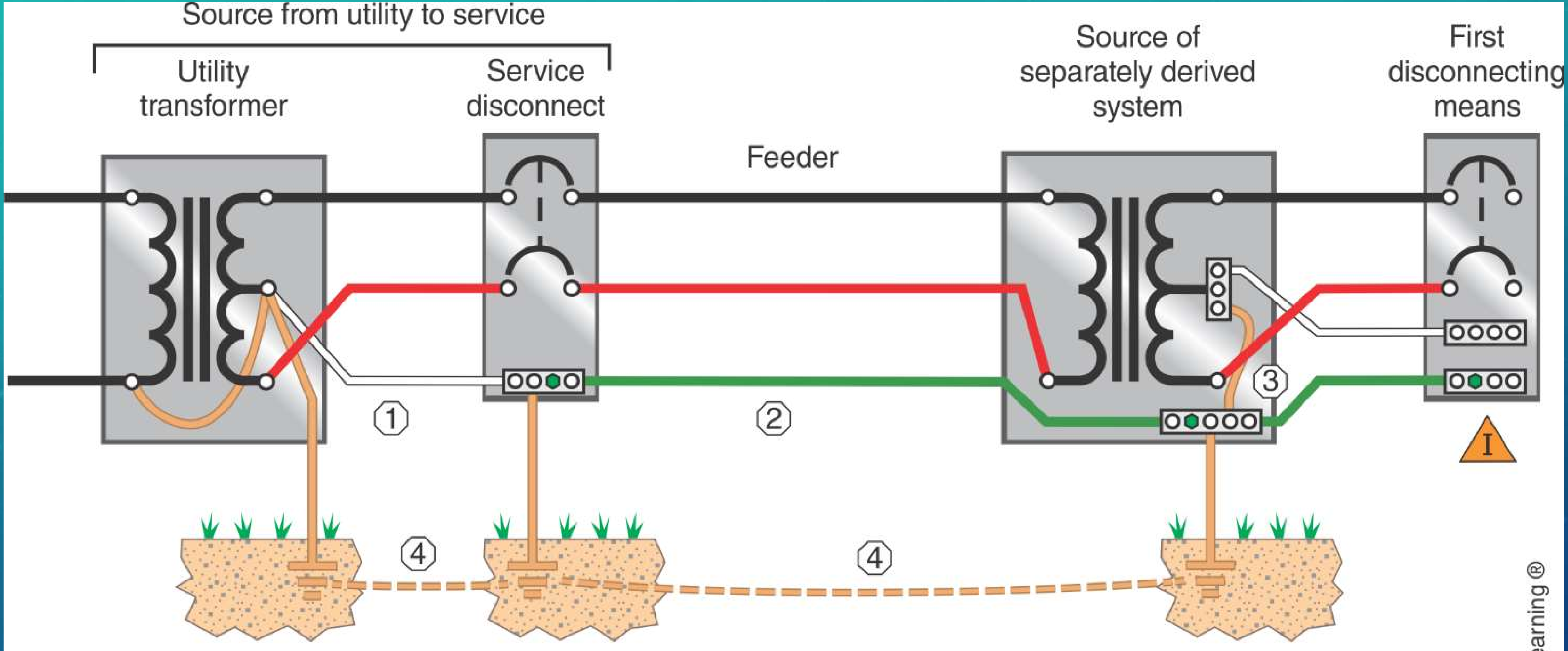
- "A device that provides a means for connecting intersystem bonding conductors for communications systems to the grounding electrode system."
  - Revised for the 2014 *NEC*® and more specific
  - Provides common location for connecting bonding conductors for communications systems
  - Common bonding helps prevent flashover due to elevated voltage events

Intersystem Bonding Termination (*NEC*® *Article 100*) (2 of 2)

Separately Derived System (*NEC® Article 100*)

- "An electrical source, other than a service, having no direct connection(s) to circuit conductors of any other electrical source other than those established by grounding and bonding connections."
- Is a premises wiring system
- Not directly supplied by the electric utility
- Transformers are "equipment other than a service."
- Transformers are "separately derived" if no bonding jumper from primary to secondary
- Path through the earth, metal enclosures, metallic raceways and equipment grounding conductors do not constitute a "direct electrical connection"

Article 100: Separately Derived System



1. Neutral connects utility system to service.
2. Equipment grounding conductor connects service to transformer enclosure.
3. System bonding jumper creates connection of derived system neutral to utility system.
4. Path through the earth provides another connection of the two systems.

I = Neutral Isolated

Generator-Supplied Separately Derived Systems

- For determining whether the system is separately derived or not, observe how the grounded conductor is treated in the transfer switch(es)
  - If switched with the ungrounded or phase conductors, the generator-supplied system is separately derived
  - If not switched, it is not separately derived

Generator-type separately derived system

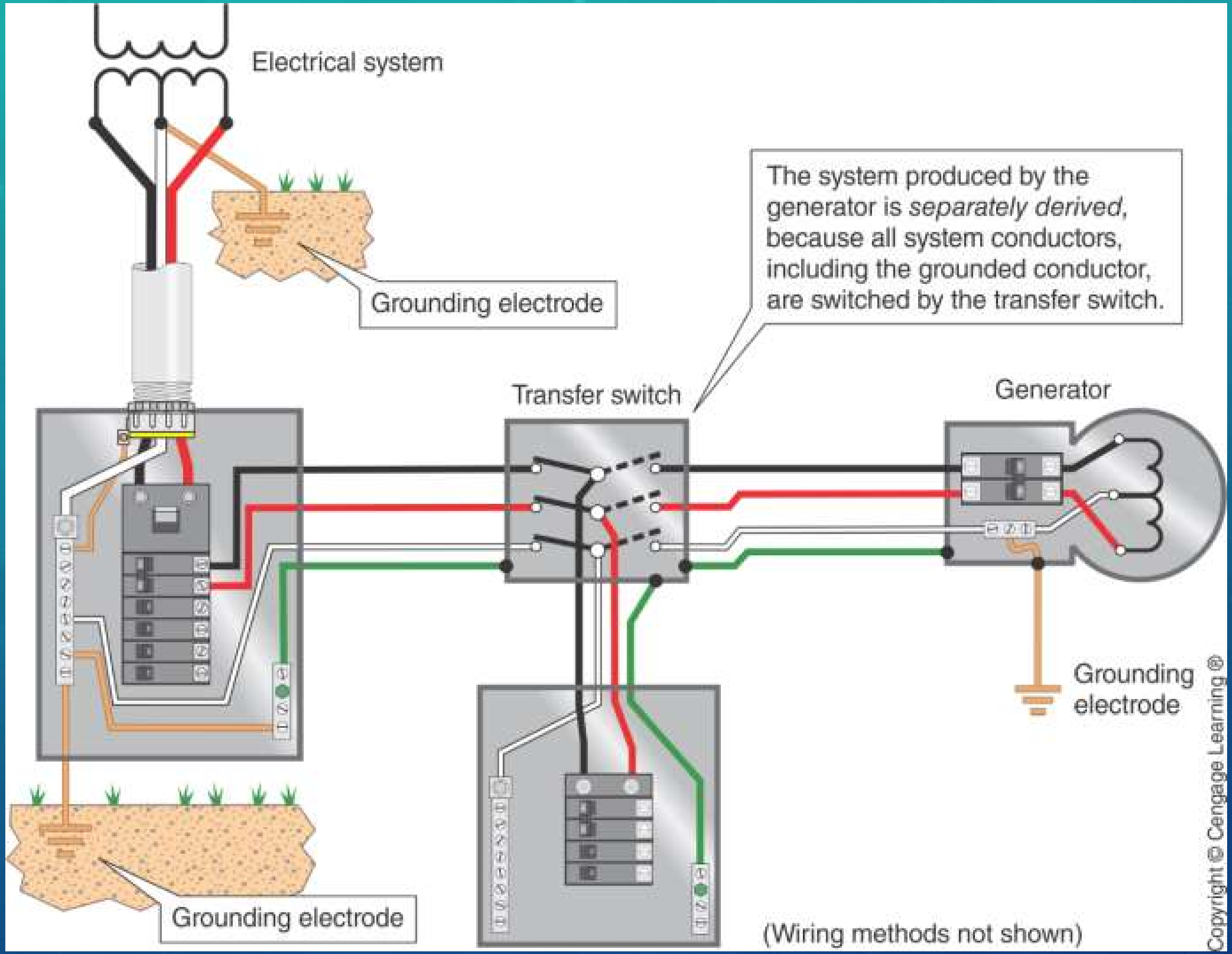


FIGURE I-19 Generator-type separately derived system.

The Ground-Fault Path

- The definitions in *Article 100* and *250.2* provide important concepts regarding an effective ground-fault return path
- Low-impedance path facilitates the operation of overcurrent devices
- Removing the fault quickly reduces the thermal and magnetic stresses
  - Most overcurrent devices are “inverse time” (the greater the current, the faster the operation of the overcurrent device)

Effective Ground-Fault Current Path (*NEC*® *Article 100*)

- "An intentionally constructed, low-impedance electrically conductive path designed and intended to carry current under ground-fault conditions from the point of a ground fault on a wiring system to the electrical supply source.
- "Facilitates the operation of the overcurrent device or ground fault detectors."
- Intentionally constructed, Deliberate steps taken to create
- Doesn't "just happen"
- Properly connect all components
- Carries fault-current to facilitate operation of overcurrent device or ground-fault detector
- Tested to carry full load current indefinitely

Ground Fault Path through the Earth

- The path through the earth is in parallel with ground-fault current return path where more than one connection to earth exists
- The earth is not considered an “effective ground-fault current path”
- Connections are made to earth for other purposes, but never to carry fault current
- Path only through the earth will result in electrical equipment presenting a dangerous electric shock hazard

Earth Path Prohibited

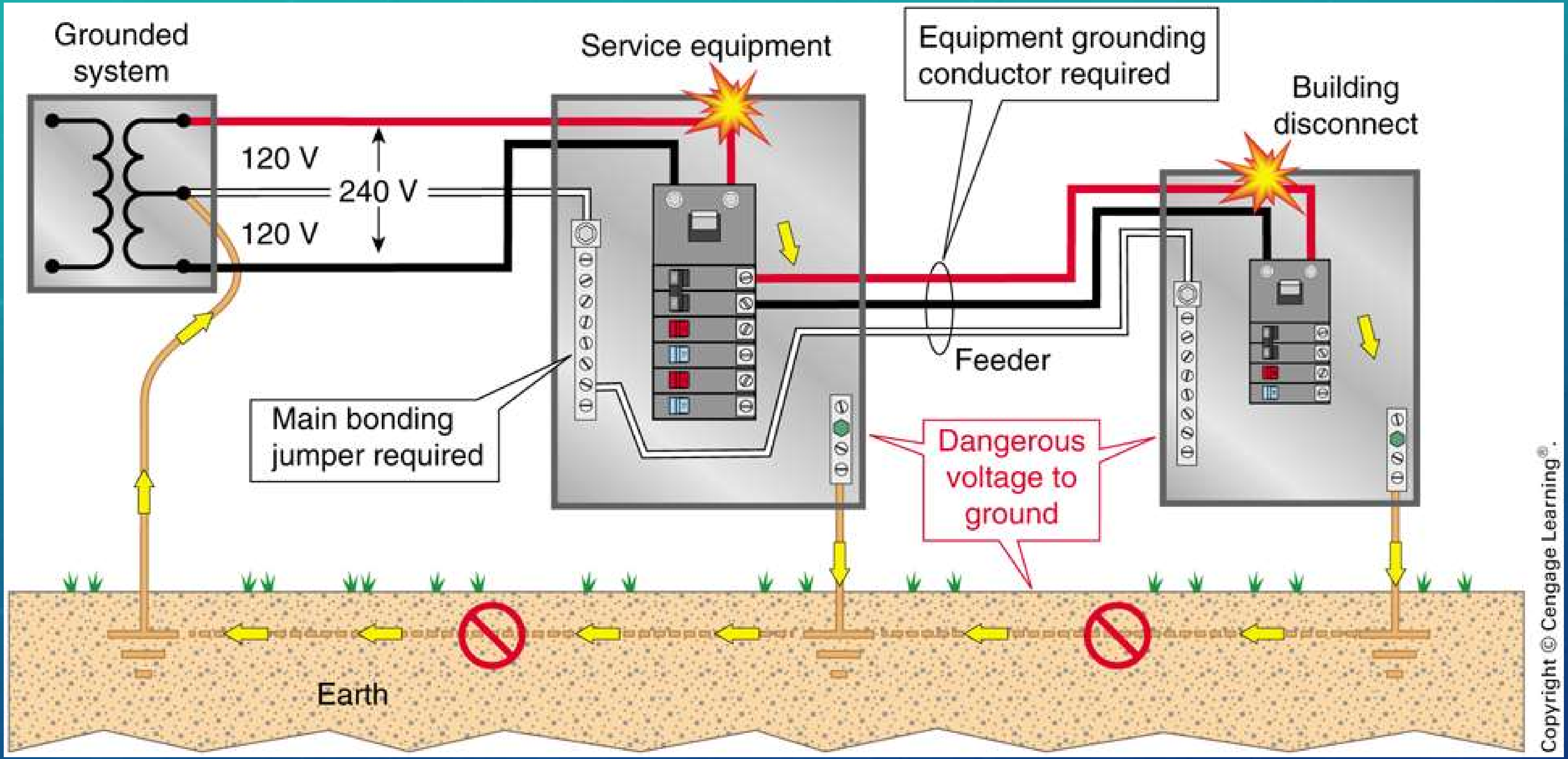
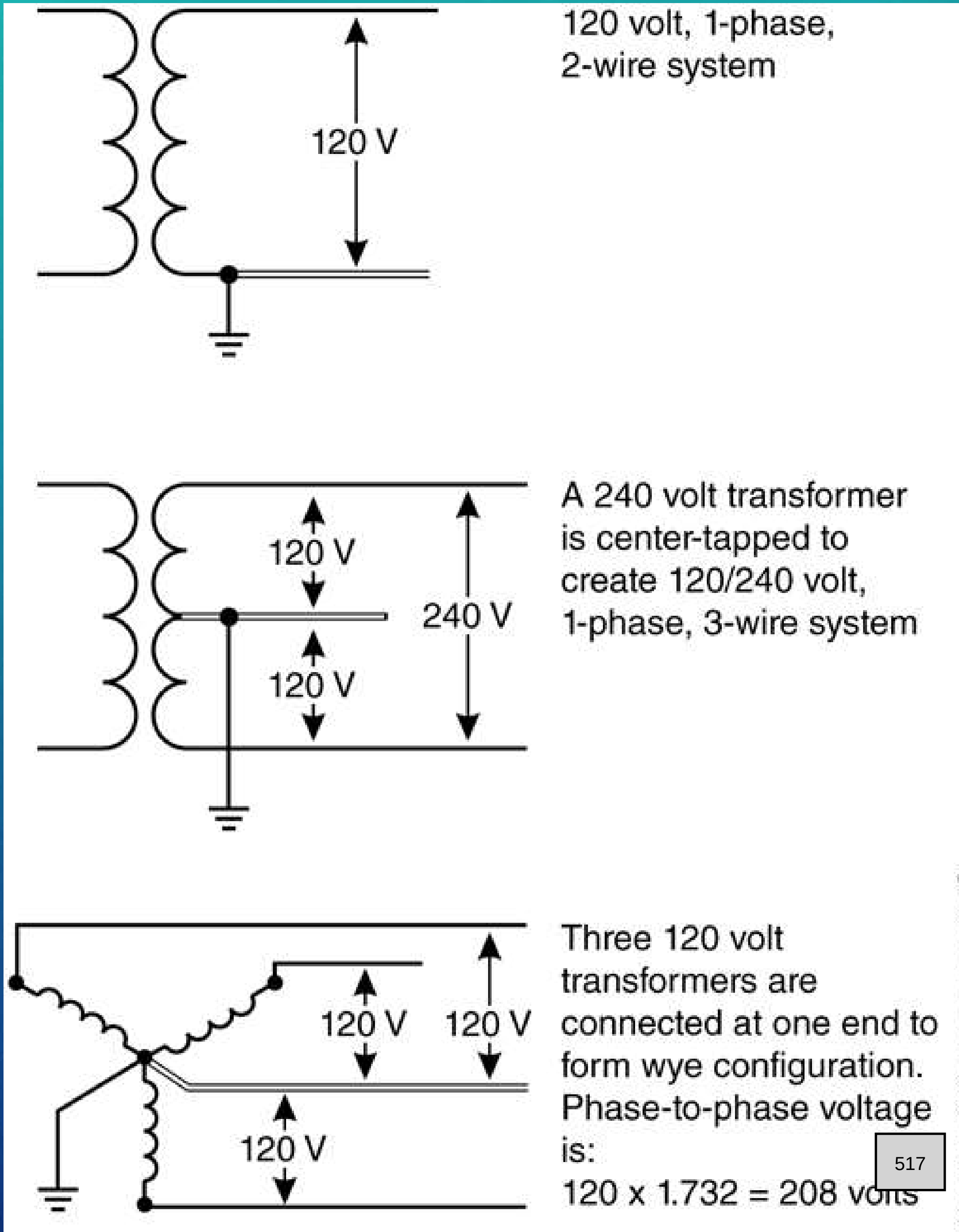


FIGURE I-23 Earth return prohibited.

250.20 AC Systems to Be Grounded

- Alternating-current systems are required to be grounded if the system meets any of the conditions in *250.20(A)*, *(B)*, *(C)*, or *(D)*
  - Other systems are permitted to be grounded
    - Compliance with Article 250 required
  - Voltage supplied by the system is considered as a general rule
  - Use of neutral for 3-phase systems also considered
- Most circuits and systems that are not required to be grounded are permitted to be grounded
  - A few circuits are not permitted to be grounded
  - If systems are grounded, the methods must comply with *Article 250*

Systems Required to be Grounded 250.20(B)(1)



Systems 50 to 1000 Volts Required to be Grounded (1 of 2)

- Where the system is 3-phase, 4-wire, wye connected in which the neutral is used as a circuit conductor
- Typical voltages:
  - 208Y/120;
  - 480Y/277;
  - 575Y/332;
  - 600Y/346

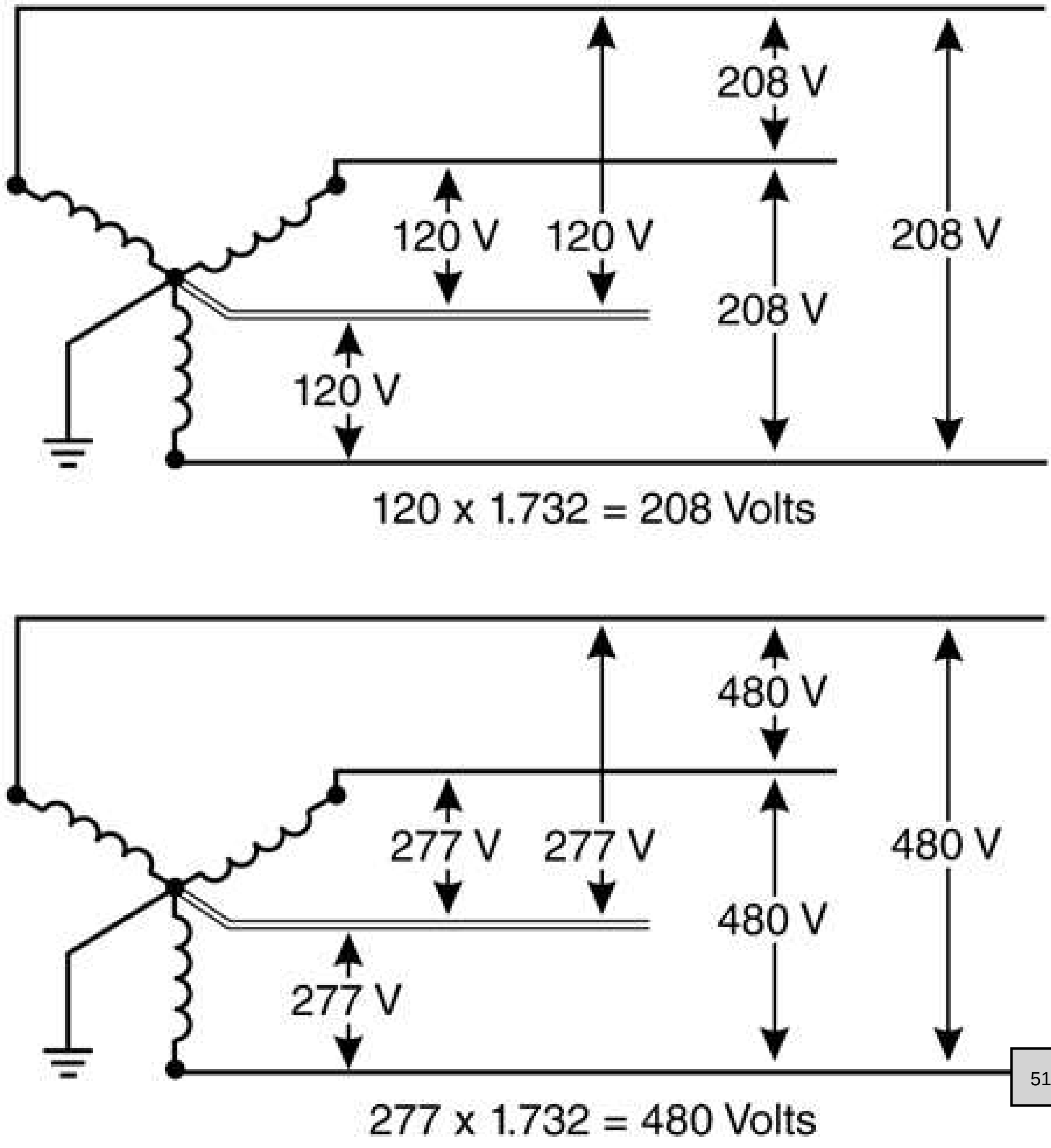


FIGURE 2-5 Wye-connected systems required to be grounded, *250.20(B)(2)*.

Systems 50 to 1000 Volts Required to be Grounded (2 of 2)

- Where the system is 3-phase, 4-wire, delta connected in which the midpoint of one phase winding is used as a circuit conductor
- High-leg identification required per *408.3(F)(1)*

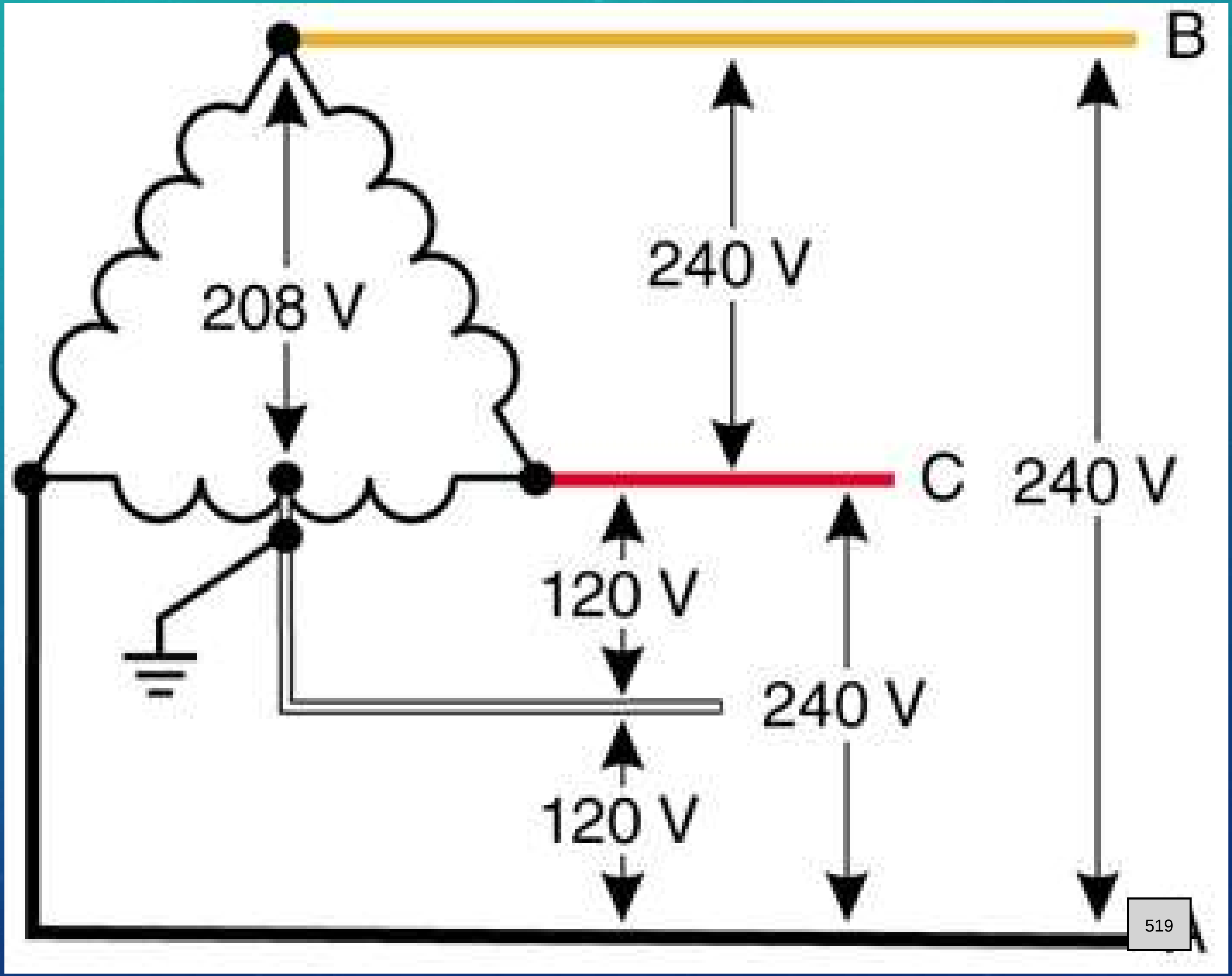


FIGURE 2-6 Delta-connected systems required to be grounded, *250.20(B)(3)*.

Conductor with higher voltage to ground

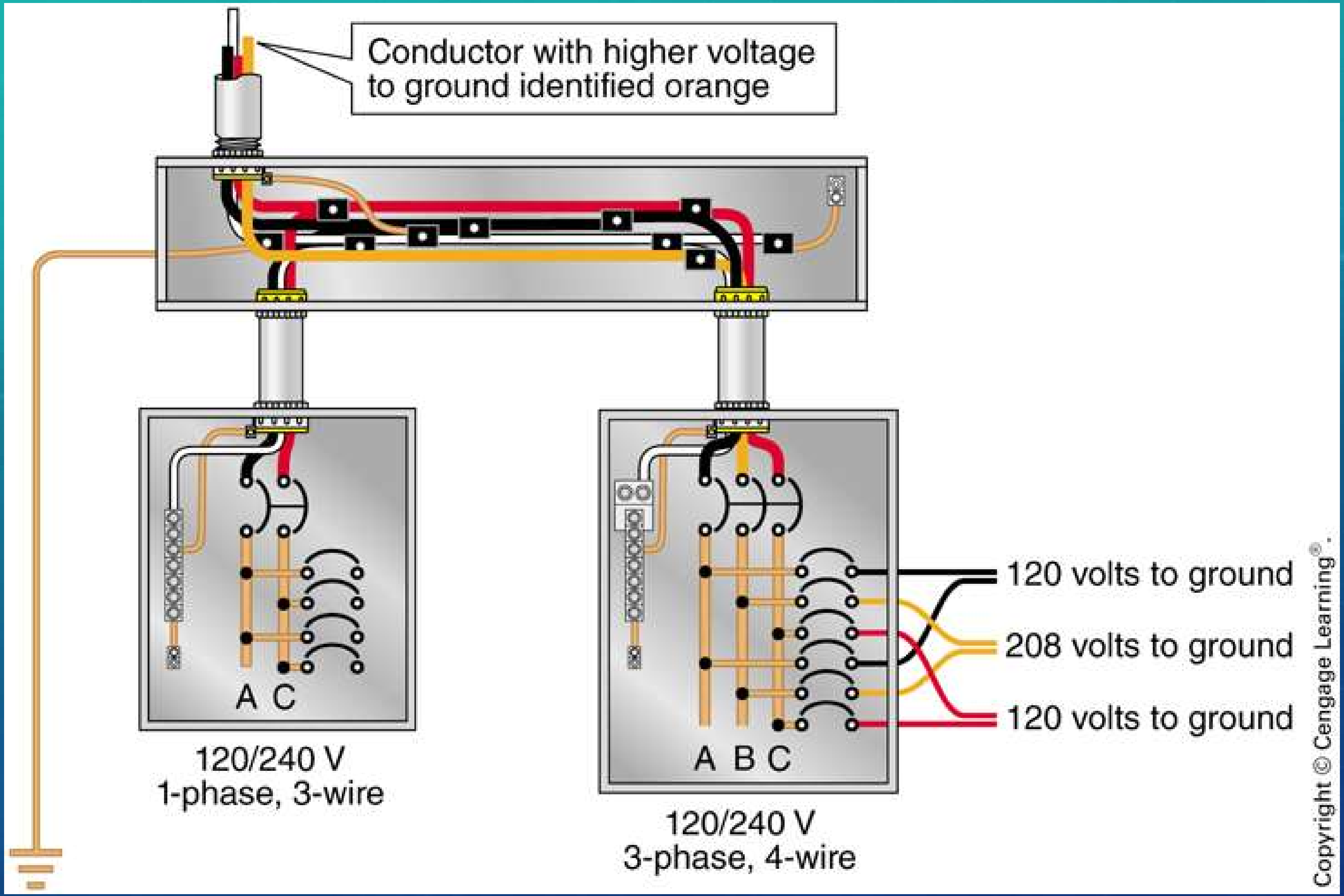
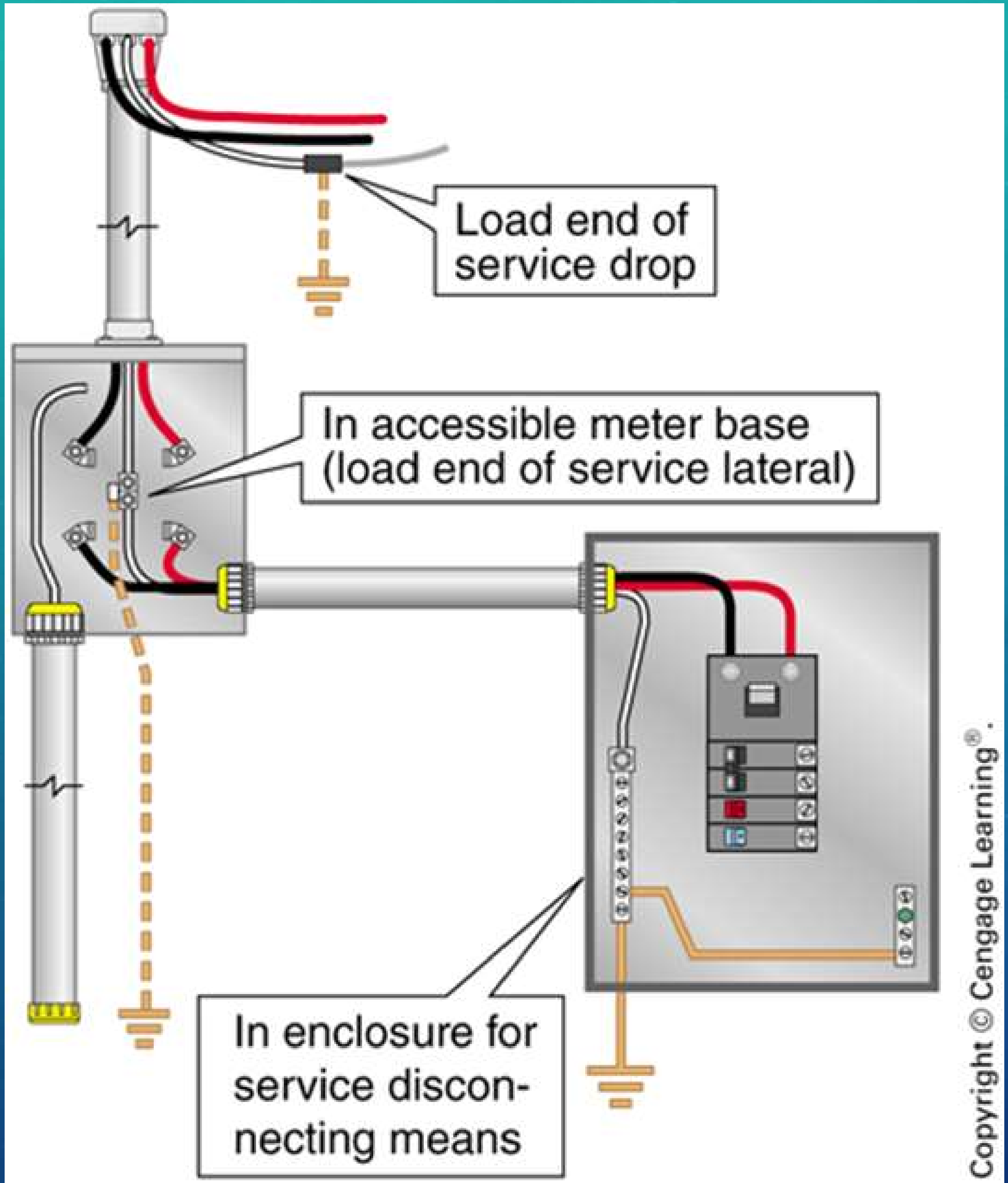
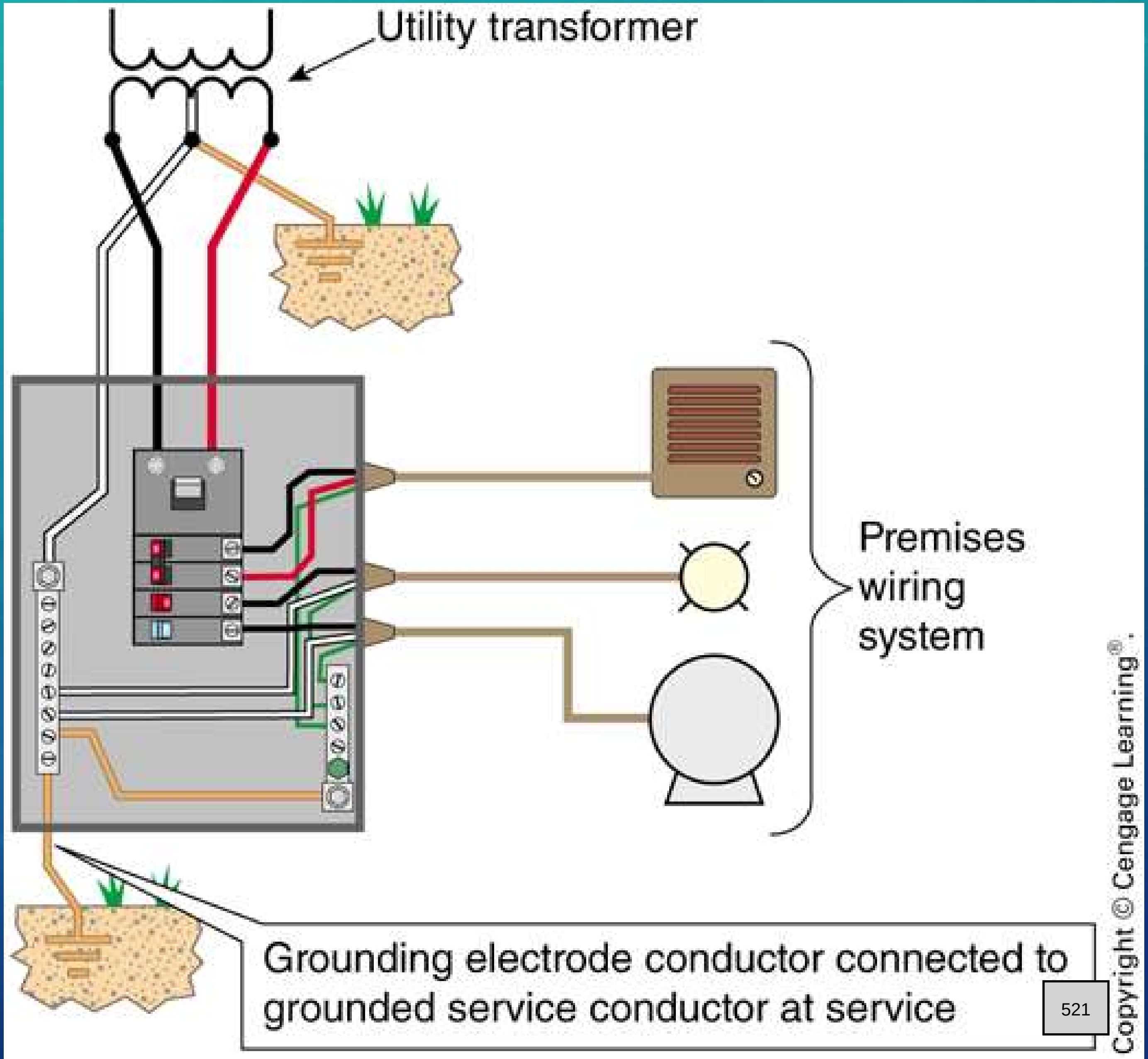


FIGURE 2-7 Conductor with higher voltage to ground, *250.20(B)(3)*.

