Board of Building Standards

EDUCATION COMMITTEE MEETING
AGENDA (REVISED 9/21/22)

DATE: SEPTEMBER 22, 2022
TIME: 10:00 AM
LOCATION: TRAINING ROOM 3, 6606 TUSSING ROAD, REYNOLDSBURG, OHIO
Click here to join the meeting

Call to Order

Consent Agenda

Course Applications

ER-1 Fire Pump Systems: An Overview and Understanding (Underwood Fire Equipment)
FPI (4 hours)
Staff Notes: Instead of slides, this course features a live-streamed feed from a technician in the pump room, plus actual physical equipment for hands-on learning. A photo of the lab setup is attached. Recommend approval, include BO, MPE, FPPE, PPE, BI, PI
Committee Recommendation:

ER-2 Ohio Household Warning Equipment (Fire Tech Productions)
All commercial certifications except plumbing and MI (5 hours)
Staff Notes: Based on 2013 RCO, not recommended for approval unless updated to incorporate 2019 RCO. Once updated, recommend for all certifications.
Committee Recommendation:

ER-3 Product Background, Standards, I-Codes, Performance, and Sustainability (Vinyl Siding Institute/OBOA Conference)
BO, MPE, BPE, BI, FPI, NRIUI, RBO, RPE, RBI, RIUI (two sessions of 1 hour each)
Staff Notes: Updated slides submitted: recommend approval.
Committee Recommendation:

ER-4 Understanding the UL Online Directories with Concentration on Wood-Framed Construction (Conference, National Gypsum)
All certifications except ESI and RIUI (2 hours)
Staff Notes: AIA approved, recommend approval for all certifications.
Committee Recommendation:

ER-5 Ohio Automatic Sprinkler and Standpipe Systems (new version, Fire Tech Productions)
All commercial certifications except PPE, PI, and MI (12.5 hours)
Staff Notes: Recommend expanded references to 2017 OBC Chapter 9, inclusion of PPE, PI and MI.
Committee Recommendation:

ER-6 Ohio Fire Alarm and Detection Equipment (new version, Fire Tech Productions)
All commercial certifications except PPE, PI, and MI (5 hours)
Staff Notes: Recommend expanded references to 2017 OBC Chapter 9, inclusion of PPE, PI and MI.
Committee Recommendation:

ER-7 Ohio Fire Pumps (new version, Fire Tech Productions)
All commercial certifications except PPE, PI, and MI (7.5 hours)
Staff Notes: Recommend expanded references to 2017 OBC Chapter 9, inclusion of PPE, PI and MI.
Committee Recommendation:

ER-8 Ohio Portable Fire Extinguishers (new version, Fire Tech Productions)
All commercial certifications except PPE, PI, and MI (6.5 hours)
Staff Notes: Recommend expanded references to 2017 OBC Chapter 9, inclusion of PPE, PI and MI.
Committee Recommendation:

ER-9 Appliances (Independent Electrical Contractors)
EPE, ESI, RBO (4 hours)
Staff Notes: Received after ESIAC submission: Recommend referral to ESIAC for recommendations.
Committee Recommendation:

ER-10 Box Fill (Independent Electrical Contractors)
EPE, ESI, RBO (4 hours)
Staff Notes: Received after ESIAC submission: Recommend referral to ESIAC for recommendations.
Committee Recommendation:

ER-11 Conductor Types, Ampacities, Correction Factors (Independent Electrical Contractors)
EPE, ESI, RBO (4 hours)
Staff Notes: Received after ESIAC submission: Recommend referral to ESIAC for recommendations.
Committee Recommendation:

ER-12 Dwelling Circuit Requirements (Independent Electrical Contractors)
EPE, ESI, RBO (4 hours)
Staff Notes: Received after ESIAC submission: Recommend referral to ESIAC for recommendations.
Committee Recommendation:

ER-13 Grounding and Bonding (Independent Electrical Contractors)
EPE, ESI, RBO (4 hours)
Staff Notes: Received after ESIAC submission: Recommend referral to ESIAC for recommendations.
Committee Recommendation:

ER-14 Voltage Drop (Independent Electrical Contractors)
EPE, ESI, RBO (4 hours)
Staff Notes: Received after ESIAC submission: Recommend referral to ESIAC for recommendations.
Committee Recommendation:

Old Business

OB-1 Education credit for recruitment/outreach activities
Chris Parmelee, BO for Lakewood Ohio, attending to discuss outreach activities he has performed.
Sample reporting form for discussion.

New Business

Adjourn

EDUCATION COMMITTEE MEETING
CONSENT AGENDA

Course Applications

EC-1	Substantial Damage Determinations (Ohio Building Officials Association) All certifications (4 hours)

File Attachments for Item:

ER-1 Fire Pump Systems: An Overview and Understanding (Underwood Fire Equipment)

FPI (4 hours)

Staff Notes: Instead of slides, this course features a live-streamed feed from a technician in the pump room, plus actual physical equipment for hands-on learning. A photo of the lab setup is attached. Recommend approval, include BO, MPE, FPPE, PPE, BI, PI

Committee Recommendation:

At this time, we do not have a prepared slide show as our visual accompaniment is a live-streamed, point-of-view feed from our technician working in the pump room. Their objective is to provide up-close, views of the equipment, as you would in the field, coinciding with the trainer's lecture. As you can see in the photos, there are three monitors, each providing a unique view of the equipment, when attendees are not physically in the pump room. We offer as much physical hands-on experience as possible in each of our pieces of training.

“Fire Pump Systems: An Overview & Understanding” Syllabus

- Introduction – Fire Pumps and Equipment
- Type of Fire Pumps
    - Horizontal Spilt Case – Electric
    - Horizontal Split Case – Diesel
    - Inline – Electric
    - Jockey Pump - Electric
- Fire Pump Drivers
- Water Sources
- Pressure Gauges
- Valves
    - Casing Relief Valve
    - Air Release Valve
    - Main Relief Valve
    - Pump Suction Control Valves
    - Pressure Reducing/Regulating Valves
- Equipment Protection
- Fuel Tanks
    - Fuel Lines
    - Leak Detection
    - Electronic Level Monitoring
    - Venting
- Alarms and Safety Devices
- Diesel Engine Preventative Maintenance
- Stuffing Box Packing Gland Adjustment
- Digital Pressure Recorders and Digital Event History
- Pressure Transducers and Pressure Sensing Lines
- Fire Pump Starting
    - Automatic
    - Manual
- Flow Meters – Digital Reports
- Recording - Visual Observations
- Recording - Life of the Equipment
- Tagging Impairments

Pietraz is the president of Underwood Fire Equipment, Inc. He is a decades-experienced fire pump professional with a demonstrated history of working in mechanical and industrial engineering. Having a bachelor’s in business administration from the University of Michigan, he quickly embraced the field of fire safety and grew to be a leader in the niche community. As a member of the American Fire Sprinkler Association, National Fire Protection Association, National Fire Sprinkler Association, and Society of Fire Protection Engineers he is dedicated to high standards in fire safety. Additionally, he sits on the NFPA 20 and NFPA 25 technical committees to forge future standards. Through innovative designs, experienced support, and a diverse network of suppliers, Damon leads his organization to meet individual projects’ needs worldwide. Underwood Fire’s products include a variety of brands of fire pumps, control panels, valves, diesel and electric engines, piping, and fiberglass storage tanks for installation projects and repair. They offer emergency fire pump trailer rentals and fabricate pump houses and skid units in-house. Underwood Fire also provides expert field technicians to handle testing and maintenance on all projects, including high-rises, healthcare facilities, big-box warehouses, and industrial and manufacturing plants. The next step for Damon is to apply is expertise and experience through training individuals on fire pump systems in The Lab, a state-of-the-art training facility featuring three unique systems where students can gain hands-on real-life experience.

[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: DAMON PIETRAZ
(Contact Name)
Organization: UNDERWOOD FIRE EQUIPMENT
(Organization/Company)
Address: 48216 FRANK STREET
(Include Room Number, Suite, etc.)
City: WIXOM State: MI Zip: 48393
E-Mail: SHELBY@UNDERWOODFIRE.COM
Telephone: 248 347 4975 Fax:
Course Sponsor: UNDERWOOD FIRE EQUIPMENT

COURSE INFORMATION:

Course Title: FIRE PUMP SYSTEMS: AN OVERVIEW AND UNDERSTANDING

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

Purpose and Objective: FIRE PUMP SYSTEMS: TEACHING ABOUT ELECTRIC INLINE PUMPS, HORIZONTAL SPLIT CASE PUMPS, AND HORIZONTAL SPLIT CASE PLD DIESEL ENGINES. REVIEW OF NFPA #20 2022 AND NFPA #25 2020 CODES. STUDENTS WILL BE ABLE ON IDENTIFY PARTS OF THE FIRE PUMP, COMMON INSTALLATION ISSUES, AND UNDERSTAND HOW THE FIRE PUMP WORKS.

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 ☐
Plumbing Plans Exam. ☐
Electrical Plans Exam. ☐
Mechanical Plans Exam. ☐
Building Inspector ☐
Fire Protection Inspector ☒
Mechanical Inspector ☐
Plumbing Inspector ☐
Non-Res IU Inspector ☐

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

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

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

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

File Attachments for Item:

ER-2 Ohio Household Warning Equipment (Fire Tech Productions)

All commercial certifications except plumbing and MI (5 hours)

Staff Notes: Based on 2013 RCO, not recommended for approval unless updated to incorporate 2019 RCO. Once updated, recommend for all certifications.

Committee Recommendation:

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.

[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
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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: Julie Miller
(Contact Name)

Organization: Fire Tech Productions
(Organization/Company)

Address: 7976 Clyo Rd.
(Include Room Number, Suite, etc.)

City: Centerville State: OH Zip: 45459

E-Mail: julie@firetech.com

Telephone: 937.434.3473 Fax: NA

Course Sponsor:

COURSE INFORMATION:

Course Title: Ohio Household Fire Warning Equipment - FAOH 103

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

Purpose and Objective: This course offers training for the state of Ohio's Household Fire Warning Equipment exam, so you can pass your state certification on the first attempt! Based on Chapter 29 of NFPA 72 2016 and The Ohio Residential Code 2013, this course addresses requirements associated with household fire alarm systems. Self-paced lessons and quizzes are provided, allowing you to test your knowledge of the course material.

Number of Instructional Contact Hours that can be obtained upon completion: 5.0

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	
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.

Ohio Course Submission

Included in this document: Course Outline, Instructor resume(s)

Course: Ohio Household Fire Warning Equipment - FAOH 103

Course Outline:

1. Welcome
2. Introduction
3. Basic Requirements and Smoke Alarms
4. Power Supplies and Equipment Performance
5. Installation and Location & Spacing
6. Ohio Residential Code
7. Glossary

Instructor: Bill Ford

Charles William Ford

OBJECTIVE

To utilize my strong administrative and people skills in combination with my technical background, to eliminate or reduce the incidence of unfriendly fire and the resulting losses through motivation, education, behavior modification and engineering principles where applicable.

EDUCATION

EASTERN KENTUCKY UNIVERSITY, Richmond, Kentucky,
B. S. Degree in Fire Prevention and Control, 1982.
Minor Studies Law Enforcement

EXPERIENCE

KETTERING HEALTH NETWORK (2021-Present)

Operation Coordinator

- Manage seven technicians who hold sprinkler technician, fire alarm technician and portable extinguisher certifications
- Responsible for the inspection/testing of fire protection systems owned and operated by Kettering Health

KETTERING FIRE DEPARTMENT (2008-2021)

Fire Marshal

- Manage the fire investigation program
- Conduct plan reviews and field fire protection system

acceptance tests for the Kettering Building Department

- Conduct fire safety code enforcement inspections

HUBER HEIGHTS FIRE DIVISON (2002- 2008)

Fire Chief

- Managed 51 person paid fire department with paramedic service with two stations
- Administered a 7.4 million dollar budget
- Developed City Emergency Operations Plan
- NIMS Compliance Coordinator
- Served as acting City Manager in the absence of the manager
- Authored FEMA Fire Act Grant for City Traffic Signal Pre-emption System

DAYTON AIRPORT FIRE DEPARTMENT (2000-2002)

Airport Fire Chief

- Managed 30 person paid fire department with paramedic service
- Responsible for budgeting, planning and policy development
- Administered 3 million dollar budget, including capital equipment
- Responsible for airport disaster planning and functional exercises
- Responded to aircraft emergencies, EMS calls, and structural alarms serving as incident command

CITY OF DAYTON FIRE DEPARTMENT (1982-2000)

Fire Protection Engineer/Fire Marshal

- Bureau head of Fire Prevention Bureau – responsible for planning, organizing and evaluation of fire prevention and hazard abatement programs and activities
- Responsible for budgeting and supervisory activities for 13 employees
- Served as acting Assistant Chief of Administration
- Sector commander at scene of major incidents
- Fire Investigator Regional Fire Investigation Unit
- Instructor - Dayton Fire Training Center and Dayton Police Academy
- Qualified fire investigation expert, Montgomery County Common Pleas Court

CITY OF DAYTON FIRE DEPARMENT (1979-1982)

Firefighter/EMT-A

- Graduate of Dayton Fire Academy, assigned to Operations Division and Fire Prevention Bureau
- Engaged in fire suppression activities and staffed ambulances serving as an EMT-A
- Conducted fire safety inspections and served as plans examiner

SINCLAIR COMMUNITY COLLEGE, (1989-2014)

Instructor – Lecturer II

- Instruct courses in Fire Science Technology Program, Department of Engineering Technologies

MONTGOMERY COUNTY SHERRIFF'S OFFICE, (1990-2015)

Commissioned Law Enforcement Officer (Deputy)

- Assigned commission as Fire Marshal for City of Dayton

SPECIAL INFORMATION

- Graduate Dayton Fire Academy, certified by the Ohio Division of Public Safety, 1979
- Graduate Dayton Police Academy, certified by the Ohio Peace Officers' Training Council, 1990
- State of Ohio Level II certified firefighter
- State of Ohio Fire Safety Inspector
- State of Ohio Fire Safety Inspector Instructor, Fire Fighter Instructor
- Hazardous Materials Operations certified
- Basic and Advanced Aircraft Rescue Firefighter certification, - American Association of Airport Executives
- Certified Fire Service and Fire Safety Inspector Instructor, State of Ohio
- Ohio Board of Building Standards, Fire Protection Inspector, Interim Fire Protection Plans Examiner certifications.
- National Fire Academy attendee
  - ✓ Strategic Analysis of Community Risk Reduction
  - ✓ Codes and Ordinances
  - ✓ Fire Prevention Specialist II
  - ✓ Microcomputers for Arson Squad Managers

PROFESSIONAL AFFILIATIONS

- Southwest Fire Safety Council
- International Code Council

Household Fire Warning Equipment -Introduction

FIRETECH
PRODUCTIONS

Welcome to the Introduction for the Household Fire Warning Equipment course.

This introduction provides a brief overview of what will be covered in the course.

You can come back to this module and reference this information anytime in your menu.

Topics that are covered in this introduction are as follows:

- State of Ohio Important References
- Preparing for the Exam
- Study Tips
- Ohio Codes
- NFPA Codes
- *NFPA* 72 2016 Definitions

When you are ready to begin, click on the button above to start the course.

Overview

Glossary

Lesson 1 of 2

Overview

Welcome

Please review this introduction before getting started on the course. The focus of this course is NFPA 72 2016, Chapter 29, and *The Residential Code of Ohio*, 2013.

We will look at key references and study tips. In addition, we will highlight key vocabulary terms in the glossary.

REFERENCES

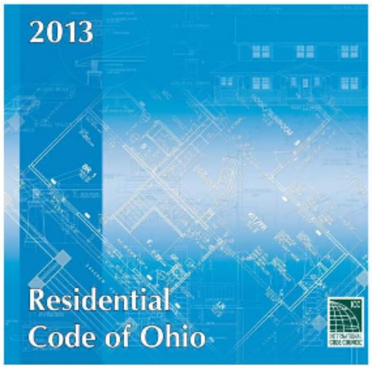
Key References

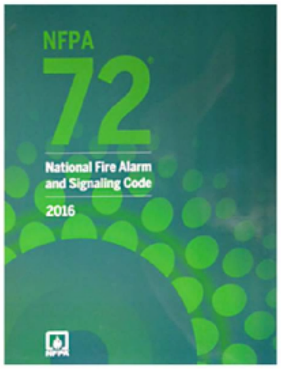
You will want to really focus on the following:

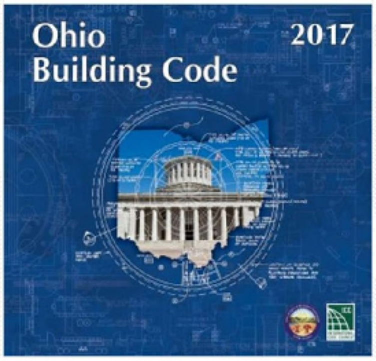
☐ *The Residential Code of Ohio*, 2013

☐ *NFPA 72 – National Fire Alarm and Signaling Code*, 2016 (Chapter 29)

☐ *Ohio Building Code*, 2017







References

The exam is prepared from the following:

- Ohio Administrative Code Section 1301:7-7-09 (Ohio Fire Code), 2013 edition Chapter 3: https://codes.iccsafe.org/content/OHRC2013U0118/chapter-3-building-planning

- *NFPA* 72, 2016 edition
- Ohio Building Code, 2017 edition

CONTINUE

Additional Resources

Below is additional information and resources for the Ohio exam.

Ohio Department of Commerce – Division of State Fire Marshal:

Ohio Department of Commerce

To access the Ohio Department of Commerce – Division of State Fire Marshal, click on this "Click Here" button.

CLICK HERE

Ohio Department of Commerce phone: **(614) 752-7126**

The following downloadable PDF is for the Fire Protection Exam Application through the Ohio Department of Commerce:

PDF

FireProtectionExamApplication.pdf
548.9 KB

PSI Candidate Information Bulletin

A very important source of information is the PSI Candidate Information Bulletin from PSI Services LLC. Take time to read it below in its **ENTIRETY**.

PDF

OhioCertificationExaminationBulletin.pdf
230.9 KB

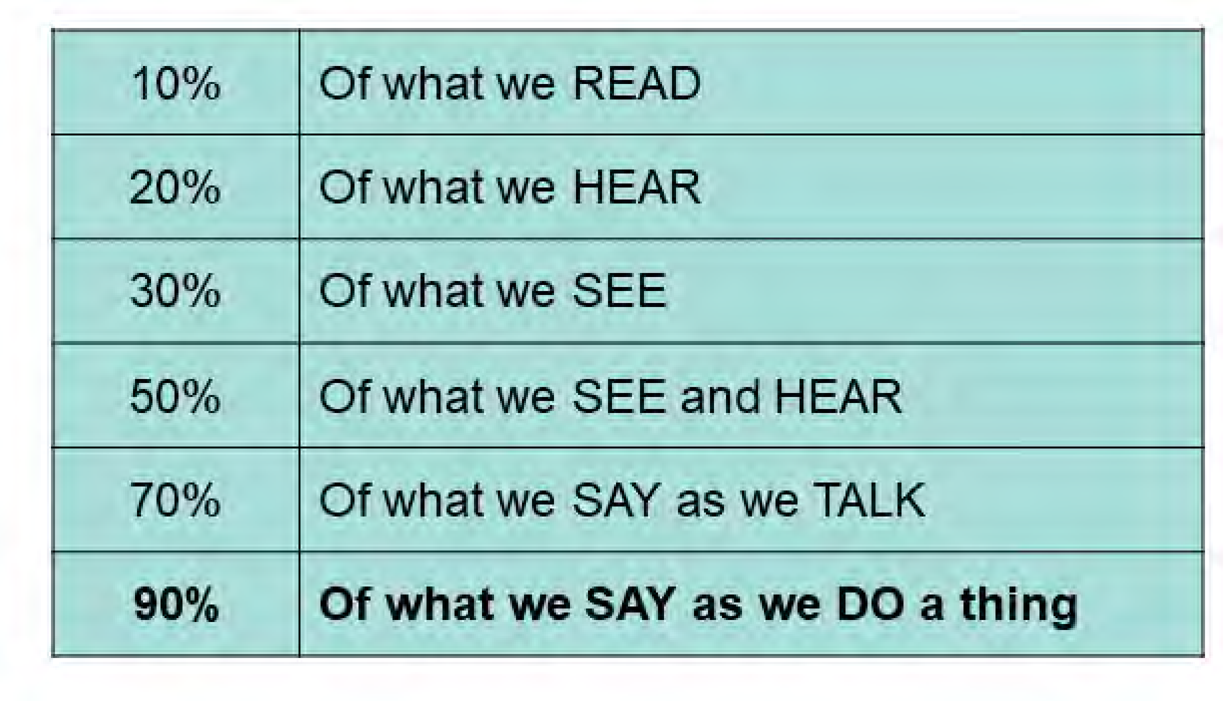
PSI Online Exams

To check for the most updated information on PSI Services, visit their website by clicking on this "Click Here" button.

CLICK HERE

HOW WE LEARN

Thinking About How We Learn



10%	Of what we READ
20%	Of what we HEAR
30%	Of what we SEE
50%	Of what we SEE and HEAR
70%	Of what we SAY as we TALK
90%	**Of what we SAY as we DO a thing**

Source: ***Skill With People*** by Les Giblin

Different people learn in different ways.

It is important to discover what works **best for you** and use your strengths to ensure you retain the material.

OHIO CODES

Ohio Codes

The Ohio Building Code has a lot of information in it. However, only a relatively small portion of the code pertains to fire alarm systems. It ***does*** give the State Fire Marshal the responsibility for promulgating and enforcing the Ohio Codes, testing and training, and licensing and certification support services.