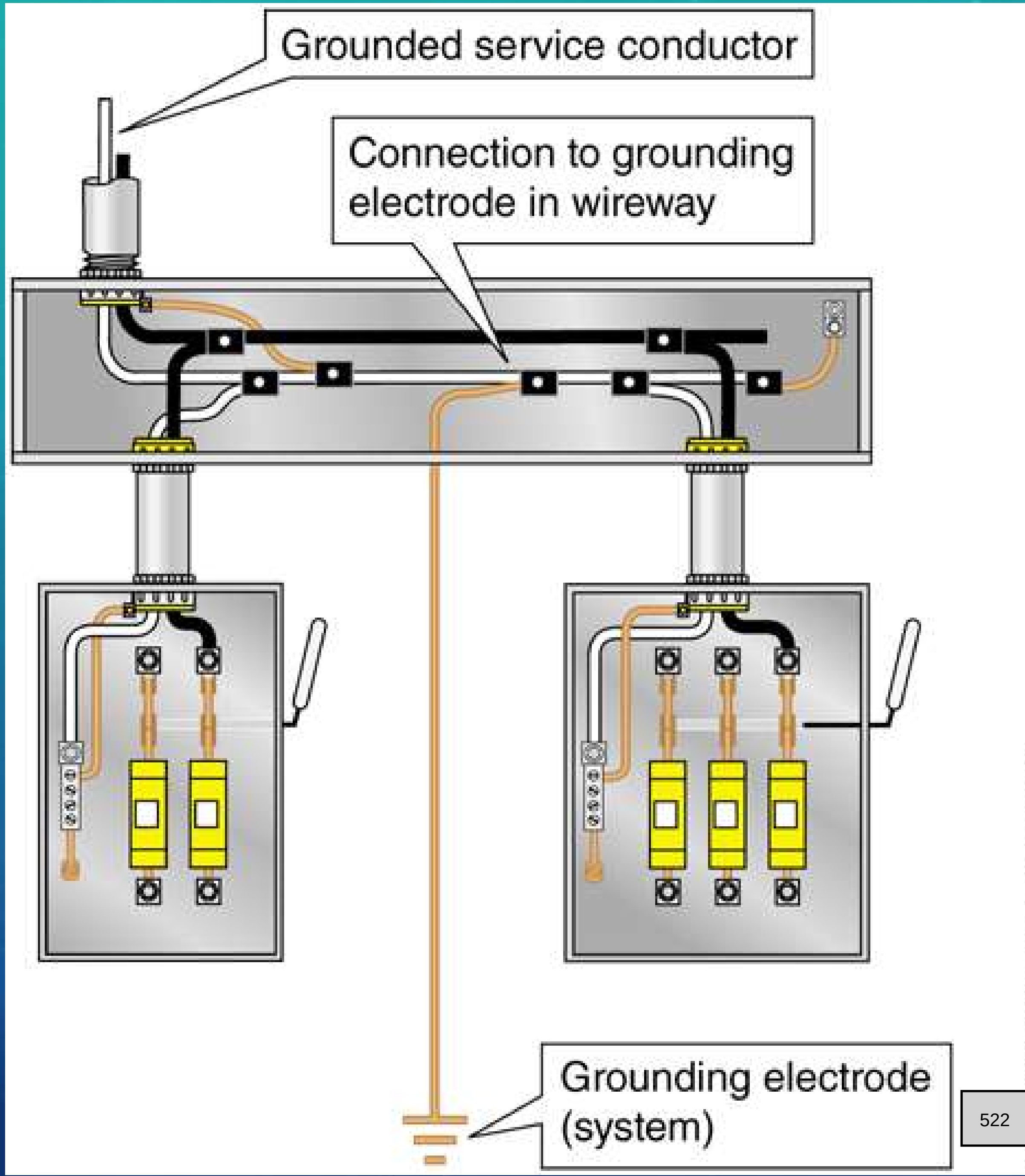
250.24(A) System Grounding Connections



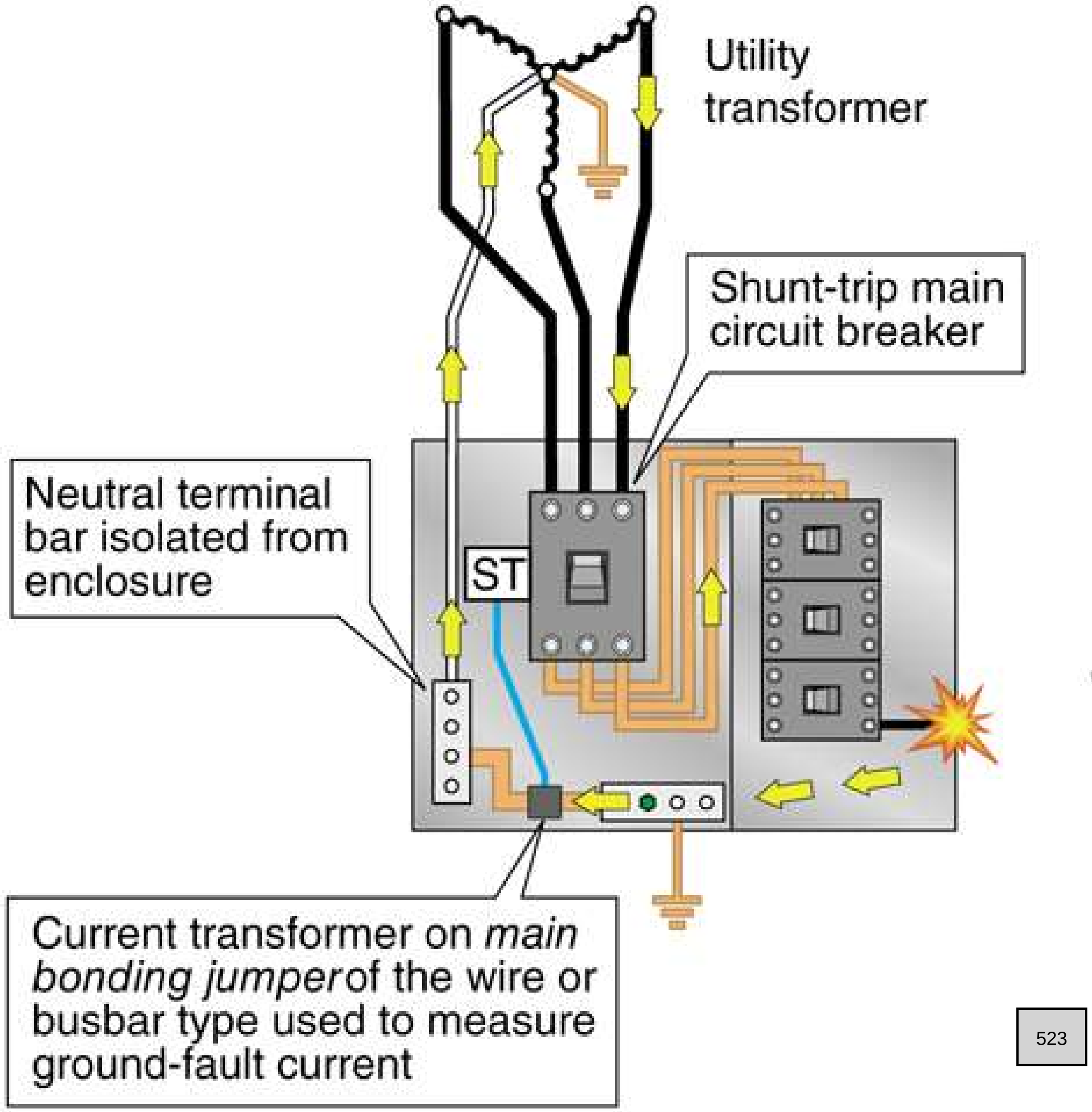


Generally Accepted Locations

1. At the weatherhead for overhead services
2. At the meter socket or current transformer enclosure (verify with the utility and electrical inspector)
3. At a wireway or auxiliary gutter on the line side of the service equipment
4. Within the service equipment enclosure



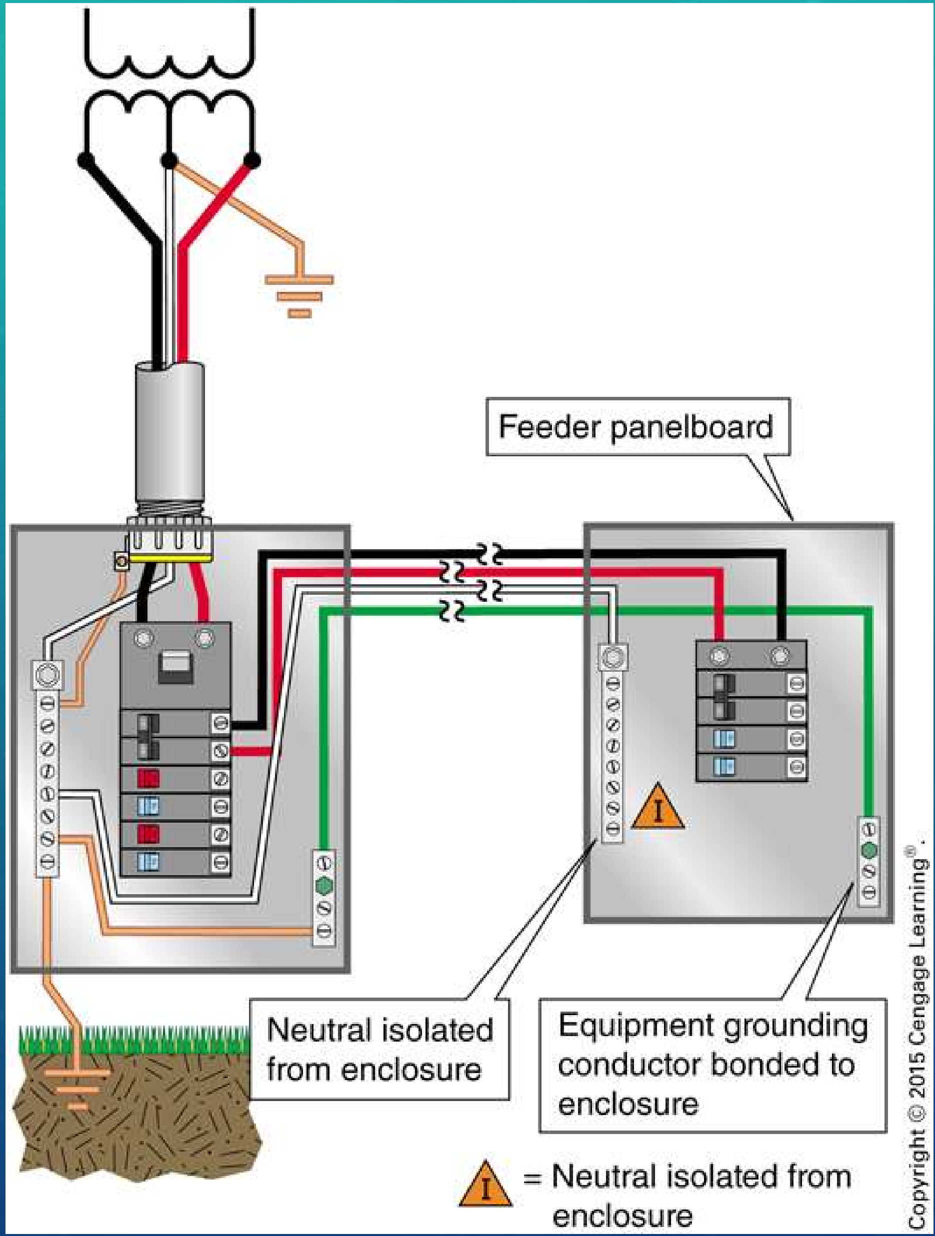
250.24(A)(4) Main Bonding Jumper as Wire or Busbar

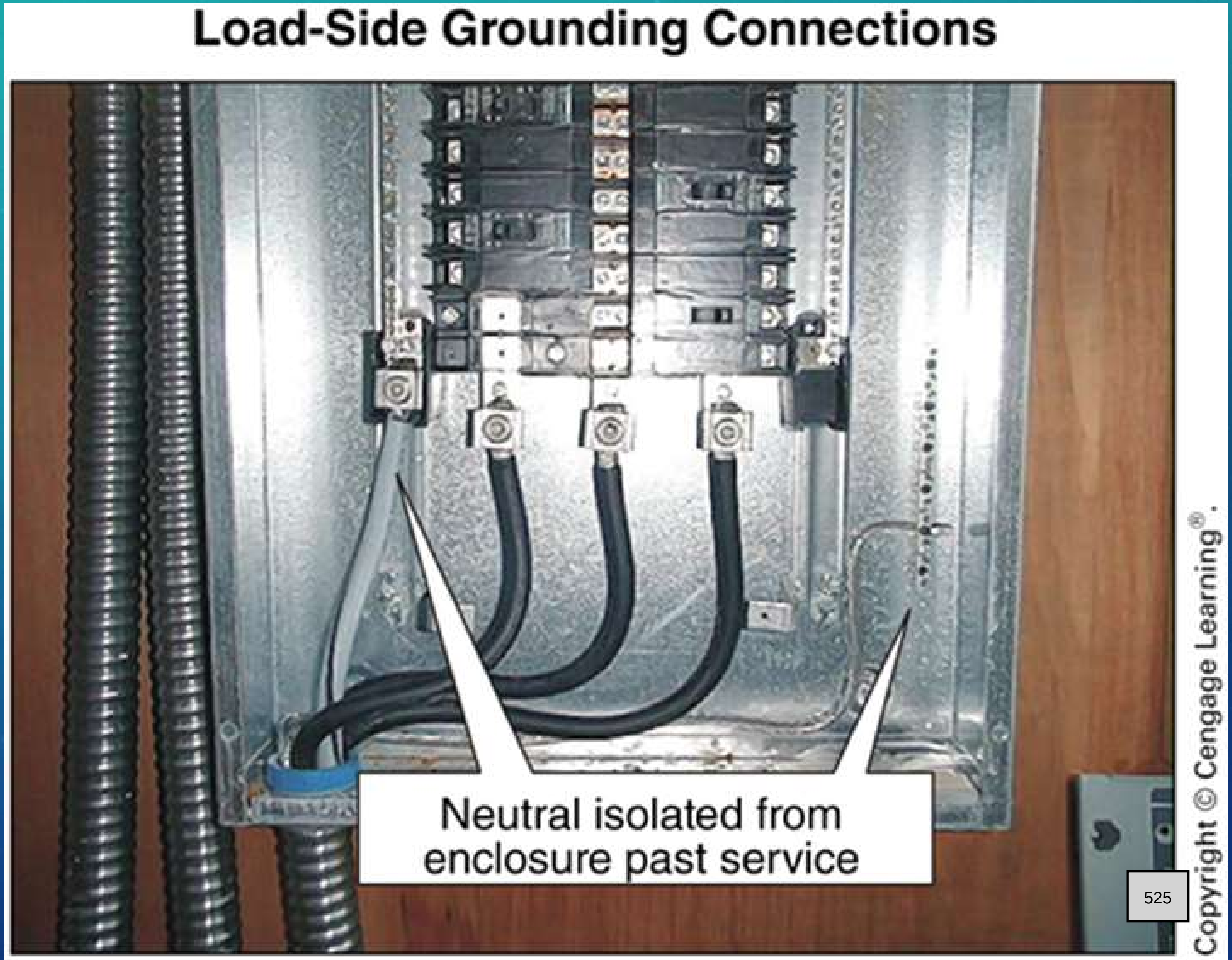


250.24(A)(5) Load-Side Grounding Connections

- A grounding connection is not permitted on the load side of the service disconnecting means unless permitted in Article 250
  - Such as a panel or junction box, down stream of the Service Disconnect
  - Neutral terminal bar isolated from enclosure
  - Equipment grounding conductor connects to enclosure
- See 250.30 for separately derived systems, 250.32 for connections at separate buildings or structures and 250.142 for other permitted uses

Neutral isolated on load side of service





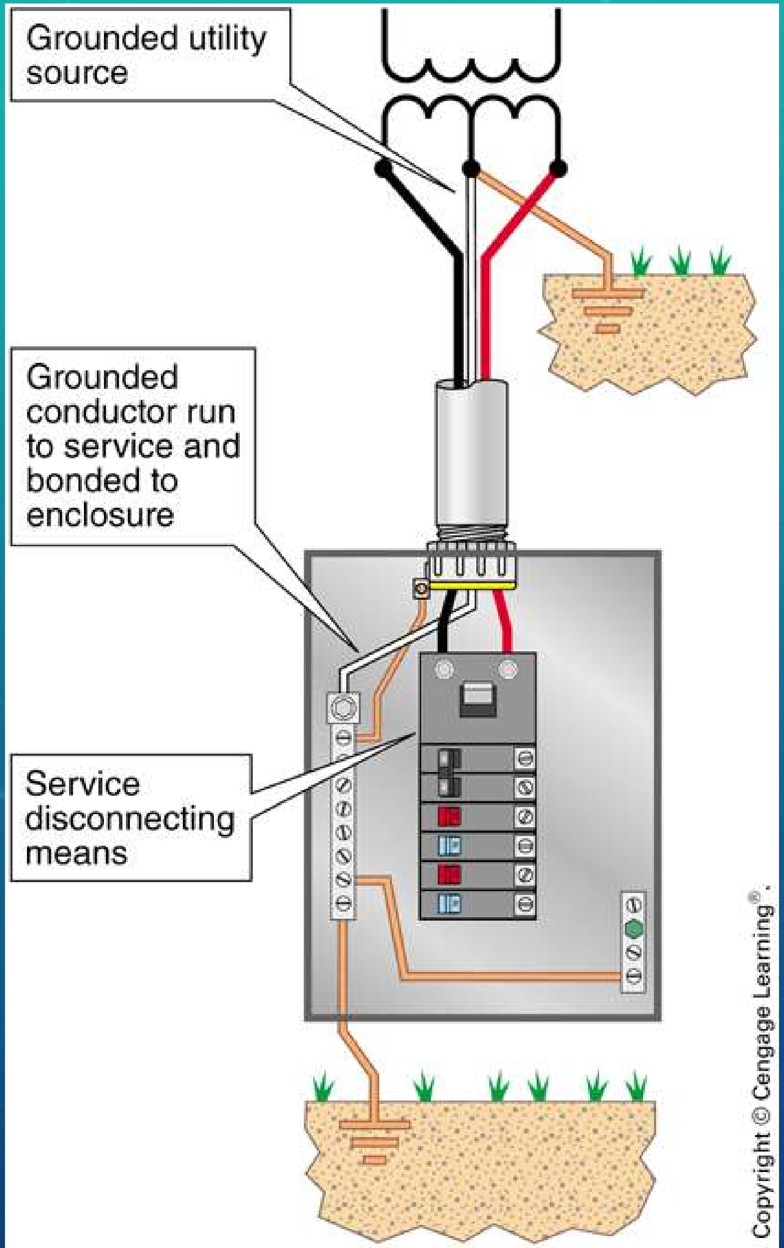
Hazard of Using Neutral to Ground Equipment

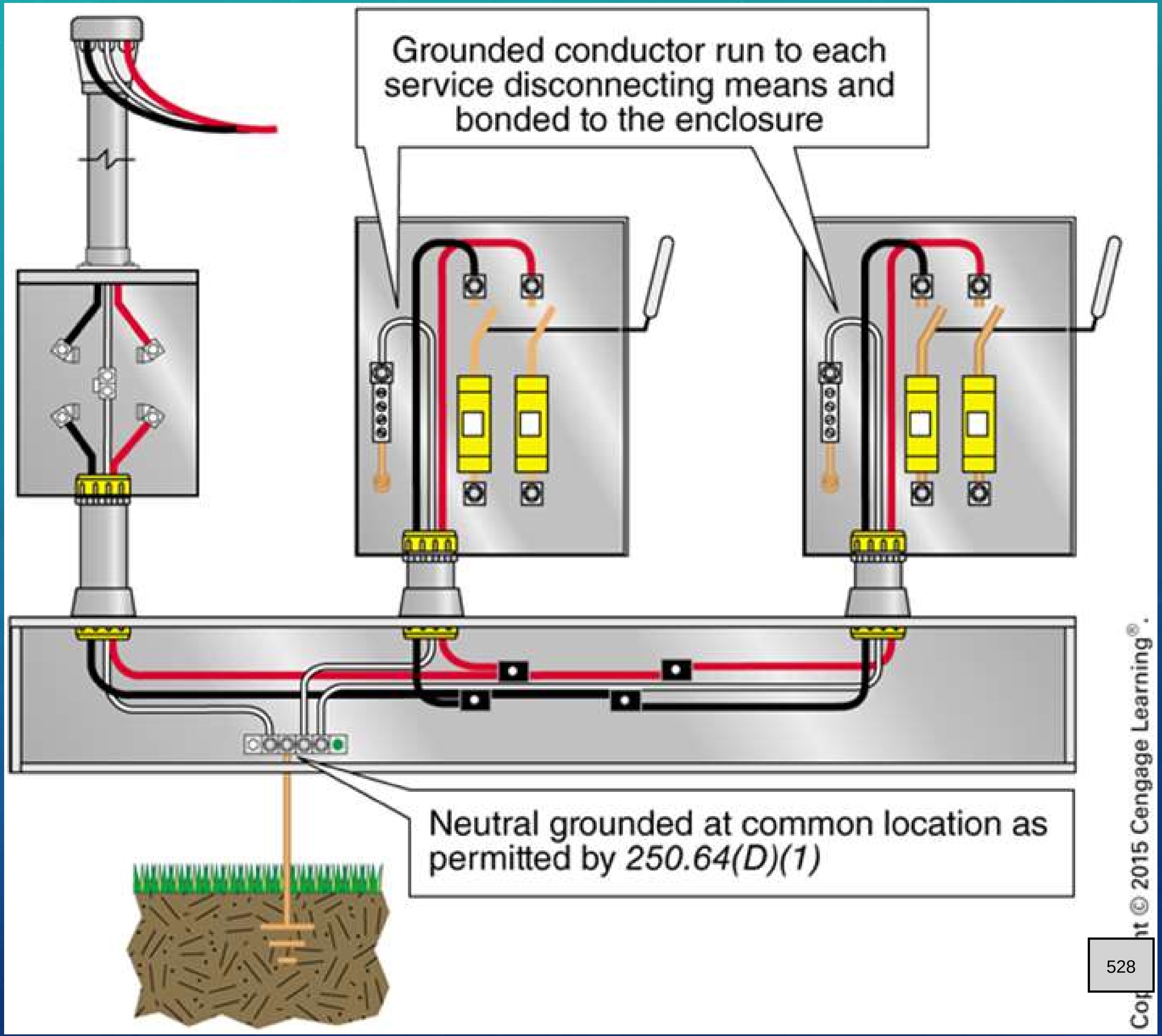
- If equipment is grounded to the neutral past the service, a loose neutral connection will result in a shock hazard if a ground fault occurs
- Current will flow across the raceway system
- Electricity will take every pathway available

Grounded Conductor to Service Equipment

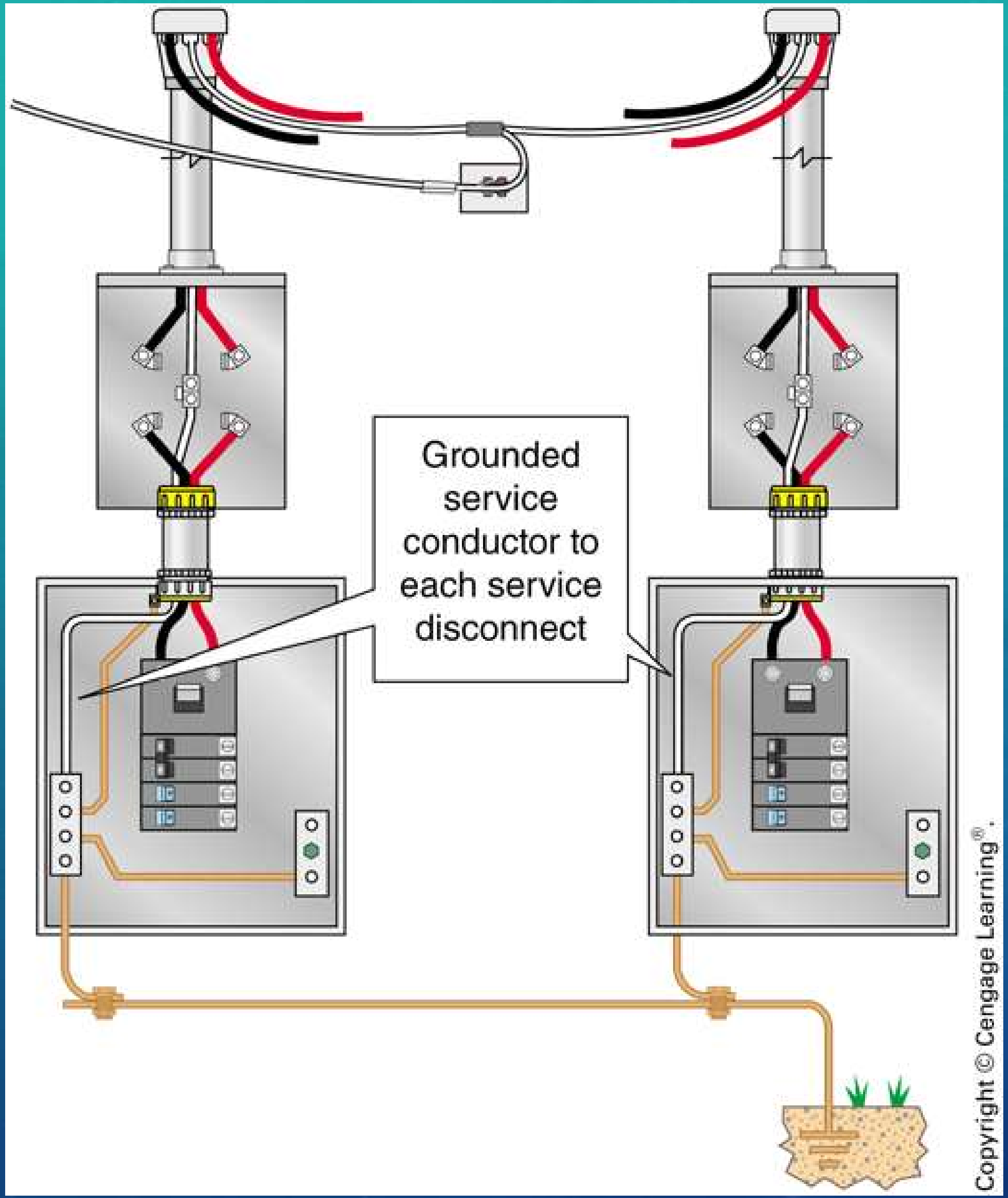
- If an ac system operates at less than 1000 volts and is grounded at any point, the grounded conductor is required to run to each service disconnecting means and to be connected to it by a main bonding jumper

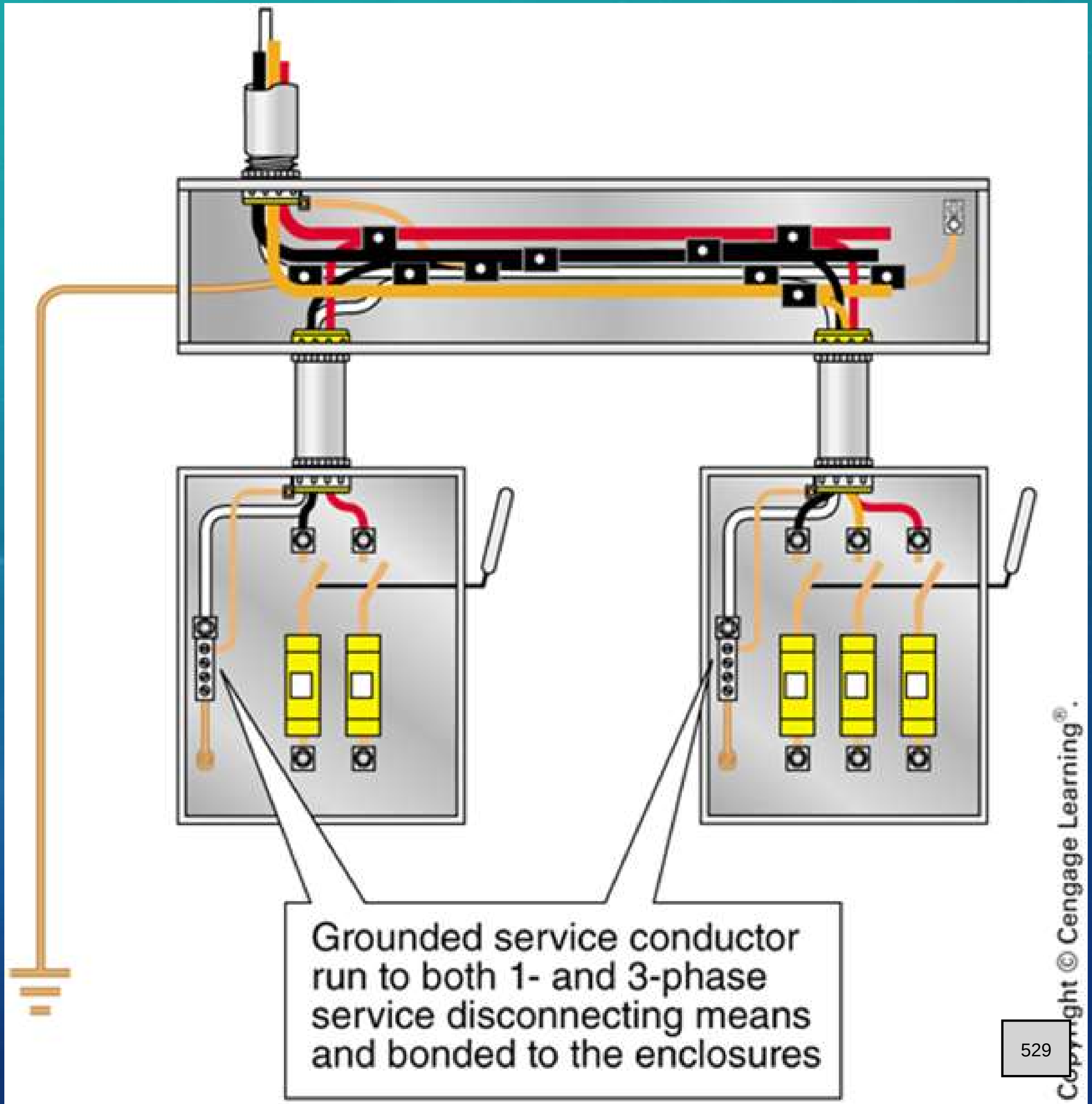
Grounded Conductor to all Service Equipment





250.24(C) Grounded Conductor Brought to Service Equipment (2 of 3)





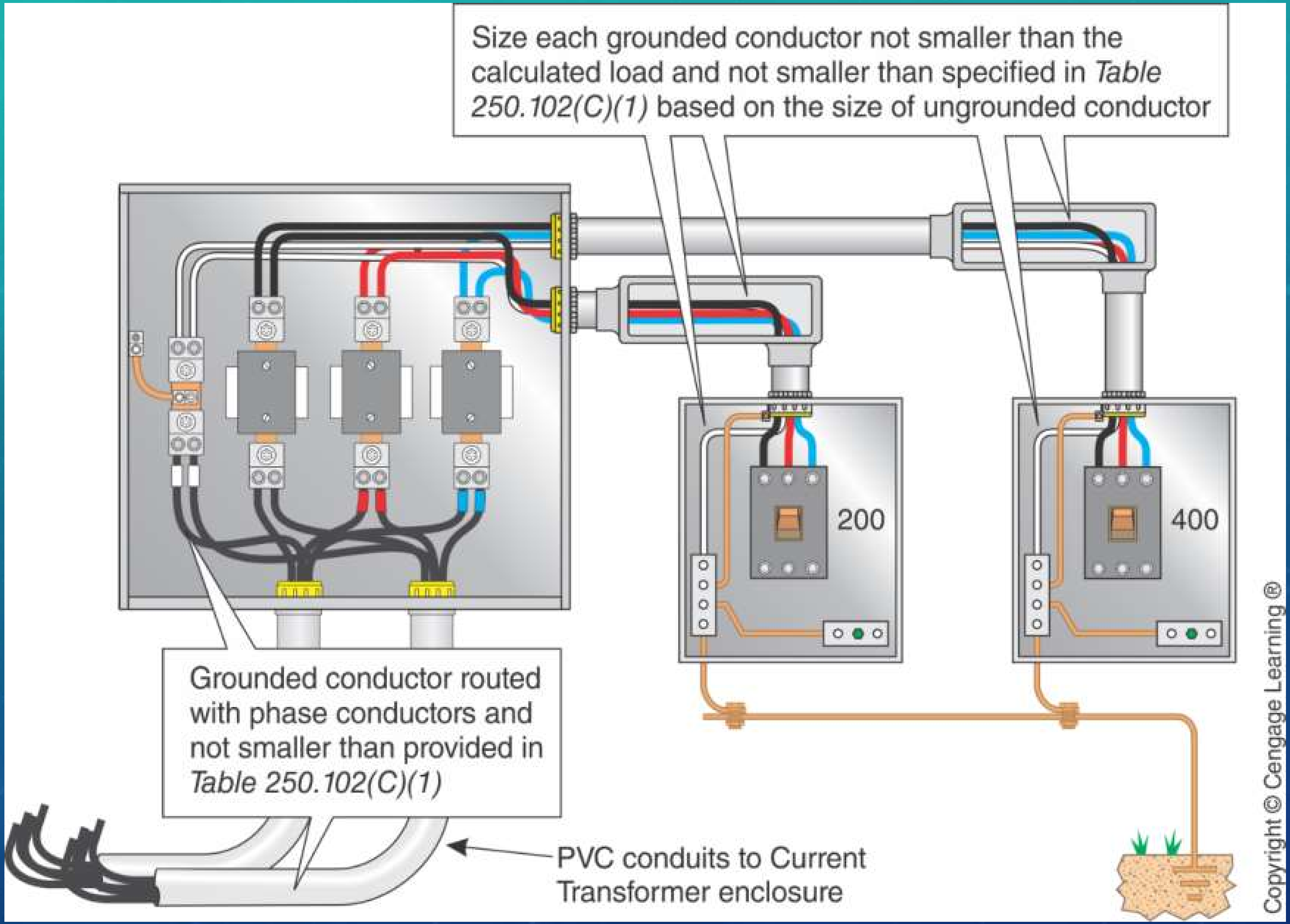
250.24(C)(1) Sizing for Single Raceway or Cable

- Grounded system conductor (often a neutral) is required to be not smaller than the conductor specified in *Table 250.102(C)(1)*
- Not required to be larger than the largest ungrounded service-entrance conductor
- Rule contemplates all service conductors are in a single conduit, wireway or cable, though they may be installed in Parallel Raceways
  - Obtain size of service-entrance conductors
  - Use the size of these conductors in *Table 250.102(C)(1)* to determine the minimum size of the grounded system conductor
  - Compare to the size of grounded conductor required from load calculation in *220.61*
  - Install the largest of these conductors

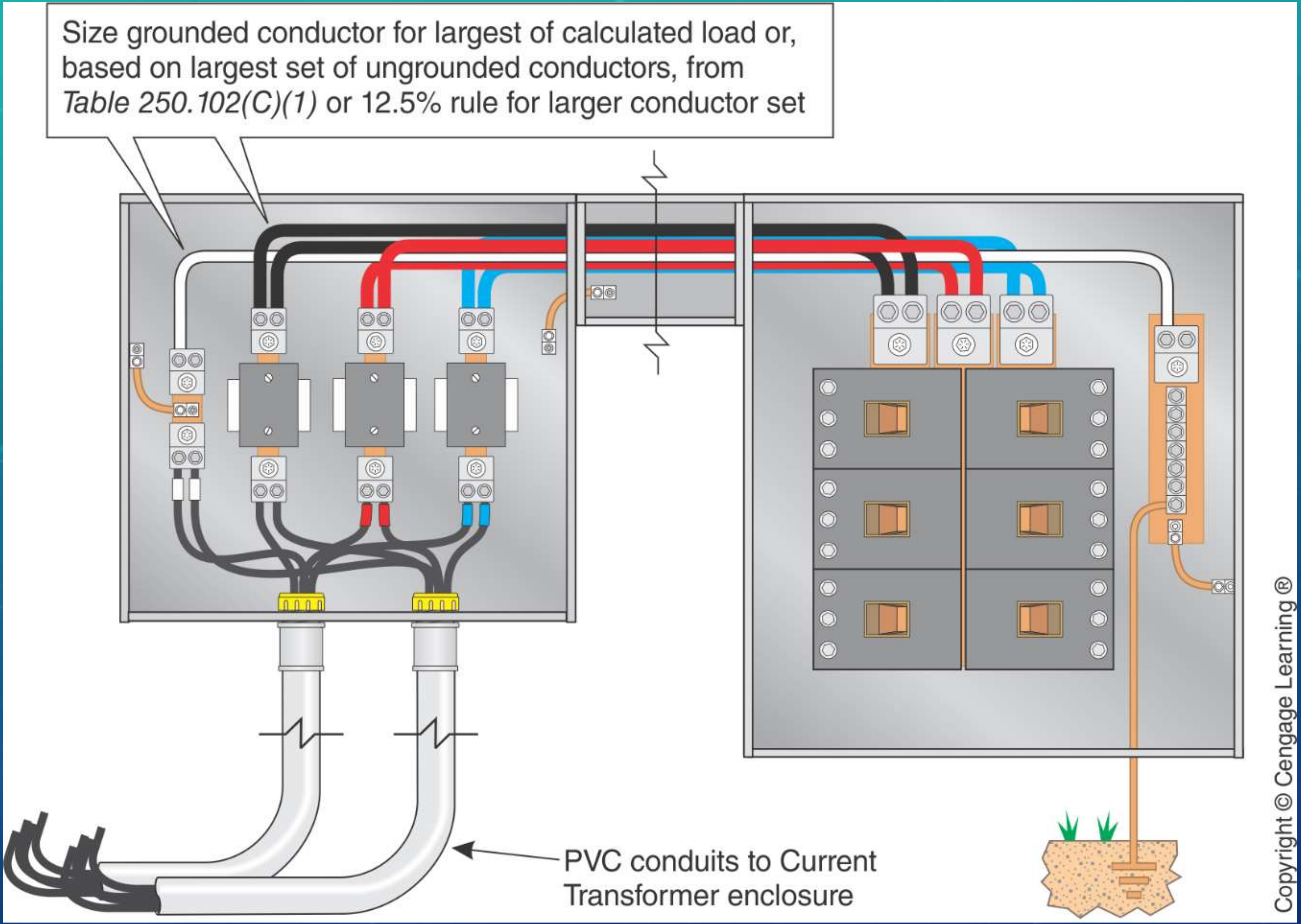
250.24(C)(1) Sizing for Parallel Raceway or Cable

- For parallel sets of conductors installed in compliance with *310.10(H)*:
  - If in one raceway such as a wireway or cable, determine the area of the largest set of conductors in parallel and consider as one conductor
  - Follow *Table 250.102(C)(1)* for the minimum size of neutral conductor
  - If the area of the largest phase set of conductors is larger than *Table 250.102(C)(1)*, apply the 12.5% rule
    - Total Circular Mill, x 12.5% = smallest conductor is allow to be.
    - Refer to NEC chapter 8, Table 9 for Circular Mill of Conductors