The Ohio Fire Code states that fire protection systems shall be installed, inspected, tested, and maintained per *NFPA* 72 2016 and *NFPA* 70 2017 (NEC). The code also defines specific rules for Ohio as well as reinforces some of the *NFPA* 72 2016 requirements.

- One of these requirements is to be certified and licensed by the state of Ohio.
- The only exception is for a provisional person in an approved formal apprenticeship program. They are permitted to work under the constant supervision of a certified person. The certified person is only allowed to supervise one provisional person.

NFPA 72 2016

NFPA 72 2016

NFPA 72 2016 is the *National Fire Alarm and Signaling Code*

- **Chapter 1** (Administration) – Defines the scope, purpose, and administration of *NFPA* 72 2016.
- **Chapter 2** (Referenced Publications) – Lists all referenced NFPA and ANSI specifications and codes.
- **Chapter 3** (Definitions) – Has a brief explanation of almost every fire alarm term.
- **Chapter 10** (Fundamentals of Fire Alarm Systems) – This large chapter includes power supplies, installation, equipment, and documentation.
- **Chapter 12** (Circuits and Pathways) – This relatively small chapter includes information on capabilities of types of circuits or system pathways.
- **Chapter 14** (Inspection, Testing and Maintenance) – Covers the requirements for the inspection, testing, and maintenance for all devices and systems.
- **Chapter 17** (Initiating Devices) – Contains all of the requirements for signaling devices, such as smoke and heat detectors.
- **Chapter 18** (Notification Appliances) – Covers the requirements for alarm bells, sirens, lights, and any device that indicates an alarm.

- **Chapter 21** (Emergency Control Functions and Interfaces) – Covers the requirements for emergency control function interfaces.

- **Chapter 23** (Protected Premises Fire Alarm Systems) – Covers system performance and integrity requirements.

- **Chapter 24** (Emergency Communications Systems (ECS)) – Covers the requirements of communications and mass notification systems.

- **Chapter 26** (Supervising Station Fire Alarm Systems) – Covers the requirements between a continuously attended supervising station and the protected premises.

- **Chapter 27** (Public Reporting Fire Alarm Systems) – Covers the requirements for municipal fire alarm systems.

- **Chapter 29** (Single- and Multiple-Station Alarms and Household Fire Alarm Systems) – Covers requirements for dwellings, hotels, day care, and nursing facilities.

ⓘ ***NFPA* 72 2016** also **contains several Annexes and supplements** that have very **valuable examples and information.** It is **recommended you study this material** as well. However, the focus of this course is **Chapter 29.**

Training Modules

Be prepared to **refer to your copy of the referenced NFPA standards constantly** throughout these modules. Be comfortable with the technical material.

Each **training module** is carefully planned and designed to **highlight areas of the standards that you need to know in order to increase your chances of success on the exam**. The goal of these training modules is to help you become knowledgeable of important areas of the standards and to gain a working understanding of how to apply these requirements.

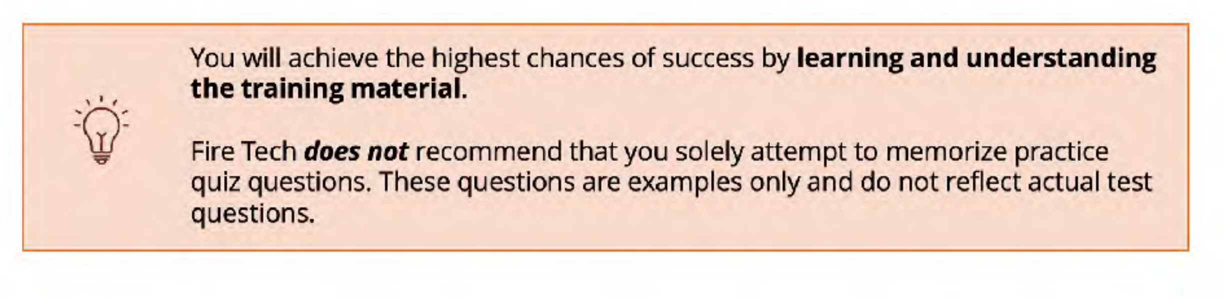
Take notes as you are studying, and **highlight** areas of the standards that are important to know.

The more familiar you are with the requirements, tables, and figures, the better your chances of success on the exam.

QUIZZES

The Quizzes

Fire Tech provides a practice quiz associated with each training module, which should be taken following completion of the module. As you take each practice quiz, use your copy of the referenced *NFPA* standards to **look up every answer to each quiz question**. This will assist you in **becoming more familiar with the requirements and where they are located** in each of the codes and standards.

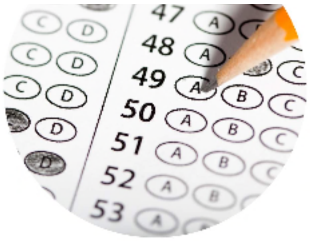


You will achieve the highest chances of success by **learning and understanding the training material.**

Fire Tech ***does not*** recommend that you solely attempt to memorize practice quiz questions. These questions are examples only and do not reflect actual test questions.

Additionally, **read each question carefully**. Sift through what is pertinent to the question and what is irrelevant information that may be included as a distractor.

You will achieve the highest chances of success by learning and understanding the training material. Fire Tech does **not** recommend that you solely attempt to memorize practice quiz questions.



KNOWLEDGE CHECKS

Knowledge Checks

To help you apply course material and prepare for the quizzes, **knowledge checks** are sprinkled throughout each course.

Completing these knowledge checks is **required** to proceed further in the lesson. If you're stuck on a question, refer to previous lesson material and use your NFPA standard to find the answer.

Knowledge checks will help you apply course material and prepare for course quizzes.

○ True

○ False

SUBMIT

Complete the knowledge check above before moving on.

Practice Exams

Once you have read all of the lessons in this course and passed all of the quizzes, you will be ready to take the **Practice Exam**.

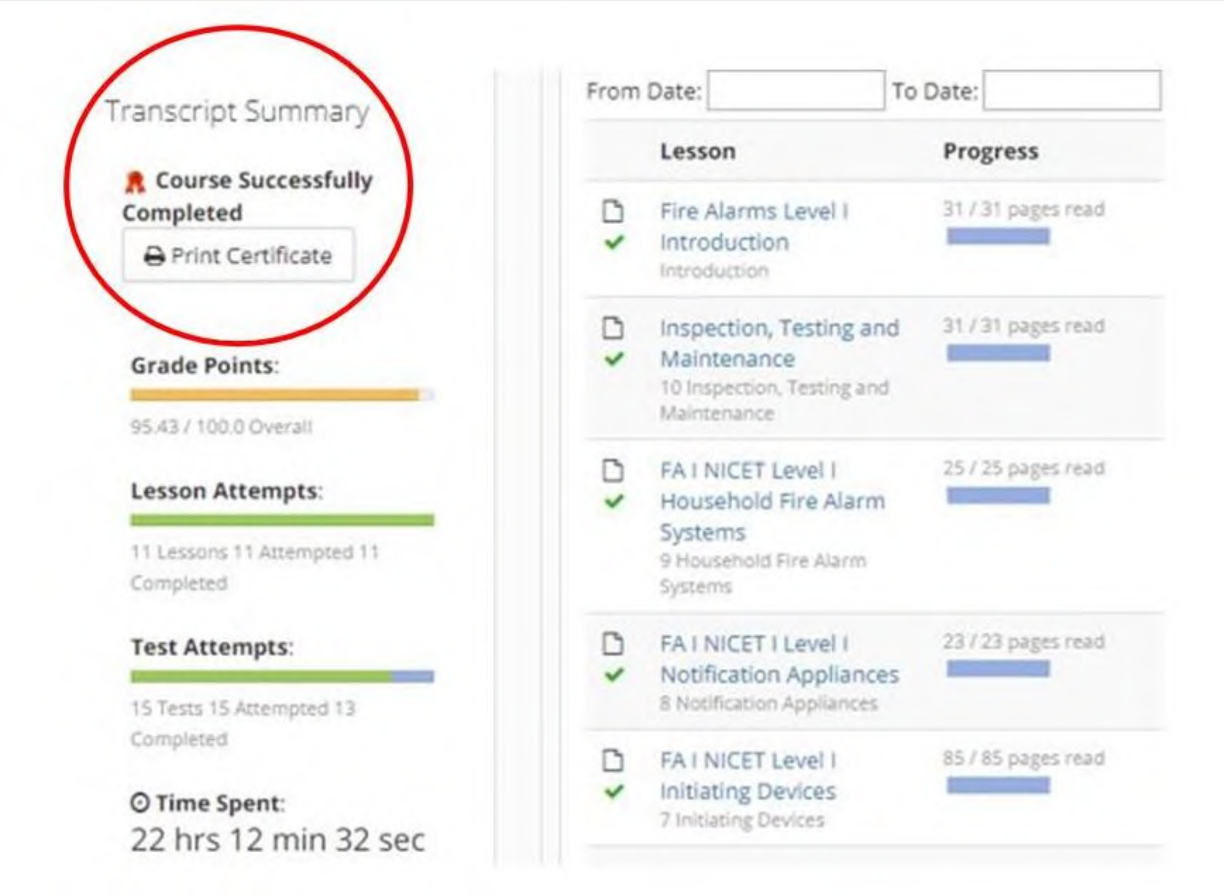
The Practice Exam consists of questions from the quizzes and are presented in a randomized manner. Fire Tech highly recommends that you take each of these practice exams.

Three practice exams are offered:

- Exam #1 is **required** to pass the course
- Exams #2 and #3 are **optional** and are not required to pass the course.

CONTINUE

Course Completion



Transcript Summary

Course Successfully Completed

Print Certificate

Grade Points:

95.43 / 100.0 Overall

Lesson Attempts:

11 Lessons 11 Attempted 11 Completed

Test Attempts:

15 Tests 15 Attempted 13 Completed

Time Spent:

22 hrs 12 min 32 sec

From Date: To Date:

	Lesson	Progress
✓	Fire Alarms Level I Introduction Introduction	31 / 31 pages read
✓	Inspection, Testing and Maintenance 10 Inspection, Testing and Maintenance	31 / 31 pages read
✓	FA I NICET Level I Household Fire Alarm Systems 9 Household Fire Alarm Systems	25 / 25 pages read
✓	FA I NICET I Level I Notification Appliances 8 Notification Appliances	23 / 23 pages read
✓	FA I NICET Level I Initiating Devices 7 Initiating Devices	85 / 85 pages read

Upon successful completion of the Practice Exam #1, you can download your course completion certificate, as shown in the transcript summary.

GLOSSARY

Lesson 2 of 2

Glossary

COMMON ACRONYMS

Common Acronyms

Every industry has its own unique terms and acronyms. Here are some common acronyms related to fire alarm systems that you will see throughout this course. Click on each "**+**" sign below to learn more about common acronyms you will see in this module and in the field. For now, take a moment to become familiar with them, and see what the letters stand for.

AHJ –

Authority Having Jurisdiction

CFPS —

Certified Fire Protection Specialist

FACU —

Fire Alarm Control Unit (also called a Fire Alarm Control Panel (FACP)

FAS —

Fire Alarm System

IBC —

International Building Code

IDC —

Initiating Device Circuit

IFC —

International Fire Code

NAC —

Notification Appliance Circuit

NEC —

National Electrical Code

NFPA —

National Fire Protection Association

NICET —

National Institute for Certification in Engineering Technologies

SLC —

Signaling Line Circuit

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GLOSSARY

Glossary

Click on each "**+**" symbol to see the definition for each word below. These words are also linked throughout the course. Remember **all** of the definitions that may be on the exam are in *NFPA* 72 2016, Chapter 3.

Alarm Signal —

A signal that results from the manual or automatic detection of an alarm condition. (*NFPA* 72 2016, Section 3.3.253.1)

Authority Having Jurisdiction (AHJ) —

An organization, office, or individual responsible for enforcing requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure. (*NFPA* 72 2016, Section 3.2.2)

Combination System –

A fire alarm system in which components are used, in whole or in part, in common with a non-fire signaling system. Examples of non-fire systems are security, card access control, closed circuit television, sound reinforcement, background music, paging, sound masking, building automation, time, and attendance. (*NFPA* 72 2016, Section 3.3.103.1)

Control Unit (Fire Alarm Control Unit-FACU) –

A component of the fire alarm system, provided with primary and secondary power sources, which receives signals from initiating devices or other fire alarm control units, and processes these signals to determine part or all of the required fire alarm system output function(s). (*NFPA* 72 2016, Section 3.3.100)

Also known as the **Fire Alarm Control Panel** (FACP), **control panel**, or **control unit**.

Detector –

A device suitable for connection to a circuit that has a sensor that responds to a physical stimulus such as heat or smoke. (*NFPA* 72 2016, Section 3.3.66)

Dwelling Unit

A single unit, providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation. (*NFPA* 72 2016, Section 3.3.79)

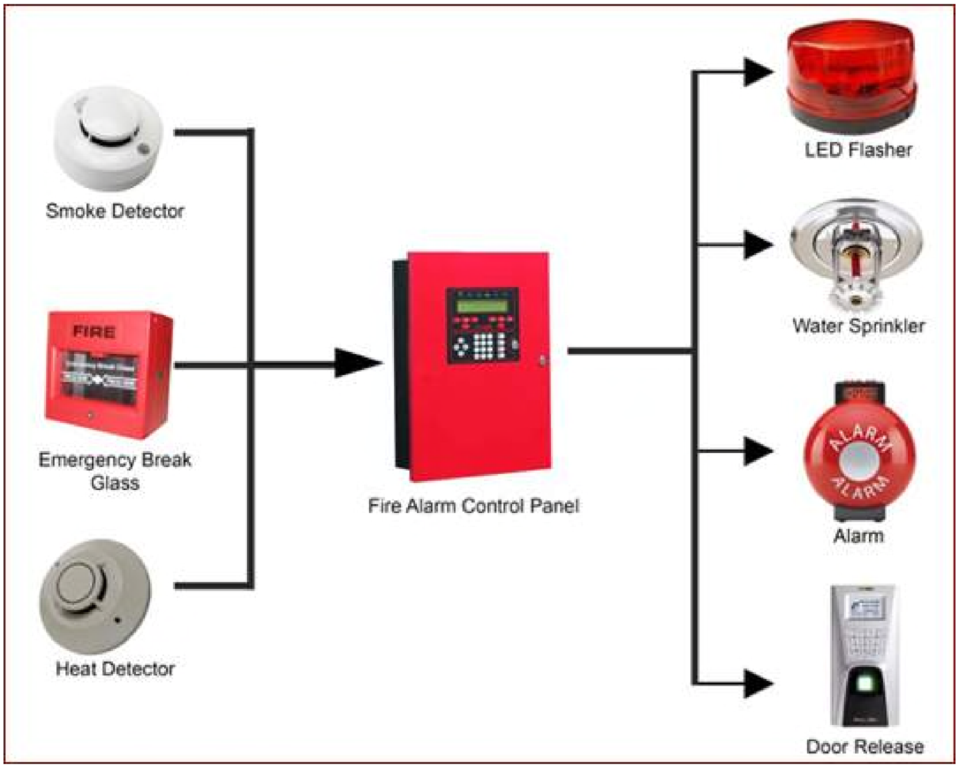
Fire Alarm Control Unit (FACU)

A component of the fire alarm system, provided with primary and secondary power sources, which receives signals from initiating devices or other fire alarm control units, and processes these signals to determine part or all of the required fire alarm system output function(s). (*NFPA* 72 2016, Section 3.3.100)

Also known as the **Fire Alarm Control Panel** (FACP), **control panel**, or **control unit**.

Fire Alarm System

A system or portion of a combination system that consists of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals.) (Section 3.3.103)



Household Fire Alarm System –

A system of devices that uses a fire alarm control unit (panel) to produce an alarm signal in the household for the purpose of notifying the occupants of the presence of a fire so that they will evacuate the premises. (*NFPA* 72 2016, Section 3.3.103.2)

Initiating Device –

A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box, or supervisory switch. (*NFPA* 72 2016, Section 3.3.131)

Multiple-Station Alarm Device –

Two or more single station alarm devices that can be interconnected so that actuation of one causes all integral or separate audible alarms to operate; or one single station alarm device having connections to other detectors or to a manual fire alarm box. (*NFPA* 72 2016, Section 3.3.161)

Notification Appliance —

A fire alarm system component such as a bell, horn, speaker, light, or text display that provides audible, tactile, or visible outputs, or any combination thereof. (*NFPA* 72 2016, Section 3.3.172)

Notification Appliance Circuit (NAC) —

A circuit or path directly connected to a notification appliance(s). (*NFPA* 72 2016, Section 3.3.173)

Shall —

Indicates a mandatory requirement. (*NFPA* 72 2016, Section 3.2.6)

Single-Station Alarm Device —

An assembly that incorporates the detector, the control equipment, and the alarm-sounding device in one unit operated from a power supply either in the unit or obtained at the point of installation. (*NFPA* 72 2016, Section 3.3.260)

Sloping Ceiling —

A ceiling that has a slope of more than 1 in 8. (*NFPA* 72 2016, Section 3.3.36.2)

Smoke Alarm —

A single or multiple-station alarm responsive to smoke. (*NFPA* 72 2016, Section 3.3.265)

Smoke Detector —

A device that detects visible or invisible particles of combustion. (*NFPA* 72 2016, Section 3.3.66.20)

Smooth Ceiling —

A ceiling surface uninterrupted by continuous projections, such as solid joists, beams, or ducts, extending more than 4 in. (100 mm) below the ceiling surface. (*NFPA* 72 2016, Section 3.3.38.3)

Trouble Signal –

A signal that results from the detection of a trouble condition. (*NFPA* 72 2016, Section 3.3.253.10)

CONTINUE

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

Household Fire Warning Equipment - Ohio Residential Code

Welcome to the Ohio Residential Code module of the Household Fire Warning Equipment Course.

By the end of this module, you will be able to do the following:

- Recognize the Residential Code of Ohio for One- Two- or Three-Family Dwellings.
- Distinguish requirements for household fire alarm systems.
- Identify carbon monoxide alarm requirements.

Key Reference for this module:

- *Residential Code of Ohio,* 2013
- *NFPA* 72 – *The National Fire Alarm and Signaling Code*, 2016

When you are ready to begin, click on the button above to start the course.

Residential Code of Ohio 2013

Lesson 1 of 1

Residential Code of Ohio 2013

Goals for this Lesson:

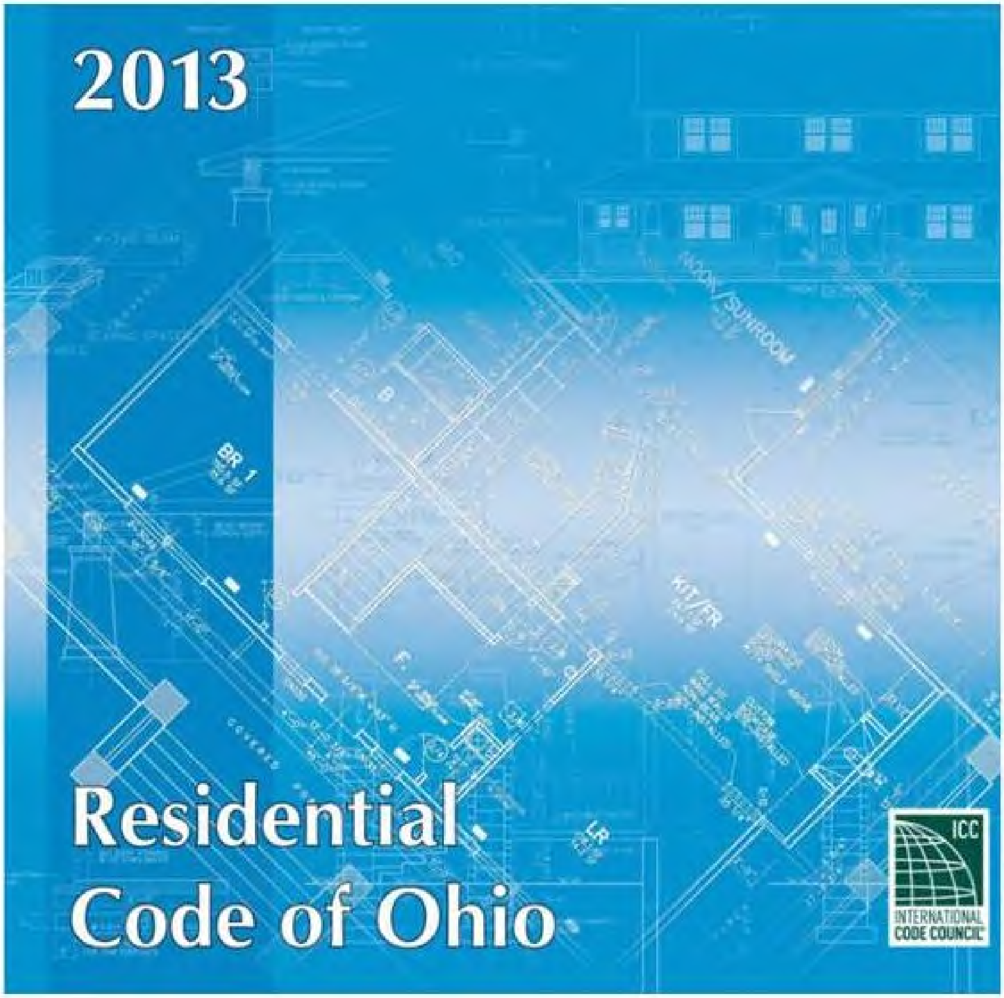
- Recognize the Residential Code of Ohio for One- Two- or Three-Family Dwellings.
- Distinguish requirements for household fire alarm systems.
- Identify carbon monoxide alarm requirements.