250.24(C)(1) Sizing for Single Raceway or Cable



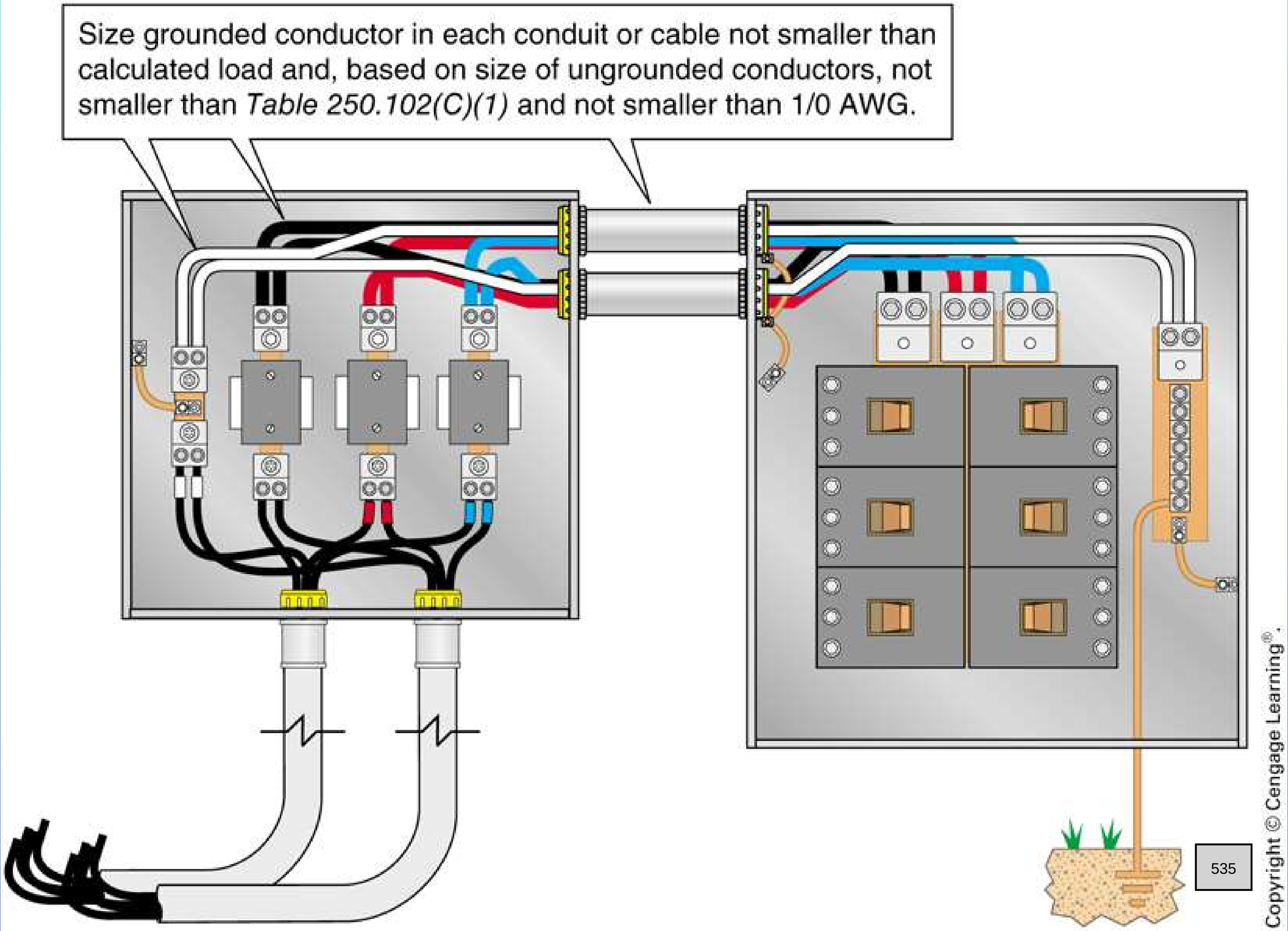
Routing and Sizing Grounded Conductor



250.24(C)(2) Parallel Conductors in Two or More Raceways or Cables

- Applies where conductors are installed in parallel in two or more raceways or cables
- Grounded conductor in each raceway must be sized on the circular mil area of the ungrounded conductor in the raceway
- Minimum size of grounded conductor connected in parallel is 1/0 AWG
- *Table 250.102(C)(1)* to be used for sizing, other than for calculated load

Size of Parallel Grounded Service Conductor



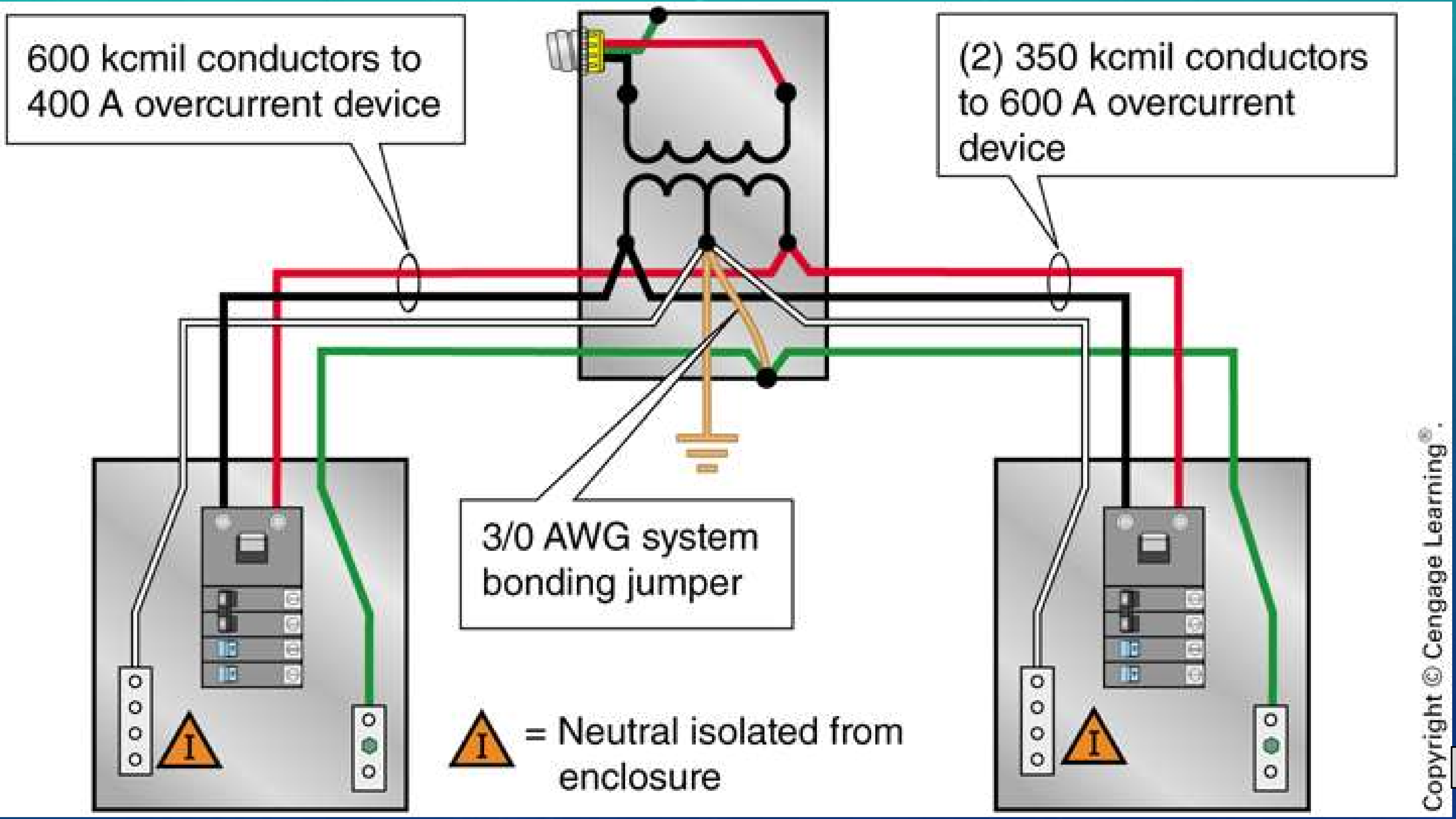
100: Separately Derived Systems (1 of 2)

- "An electrical source, other than a service, having no direct connection(s) to circuit conductors of any other electrical source other than those established by grounding and bonding connections"
- Power is derived from a source of electric energy or equipment other than a service
- No direct connection from circuit conductors of one system to circuit conductors of another system, other than connections established by grounding and bonding connections

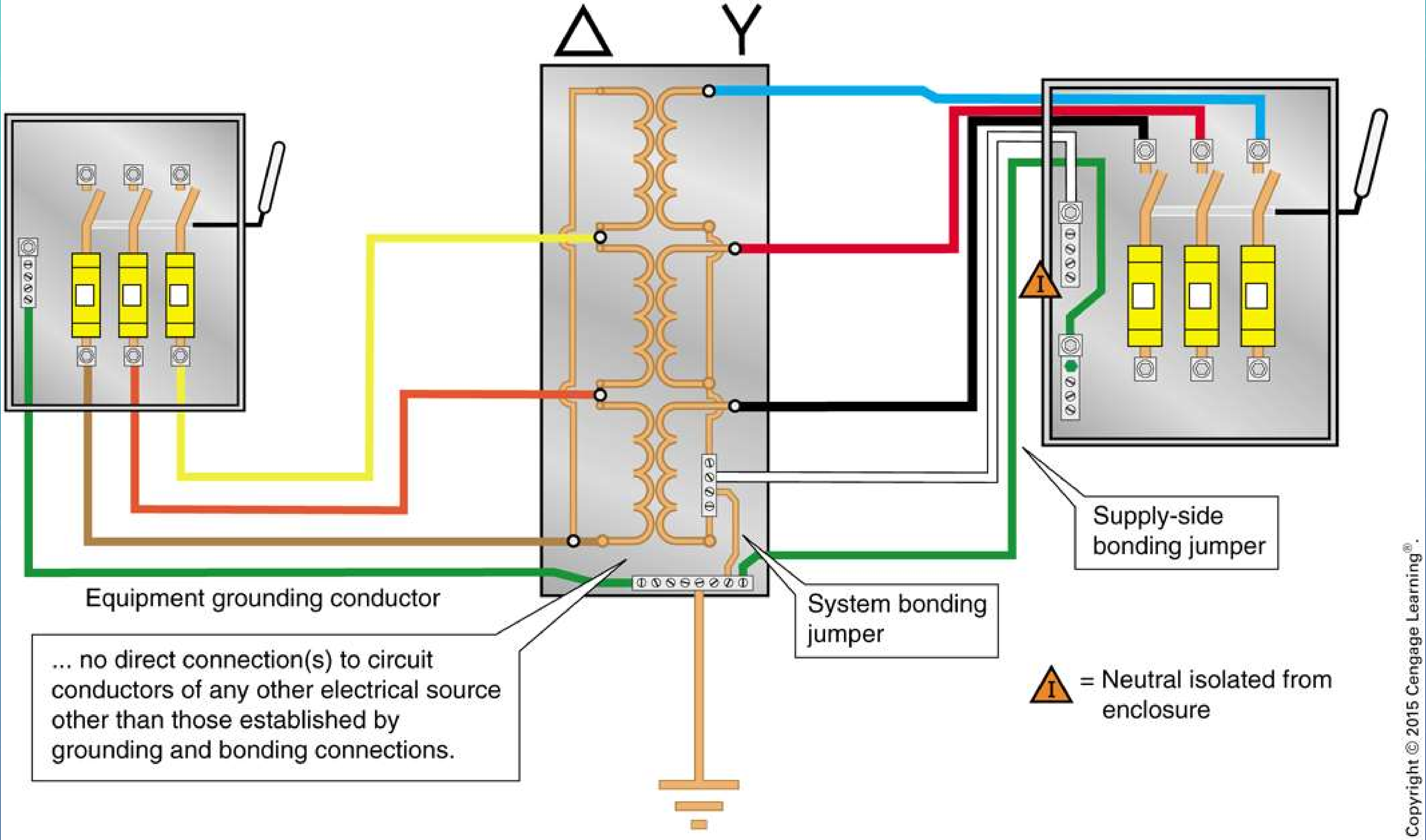
250.28(D)(3) Separately Derived System with More Than One Enclosure (1 of 2)

- If a separately derived system supplies more than one enclosure, the system bonding jumper must be installed at either the source or first system disconnecting means
- If at the first disconnecting means, use main bonding jumper supplied for listed enclosure or size according to *250.28(D)(1)*
- If at the source, size system bonding jumper per *250.28(D)(1)* based on the sum of circular mil area of derived ungrounded conductors for one phase

Separately Derived Systems



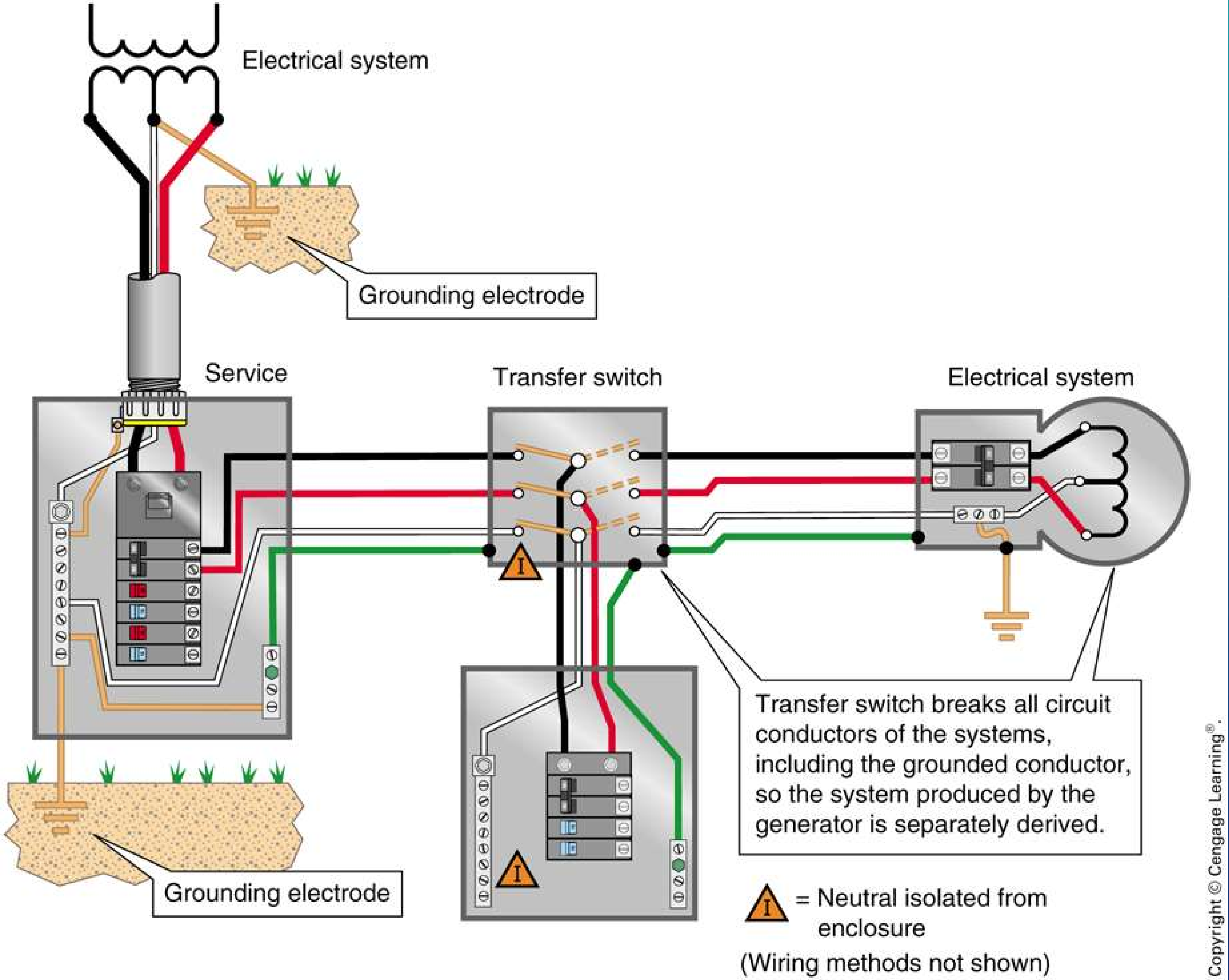
Transformer-type Separately Derived System



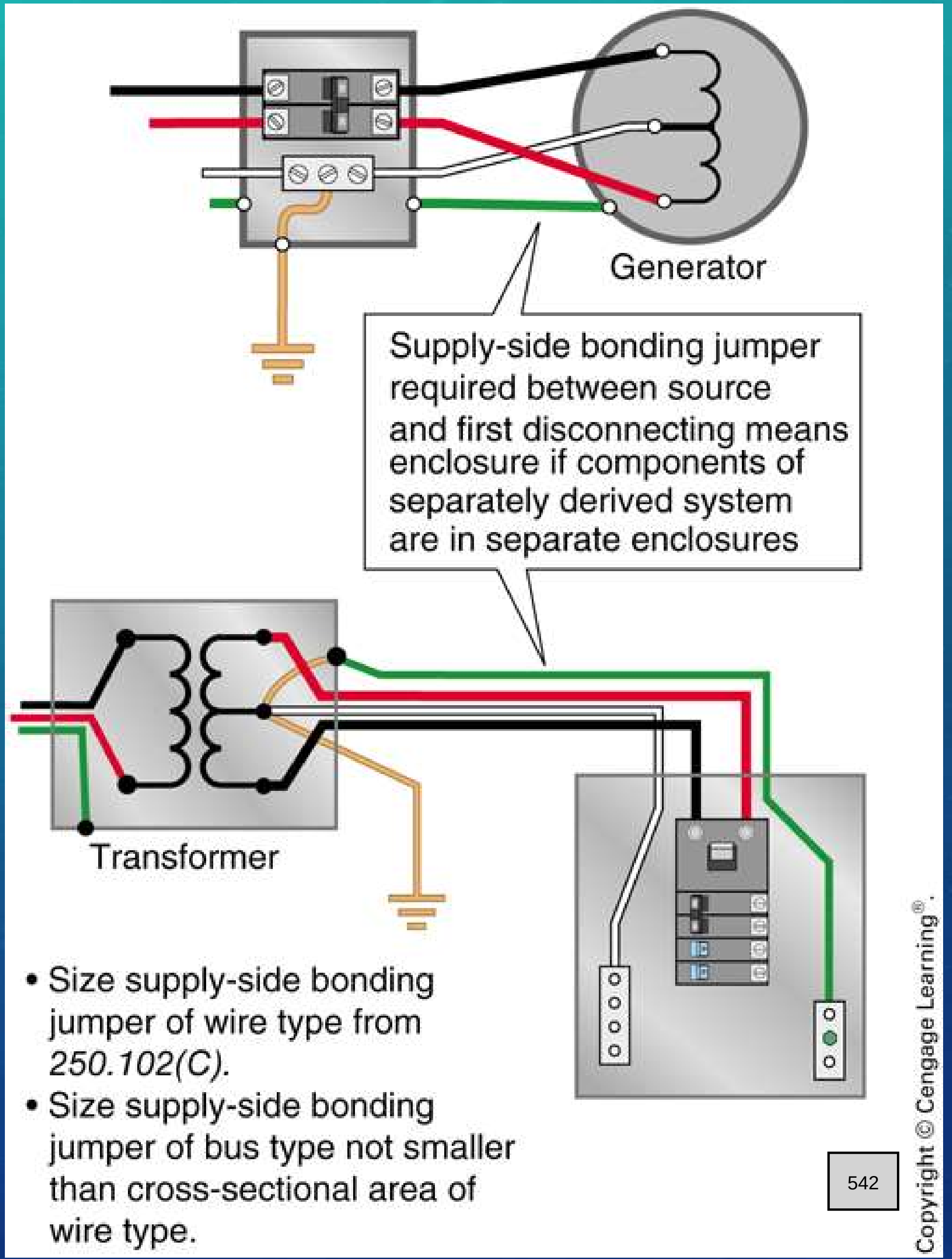
Here's How for Generators

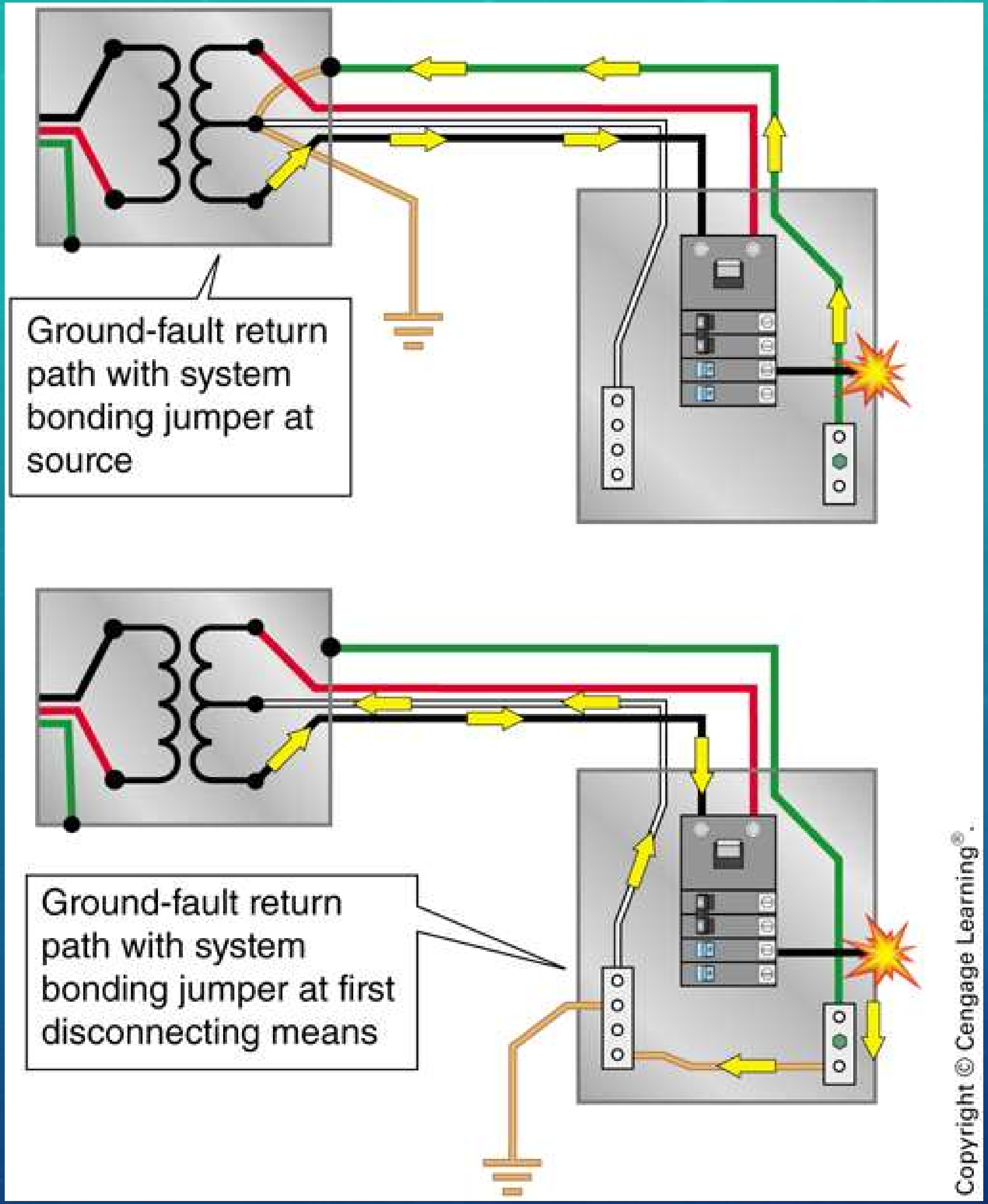
- Look in the transfer switch
- If the neutral is switched, the system supplied is separately derived
- If the neutral is not switched, the system supplied is not separately derived
- No circuit exists for current to flow other than through the transfer switch

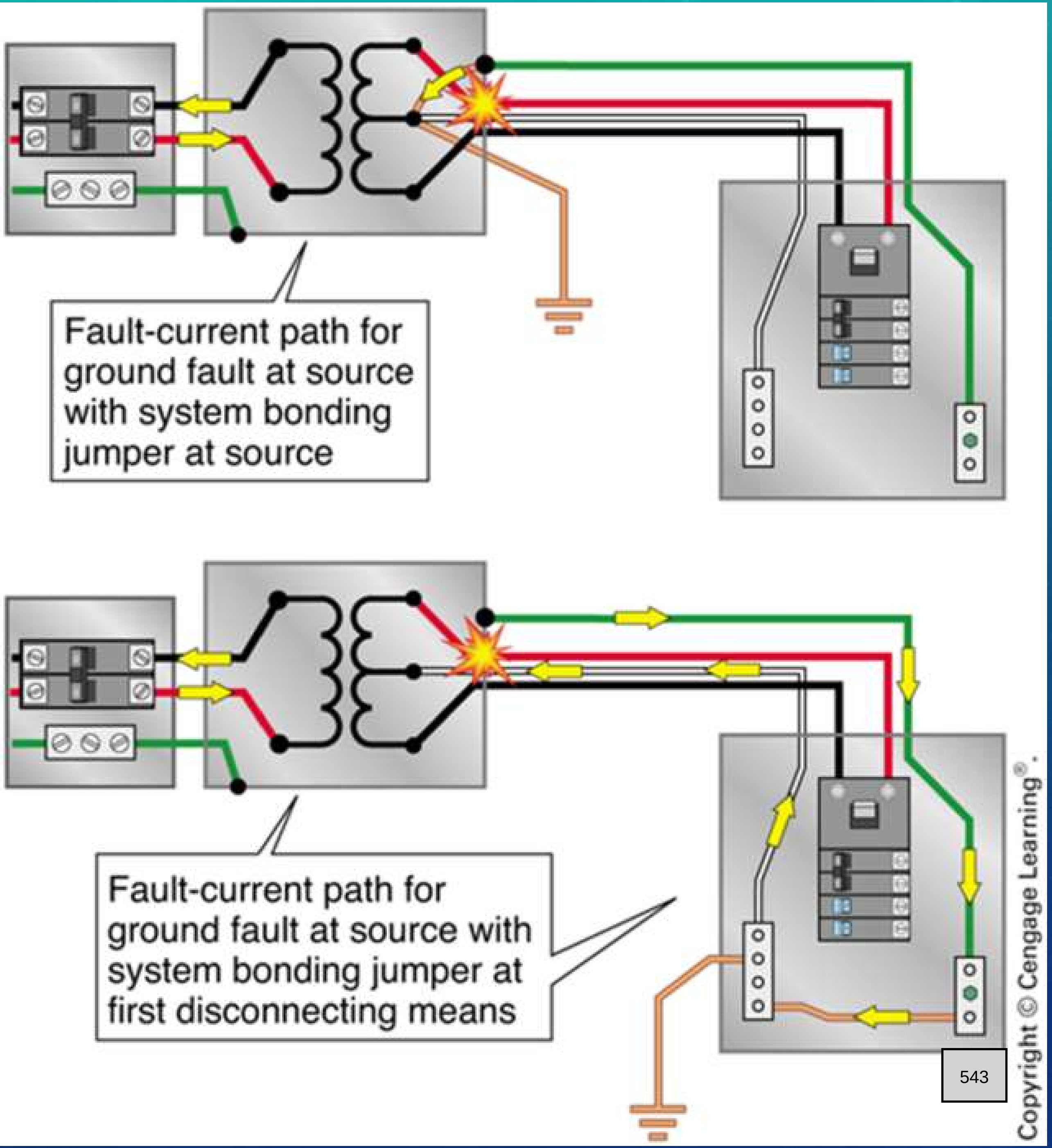
Generator-type Separately Derived System



Supply-side Bonding Jumper
250.30(A)(2)



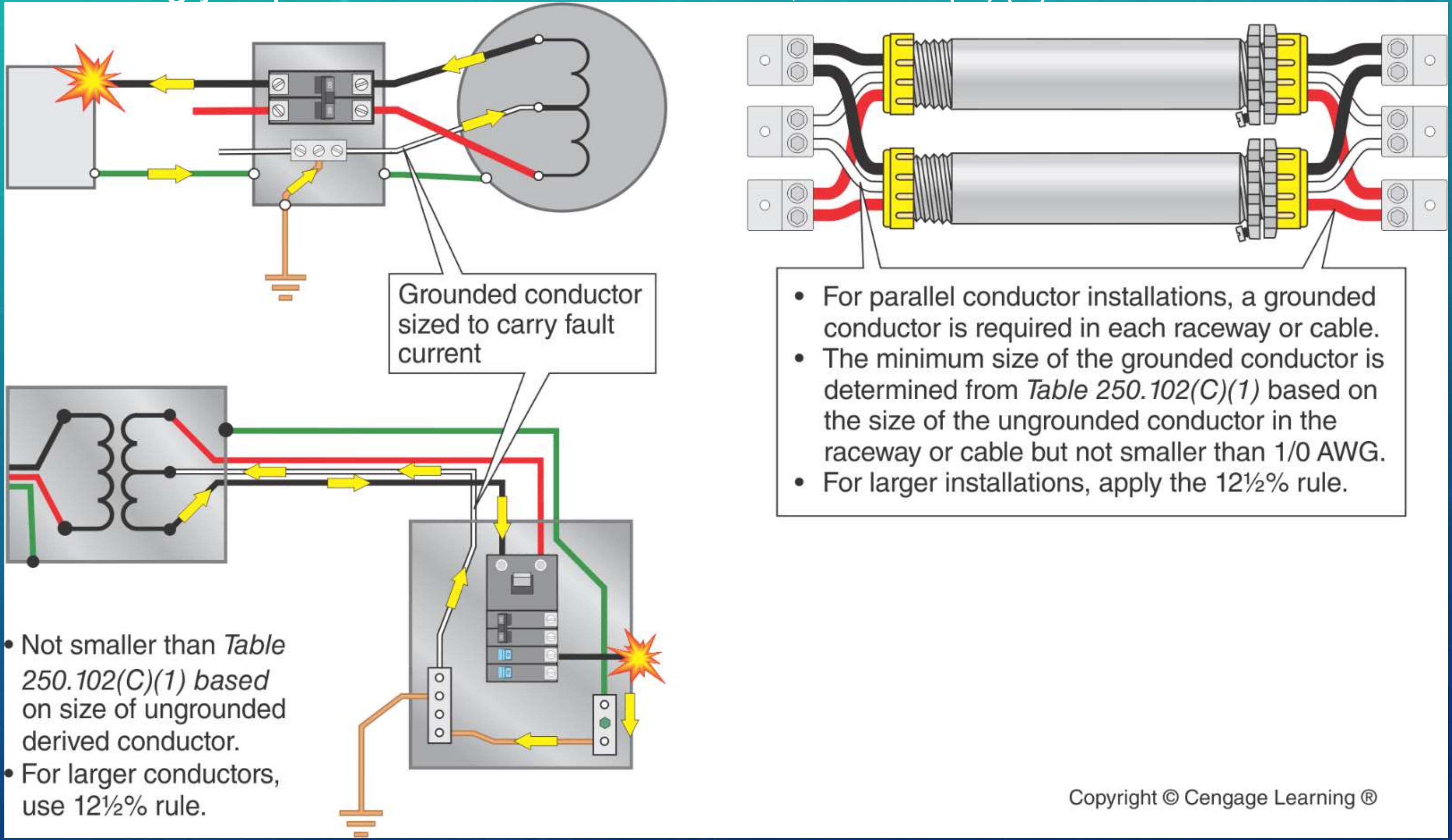

Ground-fault return path with system bonding jumper at source
Ground-fault return path with system bonding jumper at first disconnecting means
Copyright © Cengage Learning®.


Fault-current path for ground fault at source with system bonding jumper at source
Fault-current path for ground fault at source with system bonding jumper at first disconnecting means
Copyright © Cengage Learning®.

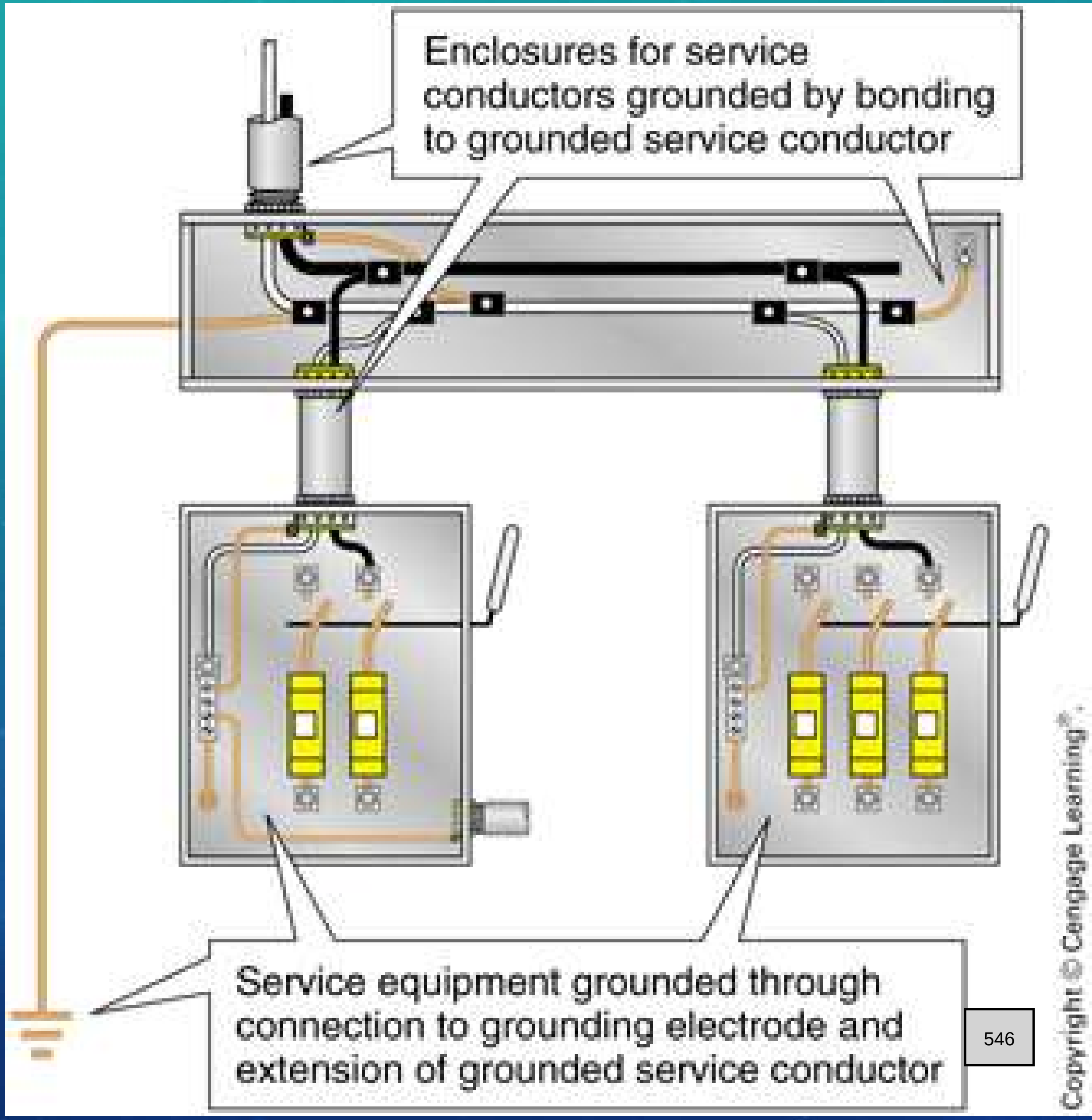
250.30(A)(3) Grounded Conductor

- *(A)(3)(a)* Rules identical to sizing grounded conductor for service
  - Ensures conductor is adequate for carrying fault current
  - Also, size for calculated load
- *(A)(3)(b)* Rules identical to sizing grounded conductors for services when installed in parallel
- *(A)(3)(c)* Rules identical to that for sizing the grounded conductor for a delta-connected service
- *(A)(3)(d)* Rules that are covered in *250.36* for high-impedance grounded neutral systems for those rated 480 to 1000 volts and in *250.187* for impedance grounded neutral systems rated over 1000 volts

Minimum size of grounded conductor to serve as ground-fault return path when system bonding jumper is not located at source, *250.30(A)(3)*.



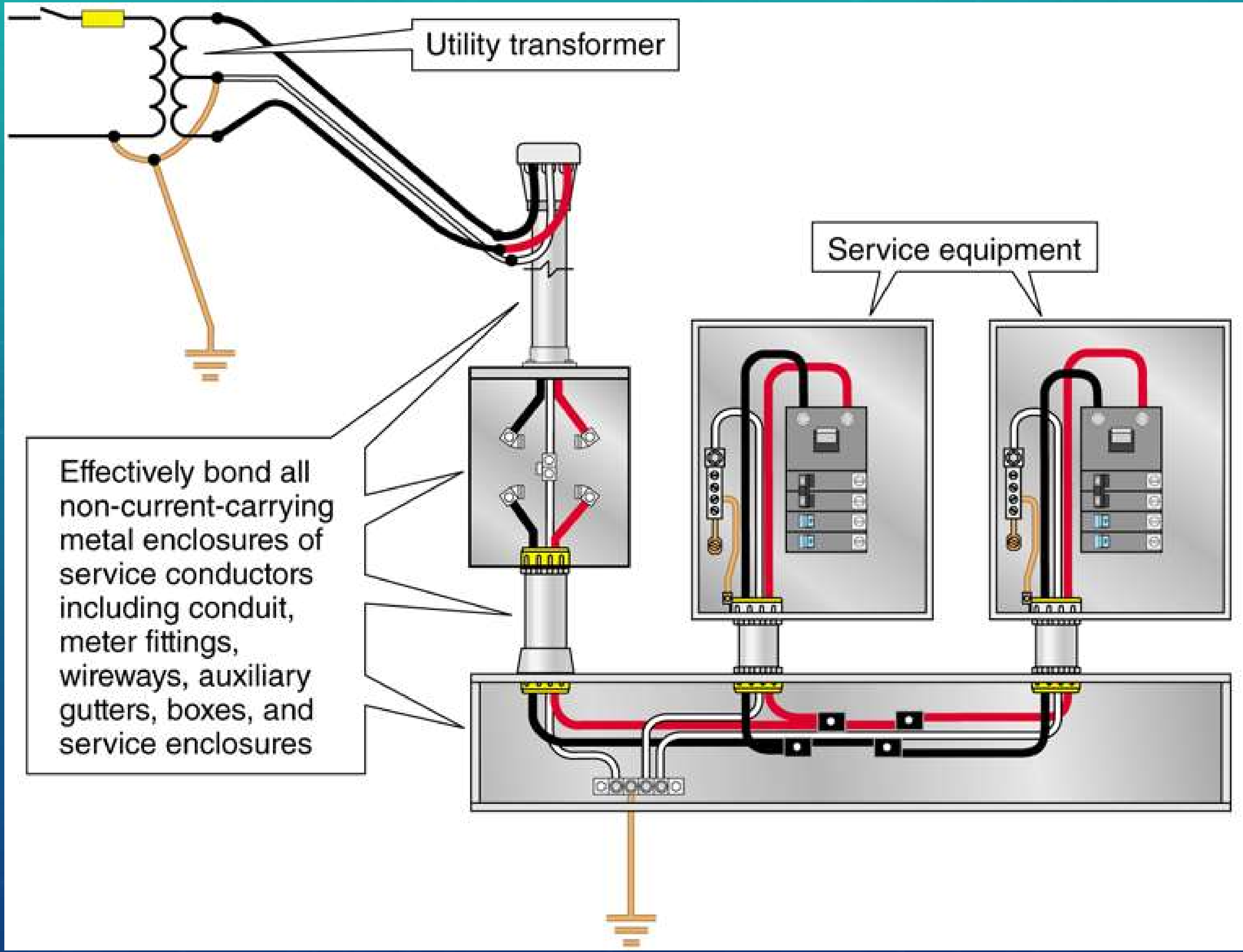
250.80 Service Raceways and Enclosures



250.92(A) Bonding of Services

- Normally non-current-carrying <u>metal</u> parts of the following equipment must be bonded together:
  1. All service raceways, cable trays, cable bus framework, auxiliary gutters, or service cable armor or sheath except as permitted in *250.80*
  2. All enclosures containing service conductors, including meter fittings, boxes, or the like, interposed on the service raceway

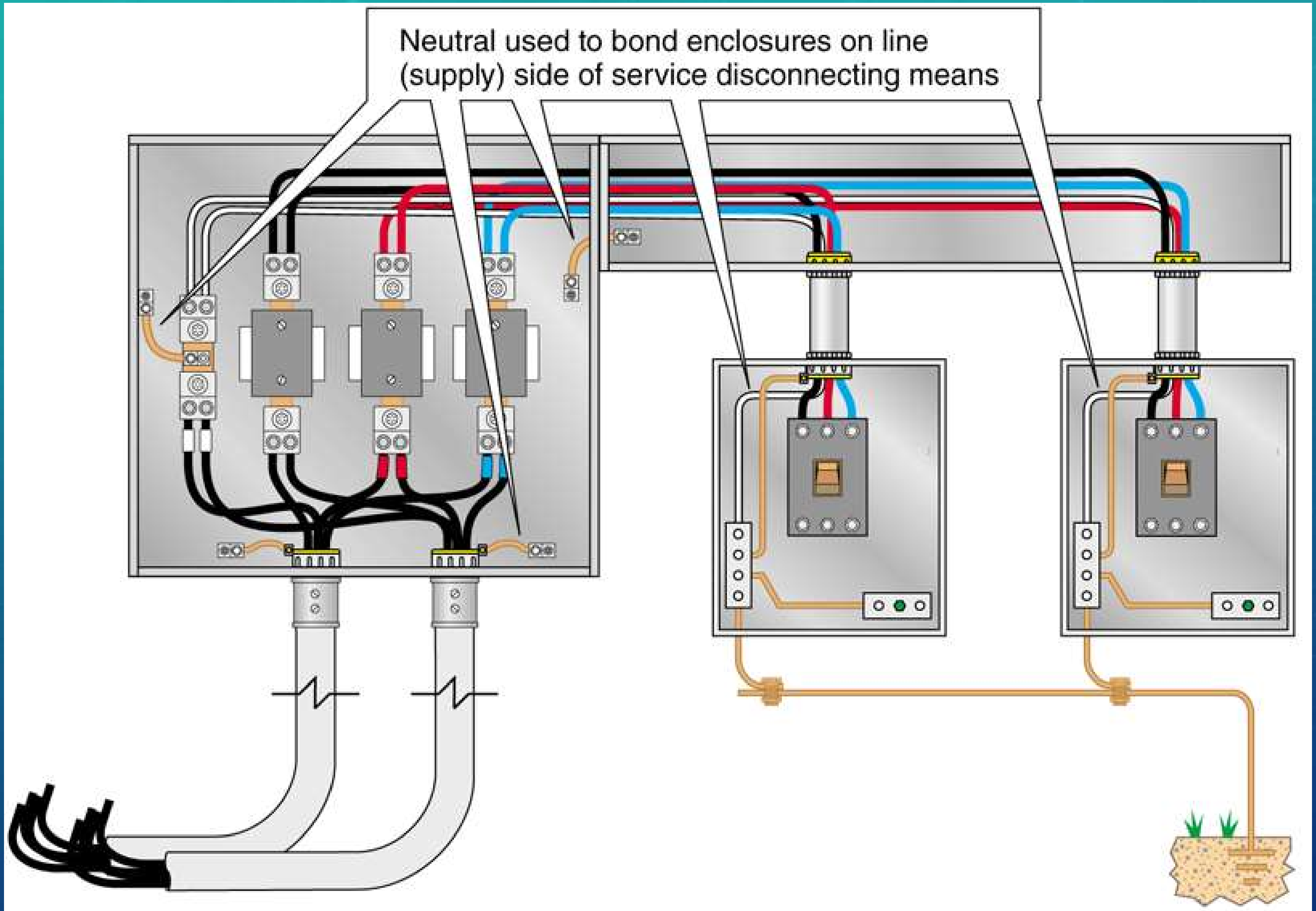
Bonding service equipment enclosures, *250.92(A)*.