LET'S GET STARTED

Ohio Building Code and Residential Code of Ohio 2013

Ohio Building Code – Section 101.2, Scope

The requirements in the Ohio Building Code apply to the construction, alteration, replacement, repair, and maintenance of every building or structure and/or appurtenances connected or attached to these buildings or structures.



While an owner may exceed Ohio Building Code requirements, keep in mind that this code directs the following to comply with the Residential Code of Ohio, as defined in **Section 310**:

1. Detached one- two- and three-family dwellings and their accessory structures
2. Single-family dwellings with five or fewer people receiving care in a supervised environment but capable of self-preservation with or without limited verbal or physical assistance

> ⓘ **This is reiterated in Section 310.1 which states the Residential Code of Ohio shall apply to structures comprised exclusively of one-, two-,**

or three-family dwellings (having independent exits) and their accessory structures, or single-family dwellings as described above.

ONE- TWO- OR THREE-FAMILY DWELLINGS

Residential Code of Ohio for One- Two- or Three-Family Dwellings

Section 314

Section 314 defines requirements for smoke alarms. All smoke alarms are to be listed per **UL 217** and installed in accordance with the Residential Code of Ohio for One- Two- or Three-Family Dwellings and the household fire warning equipment requirements found in *NFPA* 72 2016.

Smoke alarms (photoelectric and ionization) are required to be installed on each level within each dwelling unit. Separate or dual-sensing smoke alarms are permitted.

Systems that satisfy **Section 314.2** requirements are not required to include both technologies.

Smoke Detection Systems

Section 314.2

Household fire alarm systems installed per *NFPA* 72 2016 requirements that include smoke alarms or are a combination of smoke detector and audible notification devices are permitted.

The household fire alarm system is required to provide the same level of smoke detection and alarm as required for smoke alarms. If a household fire warning system is installed using a combination smoke detector and audible notification device(s), it needs to be a permanent fixture of the occupancy and owned by the homeowner.

This requirement can be waived if separate smoke alarms meet all of the requirements in this section. Maintain the system following *NFPA* 72 2016 requirements.

LOCATION

Location

Section 314.3

Install smoke alarms in the following locations:

1 In each sleeping room

2. Outside each separate sleeping area, such as in the corridors in the immediate vicinity of the sleeping rooms

3. On each additional story of the dwelling:

This includes basements and habitable attics.

This excludes crawl spaces and uninhabitable attics.

For dwellings or dwelling units with split levels and no intervening door between adjacent levels, a smoke alarm installed on the upper level is permitted to suffice for the adjacent lower level if the lower level is less than one full story below the upper level.

Smoke alarms in existing buildings are to be installed in the following spaces as required for a new dwelling:

- If alterations or repairs requiring a permit are made in a sleeping room or outside a separate sleeping area

- If one or more sleeping rooms are added to existing dwellings, the new sleeping rooms, and the immediate vicinity outside each sleeping room

LET'S REVIEW

Let's do a quick check about what has been covered so far.

Smoke alarms (photoelectric and ionization) are required to be installed on _____ level within each dwelling unit.

Type your answer here

SUBMIT

Install smoke alarms in the following locations: (Select all that apply)

☐ Crawl spaces and uninhabitable attics

☐ In each sleeping room

☐ On each additional story of the dwelling

☐ Outside each separate sleeping area, such as in the corridors in the immediate vicinity of the sleeping rooms

SUBMIT

POWER SOURCE

Power Source

Section 314.4

Primary power for smoke alarms shall come from the building wiring when wiring is served from a commercial source for the following:

- New dwelling units
- Existing dwelling units with an attic, crawl space, or basement available which could provide access for hard wiring

- Existing dwelling units where the existing interior finishes have been removed and the structure exposed

Note the exceptions:

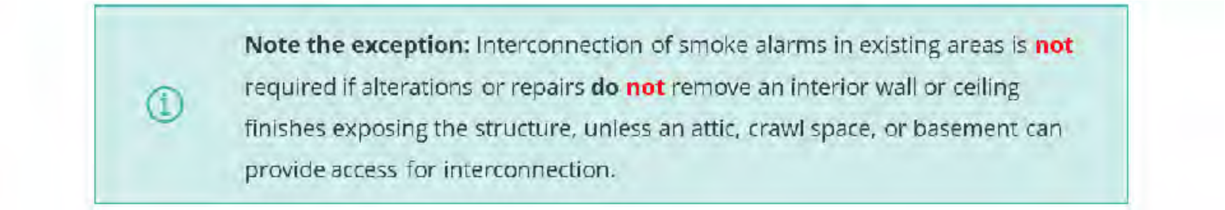
- For **buildings with no commercial power**, smoke alarms may be **battery operated.**
- **New smoke alarms** are **not required** to be **hard-wired** in existing finished areas if there is **no access to an attic, crawl space, or basement and if the removal of interior wall or ceiling finishes exposing the structure is not proposed**. Conventional battery-operated smoke alarms or wireless alarms are permitted in these existing finished areas.

INTERCONNECTION

Interconnection

Section 314.5

If **more than one smoke alarm device** is required within a dwelling unit, the devices are **required to be interconnected** so that one alarm activates all the alarms in the dwelling unit. **Wireless alarms** are **not required** to be **physically interconnected** if all alarms sound when one alarm activates.



Note the exception: Interconnection of smoke alarms in existing areas is **not** required if alterations or repairs **do not** remove an interior wall or ceiling finishes exposing the structure, unless an attic, crawl space, or basement can provide access for interconnection.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

For buildings with no commercial power, smoke alarms must be connected to a generator.

○ True

○ False

SUBMIT

CARBON MONOXIDE ALARMS

Carbon Monoxide Alarms

Section 315

Carbon monoxide (CO) alarms are required in new and existing dwelling units with fuel-fired appliances or attached garages when one of the following conditions is present:

New dwelling units – CO alarms are required outside each separate sleeping area in the immediate vicinity of the sleeping room.

Existing dwelling units – If the work requires a permit, CO alarms are to be installed in the following locations:

- An addition or creation of a new sleeping room
- An alteration to a sleeping room
- An alteration immediately outside a sleeping room
- An addition of, or alteration to, an attached garage
- An addition, alteration, repair, or replacement of a fuel-fired appliance

Carbon Monoxide Alarm Requirements – Section 315.3

Single station CO alarms are to comply with UL 2034. They shall be installed per the Residential Code of Ohio for One- Two-, or Three-Family Dwellings requirements and the manufacturer's installation guidelines.

ⓘ **There is an Ohio Building Code and an Ohio Residential Building Code. The Ohio Residential Building Code was updated in 2013 and requires Carbon Monoxide Alarms.**

LET'S REVIEW

Let's do a quick check about what has been covered so far.

According to Section 315, regarding existing dwelling units – If the work requires a permit, CO alarms are to be installed in the following locations: (Select all that apply)

☐ An addition, alteration, repair, or replacement of a fuel-fired appliance

☐ An addition or alteration to a detached garage

☐ An addition or creation of a new sleeping room

☐ An alteration immediately outside a sleeping room

☐ An alteration to a sleeping room

SUBMIT

CONTINUE

After completing this module, you should now have a better understanding of smoke and carbon monoxide requirements found in the Residential Code of Ohio 2013.

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

File Attachments for Item:

ER-3 Product Background, Standards, I-Codes, Performance, and Sustainability (Vinyl Siding Institute/OBOA Conference)

BO, MPE, BPE, BI, FPI, NRIUI, RBO, RPE, RBI, RIUI (two sessions of 1 hour each)

Staff Notes: Updated slides submitted: 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: Vinyl Siding Institute

Course Submitter: Brookklin Brown
(Contact Name)
Organization: Vinyl Sidning Institute
(Organization/Company)
Address: 1800 Diagonal Road Suite 545
(Include Room Number, Suite, etc.)
City: Alexandria State: VA Zip: 22314
E-Mail: bbrown@vinylsiding.org
Telephone: 5714896984/6149617294 Fax:
Course Sponsor: Ohio Building Officials Association

COURSE INFORMATION:

Course Title: Product Background, Standards, I-Codes, Performance, and Sustainability

New Course Submittal: ☒ Update Course: ☒ Prior Approval Number: ICC Course #BBS2018-350

Purpose and Objective: Understand how building materials fits in with sustainability and how the codes support sustainability
Learn about Chapter 7 of the IRC and Chapter 14 of the IBC
Understand product Standard how they are developed and used by the codes
Learn about fire safety and product performance measures required by the code

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

If Multi-Session, Number of Instructional Contact Hours Per Session: Two sessions @ (1) hour each for a total of (2) hours

Program Applicable for the Following Participants:

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

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

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

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

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

Matthew D. Dobson

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Burlington, NC 27215

703-244-2930

Matthewdobson1855@yahoo.com

https://www.linkedin.com/in/matt-dobson-cae-15753243/

EXPERIENCE

Vice President | **Vinyl Siding Institute, Alexandria, VA/Washington DC**

February 2004 - Present

Hands on proven industry leader with thirty years of experience in the home building, building materials, manufacturing, regulatory, legislative, and issues management areas.

Professional, driven, intuitive, and goal oriented while offering a unique combination of ability to ingrain into industry, quickly establish a knowledge base, facilitate, collaborate, and lead, while successfully pushing industry positions in external forums.

CURRENT AREAS OF FOCUS

Manufacturer Leadership and Representation
Provide leadership and representation for vinyl siding industry with strong market share of all residential cladding applications (new construction and remodeling) in the United States and Canada. Representation includes issues management, position development, and outreach/advocacy with targeted stakeholders.

Staff and Budget Management
Provide direct oversight of Directors, and consultants, and indirect Directors. Provide strategic input on organizational direction to President/CEO. Management includes delegating, accountability, and position objectives growth.

Responsible for accountability and implementation of Regulatory and Advocacy, Technical, and Product Certification budgets and provide direction for marketing, communications, and public relations programs.

Strategy Development and Tactical Implementation
Organize industry members to develop a program strategy and push through with agreed upon tactics. In multiple occasions successfully added new provisions for manufacturers' products that help with leveraging stronger market positions and reduce regulatory hurdles.

Advocacy, Regulatory and Legislative Arenas
Successfully manage advocacy program for product acceptance and perception in hundreds of local and state government locations throughout the United States and Canada which enable manufacturers to compete in markets more fairly. Success in advocacy areas includes local, state legislative and federal regulatory initiatives.

Group Facilitator and Leader
Continuously work with manufacturers members and staff by organizing groups and providing a structured meeting process that create results through consensus.

Industry Leader
Recognition of leadership ability includes the involvement in multiple industry arenas including the following appointments:

- Chair, Emissions Task Group, Vinyl Sustainability Council
- Task Group Chair and Consensus Committee Member of the ANSI National Green Building Standard
- Code Development Committee Member for the ICC'S International Building Code
- National Association of Home Builders – Chair of Green and Sustainability Subcommittee, Member of Building Products Issues Committee, Member of Environmental Issues Committee, Member of the Design Committee, and Member of Codes and Standards Committee

PAST EXPERIENCES AND POSITIONS

Codes and Standards Manager, National Association of Home Builders - 2001-2004

Operations and Construction Manager/Owner Timber Log Building Systems - 1996-2001

Industry Coordinator, Building Systems Councils, National Association of Home Builders -1992-1996

EDUCATION

Certified Association Executive
American Society of Association Executives

Bachelor of Science, College of Natural Resources
Degree: Building Construction Management
Michigan State University 1992

OTHER RELEVANT EXPERIENCES AND PERSONAL ACTIVITIES

Construction Dispute Arbitrator 2008 - present
City of Burlington - Housing Commissioner - 2009 - 2016
City of Burlington – Planning and Zoning Commissioner 2016 - 2019
City of Burlington – City Council Candidate - 2015
Blessed Sacrament Catholic Church – Catechist, Capital Campaign, Minister of Hospitality, Building Committee Member, Knights of Columbus Member
Youth Basketball Coach

Alex Fernandez

3400 Belleview Ave. ● Cheverly, Maryland 20785 ● 786- 367-5655 ● Alexfernandez13@gmail.com

Career Profile

Specializing in government affairs, policy analysis, legislative and regulatory tracking, and explaining complex issues in simple ways. Excels at forming relationships with policymakers and government officials. Employs a vast knowledge of legal terminology and legal research skills. Possesses a unique ability to build consensus and develop win-win solutions. Strong negotiator and equally strong collaborator. Politically savvy in the operations of trade associations and other corporate hierarchies.

Experience

Vinyl Siding Institute

Director of Advocacy, Washington DC November 2018 – Present

- Develop and maintain positive working relationships and communications with state legislative and regulatory officials
- Direct the identification, monitoring, and analyzation of state regulation and legislation and relevant state policy.
- Support the Association's government relations goals by lobbying, building coalitions and expanding relationships with key decision-makers, policymakers, governors, mayors and public utility commissions
- Preparation, forecasting, monitoring and tracking of the relevant aspects of the Governmental Affairs budget
- Work collaboratively with local chapters of various trade organizations to develop and implement effective advocacy strategies and member service programs
- Comprehensive understanding of sensitivities inherent to the housing and building industry

Seabury Resources for Aging

Director for Community Engagement/Government Affairs, Washington DC January 2018 – November 2018

- Create compelling, effective fundraising appeals both for direct mail and electronic appeals and oversees appeal process
- Oversee Seabury's individual cultivation program, Seabury Connects, including managing team activities and events, making follow up calls, and conducting tours;
- Assist with organizational fundraising events including staffing events and overseeing graphics and video production
- Direct strategy and production of all print and web materials, including newsletters, annual reports, website content, promotional flyers
- Disseminate information about Seabury, its programs and activities by way of various media, to include print, broadcast and social networks
- Coordinate the work of staff involved in building the public's awareness of Seabury Resources for Aging, its programs, activities and needs at networking and community events
- Build relationships with key media partners and policymakers to promote organization and develops all messaging content and press releases
- Train and coach staff, volunteers, and clients on delivering approved messaging for public speaking opportunities
- Manages the organization's branding and graphics standards
- Oversees the organization's paid advertising activities
- Develop and monitor the implementation of the organization's communications and marketing plans
- Develop issue areas and messaging for those issues
- Interview clients and staff to tell the story of Seabury's impact

Private Practice
Washington DC December 2010 – October 2017

- Responsible for the Government Affairs Practice Group and Civil Litigation Practice Group.
- Supervise junior attorneys and paralegal; previously supervised junior attorneys and investigators.
- Developed employment policies and handbooks.
- Supervised staff, involving training, quality control, conflict resolution, and production flow.
- Interact with middle managers and first-line supervisors to prepare them for depositions and trial; coach them every step of the way in dealing with employees under their supervision who have sued them.
- Conducted training in worker's compensation, OSHA, and civil law for management and clients.
- Trained other attorneys in how to organize properly to litigate a case and how to prepare witnesses.
- Enlisted community involvement regarding concerns of immigrants, families, women, and children.
- Represent individuals before courts and administrative bodies in Maryland and D.C.
- Represent individuals before the Court of Special Appeals in Maryland
- Prepare legal memoranda, argue motions, take/defend depositions, and negotiate/draft settlement agreements

Jane de Winter for Montgomery County Council
Campaign Field Director, Montgomery County, Maryland August 2010 - September 2010

- Provide political and campaign advice to candidate
- Advice and support candidate in all aspects relating to in-field campaigning
- Coordinate and manage campaign employees and volunteers

Magistrate Judge Colette Moorman
Clerkship, Dayton, Ohio August 2009 - December 2009

- Mediated landlord/tenant and loan default cases assigned to Magistrate's daily docket
- Prepared intra-office memoranda dealing with civil issues, landlord/tenant laws, and traffic citations
- Performed legal research and analysis on criminal, juvenile, and small claims issues

Education

University of Dayton School of Law, Dayton, Ohio
Juris Doctor, May 2010

Florida International University, Miami, Florida
Bachelor of Arts in International Relations, December 2006

VINYL
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WELCOME

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vinylsiding.org

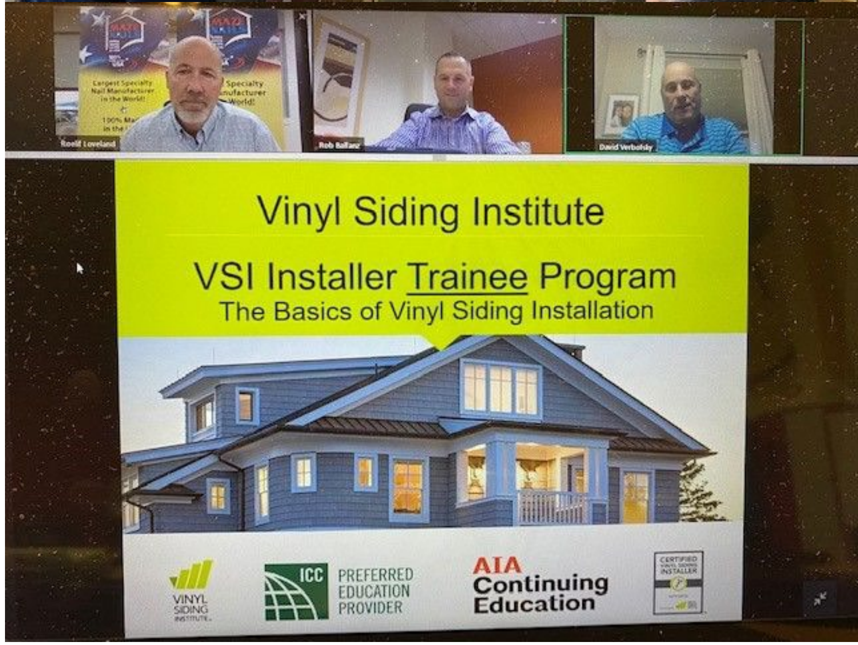
VINYL
SIDING
INSTITUTE™

Product Background, Standards, I-Codes, Performance, and Sustainability
Part I

VINYL
SIDING
INSTITUTE™

WHAT IS THE VINYL SIDING INSTITUTE?

- **We are a trade association** for manufacturers of vinyl and other polymeric siding and suppliers to the industry
- **We address regulatory issues**, including material restrictions, monitoring of building codes and planning codes
- **We provide education** of building code developers and regulators
- **We help develop materials**, product and performance standards by working through standards-making organizations and code bodies
- **We sponsor certification programs** that improve the quality of siding and its installation
- **We provide a forum** for issues of interest to the vinyl siding industry



Vinyl Siding Institute

VSI Installer Trainee Program

The Basics of Vinyl Siding Installation

VINYL
SIDING
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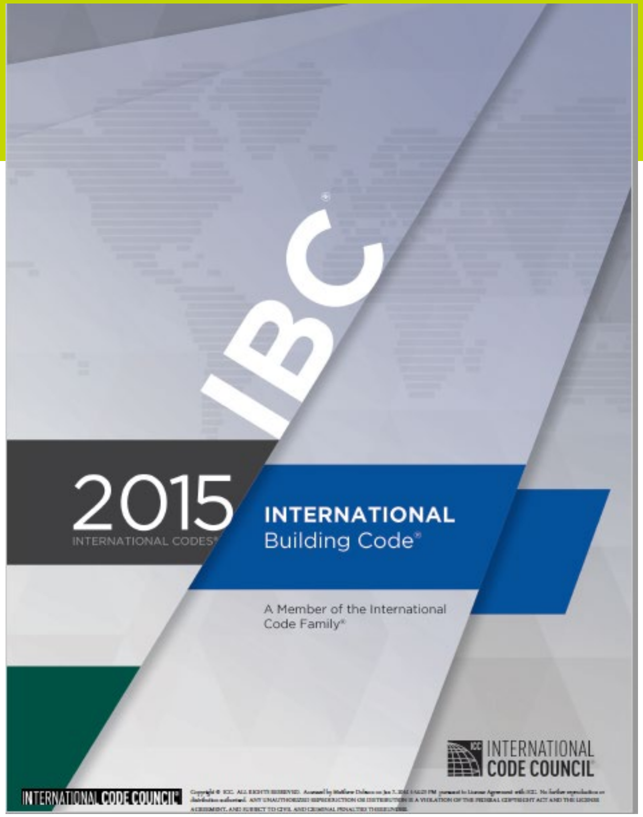
PRODUCT HISTORY & EVOLUTION

- Vinyl siding entered the market in the late 50s early 60s.
- Took over aluminum siding market in the 70s & 80s.
- Other categories have been in market for about 20 years, polypropylene siding and insulated vinyl siding.
- Vinyl siding remains the most popular cladding for over 20 years in the United States and similarly in Canada.
- Industry is continuously innovating product categories both as industry and as individual companies.
- Biggest step by industry was co-extrusion about 20 years ago.
- Wide array of polymeric cladding available today, including cellular PVC products.

2015 IBC/2018 IRC & THE EXTERIOR ENVELOPE

- IBC Chapter 14
- IRC – Chapters 3 & 7



IBC®

2015

INTERNATIONAL CODES®

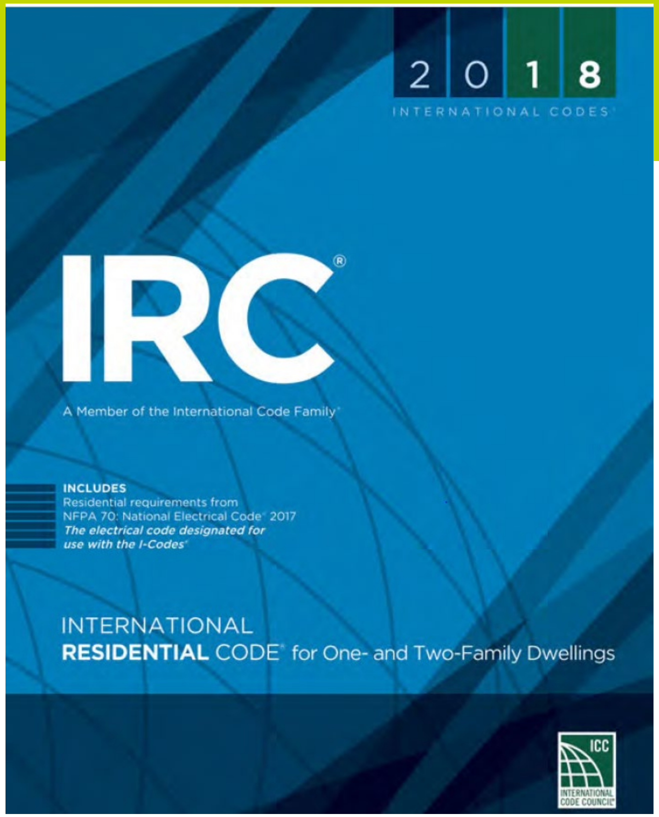
INTERNATIONAL

Building Code®

A Member of the International Code Family®

ICC INTERNATIONAL CODE COUNCIL®

INTERNATIONAL CODE COUNCIL®



2018

INTERNATIONAL CODES®

IRC®

A Member of the International Code Family®

INCLUDES
Residential requirements from NFPA 70: National Electrical Code® 2017
The electrical code designated for use with the I-Codes®

INTERNATIONAL
RESIDENTIAL CODE® for One- and Two-Family Dwellings

ICC INTERNATIONAL CODE COUNCIL®

PRODUCT CERTIFICATION, LISTINGS, & CODE COMPLIANCE REPORTS

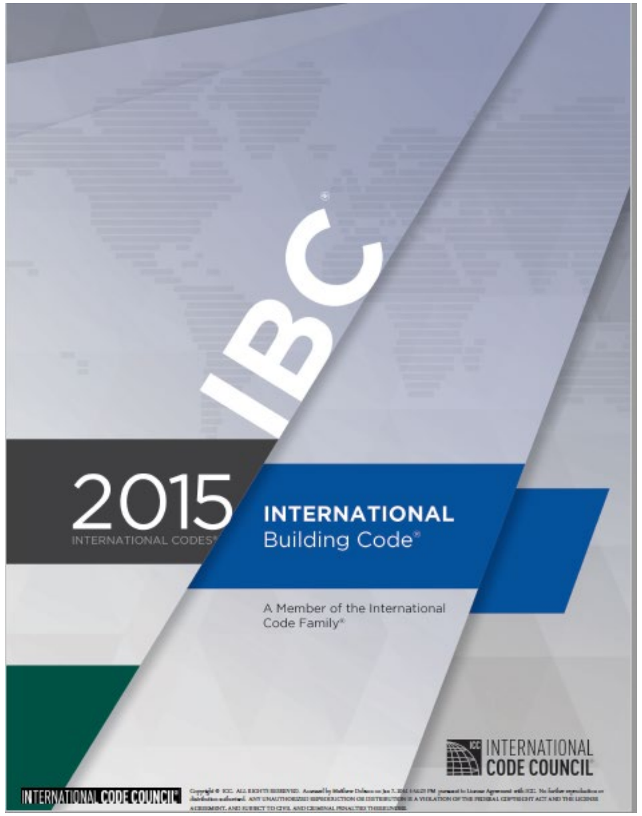
VINYL
SIDING
INSTITUTE™

DEFINING POLYMERIC SIDING

- **Vinyl Siding** – Cladding made principally of polyvinyl chloride (PVC)
- **Insulated Siding** – General category for cladding that provides continuous insulation with an R-value of 2.0 or greater
- **Insulated Vinyl Siding** – Insulated siding using vinyl siding combined with foam plastic insulation, to produce an R-value of 2.0 or greater
- **Polypropylene Siding** – Cladding made principally from polypropylene polymer
- **Other Polymeric Cladding** – Cellular PVC and others

INTERNATIONAL BUILDING CODE – CHAPTER 14 EXTERIOR WALLS

- Minimum standards for wall coverings, openings, windows, building envelope, and trim
  - Moisture, material performance and standards, installation requirements, weather protection (wind and water), fire safety, provisions for non-combustible and combustible construction
  - Provides limitations on combustible wall coverings based on areas, heights, fire separation, radiant heat exposure and other performance measures



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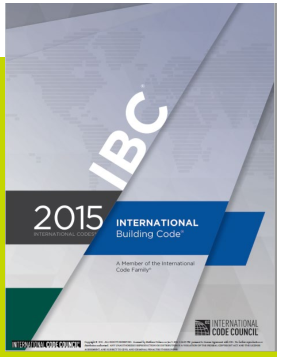
IBC CHAPTER 14 – GENERAL PERFORMANCE REQUIREMENTS (1403)

- Weather protection
  - Buildings must have some form of water-resistive barrier (behind veneer (cladding/siding).
  - Wall assembly must be designed to shed collect water and avoid condensation.
- Flood resistance consideration when applicable
- Structural? Claddings are not usually load bearing but must satisfy structural loads, such as wind loads and sometimes sheer.
- Fire resistance? Code requires several types of fire-resistance standards depending on use, size, and density.



MATERIALS STANDARDS (1404)

- Water-resistive barrier, felt or other approved products (ASTM D226)
- Wood
- Masonry
- Metal – Alum & Copper
- Concrete
- Glass unit masonry
- Plastics
- Vinyl siding
- Fiber Cement
- EIFS
- Polypropylene siding

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VINYL & POLYPROPYLENE SIDINGS

Product requirements (1404)

Products must be certified and labeled to show they conform to their established ASTM standard

- Vinyl Siding: ASTM D3679, IBC 1404.9
- Polypropylene Siding: ASTM D7254, IBC 1404.12
    - Insulated Vinyl Siding is not recognized in the IBC. Building officials may rely on code compliance reports or ICC-ES for verification based on the established standard for the product category ASTM D7793 (will be in 2021)

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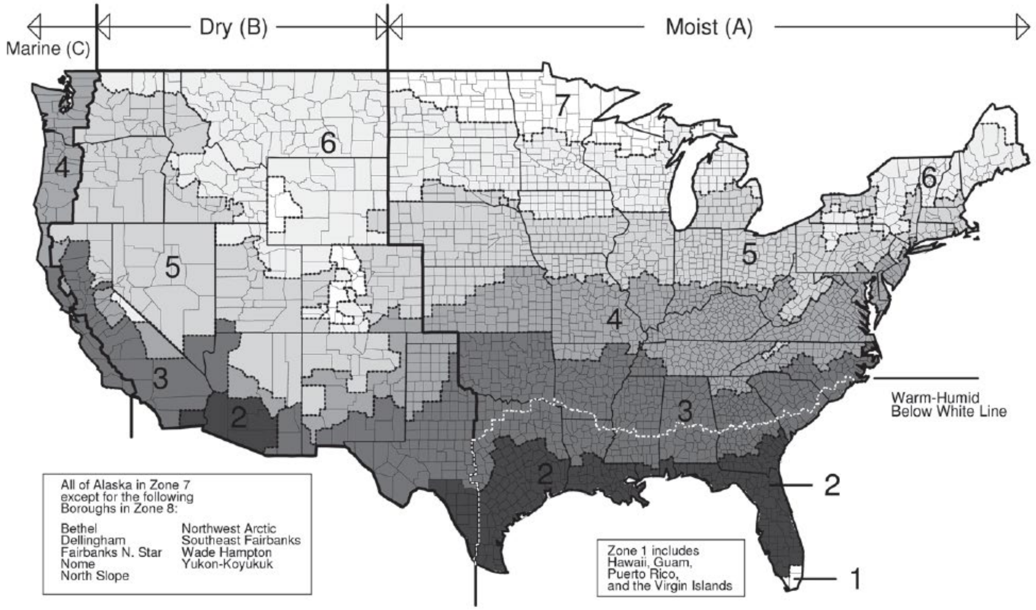
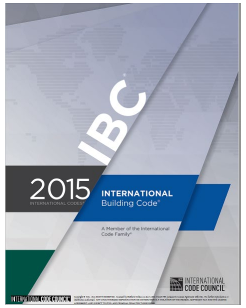
Installation (1405) – more than claddings, vapor retarders

- Provides minimum thickness for claddings (weather coverings) A-Z
  - Example vinyl siding 0.035”, wood siding .5”, fiber cement .25”
- Vapor retarders, based on climate zone (figure C301.1)
  - Class I – “Poly” (not allowed in zones 1-4)
  - Class II – Kraft paper, batts
  - Class III – latex or enamel paint
- South less use of vapor retarders, North (Zones 5-7 & Marine 4) more use of vapor retarders Class I vapor retarders
  - Vented claddings recognition helps walls breath
    - Allows use of just Class III in northern climates because of good moisture management characteristics

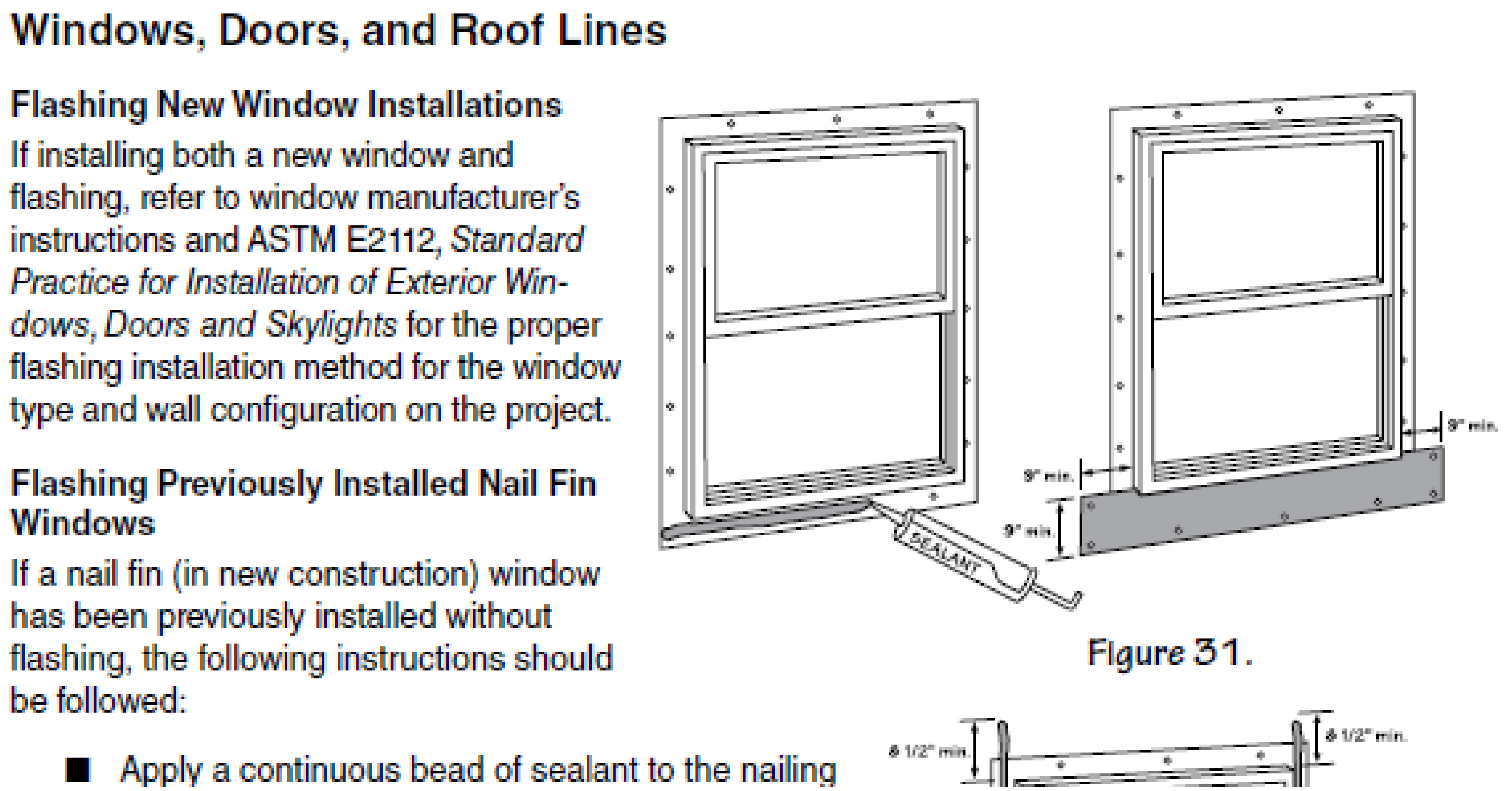




FLASHING (1405.4)

Flashing is designed to prevent moisture from entering the wall

- All exterior doors and windows
- Wall intersections with roofs, porches, decks
- Other penetrations



Windows, Doors, and Roof Lines

Flashing New Window Installations

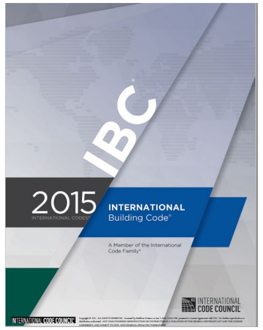
If installing both a new window and flashing, refer to window manufacturer's instructions and ASTM E2112, *Standard Practice for Installation of Exterior Windows, Doors and Skylights* for the proper flashing installation method for the window type and wall configuration on the project.

Flashing Previously Installed Nail Fin Windows

If a nail fin (in new construction) window has been previously installed without flashing, the following instructions should be followed:

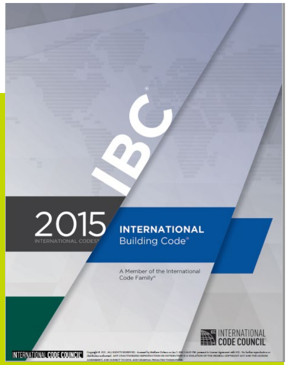
- Apply a continuous bead of sealant to the nailing

Figure 31.



INSTALLATION INFORMATION (1405)

- Wood
- Stone veneer
- Slab type veneer
- Terra cotta
- Adhered masonry veneer
- Metal veneer
- Glass veneer
- Windows and doors…?
- Vinyl siding
- Cement plaster
- Fiber-cement siding
- Polypropylene siding



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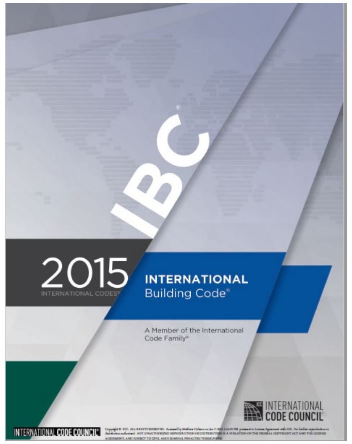
VINYL & POLYPROPYLENE SIDINGS (Insulated Vinyl Siding in 2024)

IBC Section 1405.14 & 1405.18 provides prescriptive and performance installation instructions

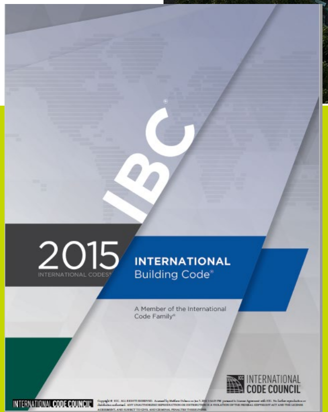
- In general, vinyl siding is installed 16 inch on center using roofing nails, although variations of this can be done.
- Polypropylene siding is typically installed at 16 inches or less on center intervals and must be installed over some type of wood sheathing, according to the manufacturer’s installation instructions.
- Prescriptively limited to 40 feet in height and wind limitation up to 100 mph, but if product can show ability to perform at higher wind it can be allowed.



HOW THE INTERNATIONAL BUILDING CODE REGULATES COMBUSTIBLE CLADDING

Polymeric siding is allowed in all types of construction including non-combustible construction.

- IBC 1406 allows the use of polymeric siding (and other combustible cladding) with non-combustible construction (Types I, II, III, IV).
- Regulated very carefully – What went wrong in the Grenfell Tower Fire in 2017? Poor design, improper material selection, aluminum composite rainscreening system (polyethylene core), only one means of egress (72 deaths) …. would not have been allowed in the U.S.



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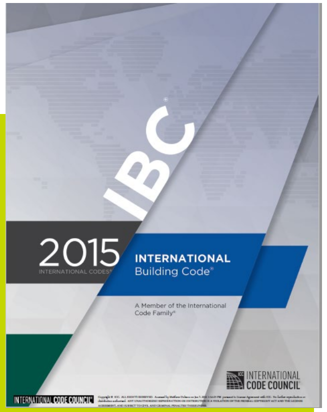
HOW THE INTERNATIONAL BUILDING CODE REGULATES POLYMERIC SIDING

- In certain instances, dependent on use and construction type, fire rated assemblies will be required.
- Polymeric siding is a part of many E119-rated assemblies. In addition, vinyl siding specifically can be part of IBC 722's calculated fire resistive approach.
- If polymeric siding is used with Types I, II, III, IV construction, it must be tested in accordance with NFPA 268 (IBC 1406.2.1.1.1) and perform to certain levels depending on the fire separation distance (density) of the building, radiant heat test.



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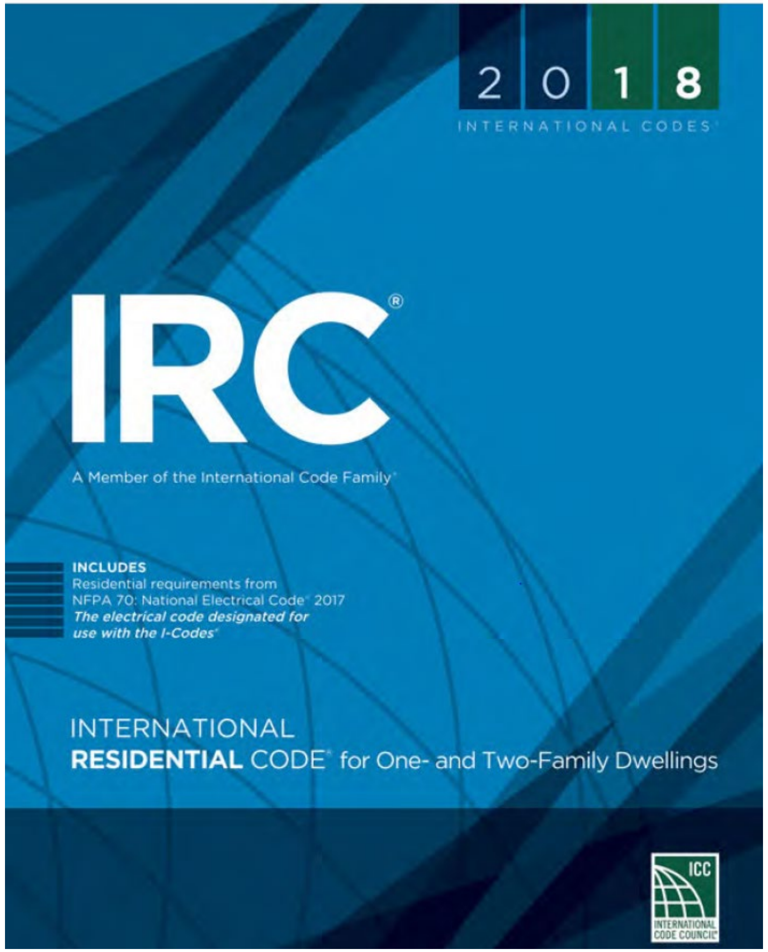
INTERNATIONAL RESIDENTIAL CODE

- 1&2 Family Dwellings including townhouses
- Intentionally designed prescriptively, cost and simplicity
  - Who remembers the southern code and CABO 1&2 Family Dwelling Code pre-2000?
- IRC continues to become more complex and larger – recently added Tiny House code, straw-bale construction code
- For claddings Chapter 3 and 7 are relevant



2018

INTERNATIONAL CODES

IRC®

A Member of the International Code Family®

INCLUDES
Residential requirements from
NFPA 70: National Electrical Code® 2017
The electrical code designated for use with the I-Codes®

INTERNATIONAL
RESIDENTIAL CODE® for One- and Two-Family Dwellings

ICC INTERNATIONAL CODE COUNCIL®

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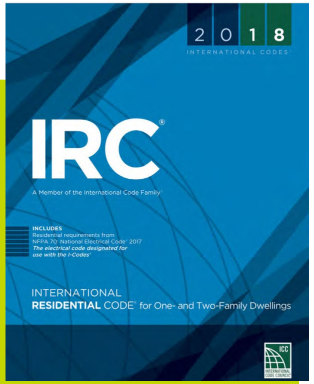
IRC – CHAPTER 3 – BUILDING PLANNING AND CONSTRUCTION

- Structural
- Fire safety
- Other core requirement areas
  - Light, ventilation, means of egress, smoke alarms
- For cladding and exterior walls the following sections are most relevant
  - Design pressure for cladding loads (manufacturers provide that)
  - R302 Fire Safety, mainly for high density development walls, soffits, other penetrations, openings in walls (windows & doors)

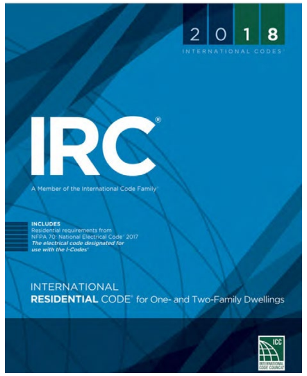


USE OF PRODUCT IN IN HIGH DENSITY DEVELOPMENTS

Polymeric siding and other combustible claddings are not limited in its application in homes built under the IRC

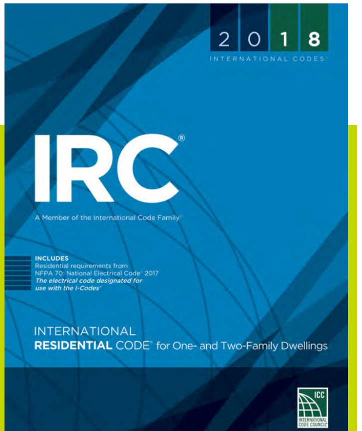
Except

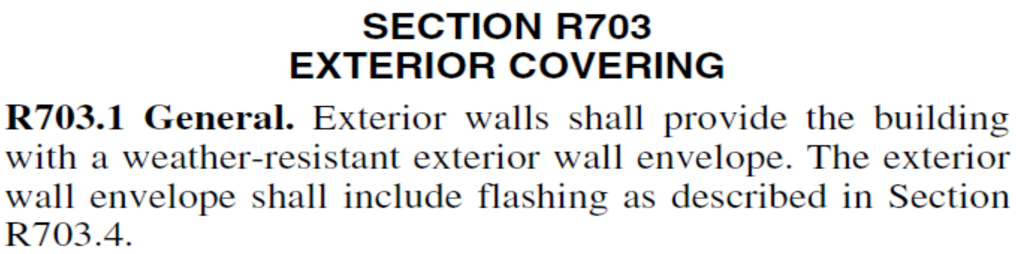
- Performance measures related to high density construction and fire will apply under Section R302 Fire-resistive construction
    - Table R302.1 (1) places requirements of a 1-hour-tested assembly according to ASTM E119 on exterior walls that are 5 feet or closer to the property line.
    - Polymeric siding is a part of many UL rated E119 assemblies.
- IRC R703.14.2 places a limitation on the use of polypropylene siding on walls that are closer than 5 feet to the property line (separation distance) and on walls 10 feet or closer to walls of other buildings on the same lot.
    - Note, this provision does not apply to walls that are perpendicular to the line used to determine the separation distance (example: front and rear elevations of townhouse construction).