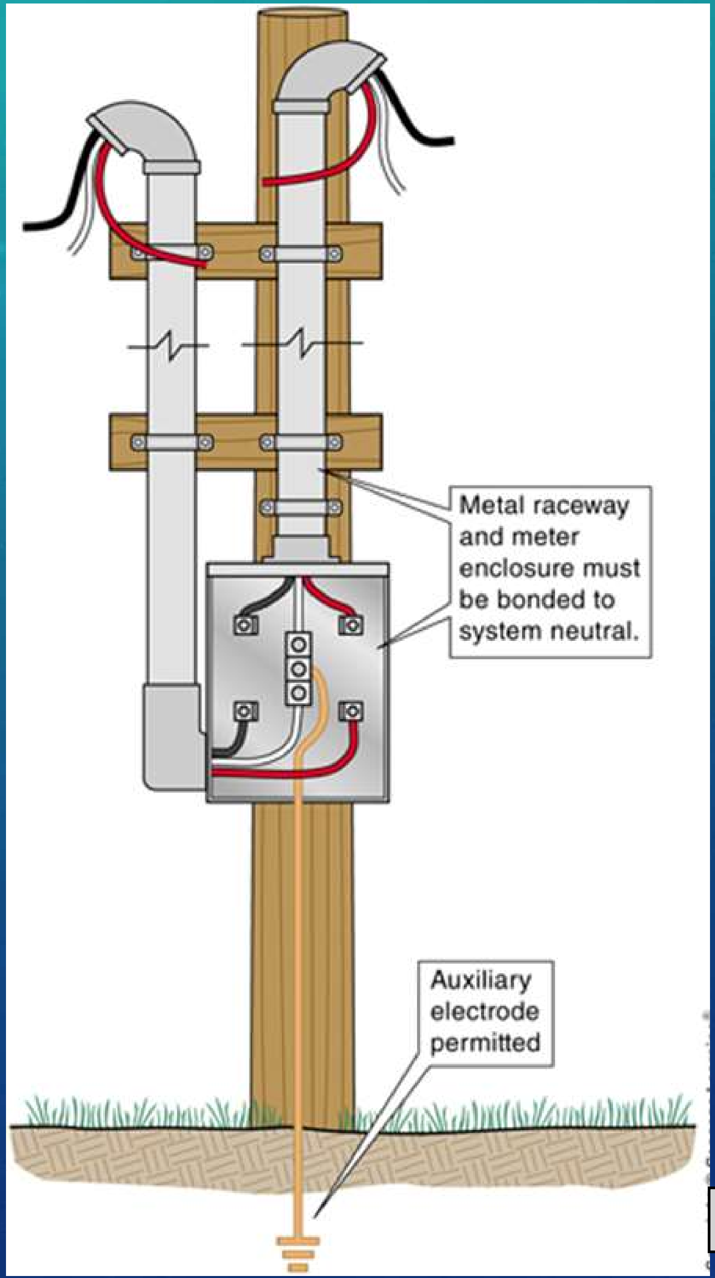


250.92(B) (2) Bonding Equipment to the Grounded Service

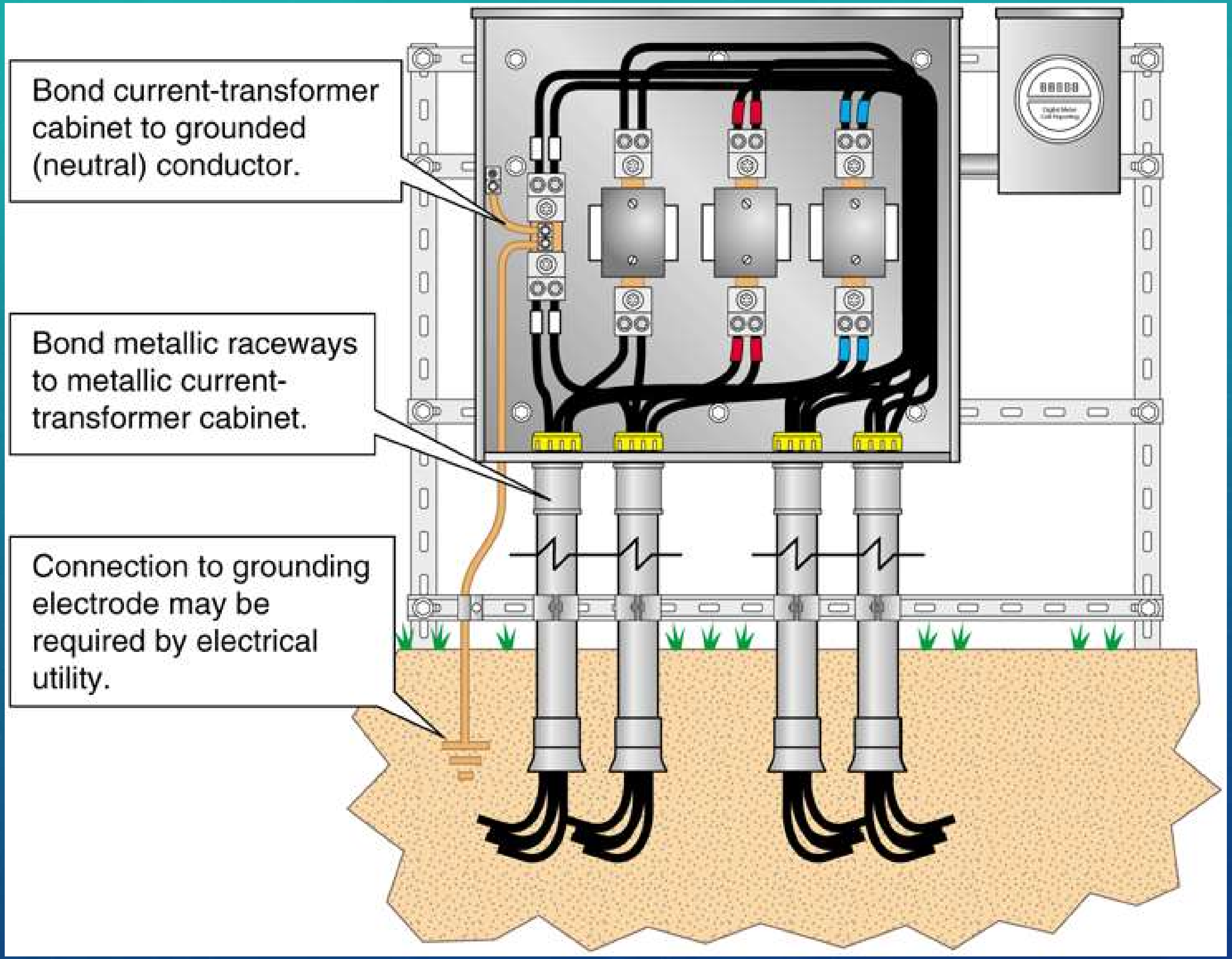
1. Bonding equipment to the grounded service conductor in a manner provided in *250.8* Bond meter base to service neutral, verify neutral terminal is bonded to the enclosure
2. Connection to grounding electrode may be required by the serving electrical utility
3. Connections utilizing threaded couplings or threaded hubs on enclosures if made up wrench tight
4. Weatherproof hubs, may be suitable for installation at service equipment
5. Thread less couplings and connectors where made up tight for metal raceways and metal-clad cable
6. Other listed devices such as bonding-type locknuts, bushings, or bushings with bonding jumpers

Use of neutral for bonding on supply side of service, *250.92(B)(1)*.





Bonding current transformer–type enclosures that are installed remote from and on the supply side of service equipment, *250.92(B)(1)*.

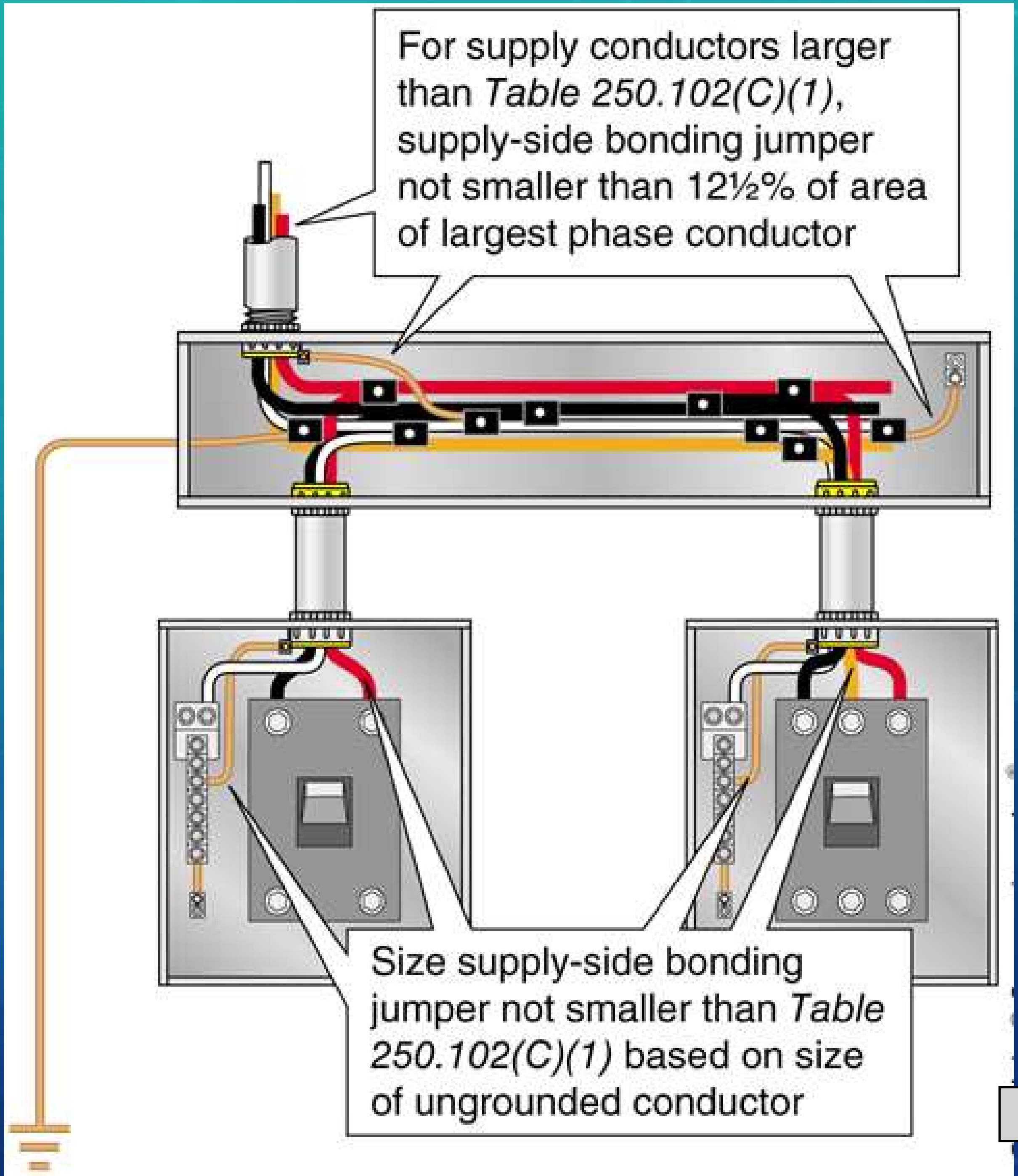


250.102(C)(1) Supply-Side Bonding Jumper in a Single Raceway or Cable

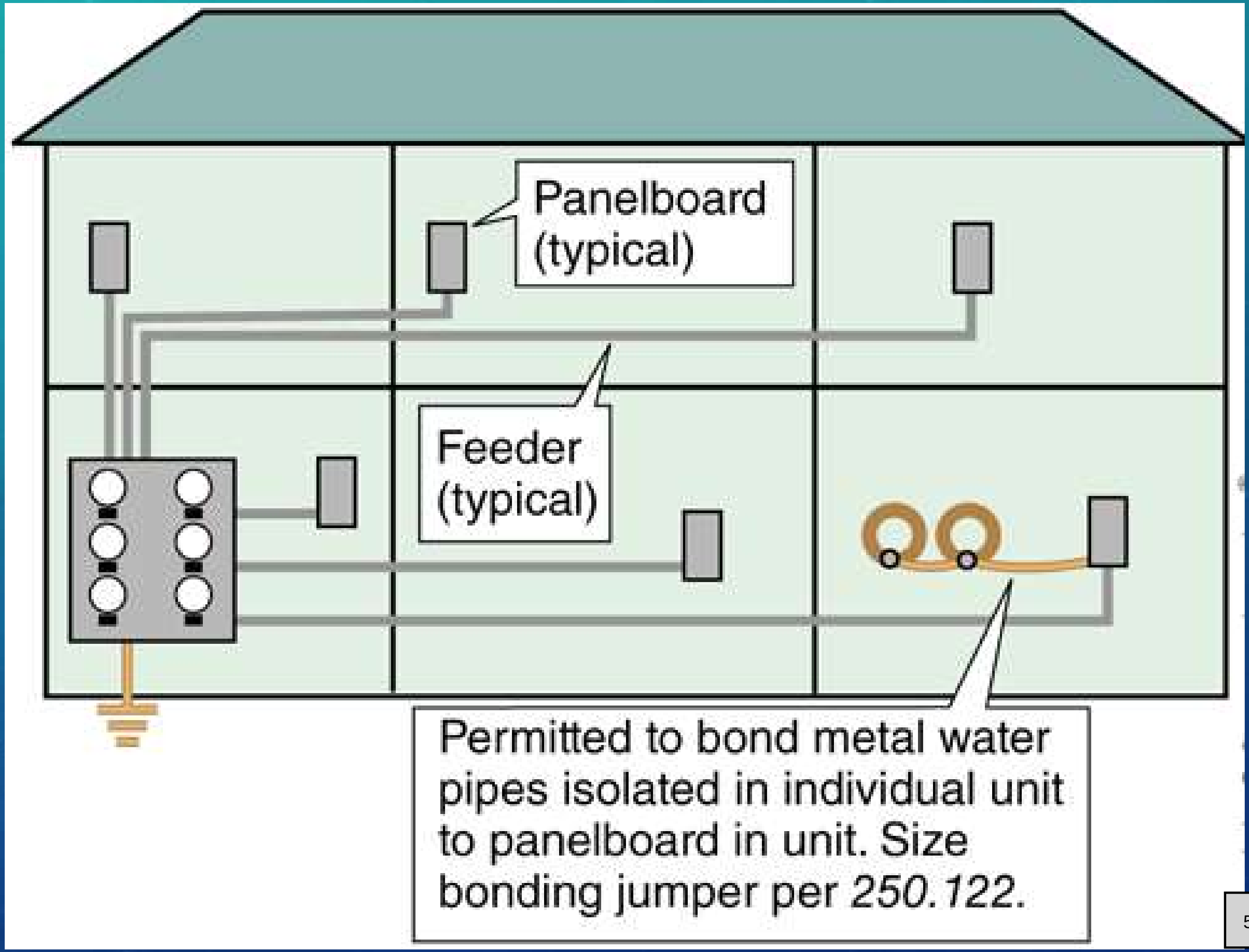
- Size according to *Table 250.102(C)(1)* based on size of the supply conductor
- For larger conductors than in the table, size not smaller than 12½ percent of largest phase conductor total circular mill

Ohio Certificate Renewal
"Since 1994"

250.102(C)(1) Supply-side bonding jumper on supply side of OCP



250.104(A)(2) Buildings of Multiple Occupancy



Questions?

File Attachments for Item:

ER-7 NEC Round Table (Greater Cincinnati Electrical Association)

ESI, BO, EPE, RBO, RPE (4 hours)

Staff Notes: These monthly round table meetings were approved for 2020, when they focused on the 2017 NEC. They now include the 2020 NEC as well. Recommend approval with usual required language.

ESIAC Recommendation: Recommend approval.

Committee Recommendation:

[redacted]

APPLICATION

FOR

Continuing Education Course Approval

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

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

COURSE SUBMITTER:

Course Submitter: TERRENCE J. EIBEL (Contact Name)

Organization: GREATER CINCINNATI ELECTRICAL ASSN. (Organization/Company)

Address: PO BOX 18643 (Include Room Number, Suite, etc.)

City: ERLANGER State: KY Zip: 41018

E-Mail: GCEA01@FUSE.NET

Telephone: 859-512-5244 Fax: 859-283-1877

Course Sponsor: GCEA

COURSE INFORMATION:

Course Title: ~~MONTHLY SEMINARS/MEETINGS~~ NEC Round Table

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

Purpose and Objective: OVERVIEW & UNDERSTANDING OF SUBJECT NEC ARTICLES
1 - NEC ARTICLES 320-398 (SEPT 20, 2021) BBS2020-089
2 - NEC ARTICLES 230 & 240 (OCT 18, 2021) BBS2019-202
3 - NEC ARTICLE 250 (NOV 15, 2021) BBS2020-081
4 - NEC ARTICLES 220 & 225 (DEC 13, 2021) BBS 2020-083

Number of Instructional Contact Hours that can be obtained upon completion: 4 - 1.0 HOURS CLASSES

If Multi-Session, Number of Instructional Contact Hours Per Session: 4 SEPARATE 1.0 HOUR CLASSES

Program Applicable for the Following Participants:

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

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

Electrical Safety Inspectors ☒
Location of ESI Course: SHARONVILLE, OH Date(s) of ESI Course(s): SEPT 20, 2021 OCT 18, 2021 NOV 15, 2021 DEC 13, 2021

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

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

Training Facility:

The seminars will be held at the Scarlet Oaks Career Development Campus at 303 Scarlet Oaks Drive, Sharonville, OH 45241

Scarlet Oaks is one of several campuses of the Great Oaks Career Development Centers. These education seminars will be held in a modern classroom setup. The room is set up to comfortably accommodate seating for 40.

Modern audio/visual equipment (computer, projector, microphone and speaker system) is available for the instructor's use. Vending machines for drinks and snacks are nearby and available. There are both men's and women's restrooms nearby.

Course Materials:

Every attendee is responsible for bringing a "NEC 2017" and a "NEC 2020" code book and a notebook. The instructor will have the PowerPoint slides associated with the topic when they help support the topic. The instructor will provide each attendee with a summary of main points, outline, and other topic associated examples, such as, calculations and FAQs.

GCEA'S 2021 "NEC" BBS MONTHLY TRAINING DATES & TOPICS SCHEDULE

With previous BBS approval class number and year

Seminars: 1.0 Hour NEC Code

Date	Description	Instructor
September 20, 2021	NEC – Articles 320 – 398 Wiring Methods and Materials **# BBS2020-089 (BO, EPE, ESI, RBO, RPE)**	Dennis Weneck Alt. Mario Mumfrey
October 18, 2021	NEC–Article 230 &240 Services and Overcurrent Protection **# BBS2019-202 (BO, EPE, ESI, RBO, RPE)**	Dennis Weneck Alt. Mario Mumfrey
November 15, 2021	NEC Article 250 Grounding and Bonding **# BBS2020-081 (BO, EPE, ESI, RBO, RPE)**	Dennis Weneck Alt. Mario Mumfrey
December 13, 2021	NEC – Articles 320 – 398 Wiring Methods and Materials **# BBS2020-083 (BO, EPE, ESI, RBO, RPE)**	Dennis Weneck Alt. Mario Mumfrey

"NEC Articles 320 – 398, Wiring Methods and Materials"

Article 320 - Armored Cable:

Article 322 - Flat Cable Assemblies: Type FC

Article 324 - Flat Conductor Cable: Type FCC

Article 332 - Mineral Insulated, Mineral Shielded Cable

Article 334 - Nonmetallic-Shielded Cable: Types NM, NMC, and NMS

Article 338 - Service-Entance

Article 342 - Intermediate Metal Conduit: Type IMC

Article 344 - Rigid Metal Conduit: Type RMC

Article 352 - Rigid Polyvinyl Chloride Conduit: Type PVC

Article 358 - Electric Metallic Tubing: Type EMT

Article 370 - Cablebus

Article 376 - Metal Wireways

Article 378 - Nonmetalic Wireways

Article 392 - Cable Trays

Article 398 - Open Wire on Insulators

"NEC Article 230 & 240"

Services and Overcurrent Protection

Article 230 - SERVICES:

I Service Distribution General Requirements

A. Listed Equipment (SUSE Rated)

B. Definitions – Services – Buildings - Structures Circuit conductor to be grounded on grounded system

C. Clearances

II Service Installation

A. Service drop conductors and laterals

B. Location (nearest point for disconnect)

C. Service grounding and bonding sizing

III Service Load Calculations

A. Article 220 – Branch circuits, Feeders & Services

B. Residential Load Summary requirement for 1, 2, & 3 Family Units

C. Plan review requirements for Multi-families & Commercial spaces

November 15, 2021 GCEA Course Outline

"NEC – Article 250, Grounding and Bonding"

Instructor: Dennis Weneck, ESI

A. Scope - Article 250.1

B. Definitions - Article 250.2

C. Grounded Systems - Article 250.4A

D. Ungrounded Systems - Article 250.4B

E. Connection of Grounding & Bonding Equipment - Article 250.8

F. AC Systems to be Grounded - Article 250.20

G. AC Systems not required to be Grounded - Article 250.21

H. Grounding Service Supplied AC Systems - Article 250.24

T. Conductor to be Grounded - AC Systems - Article 250.26

J. Main Bonding and System Bonding Junipers - Article 250.28

K. Buildings or Structures Supplied by Feeders or Branch Circuits
Article 250.32

L. Grounding Electrodes - Article 250.52

M. Grounding Electrode System Installation - Article 250.53

N. Grounding Electrode Conductor Installation - Article 250.64

O. Size of AC Grounding Electrode Conductor - Article 250.66

P. Grounding Electrode Conductor and Bonding Jumper Connection
to the Grounding Electrode - Article 250.68

December 13, 2021 GCEA Course Outline

"NEC Articles 220 & 225, Branch Circuits, Feeders and Service Load Calculations"

Branch Circuit, Feeder and Service Calculations

I General Article 220

II Branch Circuit Load Calculations

1) General Lighting Loads
2) Other Load: Appliances, Dryers, cooking, luminaries, receptacle outlets ... etc
3) Loads for additions to existing installations

III Feeder and Service Load Calculations

1) General lighting
2) Receptacle load other than dwelling units
3) Other load: Small appliances, laundry, ranges and cooking appliances....etc.
4) Feeder or Service neutral load

IV Optional Feeder and Service Load Calculations.

1) Dwelling units
2) Existing dwelling units
3) Multifamily dwellings
4) Determining existing load

Outside Branch Circuits and Feeders

I General - Article 225

II Conductor size and support Article 225.6

III Lighting equipment installed outdoors Article 225.7

IV Open-Conductor Spacings Article 225.14

V Clearances for Overhead Conductors and Cables - Article 225.18

VI Clearances from bldgs for conds. of not over 600v. - Article 225.19

VI Maximum number of disconnects – Article 225.33

VII Grouping of disconnects – Article 225.34

INSTRUCTORS

Dennis Weneck (ESI #1614) is the scheduled instructor for each seminar. In the event of Dennis Weneck not being available at any session, the backup instructor will be Mario Mumfrey.

(Resumes are attached.)

Instructor Qualifications:

Dennis Weneck – ESI# 1614

Dennis Weneck has been in the electrical industry for 36 years. He received his Certification # 1614 from the State of Ohio in 1989. He has been employed by Inspection Bureau, Inc. (IBI) for 24 years as an Electrical Safety Inspector. Dennis has taught approved O.C.I.L.B. electrical code classes for the Greater Cincinnati Electrical Association over the past eight years. Dennis is currently inspecting in IBI's C-2 territory.

Address: Suite 125-W, 250 West Court Street, Cincinnati, OH 45202
Telephone Number: 513-381-6080

Mario Mumfrey – ESI #1196

Mario Mumfrey has been in the electrical industry for 43 years. He recieved his Certification #1196 from the state of Ohio in 1989.

Mario has been employed by the Inspection Bureau, Inc (IBI) for 16 years as an Electrical Safety Inspector. He is currently inspecting in IBI's R-1 territory.

He is recognized by his peer inspectors as being the exceptionally knowledgeable in the NEC's, Article 680, swimming pools, spas, and fountain installations.

Address: Suite 125-W, 250 West Court Street, Cincinnati, OH 45202
Telephone Number: 513-381-6080

File Attachments for Item:

ER-8 Sill Plate Anchorage Solutions for Wood-Frame Construction (Simpson Strong-Tie - OBOA-ODPCA Conference)

BI, MPE, MI, RBO, RPE, RBI (1 hour)

Staff Notes: Recommend approval

Committee Recommendation:

Presenter Biography

Jim Mailey, Training Manager, Simpson Strong-Tie

Jim Mailey is the Midwest, Northeast and Mid-Atlantic market training manager for Simpson Strong-Tie – a company that for more than 50 years has developed structural products to help people build safer and stronger buildings, homes and decks. Joining Simpson Strong-Tie in 1992, Jim has given hundreds of presentations to more than 20,000 design professionals, building officials, builders, contractors and dealers. He has developed numerous programs designed to educate industry professionals about how to install Simpson Strong-Tie® products as well as how these products meet various building code requirements. Jim is considered an expert in safe, outdoor wood deck construction and provides economical product solutions to satisfy structural code requirements for wood decks. He has written articles about deck safety and has been quoted in deck contractor and home inspector publications. His program entitled "Deck Framing Connections Seminar" reviews the correct and incorrect structural methods for building a deck, shows why commonly accepted practices should not be used and provides informative tips that the novice to the most experienced deck builder will find useful. Jim earned a B.A. from Bloomsburg University in Bloomsburg, Pennsylvania, in 1980.

Greg Wujcik, Territory Manager, Simpson Strong-Tie

Greg Wujcik is the Territory Manager for the state of Ohio for Simpson Strong-Tie - – a company that for more than 50 years has developed structural products to help people build safer and stronger buildings, homes and decks. Greg has been with Simpson Strong-Tie since 2000, and has given numerous presentations to design professionals, building officials, builders, contractors, and dealers. Greg also works with these same groups educating them on the proper use and installation of Simpson Strong-Tie products in order to provide economic solutions to satisfy building code requirements. Greg earned a B.A. from Baldwin-Wallace College in Berea, Ohio in 2000.

Simpson Strong-Tie is committed to helping customers succeed by providing exceptional products, full-service engineering and field support, product testing and training. For more information, visit the company's website at www.strongtie.com.

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

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

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

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

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

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

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

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

APPLICATION

FOR

Continuing Education Course Approval

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

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

COURSE SUBMITTER:

Course Submitter: Greg Wujcik
(Contact Name)

Organization: Simpson Strong-Tie
(Organization/Company)

Address: 2600 International St.
(Include Room Number, Suite, etc.)

City: Columbus State: OH Zip: 43228

E-Mail: gwujcik@strongtie.com

Telephone: 440-263-2490 Fax: 614-876-0636

Course Sponsor: ____________

COURSE INFORMATION:

Course Title: Sill Plate Anchorage Solutions for Wood-Frame Construction

New Course Submittal: ☒ Update Course: ☐ Prior Approval Number: ____________

Purpose and Objective:
We will discuss the requirements for sill plate anchorage related to light frame wood construction, including how alternative anchors and strap anchors may be permitted. We will also present alternative anchors and strap anchors to the code prescribed anchor bolts.

Number of Instructional Contact Hours that can be obtained upon completion: 1

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

Program Applicable for the Following Participants:

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

- Res Building Official ☒
- Res Plans Examiner ☒
- Res Building Inspector ☒
- Res Mechanical Inspector ☐
- Res IU Inspector ☐

Electrical Safety Inspectors ☐
Location of ESI Course: ____________ Date(s) of ESI Course(s): ____________

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

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

Sill Plate Anchorage Solutions for Wood-Frame Construction

Presentation Description:

During this presentation, we will discuss the requirements for sill plate anchorage related to light frame wood construction, including how alternative anchors and strap anchors may be permitted. We will also present alternative anchors and strap anchors to the code prescribed anchor bolts.

Presentation Outline:

I. **Code Requirements for Sill Plate Anchorage**
   a. 2018 IRC Section R403.1.6 & 2018 IBC Section 2308.3.1 Prescriptive Anchor Bolts
   b. Typical Anchor Bolts Used for Sill Plate Anchorage

II. **Alternative Materials, Design and Methods of Construction**
   a. 2018 IBC Section 104.11 - Alternative Materials, Design and Methods of Construction
   b. 2018 IBC Section 104.11.1 - Research Reports
      i. Accredited Third-Party Certification Bodies
   c. 2018 IBC Section 104.11.2 - Tests
      i. IAS Test Lab Accreditation

III. **Alternate Anchors and Strap Anchors for Sill Plate Anchorage**
   a. Anchor Strap Alternatives for Concrete
   b. Anchor Strap Alternatives for Grout-Filled Concrete Masonry Units (GFCMU)
   c. Anchor Alternatives for Concrete
   d. Anchor Alternatives for Grout-Filled Concrete Masonry Units (GFCMU)

IV. **Resources for Sill Plate Anchorage**
   a. Code-Compliant Sill Plate Anchorage Solutions (T-A-SILPLANCH21)
   b. Connector Solutions to Meet the Wall Bracing Requirements of the International Residential Code (T-C-WALLBRACE21)
   c. Installer's Pocket Guide (S-C-INSTALL19)

Presenter Bio:

Greg Bundy, P.E. – Greg joined Simpson Strong-Tie in 2003 as a Branch Engineer providing support to 24 states throughout the Northeast, Midwest and Mid-Atlantic regions of the United States. Prior to joining Simpson, Greg acquired almost twenty years of experience at two structural engineering firms in Columbus, Ohio. He is a registered Professional Engineer in nine states and received certification in the practice of structural engineering from the Structural Engineering Certification Board (SECB). Over the years, he has presented on a wide variety of topics. These programs focus on presenting structural design concepts in an easy to understand format.

SIMPSON Strong-Tie

Sill Plate Anchorage Solutions for Wood-Frame Construction

Sill Plate Anchorage Solutions for Wood-Frame Construction

Course Outline

1	Code Requirements for Sill Plate Anchorage
2	Alternative Materials, Design and Methods of Construction
3	Alternate Anchors and Anchor Straps for Sill Plate Anchorage
4	Resources for Sill Plate Anchorage

Sill plate anchorage provides the most basic connection in a structure by preventing it from sliding off the foundation

"To prevent walls and floors from shifting under lateral loads, the code requires anchorage to the supporting foundation."

2009 IRC Commentary

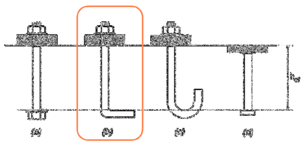
What are the sill plate anchorage requirements from the I-Codes?

Section R403.1.6

Section 2308.3.1

- ✓ ½"- diameter bolts (w/ ⅝" in some cases)
  - Exception: *approved* anchors or anchor straps
- ✓ 7" embedment into concrete or grouted cells of concrete masonry units (GFCMU)
- ✓ 6'-0" o.c. max. (in most cases)
- ✓ Installed into the middle ⅓ of the sill plate
- ✓ Nut and washer placed on bolt

What are the sill plate anchorage requirements from the I-Codes?



(A) Cast-in anchors: (a) hex head bolt with washer; (b) L-bolt; (c) J-bolt; and (d) welded headed stud.

ACI 318 cast-in anchors

- ✓ ½"- diameter bolts (w/ ⅝" in some cases)
  - Exception: *approved* anchors or anchor straps
- ✓ 7" embedment into concrete or grouted cells of concrete masonry units (GFCMU)
- ✓ 6'-0" o.c. max. (in most cases)
- ✓ Installed into the middle ⅓ of the sill plate
- ✓ Nut and washer placed on bolt

Alternative materials and methods are permitted in the I-Codes

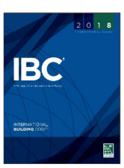
104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has 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, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

CHAPTER 2
DEFINITIONS

APPROVED. Acceptable to the code official or authority having jurisdiction.

Alternative materials and methods are permitted in the I-Codes

Section R403.1.6



Section 2308.3.1

- ✓ ½"- diameter bolts (w/ ⅝" in some cases)
  - Exception: *approved* anchors or anchor straps

Alternative materials and methods are permitted in the I-Codes

Section R403.1.6

Section 2308.3.1

- ✓ ½"- diameter bolts (w/ ⅝" in some cases)
  - Exception: *acceptable to the code official (or jurisdiction having authority)* anchors or anchor straps

Alternative materials and methods are permitted in the I-Codes

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, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

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.

ANSI

ANAB
ANSI National Accreditation Board

https://anab.ansi.org/

Alternative materials and methods are permitted in the I-Codes

Accredited Third-Party Certification Bodies

ICC Evaluation Service, LLC

Accreditation ID	1000
Organization	**ICC Evaluation Service, LLC** 3060 Saturn Street, Suite 100, Brea, CA, 92821, United States
Letter Code	ICCESLLC
Website	http://www.icc-es.org/
Accreditation Certificate	Continued Accreditation

Key Locations

Birmingham, AL	900 Montclair Road Suite ABirmingham, AL 35213, United States
Headquarters	3060 Saturn Street Suite 100Brea, CA 92821, United States
Bill Payment Date	

Accredited Scopes

Alternative materials and methods are permitted in the I-Codes

Accredited Third-Party Certification Bodies

IAPMO Uniform Evaluation Service

Accreditation ID	0675
Organization	**IAPMO Uniform Evaluation Service** 4755 E. Philadelphia St, Ontario, CA, 91761, United States
Letter Code	IAPMOES
Website	http://www.iapmoes.org/Pages/default.aspx
Accreditation Certificate	Continued Accreditation
Bill Payment Date	

Accredited Scopes

Alternative materials and methods are permitted in the I-Codes

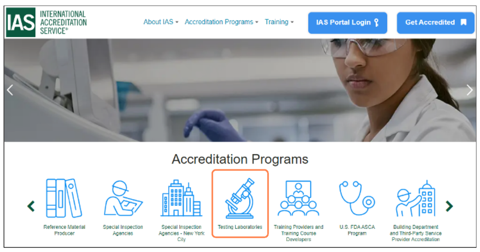
104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has 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, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

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 without 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.

Alternative materials and methods are permitted in the I-Codes

IAS Test Lab Accreditation

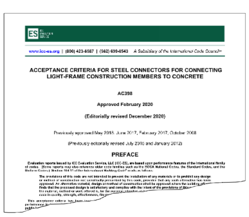


Alternative materials and methods are permitted in the I-Codes

IAS Test Lab Accreditation

- ✓ Scope of Accreditation: ANSI/TPI, ASTM, AC, EC, etc.
- ✓ Acceptance Criteria (AC's) or Evaluation Criteria (EC's) are used to evaluate the I-Code *anchor* and *anchor strap* "exceptions"

Alternative materials and methods are permitted in the I-Codes


ACCEPTANCE CRITERIA FOR STEEL CONNECTORS FOR CONNECTING LIGHT-FRAME CONSTRUCTION MEMBERS TO CONCRETE

AC398

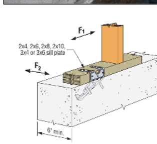
Approved February 2020

(Editorially revised December 2020)

PREFACE

- ✓ EXAMPLE:
  - AC398 – Acceptance Criteria for Steel Connectors for Connecting Light-Frame Construction Members to Concrete

Alternative materials and methods are permitted in the I-Codes



- ✓ EXAMPLE:
  - AC398 – Acceptance Criteria for Steel Connectors for Connecting Light-Frame Construction Members to Concrete

Alternative materials and methods are permitted in the I-Codes

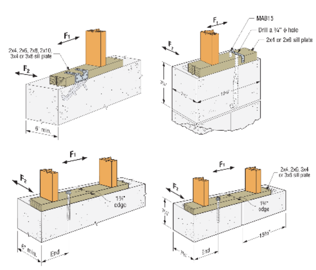
- EXAMPLE:
  - AC398 – Acceptance Criteria for Steel Connectors for Connecting Light-Frame Construction Members to Concrete
  - ESR-2555 – Simpson Strong-Tie Cast-In-Place Concrete Foundation Anchor Straps

Alternative materials and methods are permitted in the I-Codes

Summary of Code Requirements

- The code permits alternate methods and materials
- Subject to approval by code official (or authority having jurisdiction)
- Justify performance with:
  - **Research Reports** shall be provided by an accredited third-party certification body (Evaluation Reports or "Code" Reports)
  - **Testing** shall be performed in an accredited test lab (ANSI/TPI, ASTM, AC, EC, etc.)

Continuous innovation requires the code to be flexible

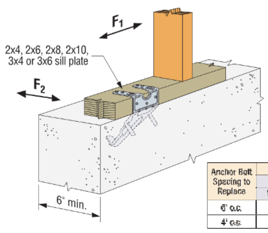


- ½"- diameter bolts (w/ ⅝" in some cases)
  - Exception: *approved* anchors or anchor straps
- 7" embedment into concrete or grouted cells of concrete masonry units (GFCMU)
- Four (4) possible exceptions!
  - strap anchors and concrete
  - strap anchors and GFCMU
  - anchors and concrete
  - anchors and GFCMU

Cast-in-place *strap anchors* in concrete are a great alternative for code prescribed anchor bolts

- AC398 – Acceptance Criteria for Steel Connectors for Connecting Light-Frame Construction Members to Concrete
- ESR-2555 – Simpson Strong-Tie Cast-In-Place Concrete Foundation Anchor Straps

Cast-in-place *strap anchors* in concrete are a great alternative for code prescribed anchor bolts

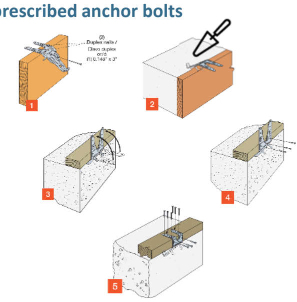


- ✓ AC398 – Acceptance Criteria for Steel Connectors for Connecting Light-Frame Construction Members to Concrete
- ✓ ESR-2555 – Simpson Strong-Tie Cast-In-Place Concrete Foundation Anchor Straps

Anchor Bolt Spacing to Replace	MASA/MASAP Spacing			
	DF/SP		HF	
	Wind and SDC A&B	SDC C-E	Wind and SDC A&B	SDC C-E
6' o.c.	6'-0"	6'-0"	6'-0"	6'-0"
4' o.c.	4'-0"	4'-0"	4'-0"	4'-0"

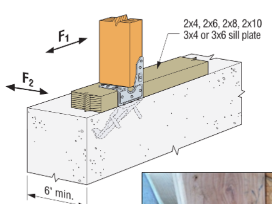
Standard Installation provides 1:1 replacement for ½" diameter anchor bolts!

Cast-in-place *strap anchors* in concrete are a great alternative for code prescribed anchor bolts



- ✓ AC398 – Acceptance Criteria for Steel Connectors for Connecting Light-Frame Construction Members to Concrete
- ✓ ESR-2555 – Simpson Strong-Tie Cast-In-Place Concrete Foundation Anchor Straps

Cast-in-place *strap anchors* in concrete are a great alternative for code prescribed anchor bolts



- ✓ AC398 – Acceptance Criteria for Steel Connectors for Connecting Light-Frame Construction Members to Concrete
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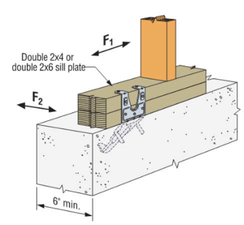

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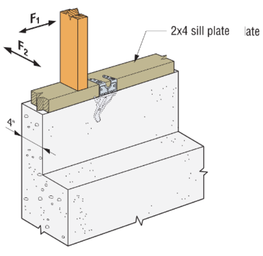
- ✓ ESR-2555 – Simpson Strong-Tie Cast-In-Place Concrete Foundation Anchor Straps

Cast-in-place *strap anchors* in concrete are a great alternative for code prescribed anchor bolts

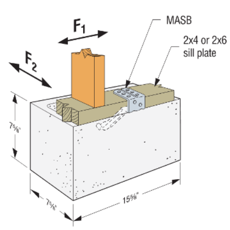


- ✓ AC398 – Acceptance Criteria for Steel Connectors for Connecting Light-Frame Construction Members to Concrete
- ✓ ESR-2555 – Simpson Strong-Tie Cast-In-Place Concrete Foundation Anchor Straps

Cast-in-place *strap anchors* in GFCMU are a great alternative for code prescribed anchor bolts

- ✓ EC002 – Evaluation Criteria for the Testing and Analysis of Joist Hangers and Miscellaneous Connectors
- ✓ ER-417 – Simpson Strong-Tie Cast-In-Place Masonry Foundation Anchor Straps

Cast-in-place *strap anchors* in GFCMU are a great alternative for code prescribed anchor bolts



- ✓ EC002 – Evaluation Criteria for the Testing and Analysis of Joist Hangers and Miscellaneous Connectors
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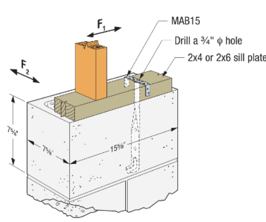
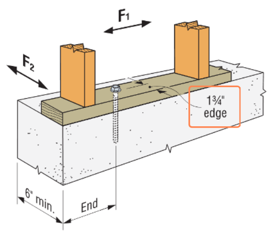


- ✓ EC002 – Evaluation Criteria for the Testing and Analysis of Joist Hangers and Miscellaneous Connectors
- ✓ ER-417 – Simpson Strong-Tie Cast-In-Place Masonry Foundation Anchor Straps

Anchor Bolt Spacing to Replace	MASB or MAB Spacing	
	DF/SP	HF
8' o.c.	5'-0"	5'-0"
	3'-10"	3'-10"
6' o.c.	3'-5"	3'-5"
	2'-8"	2'-8"

GFCMU requires closer spacing than code prescribed anchor bolts!

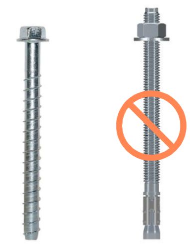
Post installed *anchors* in concrete are a great alternative for code prescribed anchor bolts



Post installed *anchors* = Screw Anchors

- ✓ AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
- ✓ ESR-2713 – Simpson Strong-Tie Titen HD Screw Anchor for Concrete

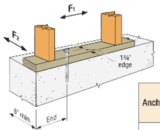
Post installed *anchors* in concrete are a great alternative for code prescribed anchor bolts



Screw Anchor **Wedge Anchor**

- ✓ AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
- ✓ ESR-2713 – Simpson Strong-Tie Titen HD Screw Anchor for Concrete

Post installed *anchors* in concrete are a great alternative for code prescribed anchor bolts

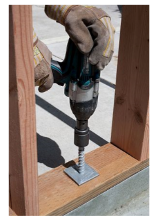


Anchor Bolt to Replace	Sill Plate Nominal Thickness
½" diameter with 7" embedment	2x
	Double 2x, 3x
⅝" diameter with 7" embedment	2x, 3x
	Double 2x
	2x, 3x

Titen HD provides 1:1 replacement for code prescribed anchor bolts!

- ✓ AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
- ✓ ESR-2713 – Simpson Strong-Tie Titen HD Screw Anchor for Concrete

Post installed *anchors* in concrete are a great alternative for code prescribed anchor bolts



Post installed *anchors* = Screw Anchors

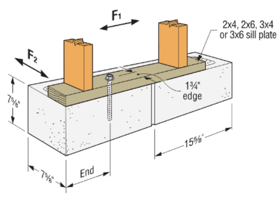
- ✓ AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
- ✓ ESR-2713 – Simpson Strong-Tie Titen HD Screw Anchor for Concrete

Post installed *anchors* in GFMCU are a great alternative to code prescribed anchor bolts

- ✓ AC106 – Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry
- ✓ ESR-1056 – Simpson Strong-Tie Titen HD Screw Anchor for Masonry

Post installed *anchors* = Screw Anchors

Post installed *anchors* in GFMCU are a great alternative to code prescribed anchor bolts

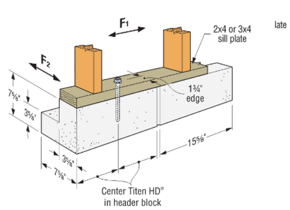


- ✓ AC106 – Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry
- ✓ ESR-1056 – Simpson Strong-Tie Titen HD Screw Anchor for Masonry

Titen HD Spacing to Replace ½" Anchor Bolts at 6'-0" o.c.
4'-6" o.c.⁴ →
4'-0" o.c.⁴

GFCMU requires closer spacing than code prescribed anchor bolts!

Post installed *anchors* in GFMCU are a great alternative to code prescribed anchor bolts



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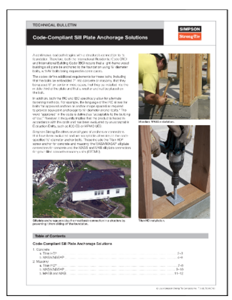
4'-6" o.c.⁴
4'-0" o.c.⁴ →

GFCMU requires closer spacing than code prescribed anchor bolts!

Fortunately, resources for sill plate anchorage are available!



- ✓ T-A-SILPLANCH21
  A technical bulletin providing an overview of code-compliant sill plate anchorage solutions
- ✓ T-C-WALLBRACE21
  A technical bulletin providing technical information about wall bracing methods and code sections that require connectors (e.g. holdowns or straps) and anchors
- ✓ S-C-INSTALL19
  A bilingual pocket installation guide for connectors

Fortunately, resources for sill plate anchorage are available!

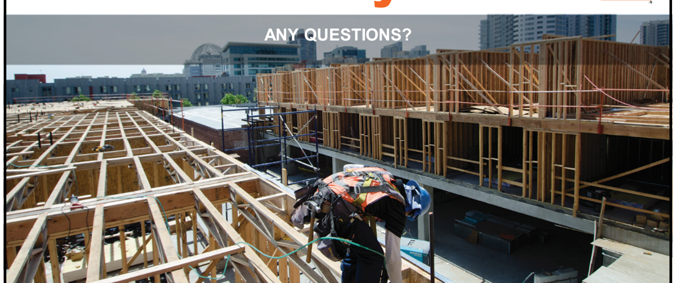
- ✓ **Building Designers (Architects and Structural Engineers):** T-A-SILPLANCH21 contains allowable loads for engineered designs (IBC) as well as prescriptive spacing information (IRC)
- ✓ **Builders:** Prescriptive information is provided in T-A-SILPLANCH21 so they can build prescriptively to the IRC (residential one- and two-family dwellings) and not necessarily need the assistance of a building designer
- ✓ **Building Departments (Authority Having Jurisdiction):** T-A-SILPLANCH21 may be handed out by building departments/code officials when they are reviewing plans lacking proper sill plate anchorage information or during building inspections when anchor bolts have been misinstalled

In conclusion, each sill plate anchorage solution has different pros/cons, design considerations, and jurisdictional requirements

- Local Jurisdiction Requirements
- Effects on Other Trades
- Subcontractor Preferences
- Design Limitations
- Load Reductions
- Available Resources

Thank you!

SIMPSON Strong-Tie



File Attachments for Item:

ER-9 Understanding the UL Fire Resistance Online Directories (National Gypsum - OBOA-ODPCA Conference)

BO, MPE, BPE, BI, FPI, MI, PI, NRIUI, RBO, RPE, RBI, EMI, RIUI (2 hours)

Staff Notes: Denied August 20 because based on Gypsum Association's GA 600 2021, whereas Ohio is on the 2015 edition. The sponsor has submitted new slides citing the 2015 edition only. Recommend approval.

Committee Recommendation:

Mark Chapman is Senior Manager of Construction Services at National Gypsum Company. He currently oversees National Gypsum's construction services department, which provides technical support to the construction industry for NGC products, gypsum board systems and specifications. He also serves on the Gypsum Association building code and technical committee. He has been involved with the development of construction systems and in the construction field for more than 40 years.

Thad Goodman is Construction Design Manger Great Lakes & Midwest areas at National Gypsum Company. He currently calls on the Architectural Community to provide technical support and building knowledge base for gypsum board systems and specifications. He serves on the Construction Specifications Institute Board of Directors at the national level. He is a former contractor in the Central Ohio area and has been in the construction field for more than 40 years.

Continuing Education Program Summary
Provider: National Gypsum Company | J299

Course: **Understanding the Online UL Fire Directories & Various Assemblies**

Credits: 2 (pending)

Description: Underwriters Laboratory discontinued printing their bright orange books in 2015. The move to online has meant more current information and brought numerous changes to their website formatting and means of access.
Learn how to use this resource in an effective and efficient way. The Gypsum Association has published the 23rd Edition of the Fire Resistance and Sound Control Design Manual. Used in conjunction with the Purple Book II this course will outline the UL requirements of fire rated assemblies and review best practices for field application.

Learning Objectives: Participants will learn access and navigation of the updated UL website; Learn about the three types of fire rated gypsum wallboard; Determine the most effective gypsum IL designs for projects and review manufacturing application best practices.

Source Materials: Online instruction templates for UL review; 23rd Edition Fire Resistance and Sound Control Design Manual; National Gypsum Purple Book II, With nearly 100 pages of often asked questions and designs from architects and building code official's through-out the country, it has become a great reference tool for the Industry

Presented with approval from the Ohio Board of Building Standards.
This course is approved for 2.0 Learning units

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

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

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

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

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

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

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

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

APPLICATION

FOR

Continuing Education Course Approval

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

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

COURSE SUBMITTER:

Course Submitter: Thad Goodman
(Contact Name)

Organization: National Gypsum Company
(Organization/Company)

Address: 4284 Loop Rd. NW
(Include Room Number, Suite, etc.)

City: Somerset State: Ohio Zip: 43783

E-Mail: thadg@nationalgypsum.com

Telephone: 614-214-5666 Fax: N/A

Course Sponsor: National Gypsum Company

COURSE INFORMATION:

Course Title: Understanding the UL Fire Resistance Online Directories, Various Assemblies, Sound & Fire Protection Partition Walls

New Course Submittal: [ ] Update Course: [x] Prior Approval Number: BBS2021-204

Purpose and Objective: Prior Course:To lead to greater understanding how to navigate the Online UL Directory, Provide real world solutions to common field related questions.
To update to the 2 hour course- Introduce new tested assembly approved horizontal membrane systems,
Review the 2021 GA-600 Fire Design Manual additional assemblies, released this July 2021,
Review Fire and Sound Rated Assemblies for compliance in Multi family construction.

Number of Instructional Contact Hours that can be obtained upon completion: 2 Hours

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

Program Applicable for the Following Participants:

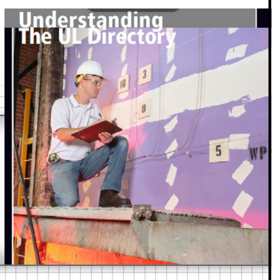
- Building Official [x]
- Master Plans Examiner [x]
  - Building Plans Exam. [x]
  - Plumbing Plans Exam. [ ]
  - Electrical Plans Exam. [ ]
  - Mechanical Plans Exam. [ ]
  - Fire Protect. Plans Exam. [ ]
- Building Inspector [x]
- Fire Protection Inspector [x]
- Mechanical Inspector [x]
- Plumbing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

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

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

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

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



Understanding the UL Fire Resistance Directories 101

Thad Goodman
thad@nationalgypsum.com
614-214-5666
@GoodmanThad

NATIONAL GYPSUM COMPANY CONTINUING EDUCATION BUILDING KNOWLEDGE TOGETHER

AIA Continuing Education Provider

1

NATIONAL GYPSUM COMPANY CONTINUING EDUCATION BUILDING KNOWLEDGE TOGETHER

2

UL Fire Resistance Directories

All volumes available on the UL website:

- http://www.ul.com/
- UL permits the reproduction of the material contained in the Online Certification Directory subject to the following conditions:
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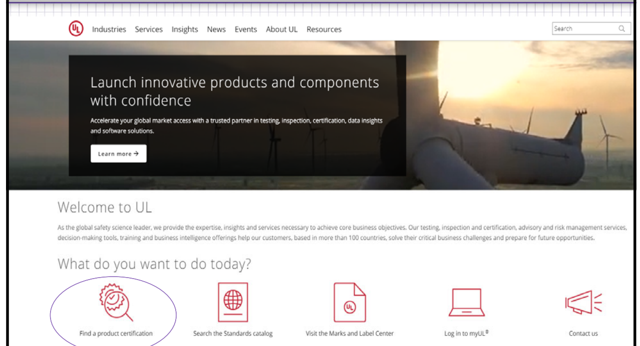

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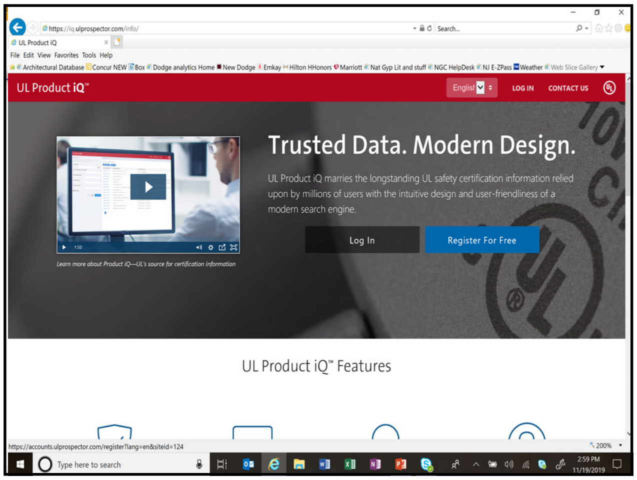
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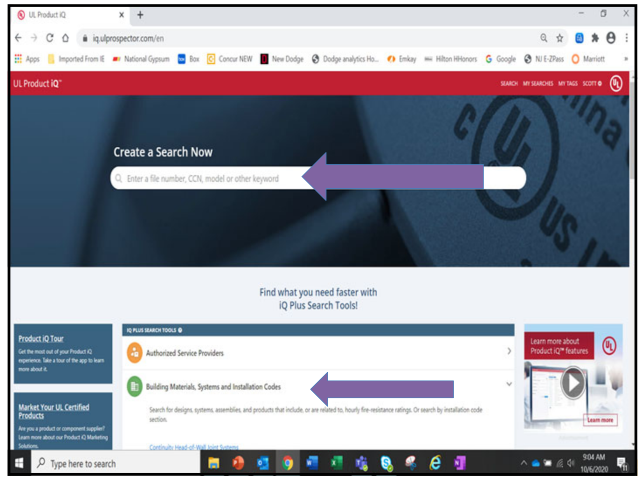
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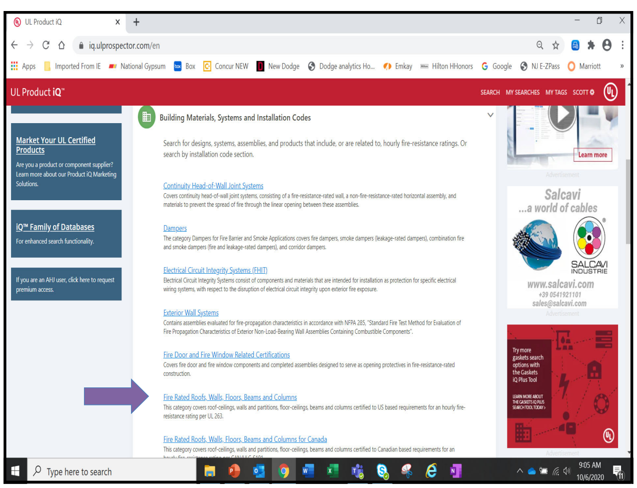
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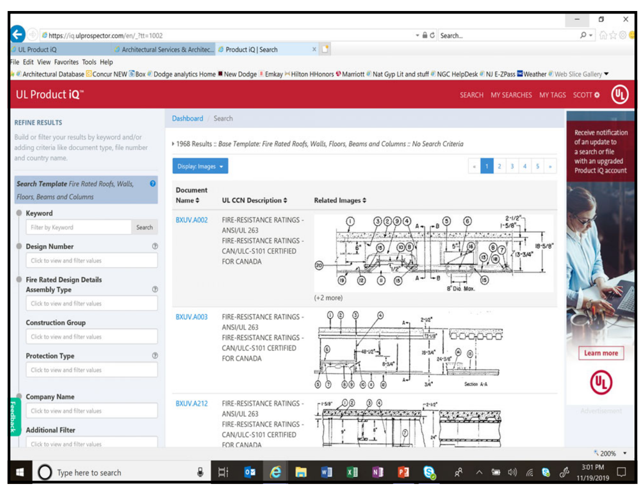
Fire Rated Roofs, Walls, Floors, Beams and Columns
Fire Rated Roofs, Walls, Floors, Beams and Columns for Canada
Salcavi
...a world of cables

7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REFINE RESULTS
1968 Results : Base Template: Fire Rated Roofs, Walls, Floors, Beams and Columns : No Search Criteria
Document Name
UL CCN Description
Related Images
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BXUV.A003
BXUV.A212
FIRE-RESISTANCE RATINGS - ANSI/UL 263
FIRE-RESISTANCE RATINGS - CAN/ULC-S101 CERTIFIED FOR CANADA

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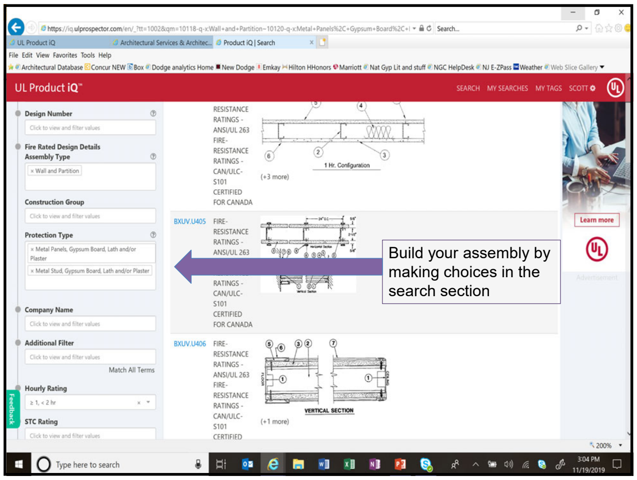
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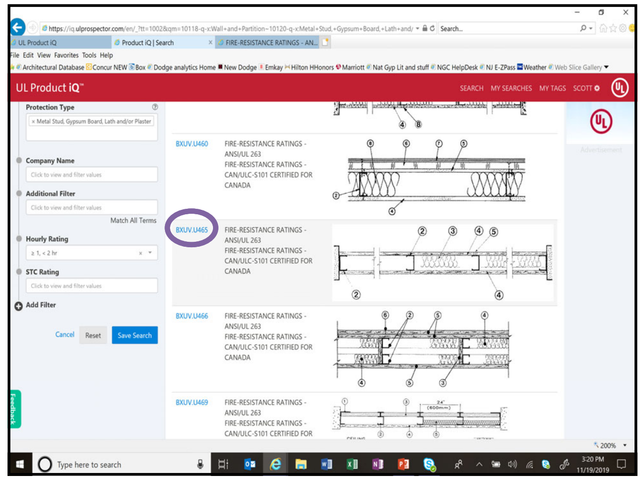
Build your assembly by making choices in the search section

9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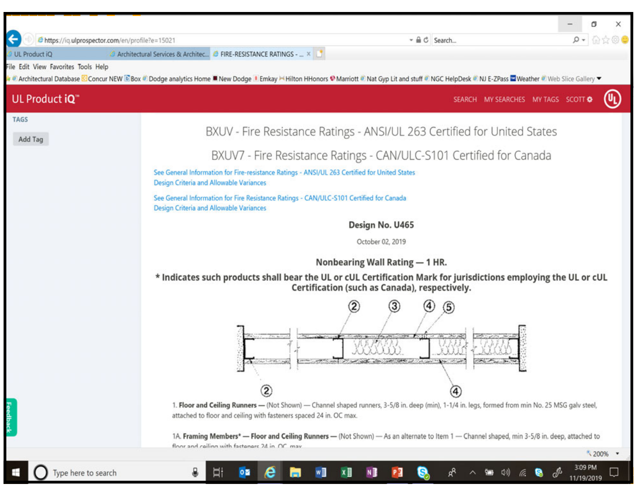
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BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States
BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada
Design No. U465
Nonbearing Wall Rating — 1 HR.

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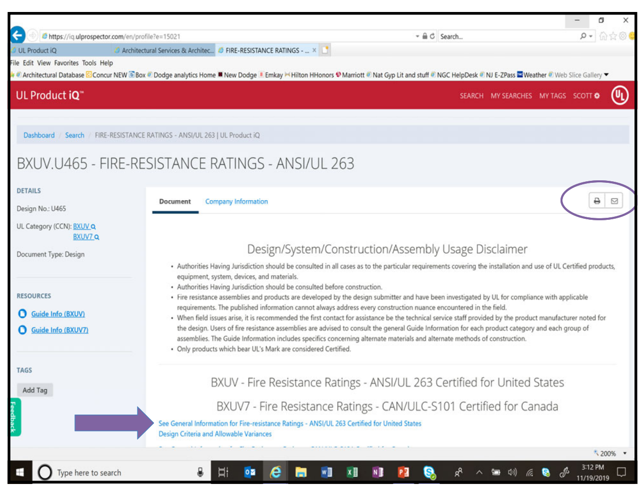
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BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

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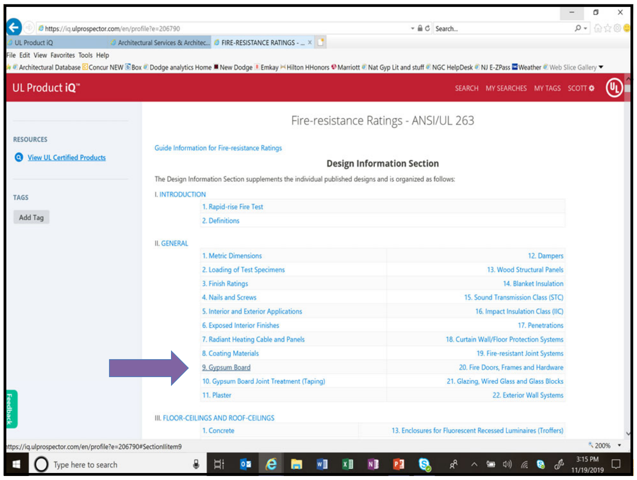

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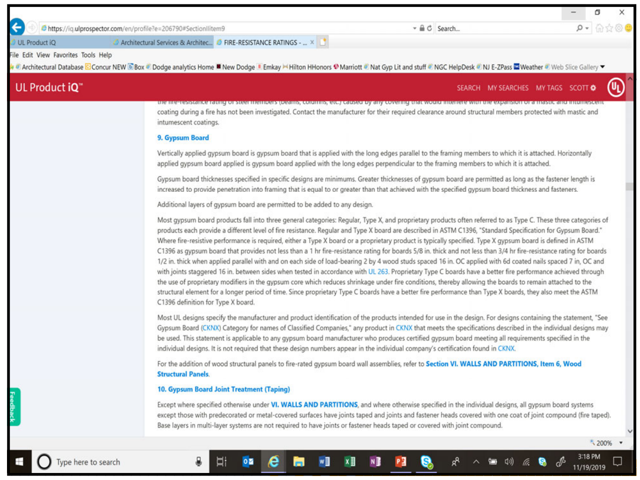
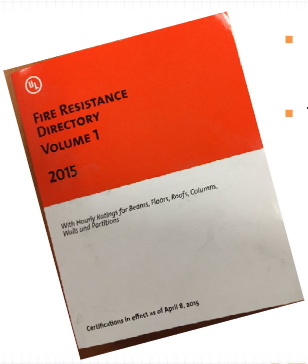


14

Volume 1



- First 10 pages (most important)
- Table on page 1

15

Important Key Passages

- Nails vs. screws
- Gypsum board orientation
- Gypsum board joint treatment (fire taping)
- Blanket insulation
- Wall and Partition Assemblies

16

Pg 5 - Nails vs. screws

- Screws meeting ASTM C1002 or ASTM C954 may be substituted for nails, one for one, when the head diameter, length, and spacing equal or exceed the requirements for the specified nails.

17

Pg 7 - Gypsum board orientation

- Vertically applied gypsum board is gypsum board that is applied with the long edges parallel to the framing members to which it is attached.
- Horizontally applied gypsum board applied is gypsum board applied with the long edges perpendicular to the framing members to which it is attached.

18

Pg 7 - Gypsum board joint treatment (fire taping)

- Unless otherwise specified in the specific design all gypsum board systems except those with predecorated or metal covered surfaces have joints taped and joints and fastener heads covered with one coat of joint compound (fire taped).

- Base layers in multi layer systems are not required to have joints or fastener heads taped or covered with joint compound.

19

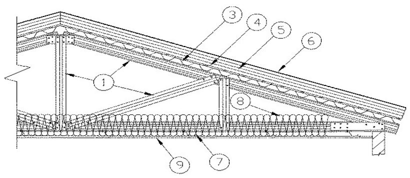
Pg 7 - Gypsum board

- Gypsum board thicknesses specified in specific designs are minimums. Greater thicknesses of gypsum board are permitted.
- Additional layers of gypsum board are permitted to be added to any design.

20

Pg 15 - Blanket Insulation

Unless specifically described in a design, the addition of insulation in the concealed space between the ceiling membrane and the floor or roof structure may reduce the hourly rating of an assembly by causing premature disruption of the ceiling membrane and/or higher temperatures on structural components under fire exposure conditions.

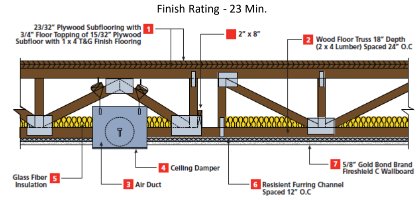


21

UL Design No. L558

Unrestrained Assembly Rating - 1 HR.

Finish Rating - 23 Min.



1. Floor System
2. Trusses
3. Air Duct
4. Ceiling Damper
5. Glass Fiber Insulation
6. Furring Channels
7. Gypsum Board

22

Floor/Ceiling Assembly

23

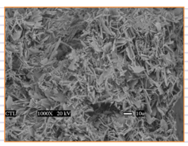
Wall and Partition Assemblies

- The size of studs are minimum unless otherwise stated in a Design.
- The spacing of studs is a maximum unless otherwise stated in a Design.
- Spacing between parallel rows of studs are minimums unless otherwise stated in the individual designs.

24

Fire Resistive Properties of Gypsum

- Gypsum is approximately 21% by weight chemically combined water
- A 5/8" Type X 4'x12' board = 22lbs of water
- This greatly contributes to its effectiveness as a fire resistive barrier



$CaSO_4 \cdot 2H_2O$

25

Pg 19 - Wall and Partition Assemblies

- The ratings for walls and partitions apply when either face of the assembly is exposed to the fire unless indicated otherwise on a specific Design...
- The hourly rating of a load bearing assembly also applies to the same assembly when it is used as a non-load bearing assembly.

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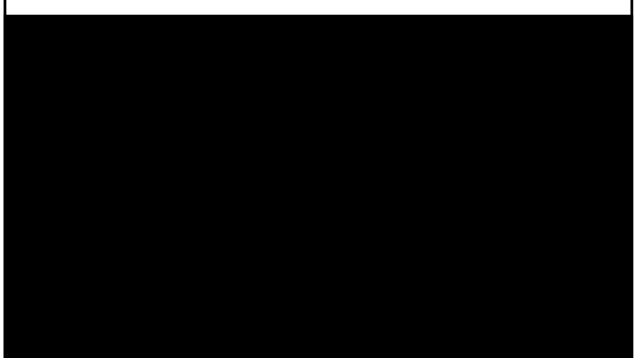
Fire Resistive Properties of Gypsum



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The Purple Book II

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GN Series - General Information

SS Series - Steel Stud Partitions 09 29 00

SW Series - Shaftwall Assemblies 09 21 16.23

ST Series - Stair Shaftwall Details

EV Series - Elevator Shaftwall Details

SR Series - Shaftwall Repair Details

HM Series - Rated Horizontal Membranes

CR Series - Rated Corridor Assemblies

FC Series - Floor-Ceiling Assemblies

CL Series - Steel Column Assemblies

BM Series - Rated Steel Beam Assemblies

PN Series - Penetrations Through Rated Wall and Floor Assemblies

SN Series - Sound Transmission Class (STC) of Rated Partitions

RE Series - Repair Details

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CLASSIFIED c UL US

GYPSUM BOARD R3501 ISSUE NO. D-3850
5/8" (24 OR 45 TO 54 IN. WIDE) TYPE FSW
FIRE RESISTANCE CLASSIFICATION
SEE UL FIRE RESISTANCE DIRECTORY

Made in the USA
NGC 24 14:20
03/04/13

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Purple Book II - ASTM Standards

ASTM Product Standards	
C475	Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
C1177	Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
C1178	Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel
C1325	Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units
C1396	Standard Specification for Gypsum Board
C1658	Standard Specification for Glass Mat Gypsum Panels
ASTM Test Standards	
C473	Standard Test Methods for Physical testing of Gypsum Panel Products
C474	Standard Test Methods for Joint Treatment Materials for Gypsum Board Construction
C1629	Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels
D3273	Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
E84	Standard Test Method for Surface Burning Characteristics of Building Materials
E90	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
E96	Standard Test Methods for Water Vapor Transmission of Materials
E119 (UL 263)	Standard Test Methods for Fire Tests of Building Construction and Materials
E136	Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
G21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
ASTM Application Standards	
C840	Standard Specification for Application and Finishing of Gypsum Board
C1280	Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing

Gypsum Association Standards	
GA-214	Recommended Levels of Gypsum Board Finish
GA-216	Application and Finishing of Gypsum Panel Products
GA-253	Application of Gypsum Sheathing

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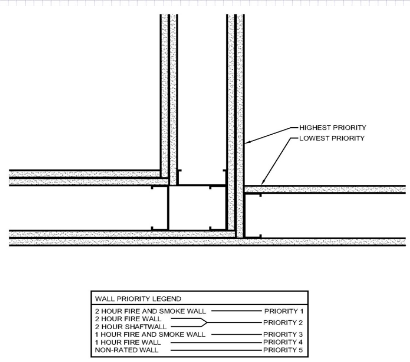
Purple Book II – Wall Priority Legend



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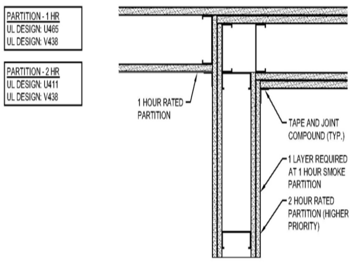
Purple Book II – Wall Priority



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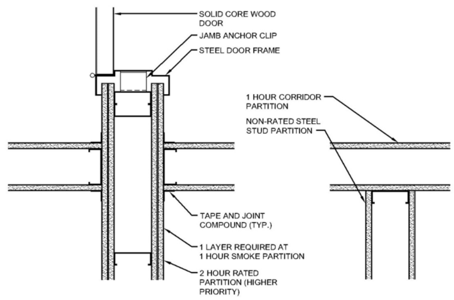
Purple Book II – Wall Priority



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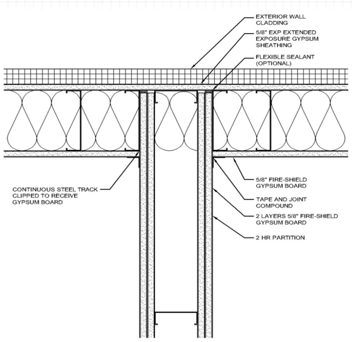
Purple Book II – Exterior Wall Priority



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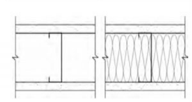
GA-600 2015

GA FILE NO. WP 1078	PROPRIETARY*	1 HOUR FIRE	45 to 49 STC SOUND

GYPSUM WALLBOARD, STEEL STUDS

One layer 5/8" proprietary type X gypsum wallboard applied parallel to each side of 3-5/8", 18 mil (25 ga.), steel studs 24" o.c. with 1" Type S drywall screws 8" o.c. at vertical joints and 12" o.c. at floor runners and intermediate studs.

Horizontal edge and butt joints on opposite sides of studs need not be staggered. Sound tested with 3" glass fiber insulation friction fit in stud space. **(NLB)**



PROPRIETARY GYPSUM BOARD

National Gypsum Company .... 5/8" Gold Bond® Brand FIRE-SHIELD® Gypsum Board

Thickness: 4-7/8"
Approx. Weight: 6 psf
Fire Test: UL R3501, 08NK09662 6-19-08, UL Design V438
Sound Test: NGC 2386, 8-4-70

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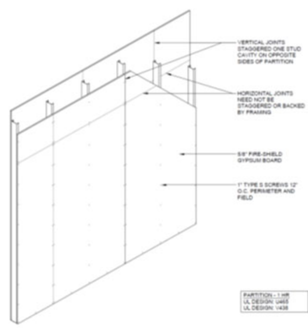
Purple Book II



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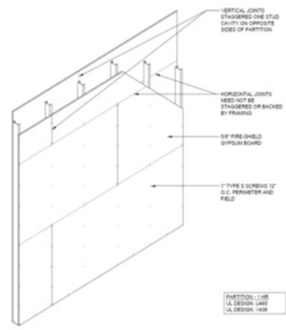
Purple Book II



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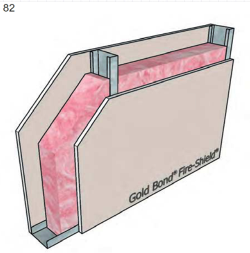
The SoundBook 2.0

Figure 82



STC-47 **NGC 2016104**

Framing: 3-5/8" steel studs, 25 gauge (18 mil), 24" o.c.
Insulation: 3-1/2" glass fiber
Side 1: 5/8" Fire-Shield Gypsum Board
Side 2: 5/8" Fire-Shield Gypsum Board

UL Design: V438, U465 - 1 hour

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GA-600 2015

GA FILE NO. WP 1049	PROPRIETARY*	1 HOUR FIRE	50 to 54 STC SOUND

GYPSUM WALLBOARD, PROPRIETARY STEEL STUDS

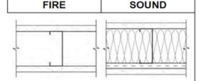
One layer 5/8" proprietary type X gypsum wallboard applied parallel to each side of 3-5/8" proprietary steel studs 24" o.c. with 1-1/4" Type S drywall screws 8" o.c. at vertical joints and wall perimeter and 12" o.c. at intermediate studs.

Joints staggered 24" on opposite sides.