CHAPTER 7 – WALL COVERINGS (INSIDE AND OUT)

- Exterior coverings addressed includes
    - Aluminum, stone & brick veneer
    - Wood, hardboard, particleboard, other wood
    - Exterior plaster, steel, fiber cement, EIFS
    - Vinyl, polypropylene, insulated vinyl sidings





SECTION R703
EXTERIOR COVERING

R703.1 General. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing as described in Section R703.4.

- R702.7 (not R703) covers Vapor retarders
- Water resistance
- Wind resistance based on Chapter 3 – wind loads
- Water-resistive barriers
- Table R703.3(1) – covers many of the prescriptive requirements for claddingR702.7 (not R703) covers Vapor retarders
- Water resistance
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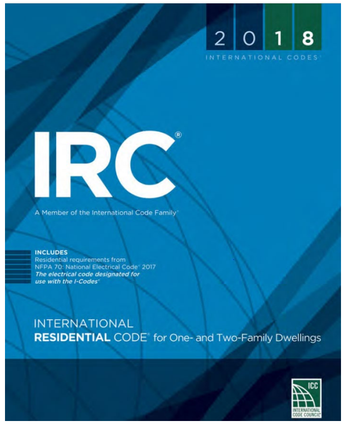
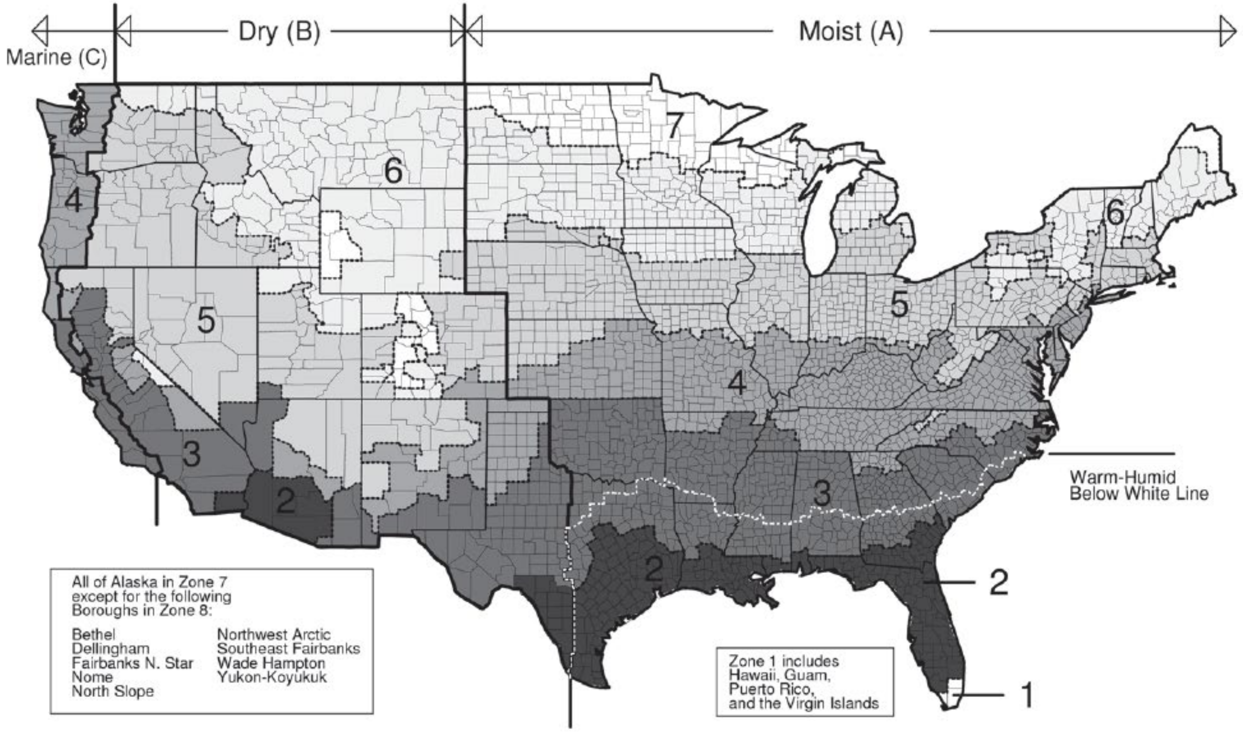
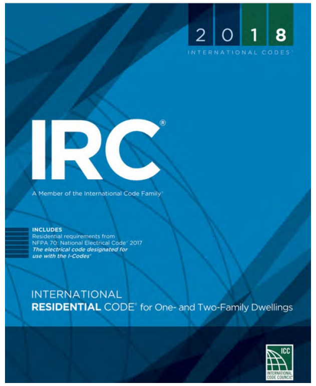


R702.7 VAPOR RETARDERS

- Vapor retarders, based on climate zone (figure C301.1)
  - Class I – “Poly”
    (not allowed in zones 1-4)
  - Class II – Kraft paper, batts
  - Class III – latex or enamel paint
- South less use of vapor retarders, North (Zones 5-7 & Marine 4) more use of vapor retarders Class I vapor retarders
- Class I or II required in Climate Zones 5-8 and Marine 4
- Vented claddings recognition helps walls breath
  - Allows use of just Class III in northern climates because of good moisture management characteristics





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WIND & WATER

R703.1.2 – Wind Resistance

- Siding, backing materials, and attachments must be capable of resisting wind loads from Chapter 3.
- All sidings must be tested to resist such loads.
- Polymeric claddings are tested to D5206.

R703.2 Water Resistant Barrier

- Type I Felt,
- Or other approved water-resistive barrier,
- Applied in shingle fashion,
- With Flashing Requirements for
    - Windows, Doors, Chimneys

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HOW THE *INTERNATIONAL RESIDENTIAL CODE* REGULATES POLYMERIC SIDING

Installation requirements

- IRC *Table R703.3 (1)* Provides prescriptive and performance installation requirements.
- In general vinyl and insulated vinyl siding are installed 16 inch on center using roofing nails, although variations of this can be done.
- Polypropylene siding is typically installed at 16 inches or less n center intervals and must be installed over some type of wood sheathing, according to the manufacturer's installation instructions.

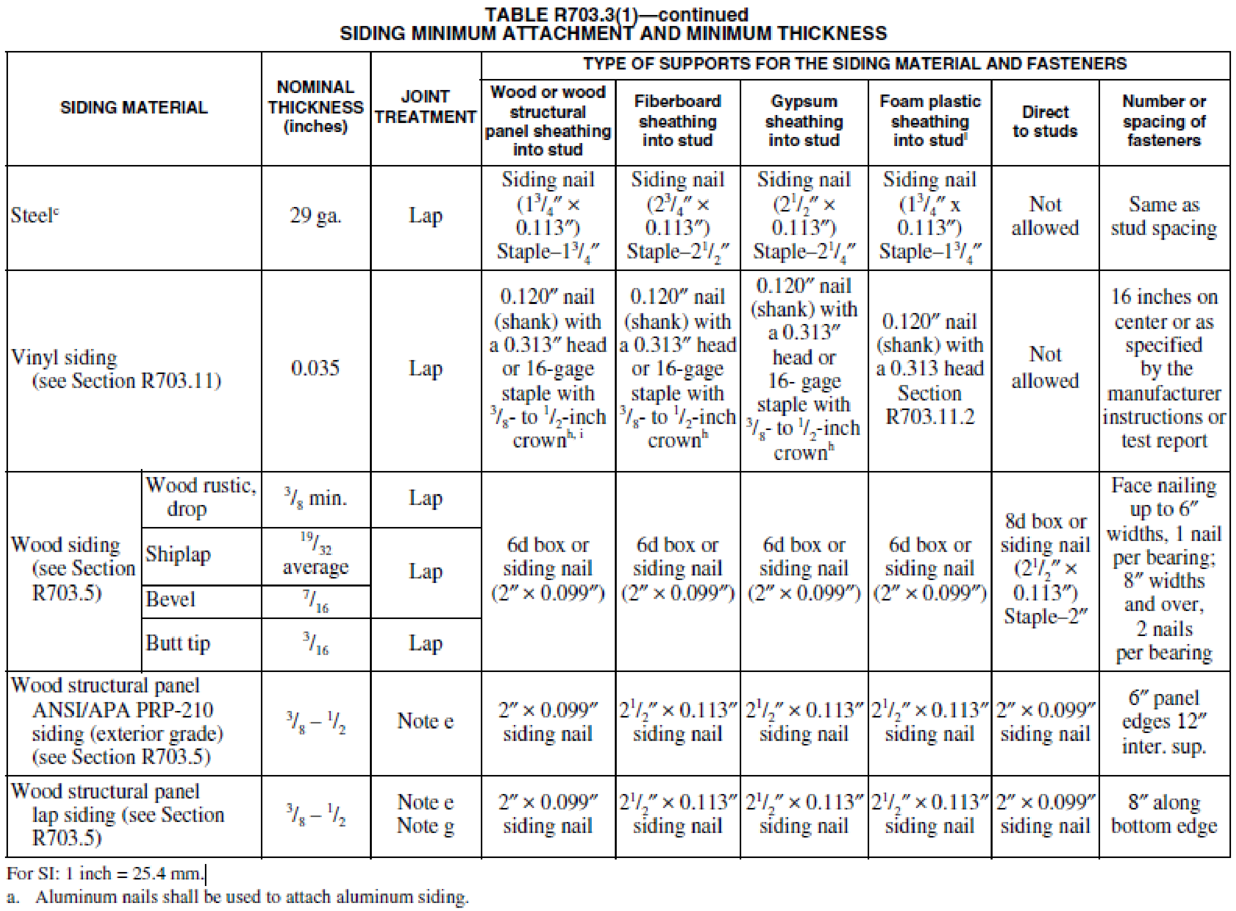
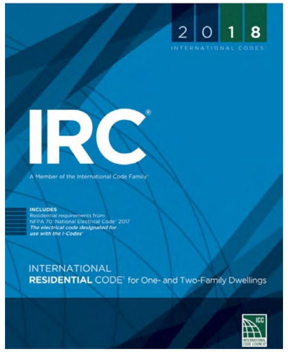


TABLE R703.3(1)—continued
SIDING MINIMUM ATTACHMENT AND MINIMUM THICKNESS

SIDING MATERIAL		NOMINAL THICKNESS (inches)	JOINT TREATMENT	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS					
				Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud[l]	Direct to studs	Number or spacing of fasteners
Steel[c]		29 ga.	Lap	Siding nail (1$^{3}/_{4}$″ × 0.113″) Staple–1$^{3}/_{4}$″	Siding nail (2$^{3}/_{4}$″ × 0.113″) Staple–2$^{1}/_{2}$″	Siding nail (2$^{1}/_{2}$″ × 0.113″) Staple–2$^{1}/_{4}$″	Siding nail (1$^{3}/_{4}$″ x 0.113″) Staple–1$^{3}/_{4}$″	Not allowed	Same as stud spacing
Vinyl siding (see Section R703.11)		0.035	Lap	0.120″ nail (shank) with a 0.313″ head or 16-gage staple with $^{3}/_{8}$- to $^{1}/_{2}$-inch crown[h, i]	0.120″ nail (shank) with a 0.313″ head or 16-gage staple with $^{3}/_{8}$- to $^{1}/_{2}$-inch crown[h]	0.120″ nail (shank) with a 0.313″ head or 16- gage staple with $^{3}/_{8}$- to $^{1}/_{2}$-inch crown[h]	0.120″ nail (shank) with a 0.313 head Section R703.11.2	Not allowed	16 inches on center or as specified by the manufacturer instructions or test report
Wood siding (see Section R703.5)	Wood rustic, drop	$^{3}/_{8}$ min.	Lap	6d box or siding nail (2″ × 0.099″)	6d box or siding nail (2″ × 0.099″)	6d box or siding nail (2″ × 0.099″)	6d box or siding nail (2″ × 0.099″)	8d box or siding nail (2$^{1}/_{2}$″ × 0.113″) Staple–2″	Face nailing up to 6″ widths, 1 nail per bearing; 8″ widths and over, 2 nails per bearing
	Shiplap	$^{19}/_{32}$ average	Lap						
	Bevel	$^{7}/_{16}$							
	Butt tip	$^{3}/_{16}$	Lap						
Wood structural panel ANSI/APA PRP-210 siding (exterior grade) (see Section R703.5)		$^{3}/_{8}$ – $^{1}/_{2}$	Note e	2″ × 0.099″ siding nail	2$^{1}/_{2}$″ × 0.113″ siding nail	2$^{1}/_{2}$″ × 0.113″ siding nail	2$^{1}/_{2}$″ × 0.113″ siding nail	2″ × 0.099″ siding nail	6″ panel edges 12″ inter. sup.
Wood structural panel lap siding (see Section R703.5)		$^{3}/_{8}$ – $^{1}/_{2}$	Note e Note g	2″ × 0.099″ siding nail	2$^{1}/_{2}$″ × 0.113″ siding nail	2$^{1}/_{2}$″ × 0.113″ siding nail	2$^{1}/_{2}$″ × 0.113″ siding nail	2″ × 0.099″ siding nail	8″ along bottom edge

For SI: 1 inch = 25.4 mm.

a. Aluminum nails shall be used to attach aluminum siding.



Product Requirements R703

- Most products in IRC have some type of product ASTM standard
- Products must be certified and labeled to show they conform to their established ASTM standard
- Vinyl siding
  - R703.11
- Insulated Vinyl Siding
  - R703.13
- Polypropylene Siding
  - R703.14

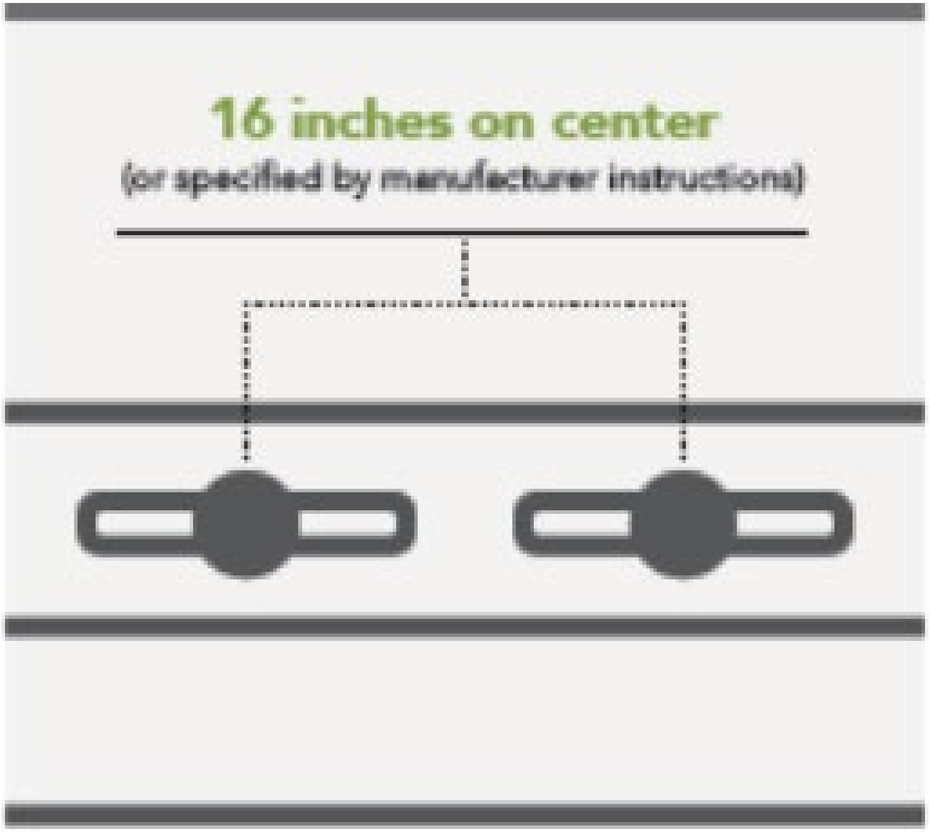
CERTIFICATION PROGRAM

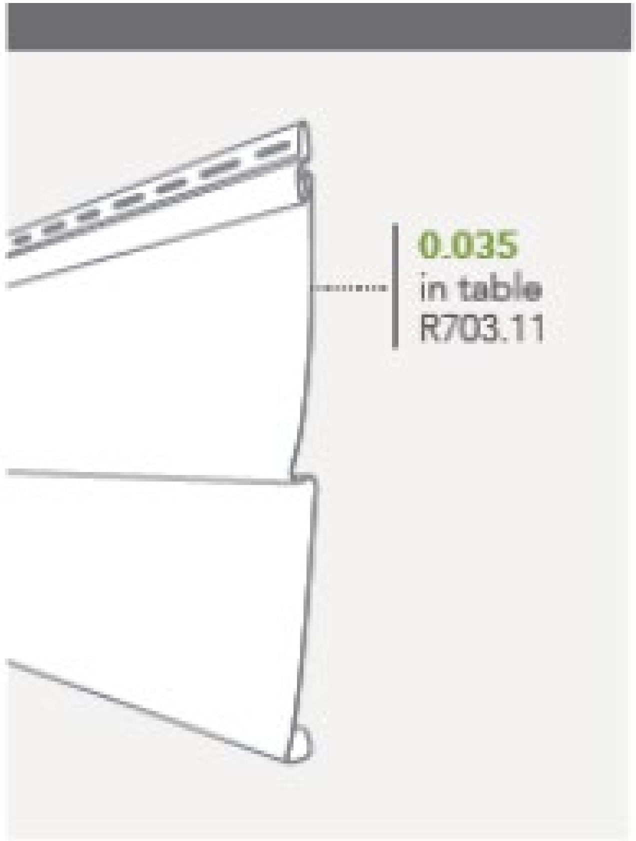
INDUSTRY IS CONSTANTLY INNOVATING

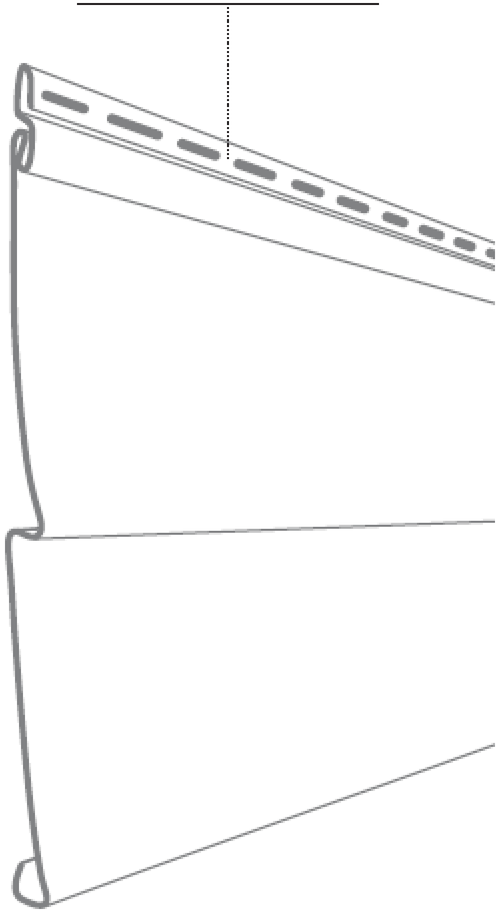
- Beginning now and fully implemented in 2020
  - Product will have more specific, published information on wind ratings through certification program
  - Currently products are certified to meet vast majority of design pressures across the country
  - With higher rated product is verified separate from the certification
  - Design pressures of actual product vs. meeting the minimum will begin in, and be fully required by the certification program in 2020
- What makes vinyl siding stronger and able to be used in coastal settings?