Sound tested with resilient channels 24" o.c. and 3-5/8" glass fiber insulation friction fit in stud space. **(NLB)**

PROPRIETARY GYPSUM BOARD

National Gypsum Company ....5/8" Gold Bond® Brand FIRE-SHIELD® Gypsum Board



Thickness: 4-7/8" (Fire)
5-3/8" (Sound)
Approx. Weight: 6 psf
Fire Test: UL R3501, 06NK12955, 7-18-06, UL Design V450
Sound Test: RAL TL05-080, 4-13-05

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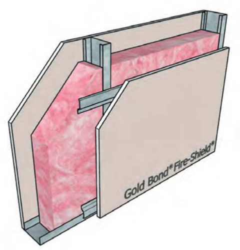
The SoundBook 2.0

Figure 87



STC-53	NGC 2017102
Framing:	3-5/8" steel studs, 25 gauge (15 mil), 24" o.c.
Insulation:	3-1/2" glass fiber
Side 1:	5/8" Fire-Shield Gypsum Board
Side 2:	5/8" Fire-Shield Gypsum Board on RC-1

UL Design: V438, U465 - 1 hour

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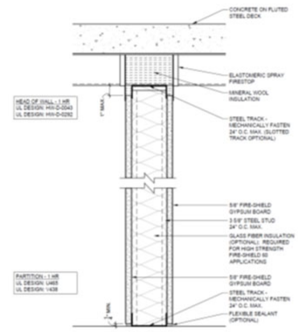
Purple Book II



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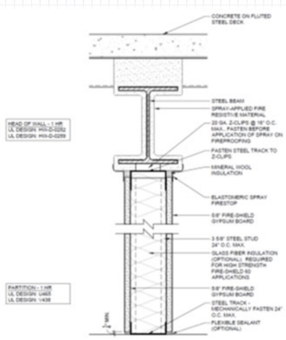
Purple Book II



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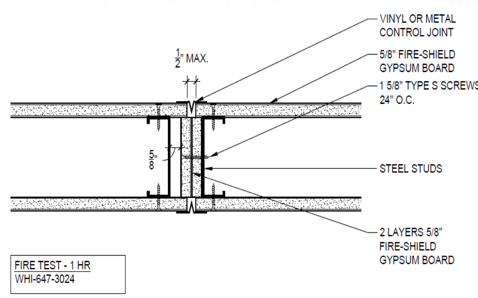
Purple Book II – Fire Rated Control Joint



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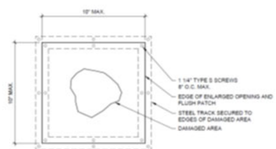
Purple Book II – GA-225



FLUSH PATCH IN RATED PARTITION
FOR MEMBRANE PENETRATIONS LESS THAN 10" IN DIAMETER

NOTES:
FOR MULTIPLE LAYER SYSTEMS STAGGER VERTICAL AND HORIZONTAL PATCH JOINTS 12" MINIMUM AND FASTEN VERTICAL EDGES TO STUD FRAMING

FOR MINOR SURFACE ABRASIONS, PAPER TEARS, OR SMALL DENTS, REMOVE ALL LOOSE PAPER AND APPLY SETTING COMPOUND OVER THE DAMAGED AREA.

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GA-600 2015

GA FILE NO. WP 1451	PROPRIETARY*	2 HOUR FIRE	60 to 64 STC SOUND

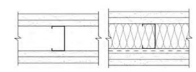
GYPSUM WALLBOARD, STEEL STUDS

Base layer 5/8" proprietary type X gypsum wallboard applied parallel or at right angles to each side of 2-1/2" proprietary steel studs 24" o.c. with 1" Type S drywall screws 24" o.c. **Face** layer 5/8" type X gypsum wallboard applied parallel or at right angles to each side with 1-5/8" Type S drywall screws 16" o.c. Face layer horizontal joints offset 12" from base layer horizontal joints. When face layer is applied at right angles to framing locate first screw 1-1/4" from board edge and locate second screw 8" from board edge.

Sound tested with resilient channels 24" o.c. and glass fiber insulation, 3-5/8", in stud cavity. **(NLB)**

PROPRIETARY GYPSUM BOARD

National Gypsum Company.......5/8" Gold Bond® Brand FIRE-SHIELD® Gypsum Board



Thickness: 5" (Fire)
5-1/2" (Sound)
Approx. Weight: 9 psf
Fire Test: UL R3501, 07NK12306, 8-24-07, UL Design V450
Sound Test: RAL TL05-081, 4-14-05

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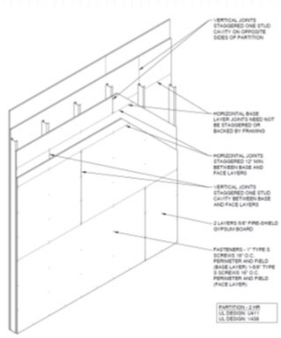
Purple Book II



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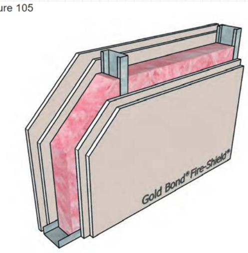
The SoundBook 2.0

Figure 105



STC-56 **NGC 2018112**

Framing: 3-5/8" steel studs, 25 gauge (18 mil), 24" o.c.
Insulation: 3 1/2" glass fiber
Side 1: 2 layers 5/8" Fire-Shield Gypsum Board
Side 2: 2 layers 5/8" Fire-Shield Gypsum Board

UL Design: V438, U411 - 2 hour

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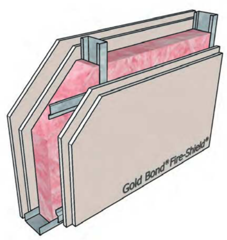
The SoundBook 2.0

Figure 111



STC-61 **NGC 2017103**

Framing: 3-5/8" steel studs, 25 gauge (15 mil), 24" o.c.
Insulation: 3-1/2" glass fiber
Side 1: 2 layers 5/8" Fire-Shield Gypsum Board
Side 2: 2 layers 5/8" Fire-Shield Gypsum Board on RC-1

UL Design: V438, U411 - 2 hour

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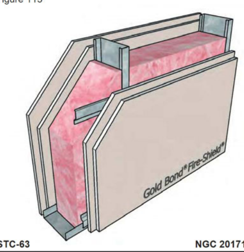
The SoundBook 2.0

Figure 113



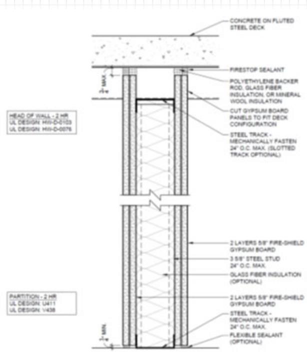
STC-63 **NGC 2017118**

Framing: 6" steel studs, 25 gauge (15 mil), 24" o.c.
Insulation: 6" glass fiber
Side 1: 2 layers 5/8" Fire-Shield Gypsum Board
Side 2: 2 layers 5/8" Fire-Shield Gypsum Board on RC-1

UL Design: V438, U411 - 2 hour

50

Purple Book II



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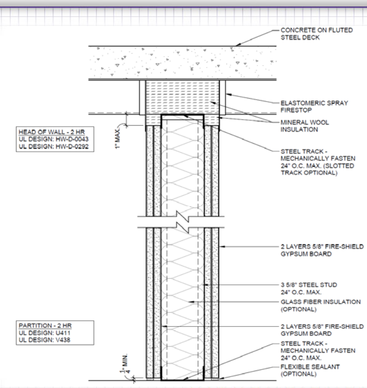
Purple Book II



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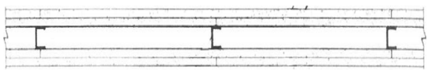
2-Hour Load-Bearing Steel Stud Partition



Base layer 5/8″ proprietary type X gypsum board applied parallel or right angles to each side of 3-1/2″, 33 mil steel studs 24″ o.c. with 1″ long Type S-12 screws 16″ o.c. **Face** layer 5/8″ proprietary type X gypsum board applied parallel or right angles to studs with 1-5/8″ long Type S-12 screws 16″ o.c.

Vertical joints centered over studs and staggered one stud cavity on opposite sides and adjacent layers. Horizontal edge joints and horizontal butt joints on opposite sides and in adjacent layers need not be staggered or backed. **(LOAD-BEARING)**

National Gypsum Company
– 5/8″ Gold Bond® Fire-Shield® Gypsum Board

UL Design W469

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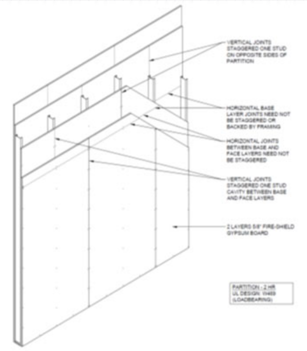
Purple Book II



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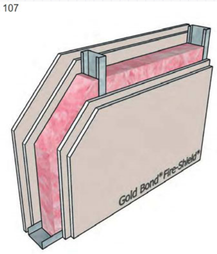
The SoundBook 2.0

Figure 107



STC-50	NGC 2017041
Framing:	3-1/2" steel studs, 20 gauge (33 mil), 24" o.c.
Insulation:	3" glass fiber
Side 1:	2 layers 5/8" Fire-Shield Gypsum Board
Side 2:	2 layers 5/8" Fire-Shield Gypsum Board

UL Design: V438, U411, W469 - 2 hour

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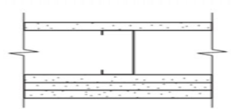
2-Hour Unbalanced Steel Stud Partition



Base layer 5/8″ proprietary type X gypsum wallboard applied parallel to each side of 3-5/8″, 18 mil steel studs 24″ o.c. with 1-1/8″ Type S screws 8″ o.c. at vertical joints and wall perimeter and 12″ o.c. at intermediate studs. **Second** layer 5/8″ proprietary type X gypsum wallboard applied parallel to studs with 1-5/8″ Type S screws 12″ o.c. **Face** layer 5/8″ proprietary type X gypsum wallboard applied over second layer and parallel to studs with 2-1/4″ Type S screws 8″ o.c. at vertical joints and wall perimeter and 12″ o.c. at intermediate studs.

National Gypsum Company
– 5/8″ Gold Bond® Fire-Shield® Gypsum Board

UL Design V449

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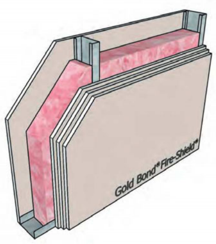
The SoundBook 2.0

Figure 104



STC-52 **NGC 2016024**

Framing: 3-5/8" steel studs, 25 gauge (18 mil), 24" o.c.
Insulation: 3" glass fiber
Side 1: 5/8" Fire-Shield Gypsum Board
Side 2: 3 layers 5/8" Fire-Shield Gypsum Board

UL Design: V449 - 2 hour

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GA-600 2015

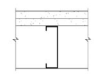
GA FILE NO. WP 1419	PROPRIETARY*	1 HOUR FIRE

GYPSUM WALLBOARD, STEEL STUDS

Base layer 5/8" proprietary type X gypsum wallboard applied parallel to ONE SIDE of 3-5/8", 18 mil (25 ga.), steel studs 24" o.c. with 1" Type S drywall screws 24" o.c. Laminating compound applied to surface of base layer with a 1/4" x 1/4" notched trowel. **Face** layer 5/8" proprietary type X gypsum wallboard applied parallel to studs with 1-5/8" Type S drywall screws 12" o.c., starting with a 6" offset from the bottom of the gypsum board.

As an alternate to laminating compound, a **third** (middle) layer of 5/8" proprietary type X gypsum wallboard applied parallel to studs with 1-5/8" Type S drywall screws 24" o.c. and **face** layer applied as described above with 2-1/4" Type S screws.

Vertical joints staggered 24" between layers. **(NLB)**



Thickness: 5 to 5-1/2"
Approx. Weight: 5 to 7 psf
Fire Test: UL R3501, 09NK18004, 4-20-10, UL Design V497

PROPRIETARY GYPSUM BOARD

National Gypsum Company .... 5/8" Gold Bond® Brand FIRE-SHIELD® Gypsum Board

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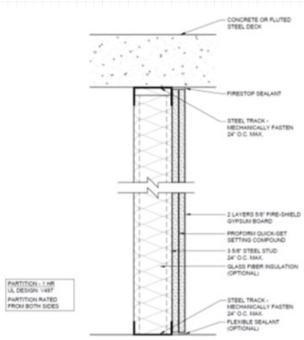
Purple Book II



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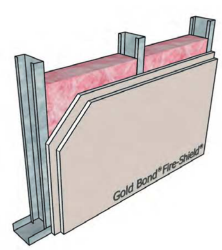
The SoundBook 2.0

Figure 3



STC-38 **NGC 2013013**

Framing: 3-5/8" steel studs, 20 gauge (20 mil), 16" o.c.
Insulation: 3-1/2" glass fiber
Side 1: None
Side 2: 2 layers 5/8" Fire-Shield Gypsum Board

UL Design: V497 - 1 hour

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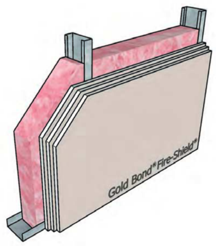
The SoundBook 2.0

Figure 77



STC-42	NGC 2018048
Framing:	3-5/8" steel studs, 20 gauge (19 mil), 24" o.c.
Insulation:	3-1/2" glass fiber
Side 1:	None
Side 2:	3 layers 5/8" Fire-Shield Gypsum Board

UL Design: V497 - 1 hour

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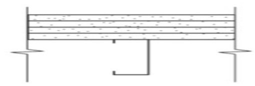
2-Hour Unbalanced Steel Stud Partition



Base layer 5/8″ proprietary type X gypsum board applied parallel or at right angles to one side of a 3-5/8″, 15 mil steel studs 24″ o.c. with 1″ Type S screws 24″ o.c. **Second** layer 5/8″ proprietary type X gypsum board applied parallel or at right angles with 1-5/8″ Type S screws 24″ o.c. **Third** layer 5/8″ proprietary type X gypsum board applied parallel or at right angles with 2-1/2″ Type S screws 16″ o.c. **Face** layer 5/8″ proprietary type X gypsum board applied parallel or at right angles with 3″ Type S screws 12″ o.c.

Vertical joints offset 24″ between layers; horizontal joints offset minimum 12″ between layers. **(NLB)**

National Gypsum Company
– 5/8″ Gold Bond® Fire-Shield® Gypsum Board

UL Design V497

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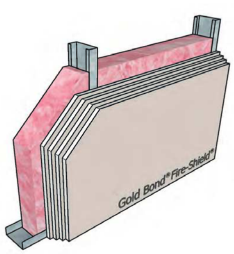
The SoundBook 2.0

Figure 79



STC-44	NGC 2018047
Framing:	3-5/8" steel studs, 20 gauge (19 mil), 24" o.c.
Insulation:	3-1/2" glass fiber
Side 1:	None
Side 2:	4 layers 5/8" Fire-Shield Gypsum Board

UL Design: V497 - 2 hour

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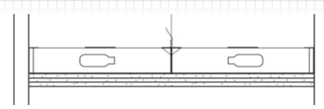
1-Hour Horizontal Membrane – Steel Stud



Perimeter channels 3-5/8″, 33 mil with 1-1/4″ legs attached to side walls 24″ o.c. Steel studs, 3-5/8″, 33 mil attached to top and bottom of perimeter channel with 3/8″ pan head screws, and spaced 16″ o.c. Flat strap 4″, 33 mil secured to top of studs at centerline of span with one 3/8″ pan head screw. **Base** layer 5/8″ proprietary type X gypsum board applied at right angles to framing with 1″ Type S screws 16″ o.c. **Second** layer 5/8″ proprietary type X gypsum board applied at right angles to framing with 1-5/8″ Type S screws 16″ o.c. **Face** layer 5/8″ proprietary type X gypsum board applied at right angles to framing with 2-1/4″ Type S screws 12″ o.c. Maximum span 8′-1″.

National Gypsum Company
– 5/8″ Gold Bond® Fire-Shield® Gypsum Board

UL Design I504

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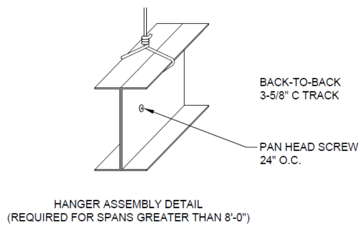
1-Hour Horizontal Membrane - Framing Splice



UL Design I504

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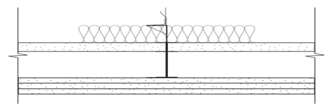
2-Hour Horizontal Membrane – Shaftwall



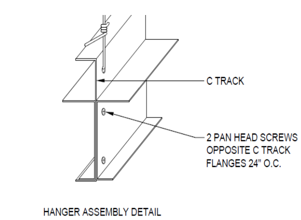
Perimeter J-Track 4″, 33 mil attached to side walls 24″ o.c. **One** layer 1″ × 24″ proprietary type X panels inserted between steel C-T studs, 4″, 33 mil and each corner secured to J-Track with 1-5/8″ Type S screws, studs attached to top and bottom of perimeter J-Track with 1/2″ pan head screws, and spaced 24″ o.c. **Base** layer 5/8″ proprietary type X gypsum board applied at right angles to framing with 1″ Type S screws 12″ o.c. **Second** layer 5/8″ proprietary type X gypsum board applied at right angles to framing with 1-5/8″ Type S screws 12″ o.c. **Face** layer 5/8″ proprietary type X gypsum board applied at right angles to framing with 2-1/4″ Type S screws 12″ o.c. Maximum span 8′- 0″.

National Gypsum Company
- 1″ Gold Bond® Shaftliner XP®
- 5/8″ Gold Bond® Fire-Shield C™ Gypsum Board

UL Design I516

66

2-Hour Horizontal Membrane – Framing Splice



UL Design I516

67

2-Hour Horizontal Membrane - Suspended Grid

Drywall suspension framing system consisting of main runners and cross-tee framing members supported by No. 12 SWG galvanized steel wire with attachment points 24″ o.c. along main runners, and steel wall angles or channels at the perimeter. **Base** layer 5/8″ proprietary type X gypsum board applied at right angles to cross-tees with 1-1/4″ Type S screws 12″ o.c. **Second** layer 5/8″ proprietary type X gypsum board applied at right angles to cross-tees with 2″ Type S screws 12″ o.c., with adjacent butt joints staggered 16″ and centered over cross-tees. **Third** layer of 5/8″ proprietary type X gypsum board applied at right angles to cross-tees with 2-1/2″ Type S screws 12″ o.c., with adjacent butt joints staggered 16″ and centered over cross-tees. Resilient channels spaced 16″ o.c. and attached perpendicular to framing with 2-1/4″ Type S screws. **Face** layer of 5/8″ proprietary type X gypsum board applied at right angles to the resilient channels with 1″ Type S screws 12″ o.c.

National Gypsum Company
- 5/8″ Gold Bond® Fire-Shield® Gypsum Board

UL Design I512

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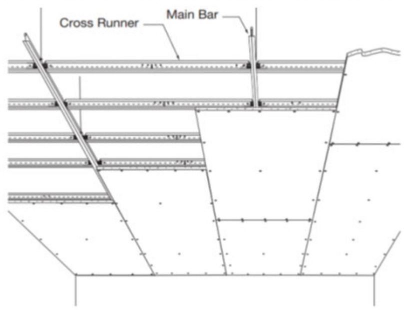
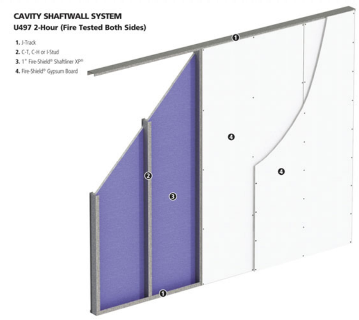
Drywall Suspension System



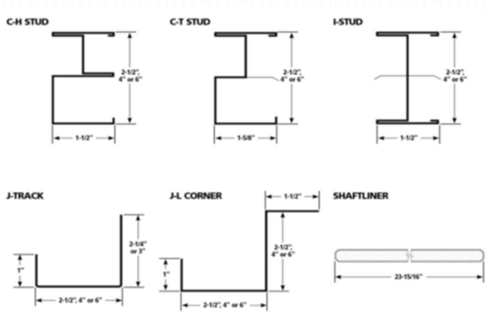
69

2-Hour Shaftwall System



70

Shaftwall Framing Components



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GA-600 2015

GA FILE NO. WP 7060	PROPRIETARY*	2 HOUR FIRE	50 to 54 STC SOUND

GYPSUM WALLBOARD, STEEL C-H, C-T, OR I STUDS

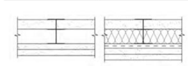
One layer 1" x 24" proprietary type X gypsum panels inserted between 2-1/2" floor and ceiling runners with tab-flange section of 2-1/2" steel C-H, C-T, or I studs between panels.

OPPOSITE SIDE: **Base** layer 5/8" proprietary type X gypsum wallboard or gypsum veneer base applied parallel to studs with 1" Type S drywall screws 24" o.c. **Face** layer 5/8" proprietary type X gypsum wallboard or gypsum veneer base applied parallel to studs with 1-5/8" Type S drywall screws 12" o.c.

Sound tested with resilient channels 24" o.c. and 1-1/2" glass fiber insulation friction fit in stud space. **(NLB)**

PROPRIETARY GYPSUM BOARD

National Gypsum Company..... 5/8" Gold Bond® Brand FIRE-SHIELD® Gypsum Board
1" Gold Bond® Brand FIRE-SHIELD® Shaftliner



Thickness:	3-3/4" (Fire) 4-1/4" (Sound)
Approx. Weight:	9 psf
Fire Test:	UC ES-7408, 11-21-75 (Rev 6-76); UL Design U497; 13NK02062, 1-14-13, UL Design W419, System B
Sound Test:	KAL 437362, 11-3-76

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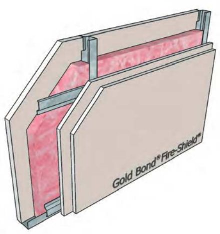
Figure 179



STC-51 **NGC 2016038**

Framing: 2-1/2" steel CT studs, 25 gauge (22 mil), 24" o.c.
Insulation: 1-1/2" glass fiber
Side 1: 1" Fire-Shield Shaftliner
Side 2: 2 layers 5/8" Fire-Shield Gypsum Board on RC-1

UL Design: U497, W419 - 2 hour

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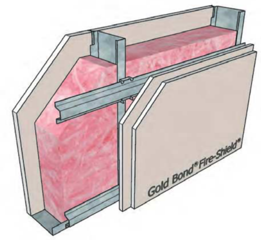
Figure 187



STC-61 **NGC 2019016**

Framing: 6" steel CT studs, 20 gauge (33 mil), 24" o.c.
Insulation: 5" glass fiber
Side 1: 1" Fire-Shield Shaftliner
Side 2: 2 layers 5/8" Fire-Shield Gypsum Board on 7/8" furring channel and resilient isolation clips
UL Design: U497, W419 - 2 hour

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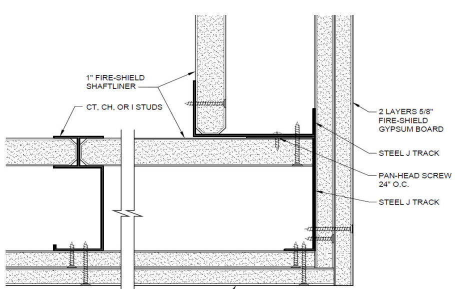
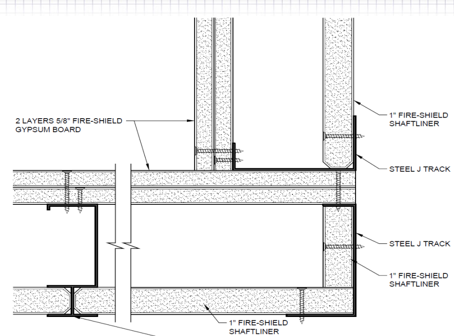
Purple Book II - Outside Shaftwall Corner



75

Purple Book II - Inside Shaftwall Corner



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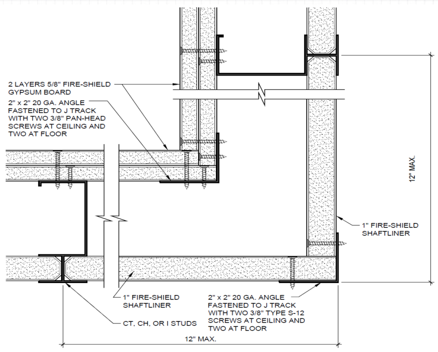
Purple Book II - Inside Shaftwall Corner



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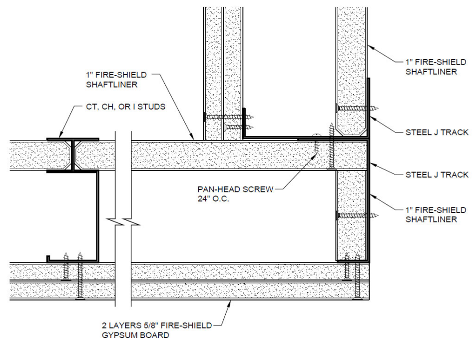
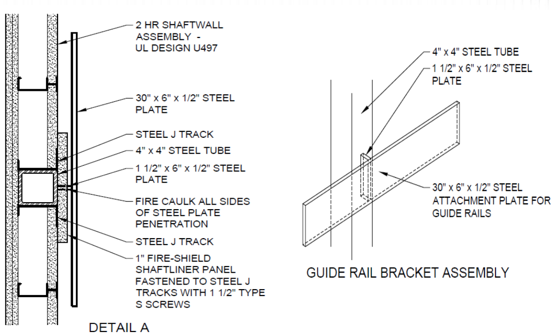
Purple Book II



78

Purple Book II



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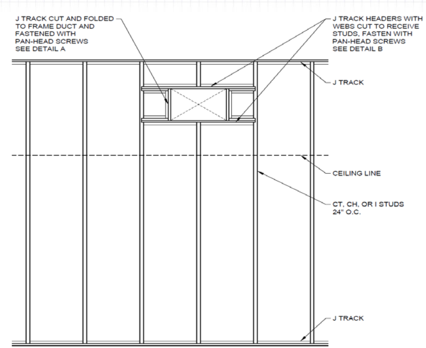
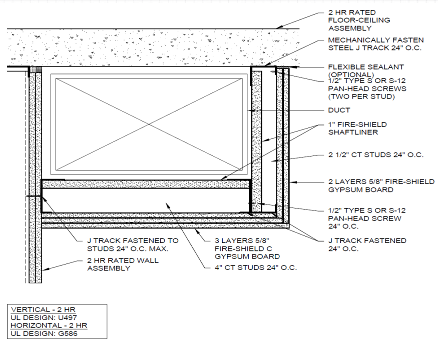
Purple Book II



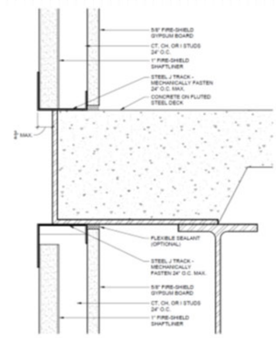
80

Purple Book II



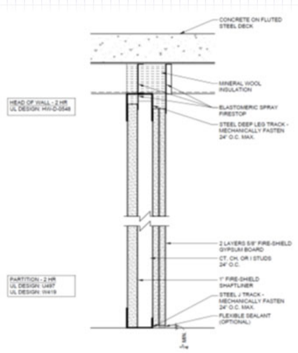
81

Purple Book II



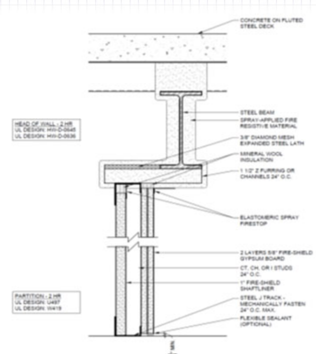
82

Purple Book II



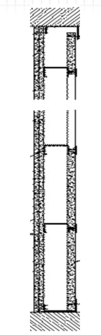
83

Purple Book II



84

2-Hour Shaftwall – Horizontal Stud Application



VERTICAL SECTION

One layer 1″ × 24″ proprietary type X gypsum board applied parallel to 4″, 33 mil steel C-H or C-T studs spaced vertically 24″ o.c. Steel C-H or C-T studs oriented horizontally and supported by vertical J track at each end and screw attached with 1/2″ long pan head screws. Free edge of board attached to the long leg of the top and bottom J Track with 1-5/8″ long Type S screws 12″ o.c. Wall width is limited by the length of the gypsum board.

OPPOSITE SIDE: **Base** layer 5/8″ proprietary type X gypsum board applied vertically and attached to stud and vertical and horizontal J track with 1″ long Type S screws spaced 16″ o.c. **Face** layer 5/8″ proprietary type X gypsum board applied vertically and attached to studs and vertical and horizontal J track with 1-5/8″ long Type S screws spaced 8″ o.c.

Vertical face layer joints offset 12″ from base layer joints. **(NLB)**

National Gypsum Company
- 5/8″ Gold Bond® Fire-Shield® Gypsum Board
- 1″ Gold Bond® Shaftliner XP® Gypsum Board

UL Design W474

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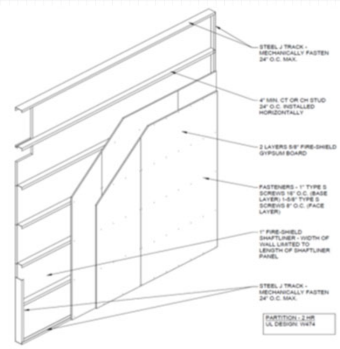
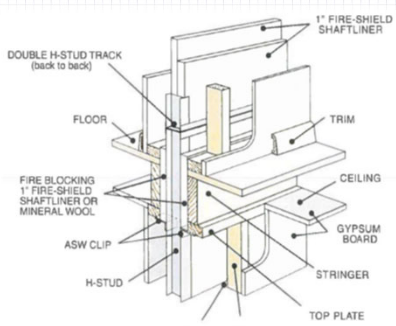
2-Hour shaftwall – Horizontal Stud Application



86

2-Hour Area Separation Wall – Floor Juncture



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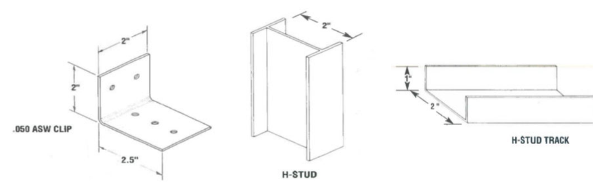
Area Separation Wall – Framing Components



88

Area Separation Wall - Fasteners

89

GA-600 2015 - 2-Hour Area Separation Wall

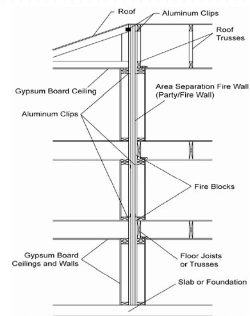


Figure 3
Typical Gypsum Board Area
Separation Fire Wall Construction

90

GA-600 2015

GA FILE NO. ASW 0981	PROPRIETARY*	2 HOUR FIRE	60 to 64 STC SOUND

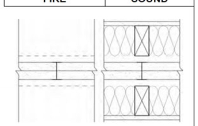
GYPSUM WALLBOARD, STEEL H STUDS

Two layers 1" x 24" proprietary type X gypsum panels inserted between 2" floor and ceiling runners with 2" steel H studs between adjacent pairs of gypsum panels. **(NLB)**

A 3/4" minimum air space must be maintained between steel components and adjacent framing (indicated by dashed lines in sketch). As an alternate, the steel components may be covered with 6" wide battens or full sheets of 1/2" type X gypsum wallboard.

Sound tested with 2 x 4 stud wall faced with 1/2" regular gypsum wallboard each side of assembly and 3-1/2" glass fiber in stud space on both sides.

Height limitation 66 feet.



PROPRIETARY GYPSUM PANEL PRODUCTS

National Gypsum Company .... 1" Gold Bond® Brand eXP® Extended Exposure FIRE SHIELD® Shaftliner

Thickness: 3-1/2" (Fire)
11-3/4" (Sound)
Approx. Weight: 9 psf
Fire Test: UL R3501, 92NK28896, 6-7-93, UL Design U347; WHI 694-200.6, 10-21 & 24-85
Sound Test: RAL TL05-199, 11-17-05

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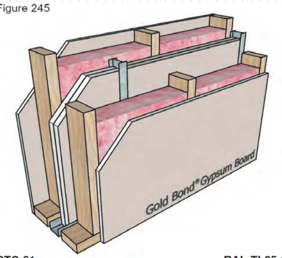
Figure 245



STC-61 **RAL-TL05-199**

Fire Wall: 2" H-studs, 24" o.c. with 2 layers 1" Fire-Shield Shaftliner between studs; 3/4" air space
Framing: 2x4 wood studs, 16" o.c. each side
Insulation: 3-1/2" glass fiber each side
Side 1: 1/2" Gold Bond Gypsum Board
Side 2: 1/2" Gold Bond Gypsum Board
UL Design: U347 - 2 hour

92

GA-600 2015

GA FILE NO. ASW 0800	PROPRIETARY*	2 HOUR FIRE	65 to 69 STC SOUND

GYPSUM PANEL PRODUCTS, STEEL H STUDS

Two layers 1" x 24" proprietary type X gypsum panels inserted between 2" floor and ceiling runners with 2" steel H studs between adjacent pairs of gypsum panels. **(NLB)**

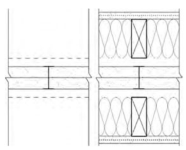
A 3/4" minimum air space must be maintained between steel components and adjacent framing (indicated by dashed lines in sketch). As an alternate, the steel components may be covered with 6" wide battens or full sheets of 1/2" type X gypsum wallboard.

Sound tested with 2 x 4 stud wall faced with 5/8" proprietary gypsum panel product each side of system and 3-1/2" glass fiber insulation in stud space.

Height limitation 66 feet.

PROPRIETARY GYPSUM PANEL PRODUCTS

National Gypsum Company .... 1" Gold Bond® Brand FIRE-SHIELD® Shaftliner
5/8" Gold Bond® Brand SoundBreak XP® Gypsum Board



Thickness: 3-1/2" (Fire)
12" (Sound)
Approx. Weight: 9 psf
Fire Test: UL R3501, 05NK28782,
4-13-06,
UL Design U347
Sound Test: NRCC B-3451.1, 10-5-06

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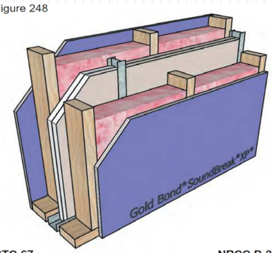
Figure 248



STC-67 **NRCC B-3451.1**

Fire Wall: 2" H-studs, 24" o.c. with 2 layers 1" Fire-Shield Shaftliner between studs; 3/4" air space
Framing: 2x4 wood studs, 16" o.c. each side
Insulation: 3-1/2" glass fiber each side
Side 1: 5/8" SoundBreak XP Wall Board
Side 2: 5/8" SoundBreak XP Wall Board
UL Design: U347 - 2 hour

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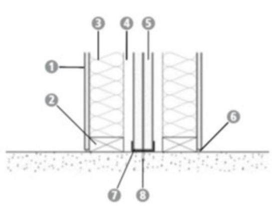
Area Separation wall – Foundation

FOUNDATION DETAIL

1. Gypsum Board
2. 2x4 Wood Plate
3. Insulation
4. Minimum 3/4" Air Space
5. 1" Fire-Shield Shaftliner
6. Sealant
7. 2" C-Track
8. Fasteners 24" o.c. Max.



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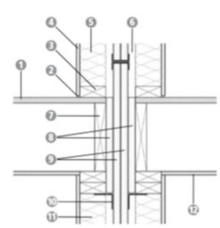
Area Separation Wall – Floor Juncture

FLOOR INTERSECTION DETAIL

1. Subfloor
2. Sealant
3. 2" Wood Plate
4. Gypsum Board
5. Insulation
6. Minimum 3/4" Air Space
7. Rim Joist
8. Gypsum Board or Mineral Wool Fire Blocking
9. 1" Fire-Shield Shaftliner
10. ASW Clip
11. 2x4 Wood Stud
12. Ceiling



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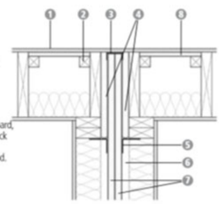
Area Separation Wall – Roof Junction

ROOF JUNCTION DETAIL

1. Roof Deck
2. 2x2 Wood Ledger
3. 2" C-Track
4. Gypsum Board or Mineral Wool Fire Blocking
5. ASW Clip
6. Minimum 3/4" Air Space
7. 1"Fire-Shield Shaftliner
8. 5/8" Fire-Shield Gypsum Board, 4' Each Side When Roof Deck is Not Constructed With Fire-Retardant Treated Wood.



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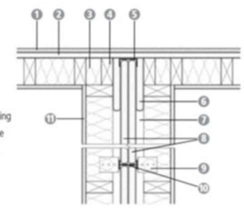
Area Separation Wall – Exterior Wall

EXTERIOR WALL JUNCTION DETAIL

1. Siding
2. 5/8" Fire-Shield Gypsum Sheathing, 4' Each Side
3. Insulation
4. 2x4 Wood Stud
5. 2" C-Track
6. Gypsum Board or Mineral Wool Fire Blocking
7. Minimum 3/4" Air Space
8. 1"Fire-Shield Shaftliner
9. ASW Clip
10. 2" H-Stud
11. Gypsum Board



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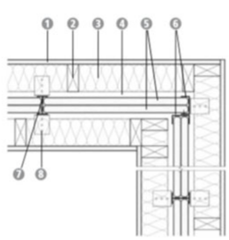
Area Separation Wall – Corner

CORNER DETAIL

1. Gypsum Board
2. 2x4 Wood Stud
3. Insulation
4. Minimum 3/4" Air Space
5. 1"Fire-Shield Shaftliner
6. 2" C-Track
7. 2" H-Stud
8. ASW Clip



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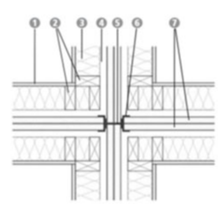
Area Separation wall – Intersection

4-WAY INTERSECTION DETAIL

1. Gypsum Board
2. 2x4 Wood Stud
3. Insulation
4. Minimum 3/4" Air Space
5. 2" H-Stud
6. 2" C-Track
7. 1"Fire-Shield Shaftliner



100

Area Separation wall – Batten Option

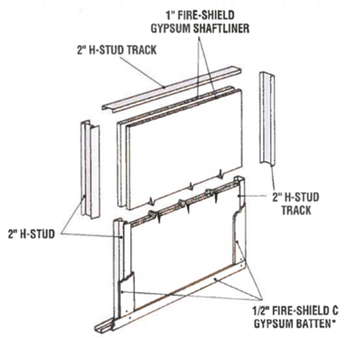


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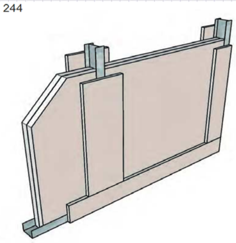
Figure 244



STC-35 **NGC 2827**

Fire Wall: 2" H-studs, 24" o.c. with 2 layers 1" Fire-Shield Shaftliner between studs
Framing: None
Insulation: None
Side 1: 6" wide 1/2" Fire-Shield C gypsum board battens
Side 2: 6" wide 1/2" Fire-Shield C gypsum board battens
UL Design: U347 - 2 hour

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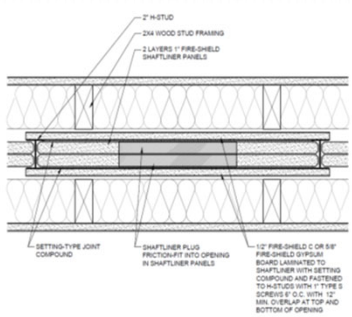
Area Separation Wall - Repair Method



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3-hour Area Separation Wall

TYPICAL FLOOR/ CEILING JUNCTURE

1. H-Stud
2. Two Layers 1" Shaftliner XP
3. 5/8" XP Fire-Shield Type C Each Side
4. Stud Framing
5. Gypsum Board
6. Double C-Track (Back to Back)
7. Bottom Plate
8. ASW Clip
9. Rim Joist
10. Top Plate
11. Subfloor

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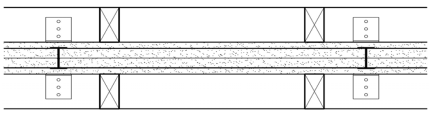
3-hour Area separation wall



Two layers 1″ × 24″ proprietary type X gypsum panels inserted between 2″ floor and ceiling runners with 2″ steel H studs between adjacent pairs of gypsum panels. **One** layer 5/8″ proprietary type X gypsum board applied parallel or at right angles to each side with 1″ Type S screws 16″ o.c. **(NLB)**

National Gypsum Company
- 1″ Gold Bond® eXP® Shaftliner
- 5/8″ Gold Bond® eXP® Interior Extreme® Fire-Shield C™ Gypsum Panels

Height limitation 70 feet.