CERTIFICATION PROGRAM

REINFORCED NAIL HEMS, NAIL SPACING, AND THICKNESS OF PRODUCTS, MAKE STRONGER PRODUCTS



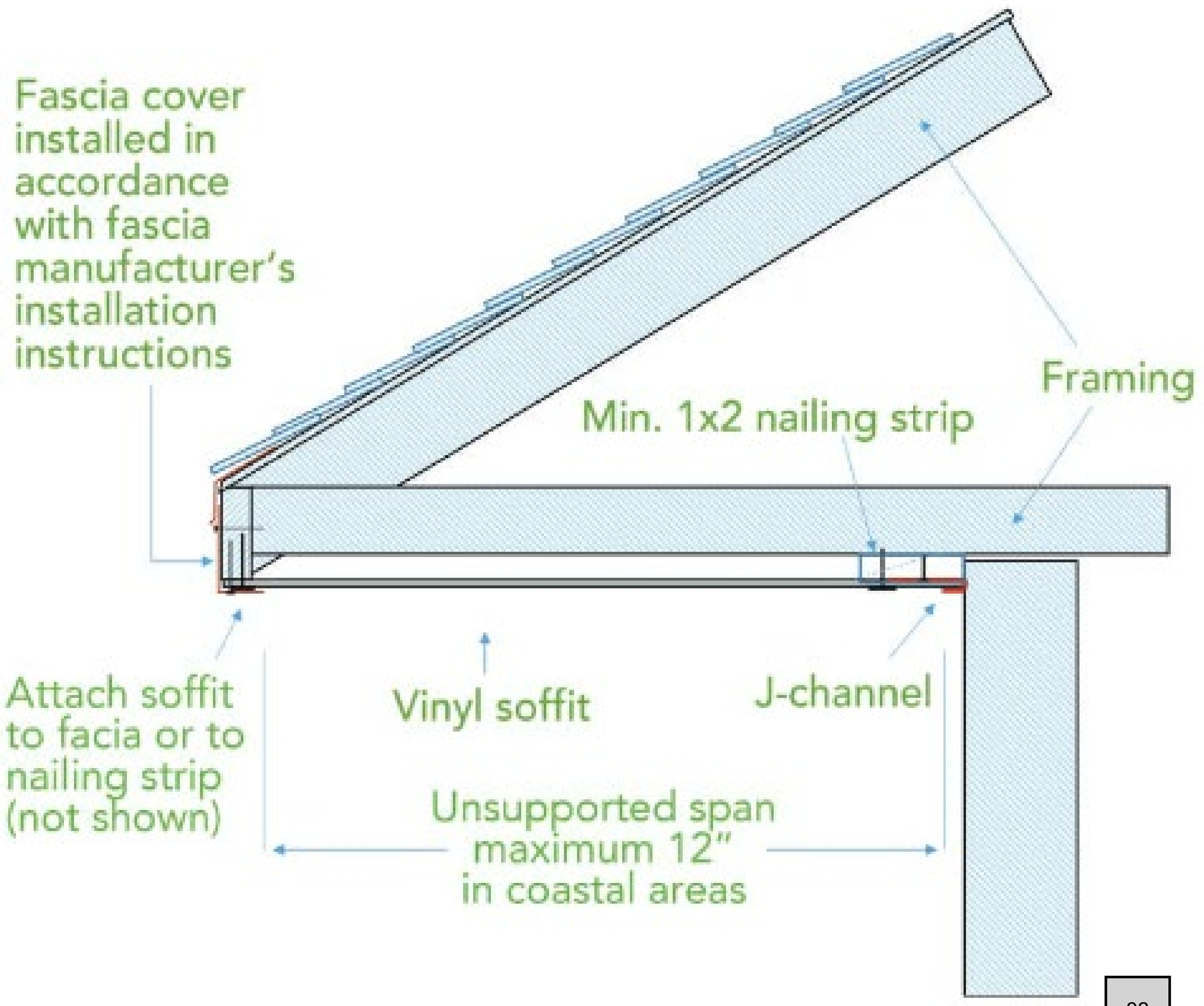




SOFFIT CHANGES AHEAD

- Fastening is required at both the wall and fascia for vinyl soffits
- R703.4 requires that each soffit panel be fastened at both the fascia and wall, and that there be no unsupported spans greater than 16 inches without the use of an intermediate nailing strip.(90 psf)
- New high wind regulations now apply too
- Where soffit is being used in high wind areas, IRC Section R703.3 requires soffit to be designed to resist component and cladding loads specified in Table R301.2(2).” (Exposure C)
- 2020 IRC contains entire section on soffit
- Will address most soffit materials, will add fascia next

Single Span Soffit Installation



Insulated siding can be used to meet the R-Value/U-factor requirements of the IECC.

CERTIFICATION PROGRAM

- The IECC prescribes insulated siding as a building material that can be used as continuous insulation outside of the building framing to provide the required total wall R-value.
- Section R402.1.3 (**N1102.1.3**) of the **2018** IECC and later allows the R-value of insulated siding to be used as part of the prescriptive R-value computation approach and may be used to satisfy the R-value insulation requirements of Table 402.1.3.
- Insulated siding's R-value is required to be published on the packaging of the product, typically on the box.

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HOW THE INTERNATIONAL WILD-URBAN INTERFACE CODE REGULATES POLYMERIC SIDING

Vinyl siding is allowed for use under this code in all conditions with certain performance requirements

- Chapter 5 shows that there are three different types of risk categories that impact the requirement for the type of Ignition Resistant (IR) wall construction.
- In the most stringent IR wall construction (**IR1 and IR2**) vinyl siding may be used so long it is a part of a 1-hour UL E119 rated assembly and can exhibit a flame spread index no greater than 25.
- When an IR3 condition applies, there are no requirements on specific type of wall construction or cladding.

VINYL SIDING INSTITUTE™

FIRE SAFETY

Home Fires and the Chemistry of Vinyl

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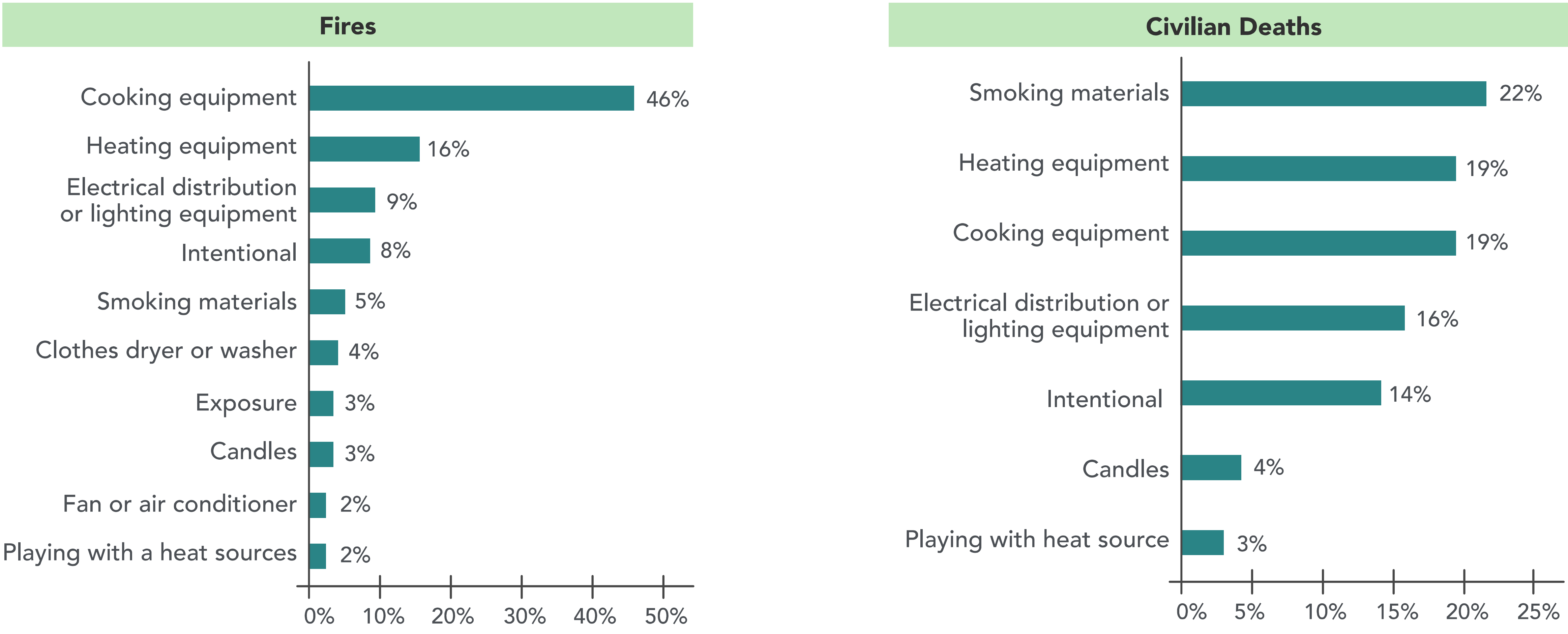
FIRE SAFETY AND CLADDING

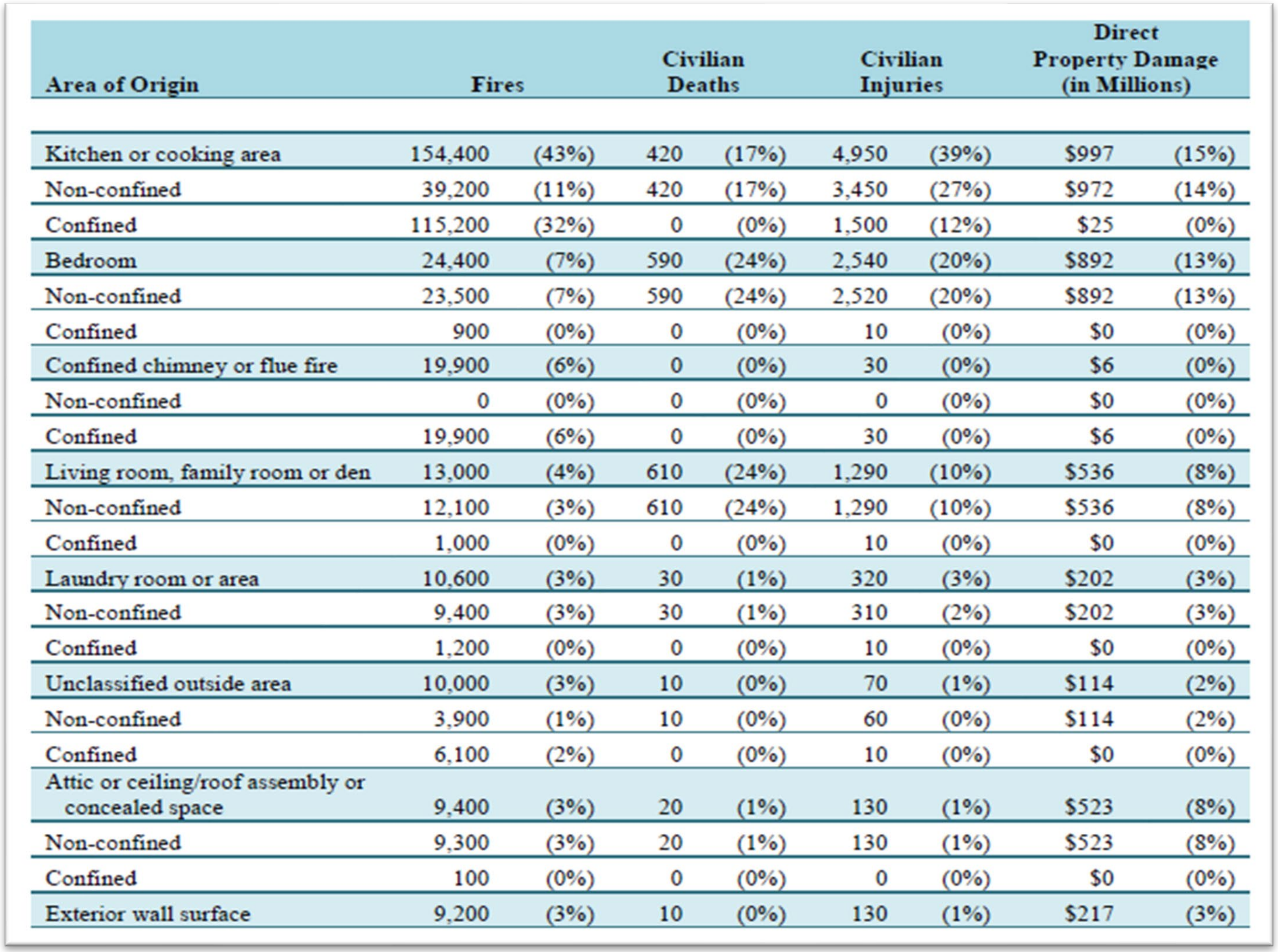
SOURCE: *NFPA'S HOME STRUCTURE FIRES REPORT* (2016)

LEADING CAUSES OF REPORTED HOME STRUCTURE FIRES: 2010- 2014



FIRE SAFETY AND CLADDING

SOURCE: *NFPA'S HOME STRUCTURE FIRES REPORT* (2016)



Area of Origin	Fires		Civilian Deaths		Civilian Injuries		Direct Property Damage (in Millions)	
Kitchen or cooking area	154,400	(43%)	420	(17%)	4,950	(39%)	$997	(15%)
Non-confined	39,200	(11%)	420	(17%)	3,450	(27%)	$972	(14%)
Confined	115,200	(32%)	0	(0%)	1,500	(12%)	$25	(0%)
Bedroom	24,400	(7%)	590	(24%)	2,540	(20%)	$892	(13%)
Non-confined	23,500	(7%)	590	(24%)	2,520	(20%)	$892	(13%)
Confined	900	(0%)	0	(0%)	10	(0%)	$0	(0%)
Confined chimney or flue fire	19,900	(6%)	0	(0%)	30	(0%)	$6	(0%)
Non-confined	0	(0%)	0	(0%)	0	(0%)	$0	(0%)
Confined	19,900	(6%)	0	(0%)	30	(0%)	$6	(0%)
Living room, family room or den	13,000	(4%)	610	(24%)	1,290	(10%)	$536	(8%)
Non-confined	12,100	(3%)	610	(24%)	1,290	(10%)	$536	(8%)
Confined	1,000	(0%)	0	(0%)	10	(0%)	$0	(0%)
Laundry room or area	10,600	(3%)	30	(1%)	320	(3%)	$202	(3%)
Non-confined	9,400	(3%)	30	(1%)	310	(2%)	$202	(3%)
Confined	1,200	(0%)	0	(0%)	10	(0%)	$0	(0%)
Unclassified outside area	10,000	(3%)	10	(0%)	70	(1%)	$114	(2%)
Non-confined	3,900	(1%)	10	(0%)	60	(0%)	$114	(2%)
Confined	6,100	(2%)	0	(0%)	10	(0%)	$0	(0%)
Attic or ceiling/roof assembly or concealed space	9,400	(3%)	20	(1%)	130	(1%)	$523	(8%)
Non-confined	9,300	(3%)	20	(1%)	130	(1%)	$523	(8%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Exterior wall surface	9,200	(3%)	10	(0%)	130	(1%)	$217	(3%)

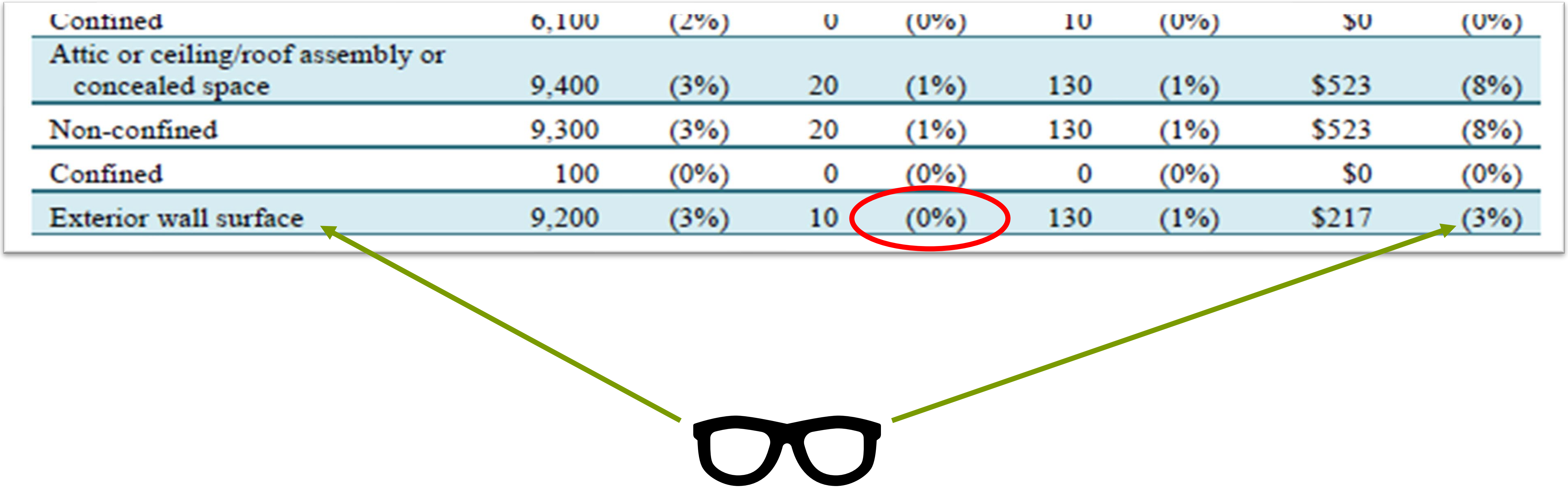
REPORTED HOME STRUCTURE FIRES,
BY AREA OF ORIGIN
2010-2014 ANNUAL AVERAGES
(UNKNOWNS WERE ALLOCATED PROPORTIONALLY)

Kitchen, Bedroom, and Living Room

are main points of fire origin

FIRE SAFETY AND CLADDING

SOURCE: *NFPA'S HOME STRUCTURE FIRES REPORT* (2016)



Confined	6,100	(2%)	0	(0%)	10	(0%)	$0	(0%)
Attic or ceiling/roof assembly or concealed space	9,400	(3%)	20	(1%)	130	(1%)	$523	(8%)
Non-confined	9,300	(3%)	20	(1%)	130	(1%)	$523	(8%)
Confined	100	(0%)	0	(0%)	0	(0%)	$0	(0%)
Exterior wall surface	9,200	(3%)	10	(0%)	130	(1%)	$217	(3%)

WHAT MAKES VINYL SIDING SAFE?

- Why does vinyl siding provide good fire performance? It is composed mainly of polyvinyl chloride, more commonly known as vinyl or PVC. Due to its chlorine base, vinyl siding does not ignite quickly and is inherently flame-retardant.
- PVC won't ignite, even from another flame, until it reaches about **730°F** (387°C) and won't self-ignite until about 850°F (454°C). Those ignition temperatures are significantly higher than common framing lumber, which ignites from a flame at **500°F** (260°C) and self-ignites at 770°F (410°C).

SIDING WITH SAFETY

VINYL SIDING IS A SAFE CLADDING OPTION

VINYL SIDING IS INHERENTLY FLAME RETARDANT

- It is composed mainly of polyvinyl chloride, more commonly known as vinyl or PVC.
- Due to its chlorine base, it's harder to ignite and easier to extinguish.
- It doesn't release much energy when it burns and will not readily spread flames on its own.

Vinyl siding won't ignite, even from another flame, until it reaches 730°F (387°C).

Common framing lumber ignites from a flame at 500°F (260°C).

WHAT MAKES VINYL SIDING SAFE?

ASTM D2863 tests show that rigid PVC's high Limiting Oxygen Index means that it needs unusually high amounts of oxygen to burn and stay burning. Rigid PVC (vinyl siding) will not independently sustain combustion in air with a normal concentration of oxygen (about 21 percent) — so it extinguishes more easily.

The 2015 International Building Code allows vinyl siding to be a part of a prescriptive fire rated assembly approach because vinyl siding does not contribute to the growth of the fire.

SIDING WITH SAFETY

VINYL SIDING IS A SAFE CLADDING OPTION

VINYL SIDING IS INHERENTLY FLAME RETARDANT

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Common framing lumber ignites from a flame at 500°F (260°C).

CODES AND THEIR ROLE WITH SUSTAINABILITY AND RESILIENCY

- International Building Code
- International Residential Code
- International Energy Conservation Code
- National Green Building Standard
- International Green Construction Code
- LEED rating system

VINYL SIDING INSTITUTE™

Product Background, Standards, 2015 IRC & 2018 IRC, Performance, and Sustainability Part II

What is Product Certification?

Product certification or product qualification is the process of certifying that a certain product has passed performance tests and quality assurance tests, and meets qualification criteria stipulated in contracts, regulations, or specifications.

Why do we need it?

- Product certification lets you know that a product is safe and reliable. It's a benchmark for product quality.
- The availability of low-cost, quick-to-market products is increasing, making it more important than ever to affirm product certification.
- Product certification signals that a company has confidence in their product

2015 IBC & 2018 IRC have hundreds of product standards which in turn require some form of product certification to meet the codes.

What is VSI Product Certification?

In 1998, the Vinyl Siding Institute (VSI) initiated the Vinyl Siding Product Certification Program, which allowed manufacturers to certify, with independent verification, that their products met or exceeded ASTM D3679. Since then, the Program has grown to include polypropylene siding (2010) and insulated vinyl siding (2012).

2015 IBC & 2018 IRC require these products to be verified to meet these standard, certified, and labeled.


QUALITY ASSURANCE

QUALITY CONTROL

TESTING

HOW THE PROGRAM SERVES BUILDING OFFICIALS

North American regulations (building codes), **including the 2015 IBC & 2015 IRC** require polymeric claddings to be “certified and *labeled* as conforming to the requirements of ASTM X by an *approved* quality control agency” (approved by the building official and State in some cases)

- VSI Program provides this certification and labeling (now Mark)
- Other organizations can offer this certification, as well, like ICC Evaluation Services or Intertek directly to the **2015 IBC & 2018 IBC**
- Program provides long term benefits to members
    - Members have certain control and governance input as Program sponsor (and now scheme owner)

INTERTEK, THE CERTIFICATION BODY

The VSI Product Certification Program is managed by Intertek out of their York, Pennsylvania facility.

intertek
Total Quality. Assured.