UL Design W454

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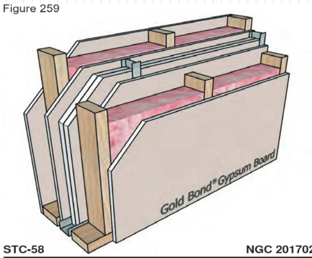
Figure 259



STC-58 **NGC 2017025**

Fire Wall:	2" H-studs, 24" o.c. with 2 layers 1" Fire-Shield Shaftliner between studs; 1 layer 5/8" Fire-Shield C Gypsum Board each side
Framing:	2x4 wood studs, 16" o.c. each side
Insulation:	3-1/2" glass fiber each side
Side 1:	1/2" Gold Bond Gypsum Board
Side 2:	1/2" Gold Bond Gypsum Board
UL Design:	W454 - 3 hour

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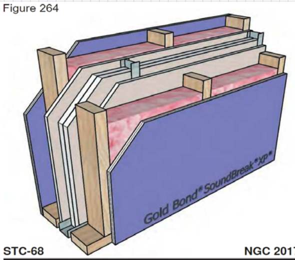
The SoundBook 2.0

Figure 264



STC-68 **NGC 2017018**

Fire Wall:	2" H-studs, 24" o.c. with 2 layers 1" Fire-Shield Shaftliner between studs; 1 layer 5/8" Fire-Shield C Gypsum Board each side
Framing:	2x4 wood studs, 16" o.c. each side
Insulation:	3-1/2" glass fiber each side
Side 1:	5/8" SoundBreak XP Wall Board
Side 2:	5/8" SoundBreak XP Wall Board
UL Design:	W454 - 3 hour

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Gold Bond® Building Products

PermaBASE® Building Products

National Gypsum®

DEXcell® Roof Board

ProForm® Finishing Products

National Gypsum Company is the exclusive service provider for products manufactured by Gold Bond Building Products, LLC, PermaBASE Building Products, LLC and ProForm Finishing Products, LLC.

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The Purple Book II

The PURPLE Book II highlights include:

- GridMarX detail
- MaX 12 detail
- New fire-rated wall and ceiling assemblies
- New corner details for steel stud partitions
- New corner details for shaftwall assemblies
- New repair details for shaft wall assemblies

<u>UPDATED</u> Fire Rated Assemblies
→ UL Designs

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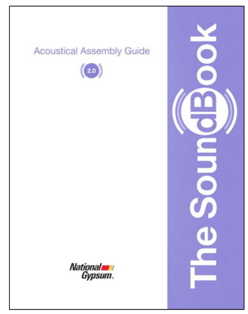
The SoundBook 2.0



The SoundBook 2.0 highlights include:

- 35-45 New Wall Assemblies Added
- Ceiling Assemblies Added
- Retrofit Assemblies Added

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1-800-NATIONAL® Construction Services Department

- Mark Chapman
- Sam Halverson
- Jim Farrell
- Monday – Friday
  - 8:00 – 4:45 EST

Thad Goodman
thad@nationalgypsum.com
614-214-5666
@GoodmanThad

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File Attachments for Item:

ER-10 Voltage Drop Prevention (Ohio Certificate Renewal)

ESI, BO, MPE, BPE, EPE, BI, FPI, NRIUI, RBO, RPE, RBI, RIUI (4 hours)

Staff Notes: 2020 NEC. Recommend approval with usual required language added.

ESIAC Recommendation: Recommend approval.

Committee Recommendation:

APPLICATION

FOR

Continuing Education Course Approval

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

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

COURSE SUBMITTER: OHIO CERTIFICATE RENEWAL (OCR)

Course Submitter: HAROLD PLANT (by MAYDA SANCHEZ SHINGLER)
(Contact Name)

Organization: OHIO CERTIFICATE RENEWAL (aka OCR)
(Organization/Company)

Address: P. O. BOX 211102
(Include Room Number, Suite, etc.)

City: COLUMBUS State: OHIO Zip: 43221-1102

E-Mail: halplant2112@outlook.com / mayda@ohiocertificate.com

Telephone: (614)451-9003 Fax: ALT MOBILE 614.395.9689

Course Sponsor: OHIO CERTIFICATE RENEWAL

COURSE INFORMATION:

Course Title: Voltage Drop Prevention (4)

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

Purpose and Objective: INSTRUCTOR (J.D. WHITE / ALT - R J SCHUTZ / ALT Sam Cronk) DIRECTED SEMINAR UTILIZING POWER POINT EITHER FROM CLASSROOM PLATFORM FOR ON-SITE PARTICIPANTS OR REMOTE INSTRUCTION VIA INTERNET E-LEARNING PLATFORM RELATING ELECTRICAL SYSTEMS DESIGN, INSTALLATION AND INSPECTION PRACTICES BY DIRECT REFERENCE TO THE LATEST EDITIONS OF THE OHIO BUILDING CODE (OBC) AND NFPA STANDARD 70 - THE NATIONAL ELECTRICAL CODE (NEC - 2020). Participants learn how to design feeders and branch circuits to minimize Voltage Drop.

Number of Instructional Contact Hours that can be obtained upon completion: 4.0

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

Program Applicable for the Following Participants:

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

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

Electrical Safety Inspectors [ ]

Location of ESI Course: OCR Classroom / Interactive Webinar Date(s) of ESI Course(s): 12/3/2021

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

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

Ohio Certificate Renewal
(614) 451-9003
Ohio Certificate Renewal
P.O. P.O. Box 211102
Columbus, Ohio 43221-1102
www.OhioCertificate.com

Ohio Certificate Renewal
"Since 1994"

Voltage Drop Prevention

Outline Presented by Ohio Certificate Renewal

Course Hours: 4.0 Four 50-minute segments / Interactive Webinar or Classroom

Course Description: A course designed to address NEC requirements regarding Voltage Drop. Covered will be Feeders and Branch Circuits designed to minimize Voltage Drop beyond an acceptable level. This course will provide the class participant with methods for the prevention of Voltage Drop. Steps required to correct Voltage Drop will be discussed.

Course Objective: Enable the participant to gain an understanding of how to design feeders and branch circuits to minimize Voltage Drop.

I.	What is Voltage Drop	7:30 AM	50 Minutes
II.	Allowable Values		
III.	Applying Standard Calculations		50 Minutes
IV.	Determining the Level of Voltage Drop		
V.	Determine Amperage Allowances		50 Minutes
VI.	Determine Conductor Size/Type Requirements		
VII.	Determine Length allowances		50 Minutes
VIII.	Q & A	11:50 AM	

JD White

6048 Astor Avenue 614-546-7884
Columbus, OH 43232 jd.white2000@gmail.com

Objective:

To provide timely and informative teaching relative to Electrical Theory/Fundamentals, Electrical Practices, and National Electric Code Compliance. Most teaching is geared for licensed contractors, architects, engineers, electrical inspectors, and electrician apprentices. I also provide Electrical Design and Drafting of small to moderate sized projects, using AutoCAD.

Teaching Experience:

06/2007 - Present
Columbus State Community College
Title: Skilled Trades Apprenticeship Supervisor
Supervisor: Doug House, 614-287-2576

06/2007 - Present
Columbus State Community College
Title: Adjunct Faculty Teaching:
Electrical Courses, National Electric Code, Employability, Construction Overview, Construction Estimating, Manual Drafting, and AutoCAD
Supervisor: Doug House, 614-287-2576

09/1999 – Present
Electrician Apprenticeship Instructor
Title: Year 1 – Year 4 Lead Instructor
OCILB Instructor, as needed
IEC Central Ohio 614-473-1050

10/2001 – Present
OCILB Instructor, 1-2 seminars per year
Ohio Contractor Training 614-203-1531

12/2008 – Present
OCILB Instructor, 4 seminars per year
Rebecca Warren Training 614-402-6551

11/2017 – Present
OCILB Instructor, 2-6 seminars per year
HalfMoon Education Services 715-835-5900

06/2020 – Present
OCILB, BBS, 8 seminars per year
Ohio Certificate Renewal 614-451-9003

JD White

6048 Astor Avenue | 614-546-7884
Columbus, OH 43232 | jd.white2000@gmail.com

Trade & Other Experience:

01/2006 – Present
Voltaire Electric Company, Inc. – Columbus, OH
Electrical System Design and Drafting
Title: Consultant 614-546-7884

10/2005 - 08/2006
MG Abbott Electric Company – Columbus, OH
Title: Commercial Electrician, Estimator, and ITS Coordinator
Supervisor: Joe Abbott-President, 614-837-3614

07/1995 - 08/2005
Just Dandy Electric Systems, Inc. – Columbus, OH
Title: Owner, Electrician, Estimator, Project Designer...

08/1989 - 07/1995
Safeway Electric Company, Inc. – Columbus, OH
Title: Commercial Electrician, Commercial Division Manager
Supervisor: Andy Untch, 614-443-7672

07/1976 - 09/1982
MG Abbott Electric Company – Columbus, OH
Title: Electrician, Field Supervisor
Supervisor: Gene Abbott-Owner

09/1982 - 08/1989
Delphos Wesleyan Church – Delphos, OH
Mansfield Wesleyan Church – Mansfield, OH
Title: Senior Pastor

07/1972 - 06/1974
US Navy – Quonset Point-RI
Title: ADJ (Aviation Machinist Mate Jet)
Supervisor: Various

JD White

6048 Astor Avenue
Columbus, OH 43232

614-546-7884
jd.white2000@gmail.com

Licensure:

Electrical
11/1990
Cities of: Columbus, Elyria, Springfield, Youngstown, Toledo, Dayton, and others
07/1992

Electrical State of Ohio
02/1996
State of Ohio #EL 14058

Fire Alarm Installer
02/2003
State of Ohio #54.25.3708

Education:

06/2005 – 05/2015
Columbus State Community College – Columbus, OH
ATS Electrical System Architecture Designer

09/1982 - 05/1987
Indiana Wesleyan University – Marion, IN
Christian Ministries & Biblical Literature

06/1981 - 05/1982
Columbus Technical Institute – Columbus, OH
General Education Studies

06/1973
GED Central High School, Columbus, OH

07/1972 - 08/1973
Naval Aviation Technical Training Center
Aviation A School Jet Engines – Memphis, TN
Naval Aviation Technical Training Center
Aviation B School Helicopters – Quonset Pt, RI
Rating: Aviation Machinist Mate Jet

References:

Joe Abbott - Previous Employer: 614-837-3614
Barb Tipton – Present Employer: 614-473-1050
Dr. Andy Rezin – Previous Supervisor: 614-551-8378
Doug House – Present Supervisor: 614-287-2576
Other References Available Upon Request

Sam Cronk

Sam Cronk has extensive knowledge and experience with the interpretation and application of the National Electrical Code. Sam has been involved in all aspects of the residential, commercial, and industrial electrical industry since 1985. His previous employment includes work as an electrical foreman, project manager, and estimator. He has held numerous certifications and licenses including electrical journeyman by the State of South Carolina, journeyman wireman with the International Brotherhood of Electrical Workers (I.B.E.W.), and electrical contractor with the State of Ohio. Sam currently holds certifications as an Electrical Safety Inspector and Electrical Plans Examiner.

Sam has instructed a variety of adult education and professional continuing education classes, including with Columbus Public Schools, NECA-IBEW Joint Apprenticeship Training Committee (J.A.T.C.), International Association of Electrical Inspectors (I.A.E.I.), and the International Code Council (I.C.C.).

Robert J. Schutz, P.E.

Robert J. Schutz, P.E. is the retired Chief Building Official of the City of Powell (OH) and is currently a Consulting Engineer serving as the contract Plans Examiner and Inspector for several municipalities in central Ohio. He is a civil engineering graduate of the Ohio Northern University with post-graduate studies at the Ohio State University and the University of Southern California.

Bob is a registered Professional Engineer and Professional Surveyor in the State of Ohio; where is also certified as a Building Official, Plans Examiner, Mechanical Inspector, Plumbing Inspector and Electrical Safety Inspector. Bob previously served as the Chief Engineer with the State of Ohio Health Department where he supervised the Plumbing Inspection program, was the Chairman of the Plumbing Advisory Board and was a member of the Ohio Board of Building Standards. Bob instructs nationally and internationally for the International Code Council (ICC), as well as for OCR on Mechanical, Fuel Gas, Plumbing and Building codes.

VOLTAGE DROP - APPLICATIONS

WHAT IT IS?

WHAT ARE THE FACTORS?

WHAT ARE THE REMEDIES?

OCR

Ohio Certificate Renewal

"Since 1994"

WHAT IT IS

- Voltage Drop is the reality of a voltage you start with, is Not the voltage you deliver to a Load
- Voltage Drop is recognized by Code, and has a Max Design allowance of 5% total including Feeder and Branch Circuit
- NEC 210.19(A) Informational Note #4
  - 3% Branch Circuit and 2% Feeders total to not exceed 5%
- NEC 215.2(1)(B) Informational Note #2
  - 2% Branch Circuit and 3% Feeders total to not exceed 5%

WHAT IT IS

- 3-5% within a Feeder and/or 3-5% within a Branch Circuit
- Motor Manufacture build in 4% with a Max Allowance of 10%
  - 120V at 4% drop = 115V and at 10% drop is 108V
  - 240V at 4% drop = 230V and at 10% drop is 216V
  - 480V at 4% drop = 460V and at 10% drop is 432V
- Most appliances have a VD tolerance of 5-10%
- Any Voltage above their listing increases the efficiency and performance.
- Heating Appliances are rated at 100% Voltage, any reduction in Voltage will result in a decrease in Wattage/BTU

WHAT IT IS

1. Voltage Drop is revealed ONLY when connected to a load
   - Open Circuits will not have any Voltage Drop – “0”
     - Reason being conductors only resist the Flow of Electrons
       - Intensity, which is the force you are placing on Electron Flow.
     - Ohms Law is the relationship of Volts, Amps, & Resistance
     - Without a Circuit under Load there is only Voltage – Zero Amps
   - When you install a Feeder or a Branch Circuit to a remote panel or piece of equipment, and test for voltage, it will be the same as the origin, until the circuit is Loaded.
       - That is Turned On

WHAT IT IS

There are Three Parts (Factors) of Voltage Drop

1. Conductor Size/Construction
   - (#12 vs. #2) and (CU vs. AL)
2. Conductor Length from origin to destination
3. Ampacity of connected Load and or Loads

WHAT IT IS

1. Every conductor or conductive material has resistance
   - Granted, it is hard to look at a 500 or 750 kcmil as a resistor
   - Chapter 9, Table 8 shows Resistance per 1,000' for CU and AL

- Every Circuit, includes a Conductor, which has a Resistive Value
  - We will focus on the C Mills Size rather than CU vs. AL Values

Chapter 9, Table 8. Conductor Properties

Size	Area	Stranding		Overall		Direct-Current Resistance at 75ºC (167ºF) Copper		Aluminum
AWG	C Mills	Qty	Diam.'	Diam.'	Area(in.2)	Uncoated (ohm/1000 ft)	Coated	(ohm/1000 ft)
14	4,110	7	0.024	0.073	0.004	3.14	3.26	5.17
12	6,530	7	0.030	0.092	0.006	1.98	2.05	3.25
10	10,380	7	0.038	0.116	0.011	1.24	1.29	2.04
8	16,510	7	0.049	0.146	0.017	0.778	0.809	1.28
6	26,240	7	0.061	0.184	0.027	0.491	0.510	0.808

WHAT IT IS

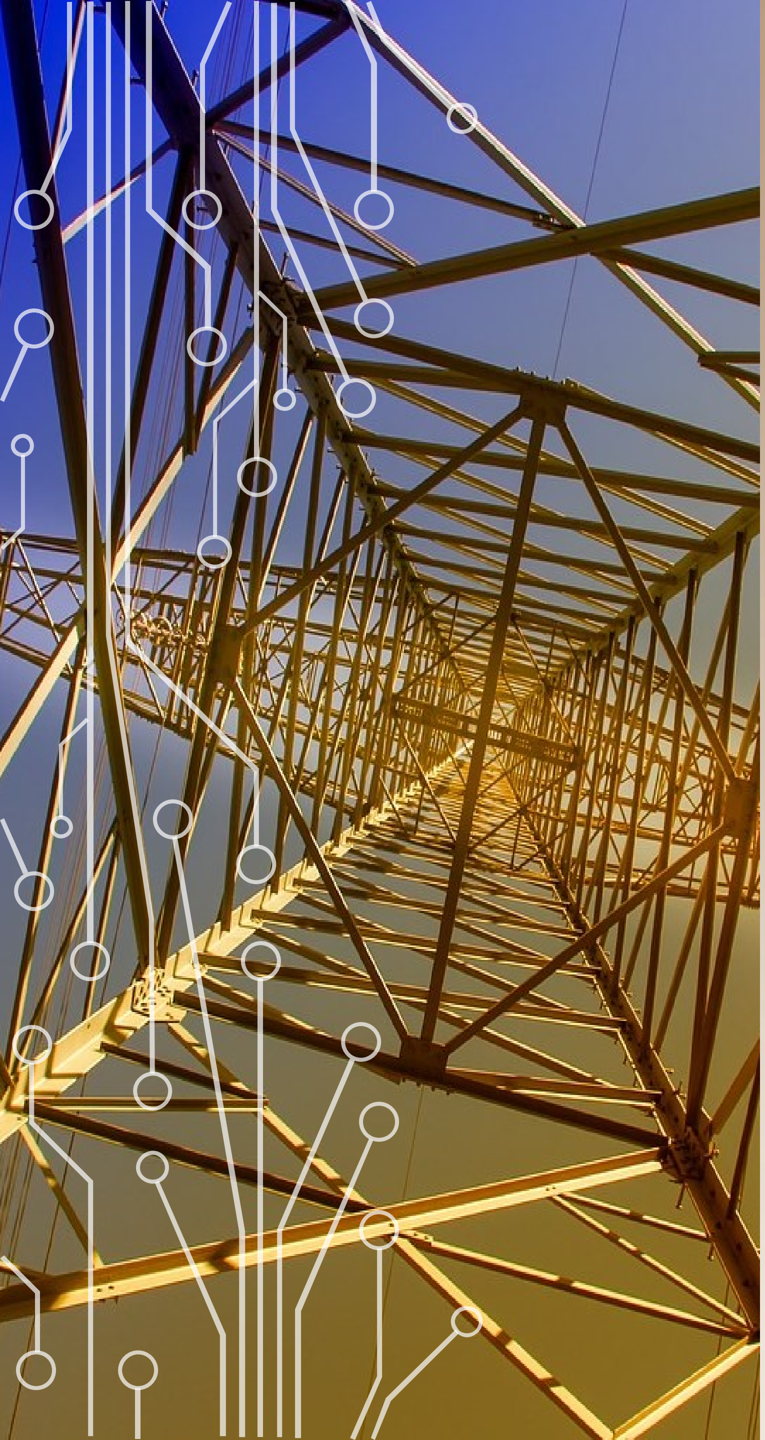
- Since we will not focus on CU vs. AL using Resistance per 1,000ft.
  - As stated, the focus this presentation is going to be based on Conductor Size.
  - This, does not fail to recognize CU is a better Conductor than AL
- Therefore, we will use a Constant Value which is different for CU/AL
  - CU uses a constant of 12.9Ω
  - AL uses a constant of 21.2 Ω

WHAT IT IS

2. Conductor Length
   - As you increase the Conductor Length you will increase the Conductor Resistance
   - True Resistance tables are based on 1,000’
     - For Example, #2 CU is 0.194 Ohms per 1,000’
     - Which results in Every foot being 0.000194 Ohms
     - Not bad until you get to 200’ then it is 0.0388 Ohms
     - A 130Amp Load at 200’ will result in 10 VD 1Ph
     - A 130Amp Load at 400’ will result in 20 VD 1Ph

WHAT IT IS

3. Ampacity of a circuit is another Factor to consider
   - As you increase the ampacity of a load, the more a conductor will resist the flow of electrons
     - For Example, #2 CU is 0.194 Ohms per 1,000’
     - Every Amp Added will increase resistance
     - Previously A 130Amp Load at 400’ will result in 20 VD 1Ph
     - Whereas A 65Amp Load at 400’ will result in 10 VD 1Ph
     - In Open Air 190Amp Load at 400’ will result in 29.5 1 Ph



THE FACTORS

- The Factors are:
  1. Conductor Type/Size
  2. Conductor Length
  3. Ampacity or Circuit
- All three factors are a part of every circuit you will/have every install

THE FACTORS

- How these Factors are Used
- There are Two principal Methods of Volt Drop Calculation:
  - Ohmic Method - factors the Resistance per 1,000’ of Conductor
  - Circular Mill Method:
    - Factors a Constant of 12.9Ω CU or 21.2 Ω AL per C Mill
      - The Constant Divided by CM Equals resistance per foot
- This Presentation will focus on the Circular Mill Method for calculations

THE FACTORS

- The Percentage of Voltage Drop is also a Constant
  - Which results in a Greater the System Voltage,
    - The Greater the Amount of VD Allowed/Tolerated
- First: You need to determine the amount of VD Allowed based on the Voltage of the Electrical System
  - 120V @ 3% = 3.6VD @ 5% = 6VD
  - 208V @ 3% = 6.24VD @ 5% = 10.4VD
  - 240V @ 3% = 7.2VD @ 5% = 12VD
  - 480V @ 3% = 14.4VD @ 5% = 24VD

THE FACTORS

- There are four different Calculations using the CM Size Method

1. Standard Calculation for Determining VD of a Circuit
   - This is where you know the Amps/Type&Size/Length but NOT VD
   - $VD = 2xKxIxL/CM$ This is for Single Phase Circuits
   - $VD = 1.732xKxIxL/CM$ This is for Three Phase Circuits
   - This method is used when you want to determine the Value of VD
   - Note: 2 or 1.732 is a circuit multiplier for 1PH or 3PH

     K is the Constant of 12.9 CU, or 21.2 AL

     I is the Ampacity applied to a circuit

     L is the *ONE-WAY* length of a circuit

THE FACTORS

- Calculation Method #2 using the CM Size Method

2. Conductor Size Needed Calculation
   - Here you know the Amps/Length/VD but NOT Type&Size Needed
   - $CM = 2xKxIxL/VD$ This is for Single Phase Circuits
   - $CM = 1.732xKxIxL/VD$ This is for Three Phase Circuits
   - This method is used when you want to determine the CM of Conductors
   - This method is most common method of solving VD Issues

THE FACTORS

- Calculation Method #3 using the CM Size Method

3. Conductor Length Allowed
   - Here you know the Amps/Type&Size/VD but NOT Length Allowed
   - $L = CMxVD/(2xKxI)$ This is for Single Phase Circuits
   - $L = CMxVD/(1.732xKxI)$ This is for Three Phase Circuits
   - This method is used when you want to determine the Length of Conductors
   - Sometimes putting a piece of equipment say 150’ rather than 250’ can make a huge cost difference effecting size of pipe and wire.
   - This method is used about the 1/4 of the time for solving VD Issues

THE FACTORS

- There are four different Calculations using the CM Size Method

4. Circuit Amperage Allowed
    - Here you know the Type&Size/Length/VD but not Allowable Amps
    - $I = CMxVD/(2xKxL)$ This is for Single Phase Circuits
    - $I = CMxVD/(1.732xKxL)$ This is for Three Phase Circuits
    - This method is used when you want to determine the Ampacity of a Circuit
    - Sometimes reducing the ampacity of a circuit can make a huge cost difference effecting size of pipe and wire.
    - This method is used about the 1/6 of the time for solving VD Issues

THE FACTORS

1. Standard Calculation for Determining VD of a Circuit
   - This is where you know the Amps/Type&Size/Length but NOT VD

- Example you know you have a Feeder to a Sub-panel which according to a drawing is 425' from the MDP (counting up/down/left/right jogs). The Feeder is 200A, using a 250kcmil AL conductor, you know the maximum continued load will not exceed 160A per calculations (80% value of OCPD). Is this, OK?
- VD=1.732xKxIxL/CM Thus 1.732x21.2x160x425/250,000 = 9.99
- If this is a 208 @ 3% you are over, but @ 5% it is OK
  - But this will not allow for any VD in the Branch Circuits

THE FACTORS

2. Conductor Size Needed Calculation
   - Here you know the Amps/Length/VD but NOT Type&Size Needed

- Back to this 425' Feeder, if you want to keep it to 3%VD to allow for up to 2%VD in the sub-panels Branch Circuits; what size will this AL feeder need to be?
- Conductor Size Equation:
- CM=1.732xKxIxL/VD Thus 1.732x21.2x160x425/6.24 = 400136 CM
- 400 kcmil is required Proof 1.732x21.2x160x425/400,000 = 6.24 VD
  - This second Calculation is a Proof Calculation – Always Recommend

THE FACTORS

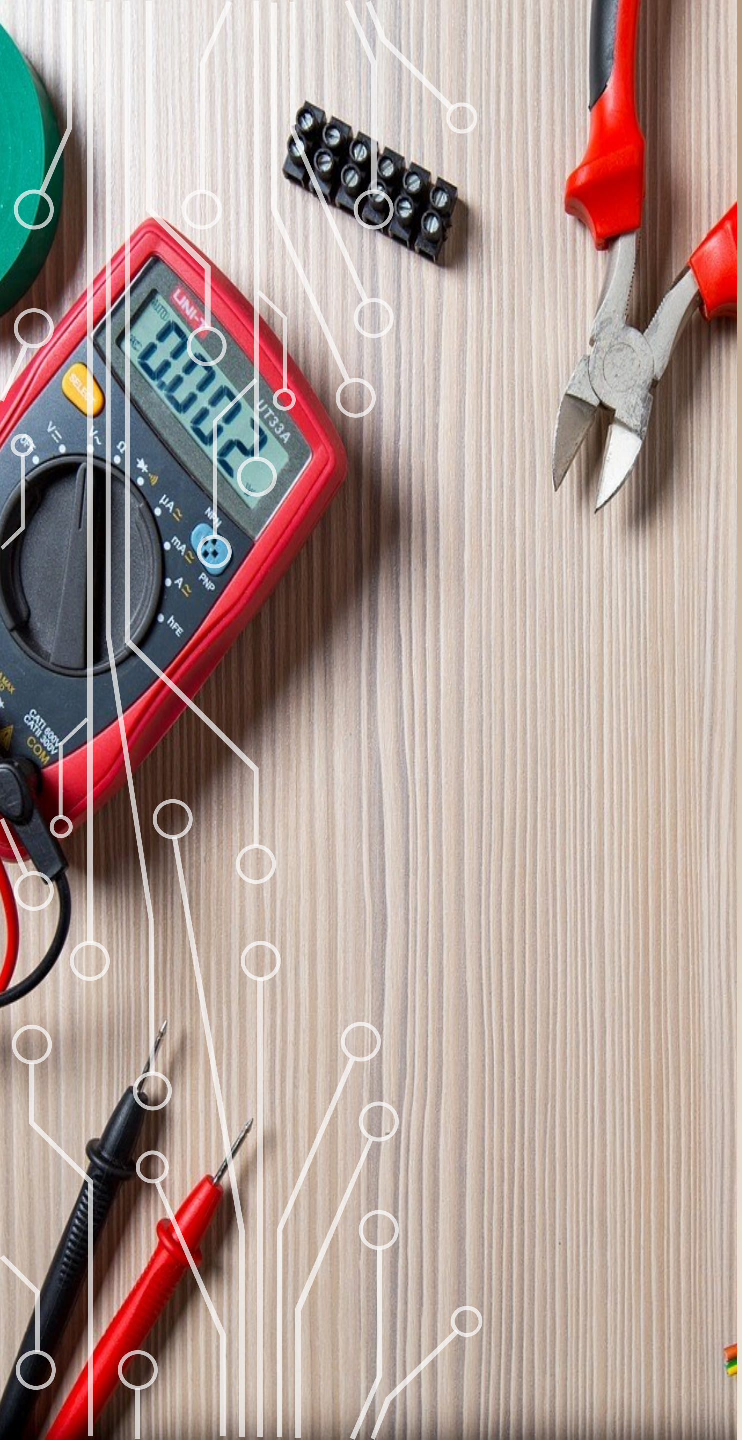
3. Conductor Length Allowed
   - Here you know the Amps/Type&Size/VD but NOT Length Allowed

- So, you do not have 400 kcmil in the budget, you priced it based on 250 kcmil. So, at 160A and a 3% VD of 6.2 you need to know the maximum length of conductor able to be used?
- Conductor Length Equation:
- L = CMxVD/(2xKxI) Thus 250,000x6.24/(1.732x21.2x160) = 265’
- 265’ is the max Length Proof 1.732x21.2x160x265/250,000 = 6.23 VD Again, the Double Check insures your good.

THE FACTORS

4. Circuit Amperage Allowed
   - Here you know the Type&Size/Length/VD but not Allowable Amps

- So, the owner says I must have the panel where it is drawn, and you inform the customer, he really does not need 200A with a 160A capacity, what if you downsize the ampacity of the feeder to 125A?
- Conductor Ampacity Equation:
- I = CMxVD/(2xKxL) Thus 250,000x6.24/(1.732x21.2x425) = 100A
- 100A is the max Amps Proof 1.732x21.2x100x425/250,000 = 6.24 VD - So you install a 125A Feeder using 250 kcmil



THE REMEDIES

- Standard VD calculation to determine if an issue Exist
- Then determine, is this a type & Size Issue?
- Is the Conductor Length an Issue?
- Is the Circuit Ampacity too great for the circuit?

THE REMEDIES

- Is there too much ampacity?
  - Typically, this is tied to a piece of equipment or loads which cannot be reduced.
  - Are the loads Single phase, possibly feed with three phase
    - Single phase uses a multiplier of 2
    - Three phase uses a multiplier of 1.732
- If converting load from single to three phase is not an option, then reducing the load ampacity may not be an option.
  - Sometimes the customer can go with a lessor piece of equipment.
  - Or you might increase the Voltage 480V rather than 208V

THE REMEDIES

- Is there a Conductor Length an Issue?
  - Often relocating a load to a closer location to the source of power may be an option.
  - However, due to operations functionality, relocation to reduce a length of conductor may not be a viable option.

THE REMEDIES

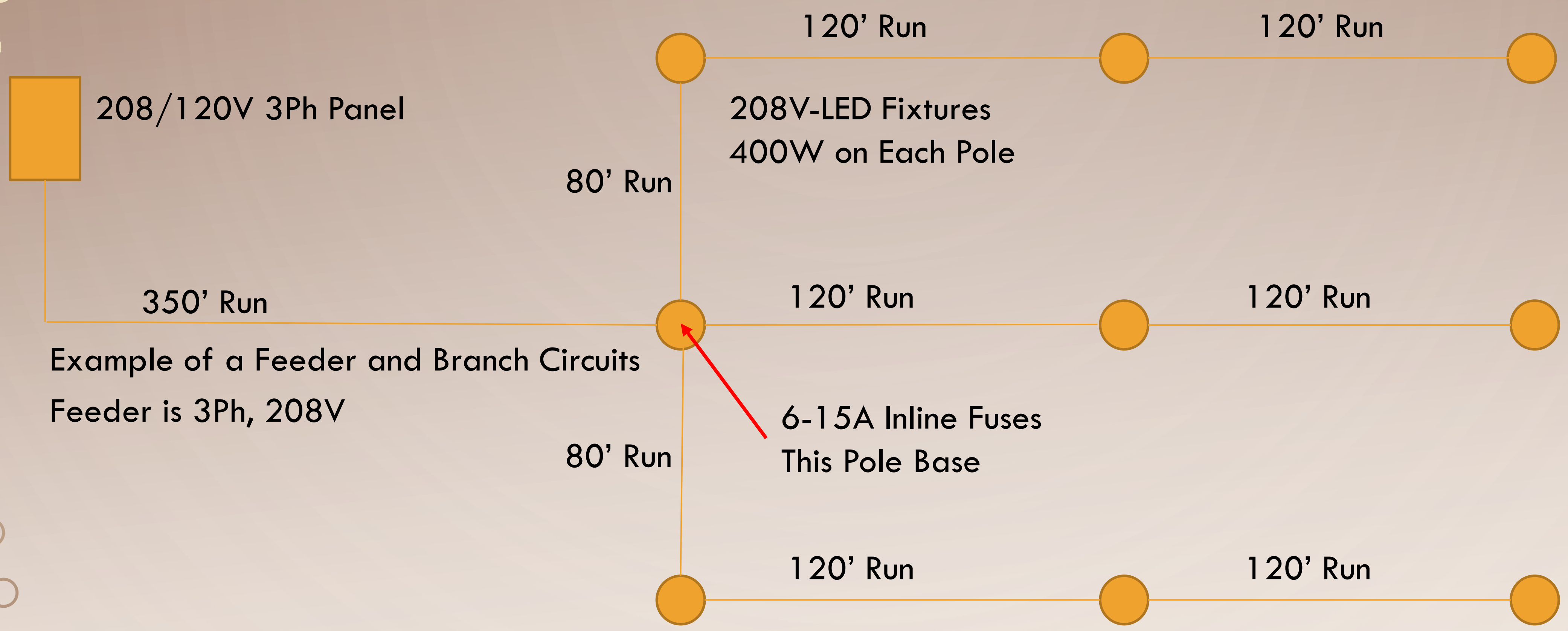
- Then determine, is this a type&Size Issue?
- In most situation, using a different type or size of conductor is the only viable option to correct a VD issue.
- Increasing Size of Conductor
- Changing to Copper rather than using Aluminum

SOME EXAMPLES OF SITUATIONS

- Customer wants a 240V 1PH 30A circuit for 24A Equipment 150' from Service Panel. There is No Feeder, only the Branch Circuit.
  - Another contractor quoted #10 CU conductors (Sounds Far)
  - Do the Check:
    - 2x12.9x24x150/10,380 = 8.95 VD
    - Only 7.2VD is allowed for this circuit
    - Size Calculation shows a #8 CU will be required
    - 2x12.9x24x150/16,510 = 5.63VD
- Now you can better quote and inform the customer.