Intertek holds various accreditations that are related to the VSI Program:

- ISO/IEC 17020 – accreditation to perform inspections
- ISO/IEC 17025 – accreditation to perform testing and calibration
- ISO/IEC 17065 – accreditation for product certification agencies

AMERICAN NATIONAL STANDARDS INSTITUTE (ASTM)

Standards developed at ASTM International are the work of over 30,000 members. Technical experts represent producers, users, consumers, government and academia from over 1400 countries. Members belong to one or more committees, each of which covers a subject area. These committees develop more than 12,000 ASTM International standards.

ASTM INTERNATIONAL
Helping our world work better

ASTM COMMITTEES

VSI is involved with ASTM standards that primarily pertain to:

- D20 Plastics
- E05 Fire Standards
- E60 Sustainability

2015 IBC & 2018 IRC have hundreds of product standards listed in the referenced standards chapters

Designation: D3679 – 21

Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Siding[1]

2015 IBC & 2018 IRC reference earlier versions of these standards, what does that mean…not too much!

VINYL SIDING

ASTM D3679 — R703.11

Physical Requirements:

- ☐ Length
- ☐ Width
- ☐ Thickness
- ☐ Camber
- ☐ Heat Shrinkage
- ☐ Impact Resistance
- ☐ Coefficient of Linear Expansion (CLTE)
- ☐ Gloss
- ☐ Surface Distortion
- ☐ Uniformity of Color
- ☐ Weathering
- ☐ Wind Load Resistance
- ☐ Nail Slot Allowance for Thermal Expansion (Nail Slot Length)
- ☐ Lead Test
- ☐ Rate of Burn

ASTM D7793 – INSULATED VINYL SIDING

Designation: D7793 – 21

Standard Specification for Insulated Vinyl Siding[1]

INSULATED VINYL SIDING

ASTM D7793 — R703.13

2015 IBC & 2018 IRC reference earlier versions of these standards, what does that mean...not too much!

Physical Requirements:

- ☐ Length
- ☐ Width
- ☐ Thickness
- ☐ Camber
- ☐ Heat Shrinkage
- ☐ Impact Resistance
- ☐ Coefficient of Linear Expansion (CLTE)
- ☐ Gloss
- ☐ Thermal Distortion
- ☐ Uniformity of Color
- ☐ Weathering
- ☐ Wind Load Resistance
- ☐ Nail Slot Allowance for Thermal Expansion (Nail Slot Length)
- ☐ Compatibility of Adhesives
- ☐ Thermal Insulation Value
- ☐ Surface Flame Spread
- ☐ Lead Test
- ☐ Rate of Burn

ASTM D7254 – POLYPROPYLENE SIDING

INTERNATIONAL

Designation: D7254 – 21

An American National Standard

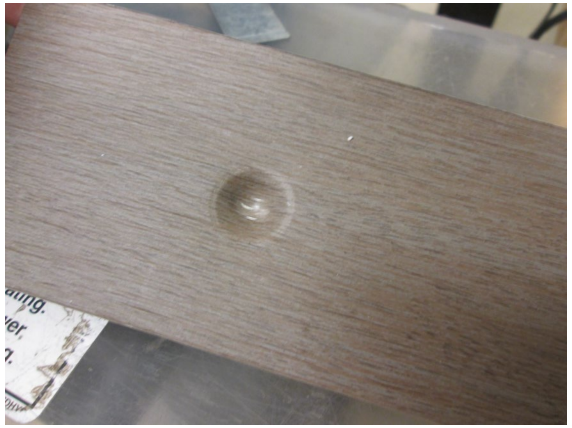
Standard Specification for
Polypropylene (PP) Siding[1]

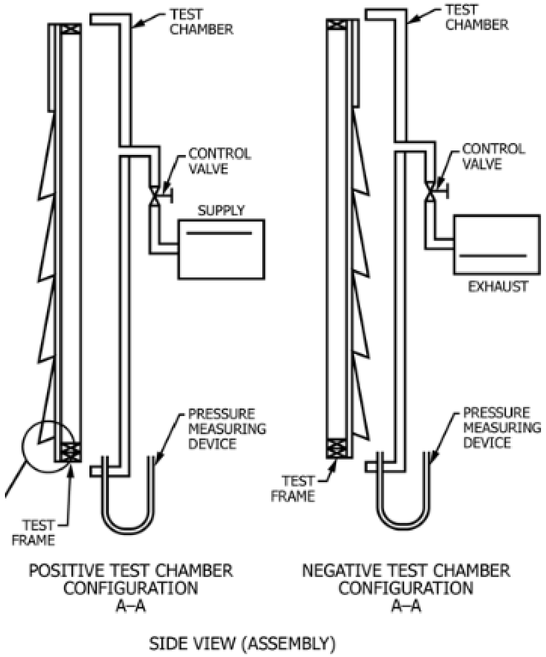
2015 IBC & 2018 IRC reference earlier versions of these standards, what does that mean...not too much!

POLYPROPYLENE SIDING
ASTM D7254 — R703.14

Physical Requirements:

- ☐ Color
- ☐ Impact Resistance
- ☐ Weathering
- ☐ Film Adhesion
- ☐ Wind Load Resistance
- ☐ Surface Flame Spread





CERTIFIED PRODUCT TESTING

2015 IBC & 2018 IRC reference these tests through the standards.

CERTIFIED PRODUCT TESTING HEAT TEST

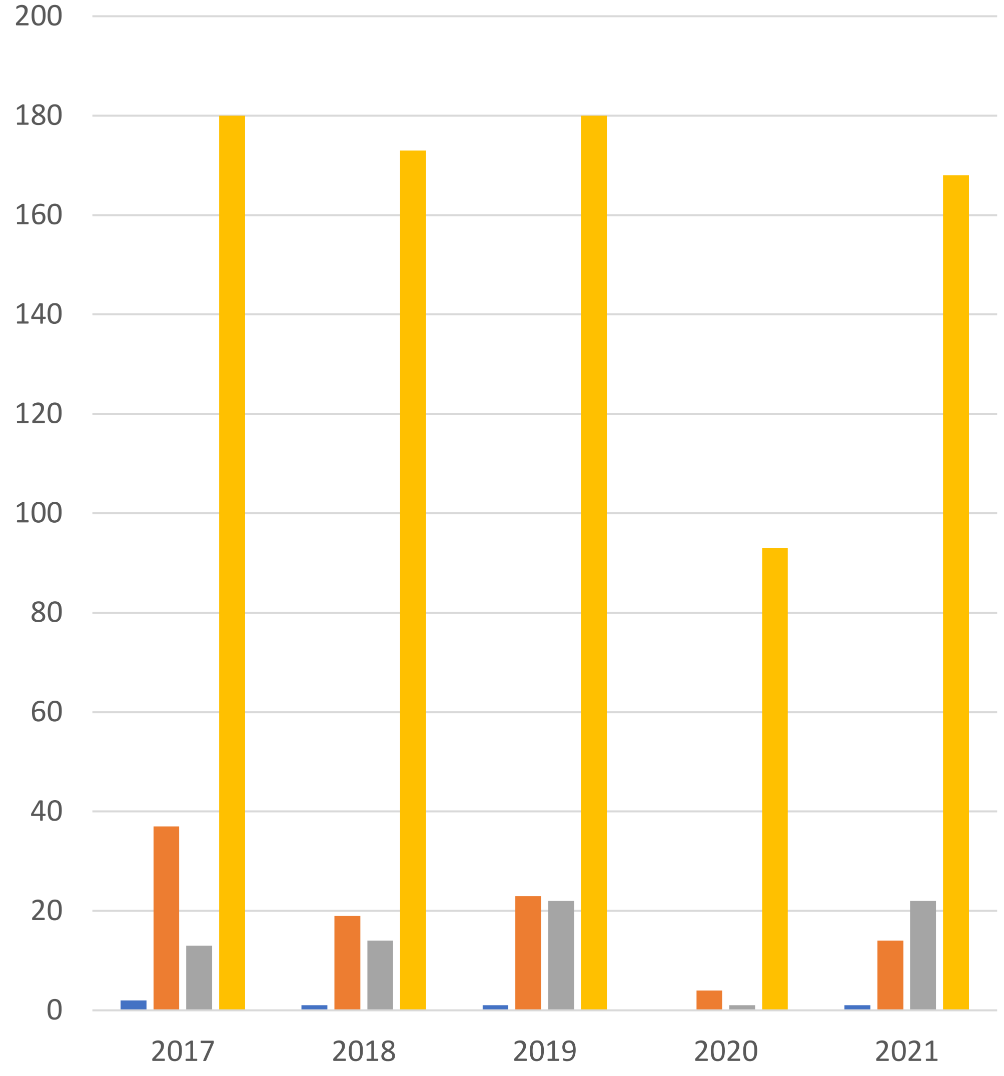
2015 IBC & 2018 IRC reference these tests through the standards.

VSI PROGRAM FOUNDATION

The Program requires qualification testing, documented quality control procedures (i.e. quality manual), and semi-annual plant inspections with random samples pulled at all manufacturing facilities for testing to the appliable product standard(s).

9 manufacturers and a total of 24 plants are enrolled across the US and Canada, producing vinyl siding, insulated vinyl siding, and polypropylene siding, with some making more than one product type.

Vented products and accessories are not recognized in the Program.



5-Year Inspection History

PROGRAM EVOLUTION

The upgraded Program includes a comprehensive Certification Scheme, a new Certification Mark, new code deliverables, and access to the Intertek directory of listed products.

Project Initiation

Test Plan

Sample Selection & Plant Audit

Quality Documents

Testing and Evaluation

Technical Review

Data Submission

Certification Review

Mark/Label Review

Certification Issuance (Mark Authorization)

Follow Up Inspections

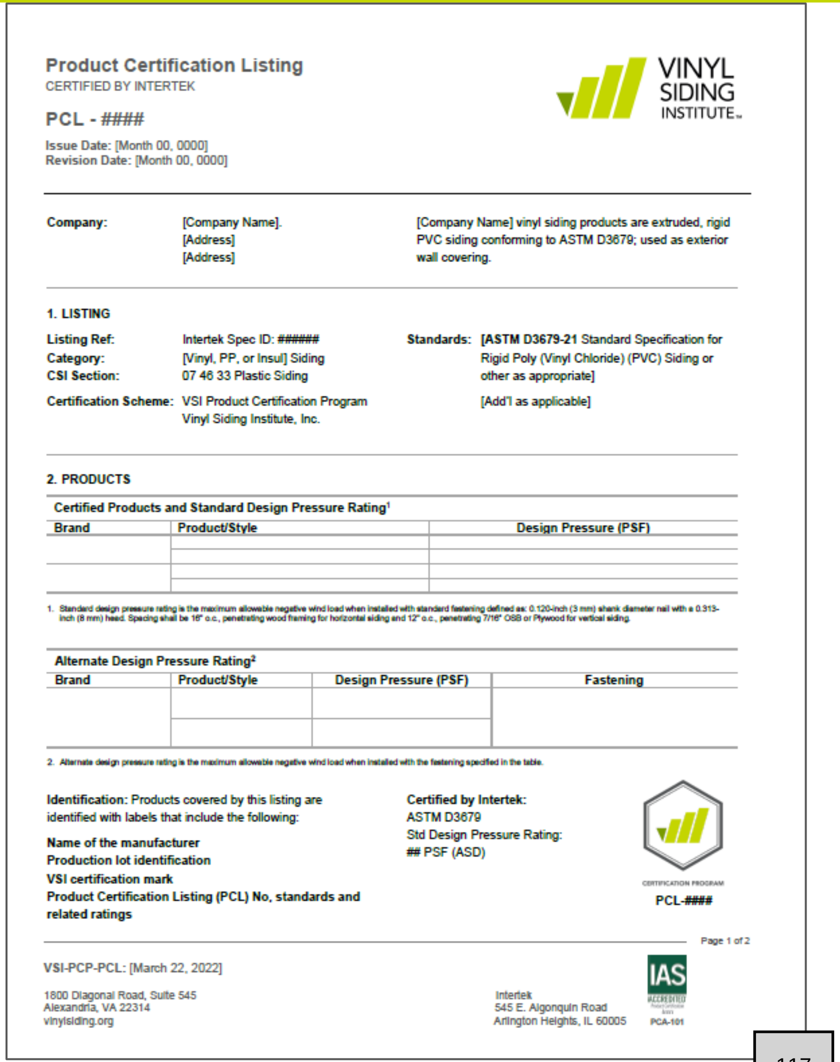
Certification Maintenance

CERTIFICATION FLOWCHART

WHAT’S NEW?
PRODUCT CERTIFICATION LISTING (PCL)

Purpose: To show compliance with a typical testing standard, such as ASTM in a standardized format.

Each PCL represents one product type; vinyl siding, insulated vinyl siding, or polypropylene siding.



Product Certification Listing
CERTIFIED BY INTERTEK

PCL - ####

Issue Date: [Month 00, 0000]
Revision Date: [Month 00, 0000]

Company: [Company Name].
[Address]
[Address]

[Company Name] vinyl siding products are extruded, rigid PVC siding conforming to ASTM D3679; used as exterior wall covering.

1. LISTING

Listing Ref: Intertek Spec ID: ######
Category: [Vinyl, PP, or Insul] Siding
CSI Section: 07 46 33 Plastic Siding
Certification Scheme: VSI Product Certification Program
Vinyl Siding Institute, Inc.

Standards: [**ASTM D3679-21** Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding or other as appropriate]
[Add'l as applicable]

2. PRODUCTS

Certified Products and Standard Design Pressure Rating[1]

Brand	Product/Style	Design Pressure (PSF)

1. Standard design pressure rating is the maximum allowable negative wind load when installed with standard fastening defined as: 0.120-inch (3 mm) shank diameter nail with a 0.313-inch (8 mm) head. Spacing shall be 16" o.c., penetrating wood framing for horizontal siding and 12" o.c., penetrating 7/16" OSB or Plywood for vertical siding.

Alternate Design Pressure Rating[2]

Brand	Product/Style	Design Pressure (PSF)	Fastening

2. Alternate design pressure rating is the maximum allowable negative wind load when installed with the fastening specified in the table.

Identification: Products covered by this listing are identified with labels that include the following:

Name of the manufacturer
Production lot identification
VSI certification mark
Product Certification Listing (PCL) No, standards and related ratings

Certified by Intertek:
ASTM D3679
Std Design Pressure Rating:
PSF (ASD)

CERTIFICATION PROGRAM
PCL-####

Page 1 of 2

VSI-PCP-PCL: [March 22, 2022]

1800 Diagonal Road, Suite 545
Alexandria, VA 22314
vinylsiding.org

Intertek
545 E. Algonquin Road
Arlington Heights, IL 60005

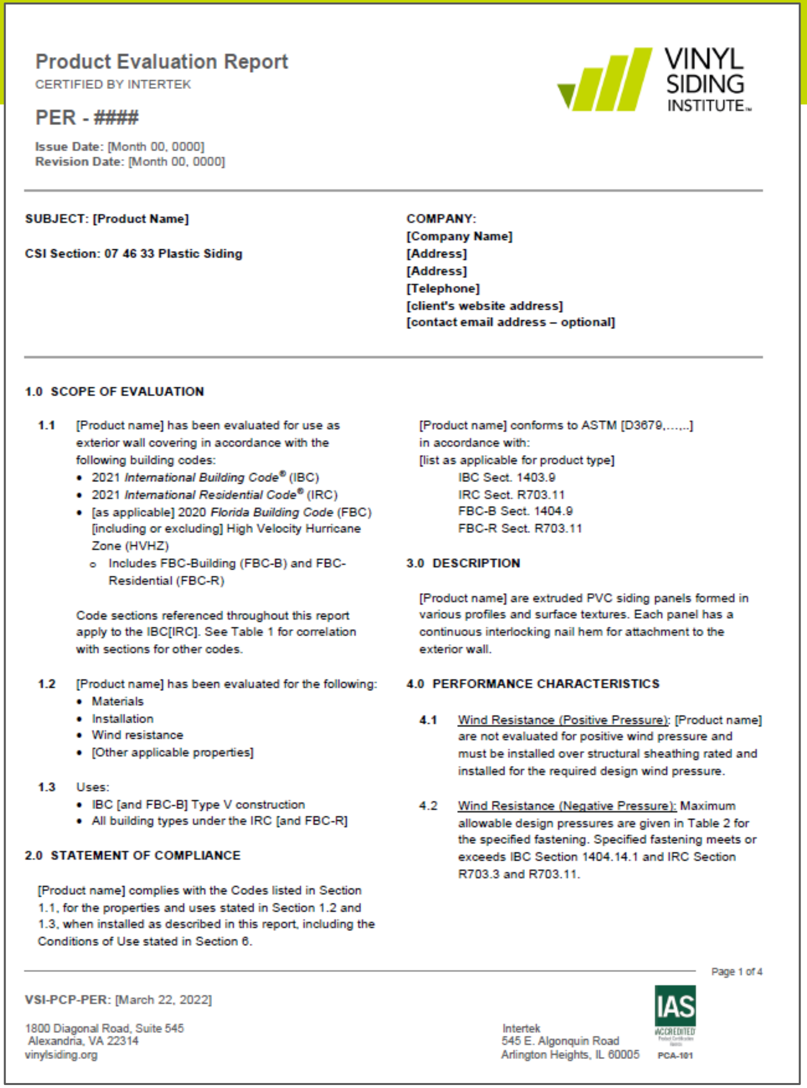
IAS
PCA-101

WHAT'S NEW?
PRODUCT EVALUATION REPORT (PER)

Purpose: The report demonstrates to architects, code officials, contractors, and any other people involved with product approval that these products comply with the applicable code requirements.

PERs are code compliance reports comparable to an ICC-ES ESR, IAPMO report, Intertek CCRR, etc.

2015 IBC & 2018 IRC referenced in these reports.



Product Evaluation Report

CERTIFIED BY INTERTEK

PER - ####

Issue Date: [Month 00, 0000]
Revision Date: [Month 00, 0000]

VINYL SIDING INSTITUTE™

SUBJECT: [Product Name]

CSI Section: 07 46 33 Plastic Siding

COMPANY:
[Company Name]
[Address]
[Address]
[Telephone]
[client's website address]
[contact email address – optional]

1.0 SCOPE OF EVALUATION

1.1 [Product name] has been evaluated for use as exterior wall covering in accordance with the following building codes:

- 2021 *International Building Code*® (IBC)
- 2021 *International Residential Code*® (IRC)
- [as applicable] 2020 *Florida Building Code* (FBC) [including or excluding] High Velocity Hurricane Zone (HVHZ)
  - Includes FBC-Building (FBC-B) and FBC-Residential (FBC-R)

Code sections referenced throughout this report apply to the IBC[IRC]. See Table 1 for correlation with sections for other codes.

1.2 [Product name] has been evaluated for the following:

- Materials
- Installation
- Wind resistance
- [Other applicable properties]

1.3 Uses:

- IBC [and FBC-B] Type V construction
- All building types under the IRC [and FBC-R]

2.0 STATEMENT OF COMPLIANCE

[Product name] complies with the Codes listed in Section 1.1, for the properties and uses stated in Section 1.2 and 1.3, when installed as described in this report, including the Conditions of Use stated in Section 6.

[Product name] conforms to ASTM [D3679,…,..] in accordance with:
[list as applicable for product type]
IBC Sect. 1403.9
IRC Sect. R703.11
FBC-B Sect. 1404.9
FBC-R Sect. R703.11

3.0 DESCRIPTION

[Product name] are extruded PVC siding panels formed in various profiles and surface textures. Each panel has a continuous interlocking nail hem for attachment to the exterior wall.

4.0 PERFORMANCE CHARACTERISTICS

4.1 Wind Resistance (Positive Pressure): [Product name] are not evaluated for positive wind pressure and must be installed over structural sheathing rated and installed for the required design wind pressure.

4.2 Wind Resistance (Negative Pressure): Maximum allowable design pressures are given in Table 2 for the specified fastening. Specified fastening meets or exceeds IBC Section 1404.14.1 and IRC Section R703.3 and R703.11.