COMPOUND SITUATION

- Parking Lot Lights:

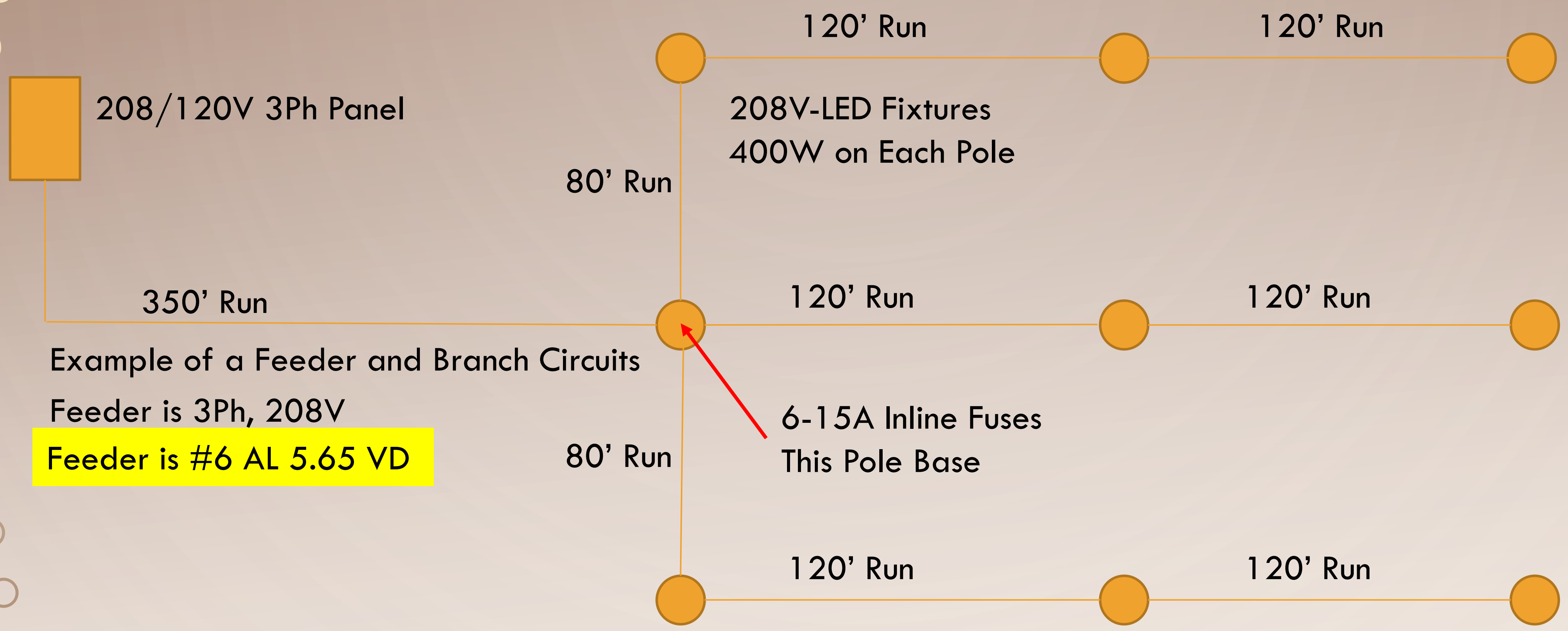


SOLUTION FEEDER

1. The OCPD will be 30A in Service Panel for Lighting Circuit
2. At Least a #8AL conductor would be required
   A. Load on each phase will be 11.54A
   B. I select to use 3% VD for the feeder, 2% VD for the Branches
   C. At 3%, the 208 VD allowed is 6.24 Volts
3. I'll use the Conductor Size Calculation to see if #8AL is OK
   - $1.732x21.2x11.54x350/6.24 = 23{,}767$ CM
   - #8 AL is only 16,510 Thus a #6 AL is required at 26,240 CM
   - $1.732x21.2x11.54x350/26{,}240 = 5.65$ VD Feeder is Good

COMPOUND SITUATION

- Parking Lot Lights:

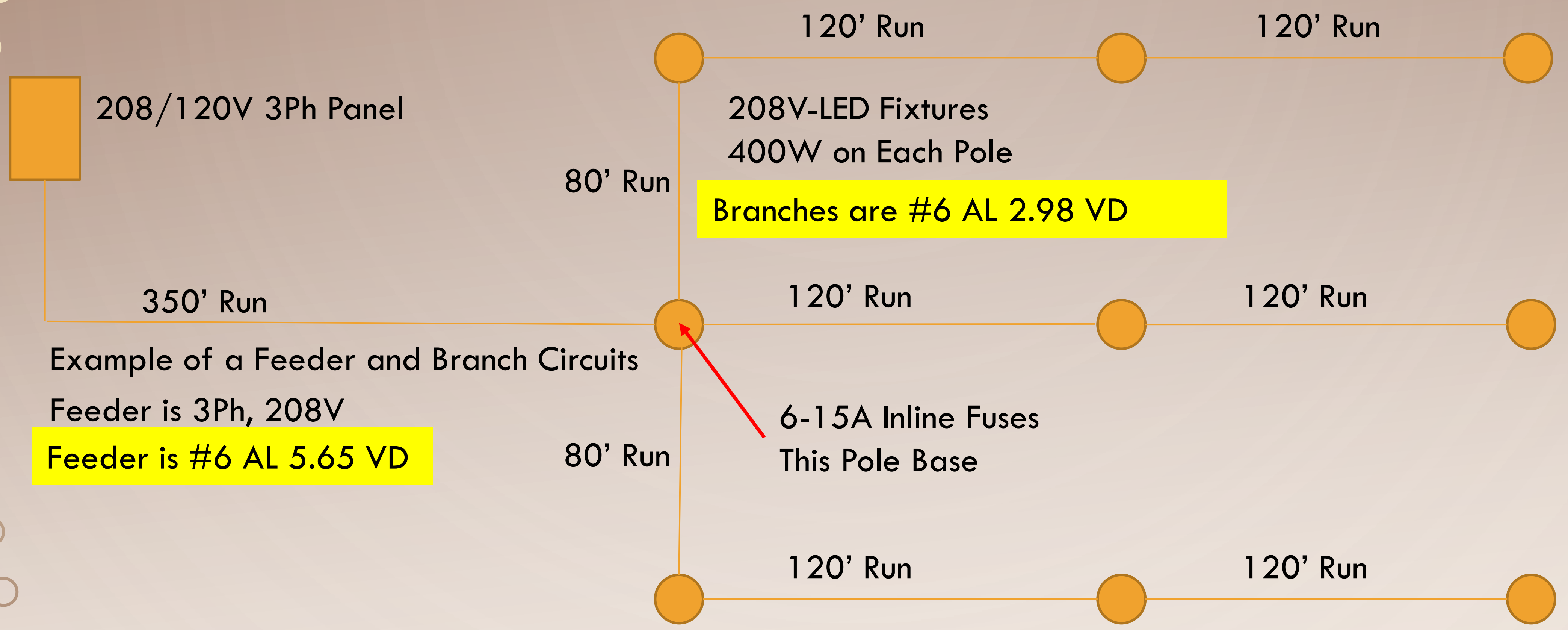


SOLUTION BRANCH

1. The OCPD will be 15A inline Fuses Central Pole
2. At Least a #10 AL conductor would be required for Branches
   A. Load on each phase of Branches will be 5.77A
   B. I use 2% VD for the Branches
   C. At 2%, the 208 VD allowed is 4.16 Volts
3. I'll use the Conductor Size Calculation to see if #10 AL is OK
   - $2x21.2x5.77x320/4.16 = 18{,}819$ CM
   - #10 AL is only 10,380 Thus a #6 AL is required at 26,240 CM
   - $2x21.2x5.77x320/26{,}240 = 2.98$ VD Branch is Good

COMPOUND SITUATION

- Parking Lot Lights:

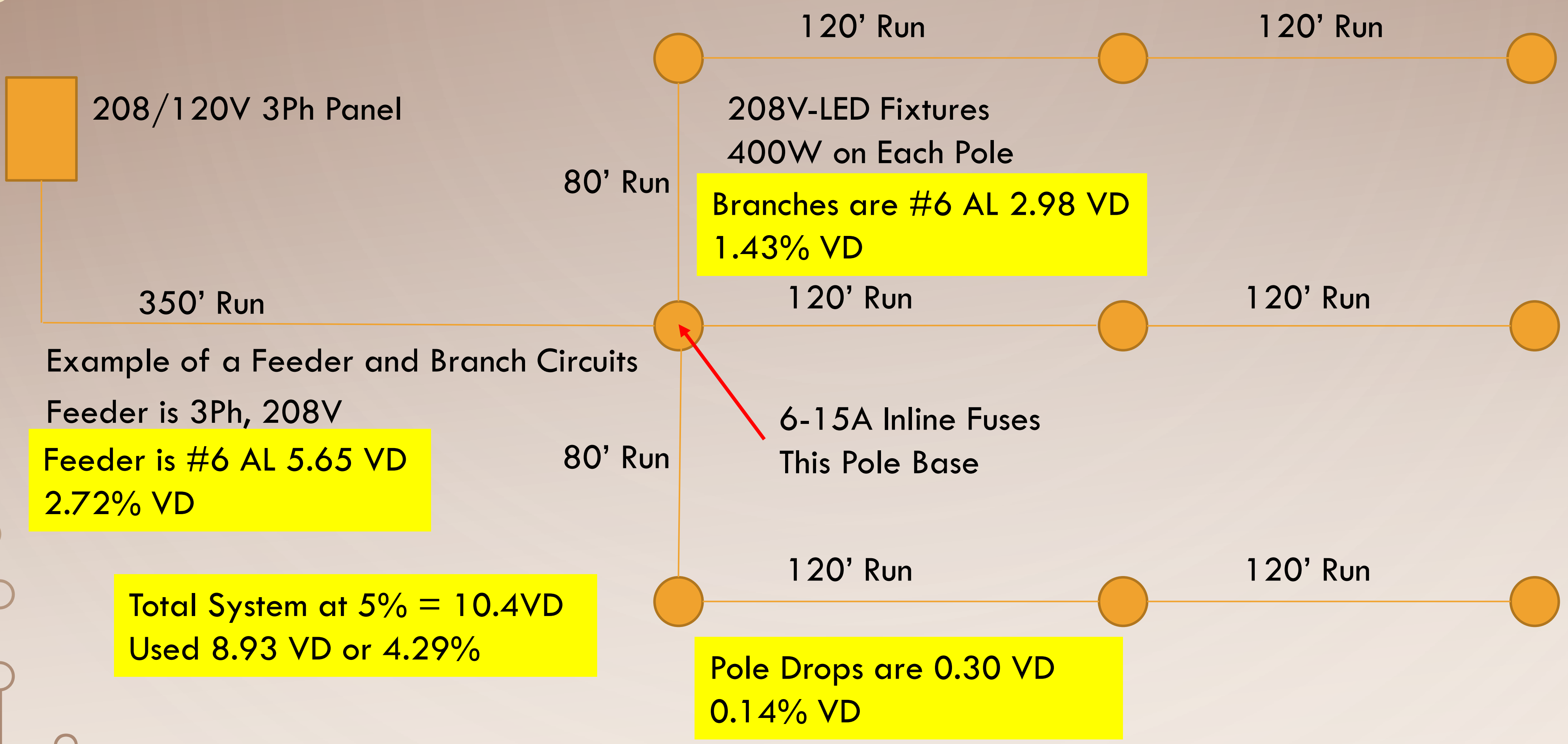


SOLUTION EACH POLE

1. The OCPD will be 15A inline Fuses Central Pole
2. At Least a #14 CU conductor required Each Pole Drop
   A. Load on each phase of Drops will be 1.92A
   B. I use 2.98 VD for the Branches
   C. This leaves 1.18 VD Allowed (2% of 208=4.16V - 2.98V Used)
3. I'll use the Volt Drop Calculation to see if #14 CU is OK
   - $2x12.9x1.92x25/4{,}110 = 0.30$ VD Pole Drops are Good

COMPOUND SITUATION

- Parking Lot Lights:



SOLUTION RACEWAY & EGC

1. Article 250.122(B)
   - By the Same portion Ungrounded conductors are increased due to Voltage Drop, the EGC shall also be increased by that Portion
   - However, in now way shall the EGC be required to be larger than the largest ungrounded phase conductor.
   - Therefore, the EGC will need be #6 AL
   - The Raceway Minimum of 1” PVC, but 1-1/4” Due to Run is Better
   - Raceways to other poles could be a 1” PVC

K Method VOLTAGE DROP FORMULAS

The NEC recommend a maximum of 3% voltage drop for either a Feeder or a Branch with not more than 2% additional for the other. Thus no circuit should have more than 5% total Voltage Drop.

Single-Phase:

$$VD = \frac{2 \times K \times I \times L}{CM}$$

Three-Phase:

$$VD = \frac{1.732 \times K \times I \times L}{CM}$$

VD = Volts dropped within the circuit
K = 12.9 Ohms for Copper, and 21.2 Ohms for Aluminum, (based on an operating temperature of 75C)
I = Amps, based on 100% of Actual load
L = Length in Feet, one way distance
CM = Circular-Mills, of Conductor wire size, based on Chapter 9 Table 8 NEC
2 = Single Phase Value of a Complete Single Phase Circuit
1.7 = Three Phase Value of a Complete Three Phase Circuit

CONDUCTOR SIZE / VOLTAGE DROP

Increase the size of the conductor to decrease the Voltage drop of a Circuit (Reduces Resistance)

Single-Phase:

$$CM = \frac{2 \times K \times I \times L}{VD}$$

Three-Phase:

$$CM = \frac{1.732 \times K \times I \times L}{VD}$$

CONDUCTOR LENGTH / Circuit x K x I

Reduce the Length of the conductor to decrease the Voltage drop of a Circuit (Reduces Resistance)

Single-Phase:

$$L = \frac{CM \times VD}{(2 \times K \times I)}$$

Three-Phase:

$$L = \frac{CM \times VD}{(1.732 \times K \times I)}$$

CONDUCTOR AMPERAGE / Circuit x K x L

Reduce the Amps placed on a conductor to decrease the Voltage drop of a Circuit (Reduces Amps)

Single-Phase:

$$I = \frac{CM \times VD}{(2 \times K \times L)}$$

Three-Phase:

$$I = \frac{CM \times VD}{(1.732 \times K \times L)}$$

FREE RESOURCE

- Email JD White at:
  jd.white2000@gmail.com
- Free Single Sheet PDF
- This has all four VD Calculation with Single and Three Phase Notes

Simply request the VD Sheet

QUESTIONS?

Email JD White at:

jd.white2000@gmail.com

THANKS FOR ATTENDING

File Attachments for Item:

ER-11 Ventilation Best Practices (Owens Corning)

All certifications except ESI (1 hour)

Staff Notes: Received 4:15 pm Tuesday: Recommend tabling for technical review.

Committee Recommendation:

OUTLINE AND TIMING

VENTILATION BEST PRACTICES: FROM CODES TO EXECUTION

2 Minutes	Introduction, Agenda and Outline Review
10 Minutes	Review of Code Requirements for Ventilation
	Chapter 12, OBC
	Chapter 8, RCO
	ICC-ES AC132
5 Minutes	Benefits of Proper Ventilation
10 Minutes	Assessment of Ventilation – New and Existing Structures
3 Minutes	Inspection checklist
5 Minutes	Exhaust vs. Intake Ventilation
5 Minutes	Types of Products for Various Applications
10 Minutes	Product Testing Requirements
10 Minutes	Questions and Discussion

Gregory Keeler
Technical Services Leader

Greg Keeler is the Technical Services Leader for Owens Corning, a world leader in building materials and composite solutions. He is primarily responsible for providing worldwide codes and standards expertise to the OC roofing and asphalt business. His role encompasses providing code interpretations and advice to product development teams; acting as a liaison between OC and various trade organizations and code enforcement entities; seeking and maintaining product approvals for various products; and overseeing all code certification testing. He is considered the internal expert on testing of roofing and accessory products. Greg is also highly regarded In the roofing industry as an expert on all code requirements for roofing products. He is also always looking at ways Owens Corning can use codes to their advantage in the roofing industry and is actively involved in providing technical education to various groups, including OC employees, contractors, architects, engineers, and building officials.

Prior to joining Owens Corning, Mr. Keeler served as a Building Code Official for a municipal building code department. Office management, building plan review, and building inspection were all an integral part of Mr. Keeler's duties. He conducted various public outreach programs and developed and provided continuing education courses for building officials, contactors, and architects. He also served as a Director-At-Large on the Board of Directors and on a number of committees for the Central Ohio Code Officials Association.

Additionally, Mr. Keeler has over 35 years of experience in building design. Projects on which he has worked include custom homes, office and retail occupancies, and light industrial spaces.

Mr. Keeler serves on many committees with various industry and technical organizations. These include: ASTM D08 Committee on Roofing and Waterproofing and the ASTM E05 Committee on Fire Standards; UL Standards Technical Panels 2218, Impact Resistance of Prepared Roof Covering Materials; UL 580/UL 1897, Uplift Resistance; and UL 790, Standard Test Methods for Fire Tests of Roof Coverings ; and on the ARMA Cool Roof Steering Group, and Residential Roofing Manual and Steep Slope Publication Review Task Force. Greg also serves as the Chairman of the ARMA Codes Steering Group and is the past chair for the Technical Affairs Committee and Technical Resources Group. Greg is also a voting member of the Cool Roof Rating Council Technical Committee; the Florida Roofing and Sheet Metal Contractors Association Codes Committee, Codes Subcommittee, and Roof Tile Committee; and the Canadian Standards Association A123 Committee on Bituminous Roofing and Waterproofing.

Greg attended The Ohio State University where he majored in Architecture.

OWENS CORNING®
INNOVATIONS FOR LIVING™

AWARDS AND ACHIEVEMENTS

Florida Roofing and Sheet Metal Contractor's Association (FRSA)

- 2021 Earl Blank Memorial Heart Award – exceptional service
- Author of numerous articles for Florida Roofing magazine

American Society for Testing and Materials (ASTM International)

- Award of Recognition for successful approval of ASTM D8257 Standard Specification for Mechanically Attached Polymeric Roof Underlayment Used in Steep Slope Roofing
- Chair or Co-Chair of the following Task Groups:
  - ASTM D3462
  - ASTM D3161
  - ASTM D7158
  - ASTM D1970
  - ASTM D7349
  - ASTM D8257

Asphalt Roofing Contractors Association (ARMA)

- Award of Recognition of service as Chair of the ARMA Technical Affairs Committee
- Chair of the following Committees:
  - Codes Steering Group
  - Technical Resources Group Florida Building Code Modification Task Group and Texas Department of Insurance Task Group

PRESENTATION HISTORY

Building Officials

- Building Officials Association of Florida Annual Conference – 8 consecutive years
- Ohio Building Officials Association
- Lake County, Florida
- Brevard County (FL) Building Officials Association
- Excambia County/Pensacola, Florida
- Manasota (FL) Building Officials Association
- Hillsborough County (FL)
- Mobile County (AL)
- Texas Department of Insurance Windstorm Inspectors

Architects

- Carmel, IN
- Albany, NY
- Long Island, NY
- Palm Beach, FL
- Salt Lake City, UT
- Los Angeles, CA

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

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

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

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

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

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

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

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

Ohio Board of Building Standards
6606 Tussing Road
PO Box 4009
Reynoldsburg, OH 43068-9009 U.S.A.

Gerald O. Holland, Chairman

614 | 644 2613
Fax 614 | 644 3147
TTY/TDD 800 | 750 0750
www.com.ohio.gov

APPLICATION
FOR
Continuing Education Course Approval

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

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

COURSE SUBMITTER:

Course Submitter: Greg Keeler
(Contact Name)

Organization: Owens Corning Science & Technology
(Organization/Company)

Address: 2790 Columbus Road
(Include Room Number, Suite, etc.)

City: Granville State: Ohio Zip: 43023

E-Mail: greg.keeler@owenscorning.com

Telephone: 740-321-6345 Fax: Mobile 740-404-7829

Course Sponsor: Owens Corning

COURSE INFORMATION:

Course Title: Ventilation Best Practices

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

Purpose and Objective: Review of code requirements from ventilation, based on 2017 OBC & 2019 ROC

Number of Instructional Contact Hours that can be obtained upon completion: (1) hour

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

Program Applicable for the Following Participants:

Building Official ■ Master Plans Examiner ■ Building Inspector ■ Fire Protection Inspector ■ Mechanical Inspector ■

Building Plans Exam. ✔
Plumbing Plans Exam. ■
Electrical Plans Exam. ■
Mechanical Plans Exam. ■
Fire Protect. Plans Exam. ✔

Plumbing Inspector ■
Non-Res IU Inspector ■

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

Electrical Safety Inspectors ☐
Location of ESI Course: ____ Date(s) of ESI Course(s): ____

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:

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

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

VENTILATION BEST PRACTICES

From Codes to Execution

Greg Keeler

Owens Corning

Technical Services Leader

Illustrations/ photos courtesy of Owens Corning

November, 2021

Course Objectives

- Review of code requirements for ventilation
  - Based on the 2017 OBC and 2019 RCO
- Benefits and calculation of proper ventilation
- Assessment of ventilation on existing structures
  - Inspection Checklist
- Exhaust vs. Intake
- Types of products for various applications
- Product Testing Requirements

Photo courtesy of Owens Corning

Instructor Bio

GREG KEELER

- Technical Services Leader – Owens Corning
- 10 Years with OC
- 24 Years as Building Official
- 35 Years in building design
- Member of UL Standards Technical Panels for UL 790 (fire resistance), UL 580/1897 (uplift resistance), and UL 2218 (impact resistance
- Member of ASTM Committees D08 (roofing and waterproofing) and E05 (fire resistance)
- FRSA Codes Committee Member
- Chair, ARMA Codes Steering Group and Miami-Dade Technical Resource Group
- Member of numerous industry organizations and committees

Code Requirements

Section R806 – Roof Ventilation

R806.1 Ventilation required. Enclosed *attics and enclosed* rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilation openings shall have a least dimension of 1/16 inch (1.6 mm) minimum and 1/4 inch (6.4 mm) maximum. Ventilation openings having a least dimension larger than 1/4 inch (6.4 mm) shall be provided with corrosion-resistant wire cloth screening, hardware cloth, or similar material with openings having a least dimension of 1/16 inch (1.6 mm) minimum and 1/4 inch (6.4 mm) maximum. Openings in roof framing members shall conform to the requirements of Section R802.7. Required ventilation openings shall open directly to the outside air.

> **Exception:** Attic ventilation shall not be required when determined not necessary by the code official due to atmospheric or climatic conditions.

Code Requirements

Section R806 – Roof Ventilation

R806.2 Minimum vent area. The minimum net free ventilation area shall be 1/150 of the vented space.

Exception: The minimum net free ventilation area shall be 1/300 of the vented space provided one or more of the following conditions are met:

1. In Climate Zones 6, 7 and 8, a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.
2. At least 40 percent and not more than 50 percent of the required ventilating area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located no more than 3 feet (914 mm) below the ridge or highest point of the space, measured vertically, with the balance of the required ventilation provided by eave or cornice vents. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet (914 mm) below the ridge or highest point of the space shall be permitted

Code Requirements

Climate Zones

Climate Zone 5

Climate Zone 4

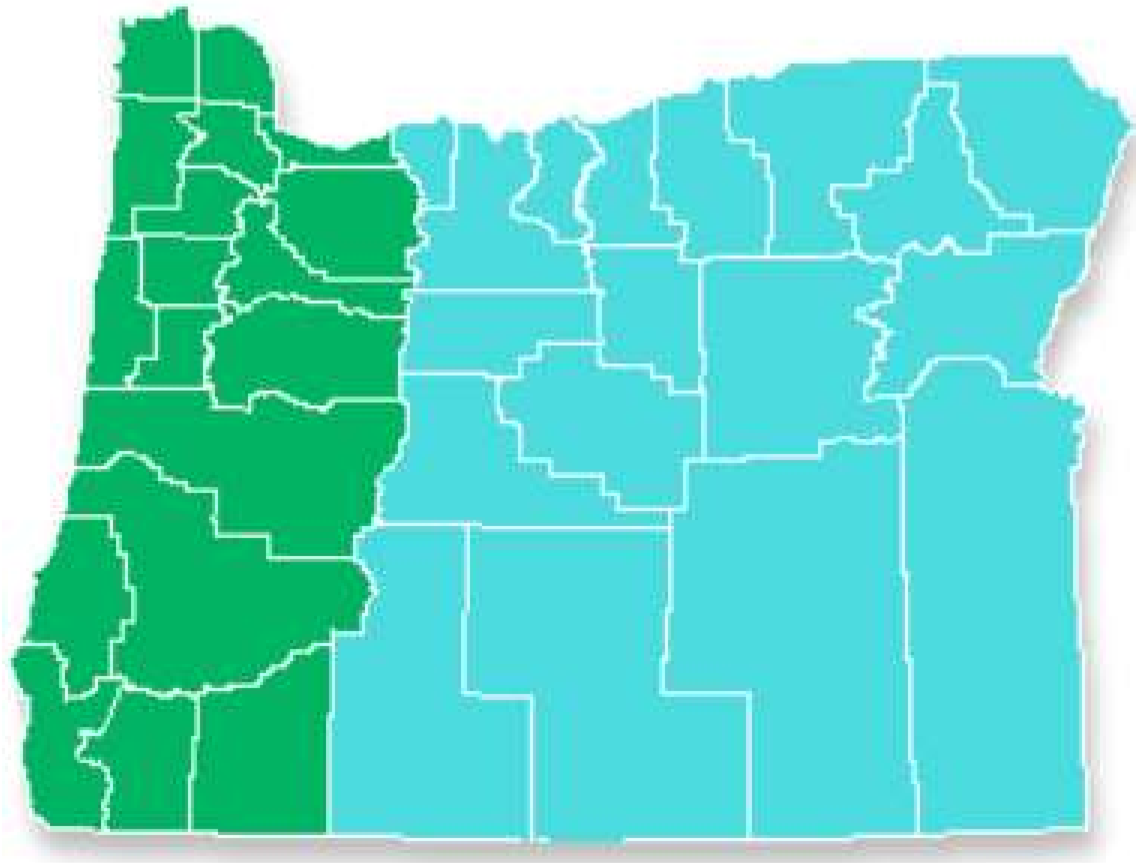
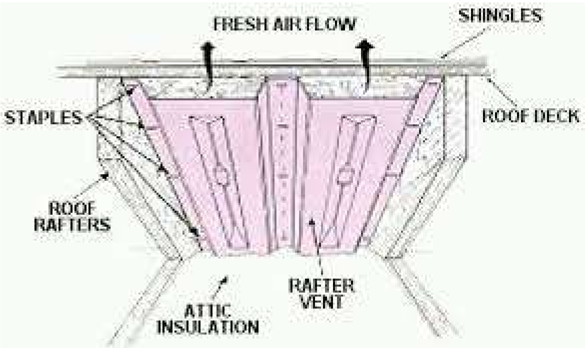


Illustration courtesy of energycode.pnl.gov

Code Requirements

Section R806 – Roof Ventilation



R806.3 Vent and insulation clearance. Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of a 1-inch (25 mm) space shall be provided between the insulation and the roof sheathing and at the location of the vent.

R806.4 Installation and weather protection. Ventilators shall be installed in accordance with manufacturer's installation instructions. Installation of ventilators in roof systems shall be in accordance with the requirements of Section R903. Installation of ventilators in wall systems shall be in accordance with the requirements of Section R703.1.

Illustrations/photos courtesy of Owens Corning

Code Requirements

Roof Vents – ICC-ES AC132

The IRC and IBC don't contain many specific requirements for the actual vents themselves.

The International Code Council Evaluation Service has adopted an Acceptance Criteria for roof vents – ICC-ES AC132.

As part of this Criteria, vents must be tested for the following attributes:

- **Wind-driven Rain**
- **Net Free Ventilating Area**
- **Burning characteristics of plastics**
- **Weathering characteristics of plastics (if exposed)**
- **Temperature Cycling (to test dimensional stability)**
- **Dust exposure**

Photos and videos of this testing will be shown later in this presentation

Is Code Required Minimum Ventilation Adequate?

Question:

If I follow the code minimum, could I install 1 square foot of soffit ventilation for each 150 square feet of attic area (with no exhaust) and comply with the code?

OC Recommendation

Answer:

Yes, you would be in compliance with the code. However, it is our position that in order for any ventilation to be effective, it must be balanced. With a balanced system, cooler fresh air will be drawn into the attic/rafter space and begin to heat, which will make the air rise, and be exhausted through the upper openings.

The fresh air will carry moisture and hot air with it through the exhaust vents.

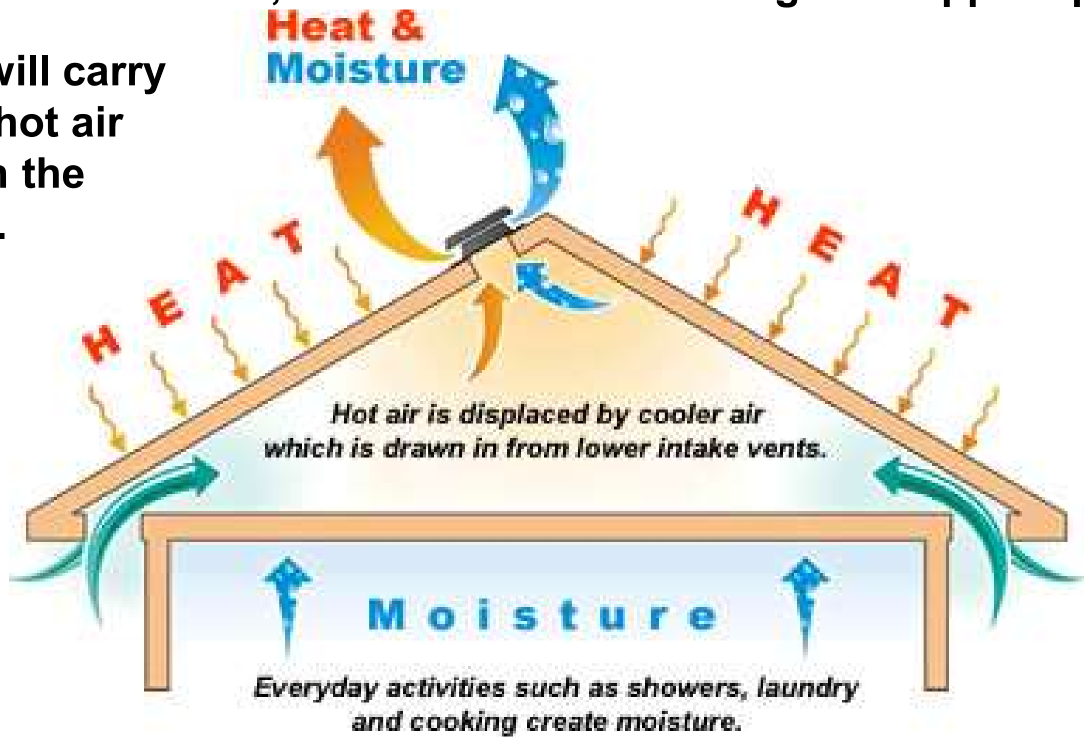


Illustration courtesy of Owens Corning

Benefits of Proper Ventilation

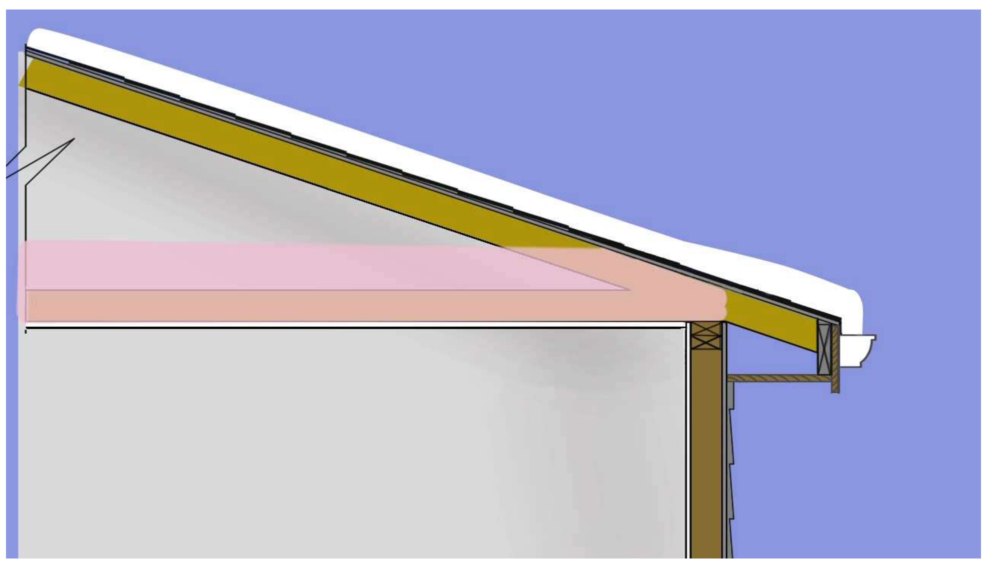
- **Reduction of potential for ice damming**
- **During warm weather, keeps attic cool, thereby helping to keep the interior of the home cool and help reduce energy consumption**
- **During colder weather, reduces moisture buildup to keep attic dry**
- **Increased service life of shingles and roof deck**
- **Reduced potential for mold in attic**

Photos courtesy of Owens Corning

Ice Damming

Ice damming occurs when:

- ***Warm air in the attic heats the roof deck and melts standing snow***
- ***Cold air at the eaves re-freezes the melted snow, forming a dam of ice***



Photos and animation courtesy of Owens Corning

Ice Damming

Ice damming is primarily caused by:

- ***Inadequate ceiling insulation***
- ***Contact between the insulation and roof deck***
- ***Inadequate ventilation***

CODED NOTES

1. Inadequate Attic Insulation Depth (R-Value) for the Region
2. Insulation Does Not Even Achieve Label Thickness
3. Ventilation Path Blocked
4. Path of Least Resistance For Heat Flow
5. Ice Dam
6. Water Pool
7. Snow

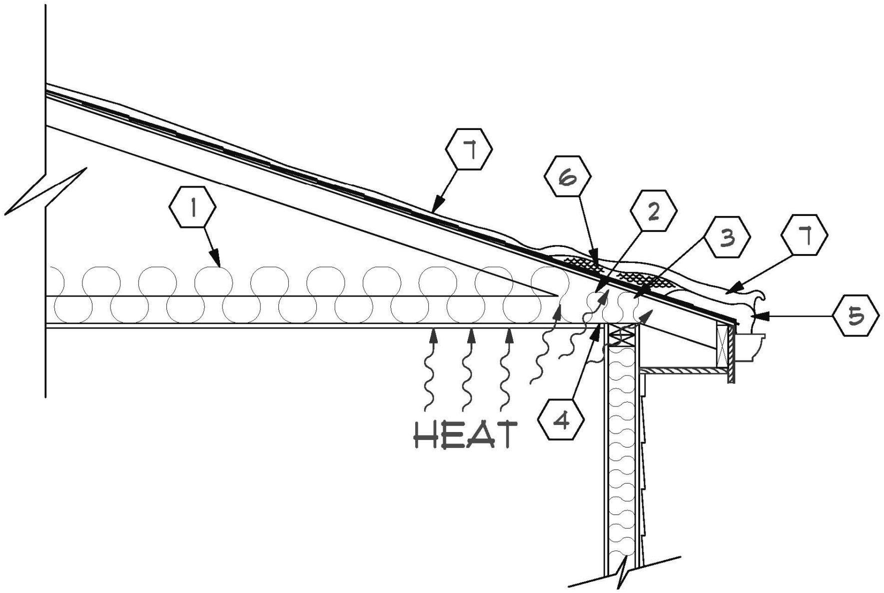


Photo and illustration courtesy of Owens Corning

Sample Ventilation Calculation – Unbalanced System

EXAMPLE:

Ranch home – 24’-0” x 42’-0” = 1008 ft^2

1008 ÷ 150 = 6.72 ft^2 Net Free Vent Area (NFVA) Required

Convert to square inches:

6.72 ft^2 x 144 = 967.68 in^2 Net Free Vent Area (NFVA) Required (rounded to 968)

968 in^2 ÷ 2 = 484 in^2 per side of roof

Soffit – 42’ LF per side ÷ 484 in^2 = 11.5 in^2/LF of Soffit

Sample Ventilation Calculation – Balanced System

EXAMPLE:

Ranch home – 24’-0” x 42’-0” = 1008 ft^2

1008 ÷ 300 = 3.36 ft^2 Net Free Vent Area (NFVA) Required

Convert to square inches:

3.36 ft^2 x 144 = 483.44 in^2 Net Free Vent Area (NFVA) Required (total)

483 x .5 (50%) = 241.5 in^2 Exhaust (high) Maximum and 241.5 in^2 Intake (low) Minimum (122 in^2 per side).

Net Free Vent Area

Net Free Ventilating Area (NFVA) is the total area of a given vent product that allows air to pass through.

After calculating the NFVA required, you must then choose the appropriate product(s) based on their NFVA data.

NFVA for Exhaust/Ridge Vent Products:

- From 12 in.^{2} to 20 in.^{2} per lineal foot of vent (ridge)
- From 40 in.^{2} to 150 in.^{2} per unit (off ridge)

NFVA for Intake/Soffit Vent Products

- From 8 in.^{2} to 10 in.^{2} per lineal foot of vent (continuous)
- From 25 in.^{2} to 56 in.^{2} per unit (louvers)

Exhaust vs. Intake

Exhaust and intake ventilation are each important and should be used together to provide a ventilation *SYSTEM*.

Intake Ventilators Should:

- be located as low as possible on the roof
- be unobstructed
- have sufficient NFVA to provide 50% - 60% of the total required ventilation
- comply with code requirements (ICC-ES AC132)

Exhaust Ventilators Should:

- be located as high on the roof as possible, but no more than 3 feet lower than the ridge
- be unobstructed
- have sufficient NFVA to provide 40% - 50% of the total required ventilation
- comply with code requirements (ICC-ES AC132)

What If?

What if the building has no soffit/eaves?

What If?

What if the building has open rafter tails?

Ventilation Calculation
Additional Resources

Visit the Owens Corning Roofing website at:

http://www.owenscorning.com/roofing/accessories/ventilation/determine-your-requirements

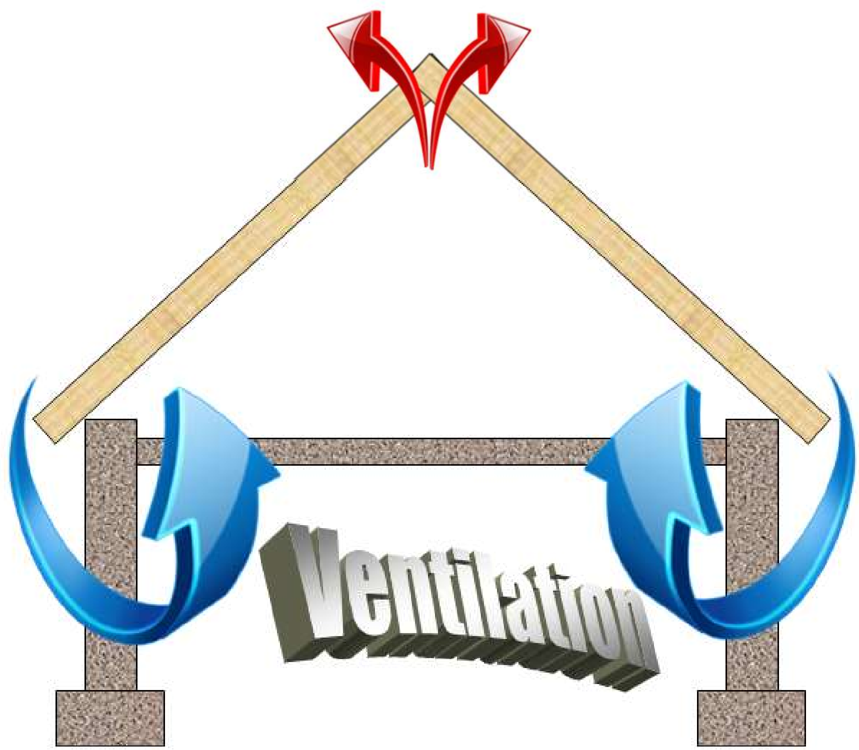
This web page includes a very useful calculator for determining ventilation requirements. Enter either building dimensions or choose from a dropdown of footages in 100 ft^2 increments.

Additionally, the data sheets for our vent products also include calculators to assist in determining ventilation needs.

Inspection Checklist

Instead of being an afterthought, ventilation should be the *FIRST* thing you look at when estimating a roof!

Proper ventilation is the foundation of a healthy roof, and a healthy roof will provide more years of service.



Inspection Checklist

LOWER ROOF AREAS

- Existing soffit vents?
  - Painted Over?
  - Blocked by Insulation?
  - Sufficient NFVA?

Photos courtesy of Owens Corning

Inspection Checklist

FIELD OF ROOF

- **Blistering of Shingles**
- **Curling or Cracking of Shingles**
- **Buckling of Roof Sheathing**

Photos courtesy of Owens Corning

Inspection Checklist

UPPER ROOF/RIDGE

- **Existing Vents?**
  - **Unobstructed?**
  - **Sufficient NFVA?**
  - **Is Existing Ventilation Short Circuited?**

Photo courtesy of Owens Corning

Inspection Checklist

INTERIOR OF ATTIC

- Mold
- Moisture
- Evidence of Excessive Moisture
  - Buckling of sheathing
  - Wet Insulation
  - Condensation
- Insufficient Attic Insulation
- Insulation Baffles
- Can You See Daylight Through Soffit and Ridge?
- Bathroom or Kitchen Exhaust Fans Venting Into Attic
- Can Lights
- Other penetrations

Not all jobs should be done – know when to walk away.

Photo courtesy of Owens Corning

Exhaust vs. Intake

Exhaust and intake ventilation are each important and should be used together to provide a ventilation *SYSTEM*.

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- comply with code requirements (ICC-ES AC132)

Product Types and Applications

PASSIVE VENTILATORS

Intake

Photos courtesy of Owens Corning

Product Types and Applications

PASSIVE VENTILATORS

Exhaust

Photos courtesy of Owens Corning

Product Types and Applications

ACTIVE VENTILATORS

Exhaust

Caution should be exercised when specifying active ventilators to ensure they don't draw conditioned air out of the living space.

Photos courtesy of Owens Corning

Product Testing

WIND-DRIVEN RAIN

- FBC TAS 100 (A)
- Wind velocity up to 110 mph
- Simulated rainfall of 8.8”/hour

Video courtesy of Owens Corning

Product Testing

DUST EXPOSURE

- Dust Entrained into fan-induced wind
- Wind velocities of 5, 10, and 15 mph
- 15.4 lbs of dust total
- 150 minutes of exposure
- Measures air flow loss due to dust

Photos and Video courtesy of Owens Corning

Product Testing

CLASS A FIRE RESISTANCE

- **Similar to Class A test for roof coverings**

Video courtesy of Owens Corning

REVIEW

- Look at ventilation ***FIRST!***
- Ventilation needs to be ***balanced*** to be effective
  - Never more exhaust than intake

- More is Better
  - Doesn't apply to exhaust
- Look for signs of moisture issues

- Use vent products that comply with ICC-ES AC132

Photos and Video courtesy of Owens Corning

QUESTIONS?

Thank You For Your Attention.