Page 1 of 4

VSI-PCP-PER: [March 22, 2022]

1800 Diagonal Road, Suite 545
Alexandria, VA 22314
vinylsiding.org

Intertek
545 E. Algonquin Road
Arlington Heights, IL 60005

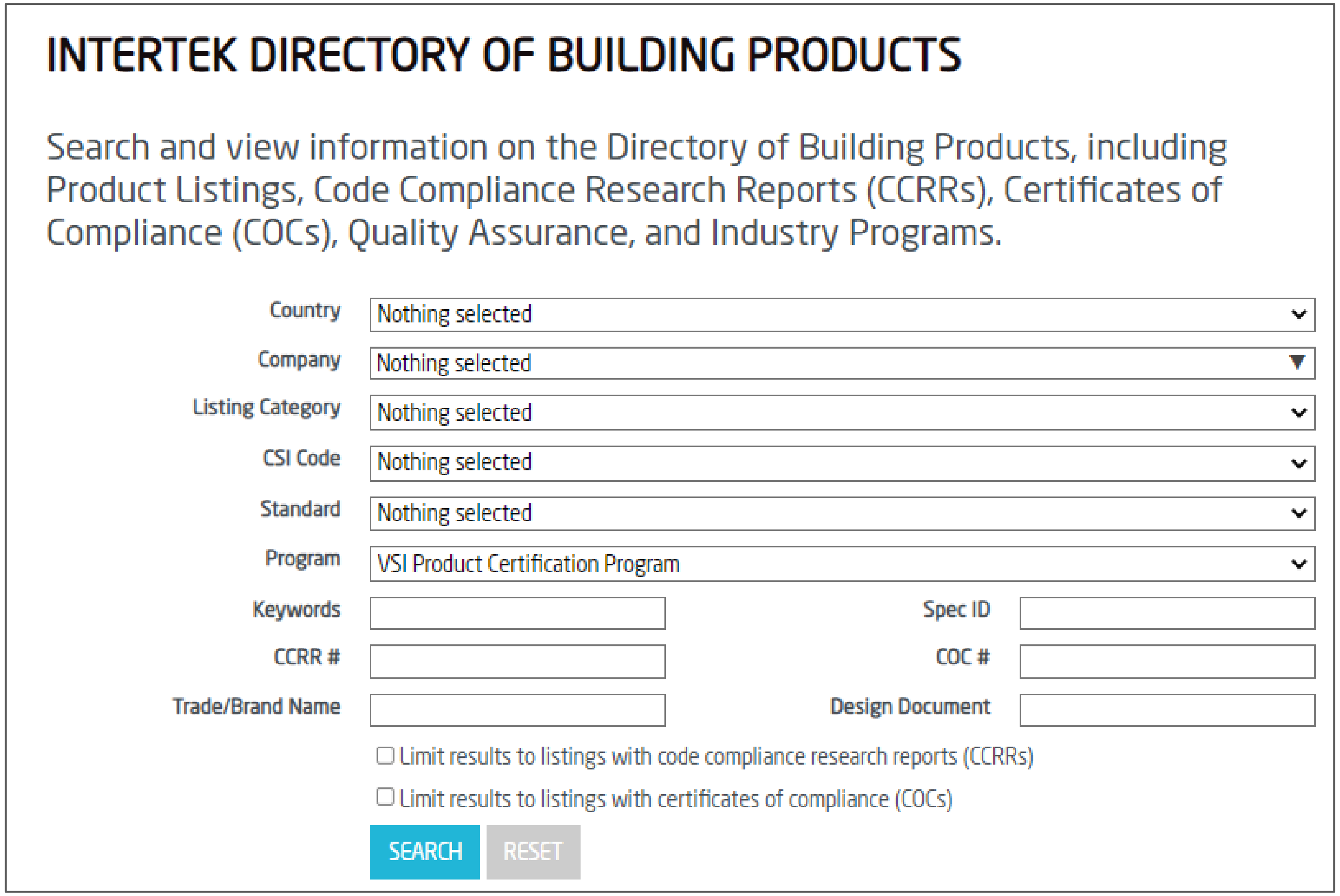
IAS ACCREDITED
PCA-101

INTERTEK DIRECTORY

A requirement of the Certification Body is that they maintain their own directory of listed products.

All products in the new Program will be listed in the Intertek directory, which can be found here:

https://bpdirectory.Intertek.com/pages/DLP_Search.aspx



INTERTEK DIRECTORY OF BUILDING PRODUCTS

Search and view information on the Directory of Building Products, including Product Listings, Code Compliance Research Reports (CCRRs), Certificates of Compliance (COCs), Quality Assurance, and Industry Programs.

Country	Nothing selected		
Company	Nothing selected		
Listing Category	Nothing selected		
CSI Code	Nothing selected		
Standard	Nothing selected		
Program	VSI Product Certification Program		
Keywords		Spec ID	
CCRR #		COC #	
Trade/Brand Name		Design Document	

☐ Limit results to listings with code compliance research reports (CCRRs)

☐ Limit results to listings with certificates of compliance (COCs)

VINYL
SIDING
INSTITUTE™

SUSTAINABILITY, RESILIENCY & DESIGN: POLYMERIC CLADDING

ICC PREFERRED EDUCATION PROVIDER

AIA Continuing Education

Sustainability – the ability to maintain a certain level of performance indefinitely or for a very long period

Resiliency – the ability to maintain or return even through consequences of external forces

Cladding and façades roles with sustainability and resilience

Sustainable – does it minimally impact the environment, is it affordable and socially sound?

Resilient – first line of defense from elements

- ○ Wind, rain, moisture, sun (UV), in extreme hurricanes, time and fire
- ○ Not structural, but protects structural components
- ○ Is it intact after extreme external forces and does it last long with minimal maintenance

2015 IBC & 2018 IRC define these characteristics.

Sustainability and Abundance

Are plastics sustainable?

- Some. All plastics are not the same.
- Durable vs. Disposable

What is vinyl made from?

Material Sustainability – Environmental impact Where's the science?

- **Green Washing Is An Issue**
  Where's the science on environmental impact?
- **Life Cycle Analysis, what is it?**
  A scientific approach to understanding how – in this case – building materials are made and how they impact the environment based on established ISO and other globally recognized standards

Environmental Impact Measures – Everything Impacts The Environment

- Global Warming Potential
- Acidification
- Eutrophication
- Fossil (resource) Fuel Depletion
- Indoor Air Quality
- Habitat Alteration

Environmental Impact Measures – Everything Impacts The Environment

- Water Intake/Use
- Criteria Air Pollutants
- Human Health
- Smog
- Ozone Depletion
- Ecological Toxicity

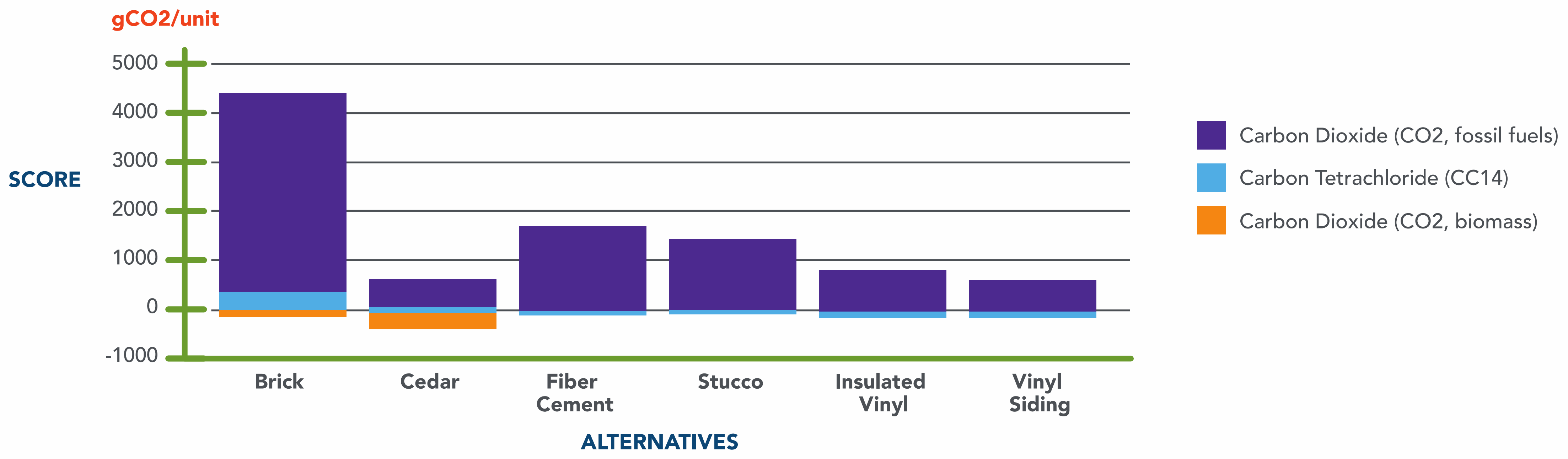
Transparency with Environmental Product Declaration

- Provides transparent third-party verified information on how the product is made and its environmental impact
- Comprehensive and includes Life Cycle Assessment (LCA) data
- References LCA standards, as well as material standards and building codes
- Is based on industry standard for material application – in this case “cladding”
- Vinyl siding has lifespan of at least 50 years and has improved over the years due to changes in technology

ENVIRONMENTAL PRODUCT DECLARATION
Vinyl Siding
Industry Averaged Vinyl Siding

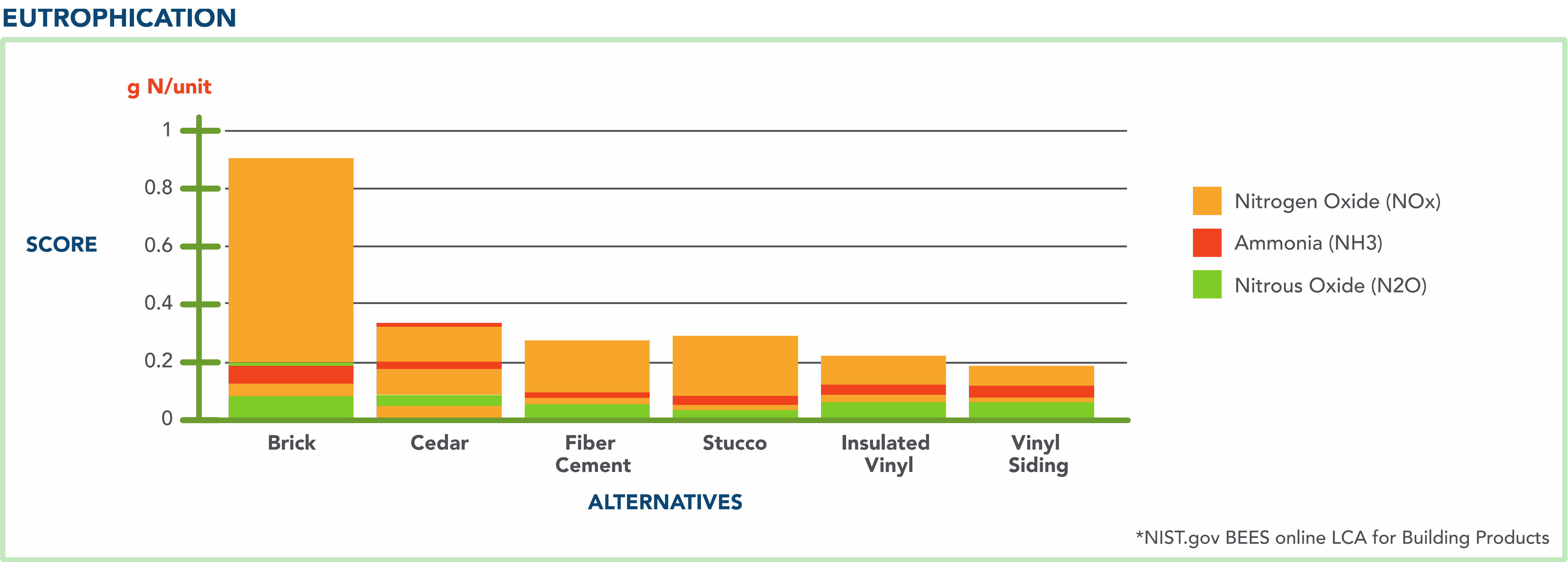
Examples of Product Performance* Global Warming

GLOBAL WARMING



*NIST.gov BEES online LCA for Building Products

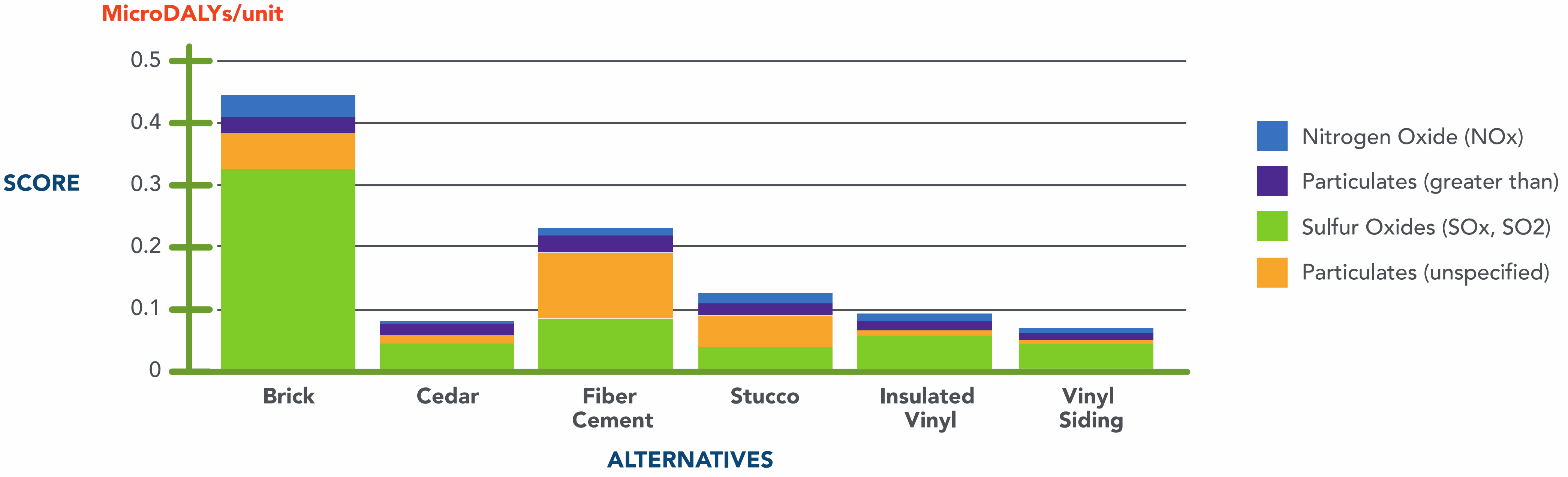
Examples of Product Performance* Eutrophication



*NIST.gov BEES online LCA for Building Products

Examples of Product Performance* Air Pollutants

CRITERIA AIR POLLUTANTS



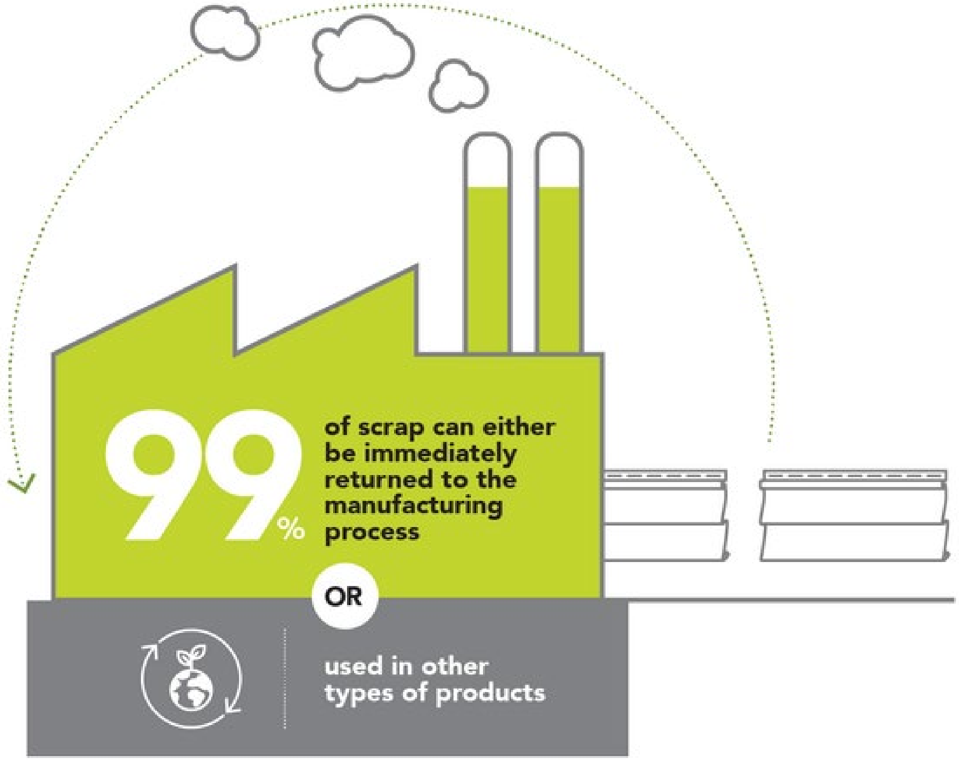
*NIST.gov BEES online LCA for Building Products

Recycling

- **Making new products from waste material**
- How does it help improve the environment?
    - Reduces waste
    - Natural resource efficiency
- **Thermoplastics can be ground-up**, re-melted and formed into new products
- **More than 1 billion pounds of vinyl are recycled** in the U.S. and Canada annually
- Since 2014 a **40% increase** in post-consumer recycling
- **VSI's Sustainability Committee** is now focused on recycling as an issue

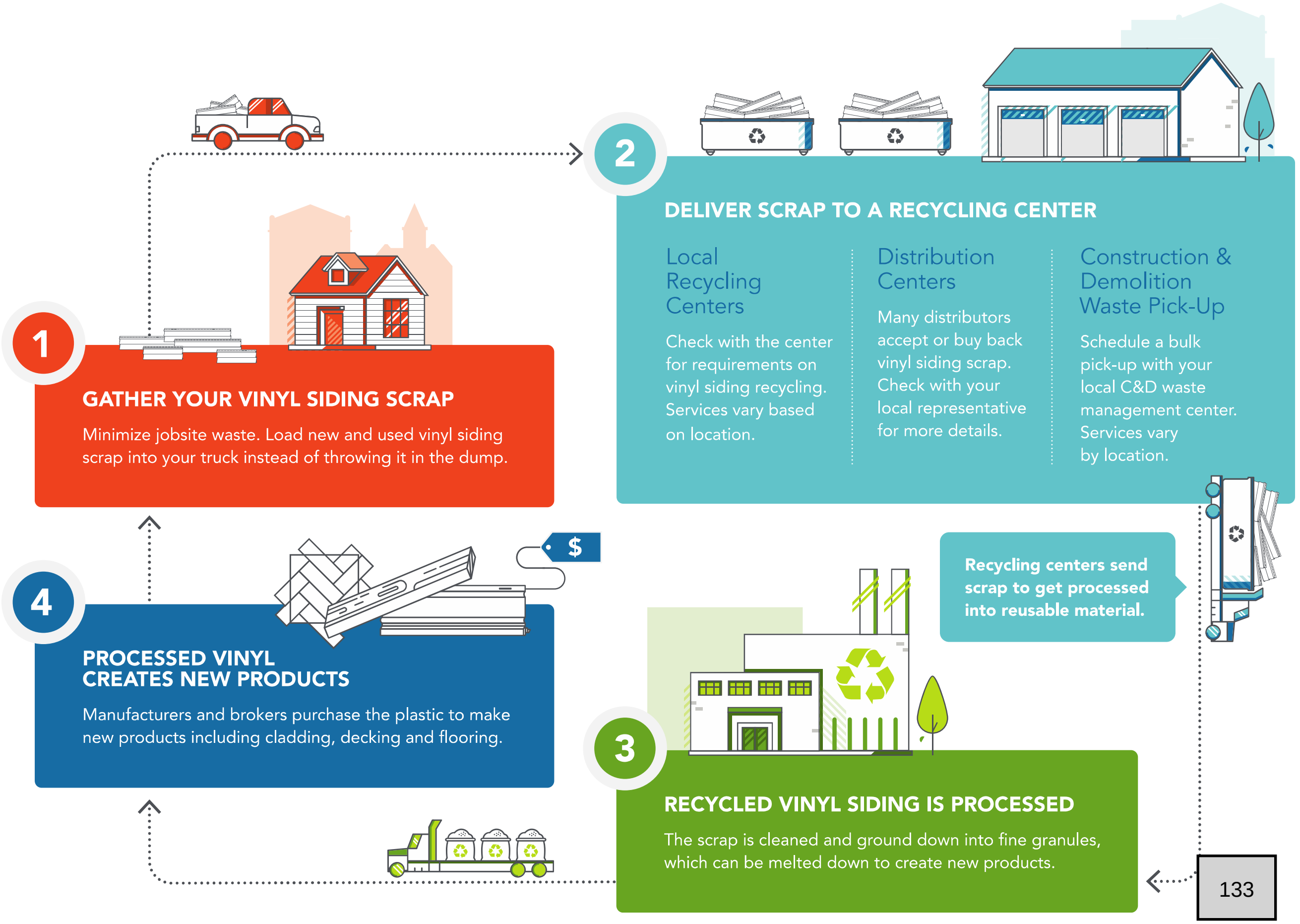
VINYL SIDING STAYS ON THE HOUSE—NOT IN A LANDFILL

And once installed, vinyl siding boasts a "lifetime" expectancy—so it lasts a lifetime on the house, not in the landfill.



How is our industry recycling?

- Complex issue
- Some products have post-consumer and/or post-industrial recycled content in them, but not many
- Industry is shifting to landfill diversion tactics
- Case study/Pilot in Northeast Ohio



1 **GATHER YOUR VINYL SIDING SCRAP**

Minimize jobsite waste. Load new and used vinyl siding scrap into your truck instead of throwing it in the dump.

2 **DELIVER SCRAP TO A RECYCLING CENTER**

Local Recycling Centers

Check with the center for requirements on vinyl siding recycling. Services vary based on location.

Distribution Centers

Many distributors accept or buy back vinyl siding scrap. Check with your local representative for more details.

Construction & Demolition Waste Pick-Up

Schedule a bulk pick-up with your local C&D waste management center. Services vary by location.

Recycling centers send scrap to get processed into reusable material.

3 **RECYCLED VINYL SIDING IS PROCESSED**

The scrap is cleaned and ground down into fine granules, which can be melted down to create new products.

4 **PROCESSED VINYL CREATES NEW PRODUCTS**

Manufacturers and brokers purchase the plastic to make new products including cladding, decking and flooring.

Communication and Logistics are the Challenge

- **Vinyl is very recyclable**, no need to downcycle – vinyl siding waste can become vinyl siding again
- Misinformation about recyclability
- How can it be done?
- Who is involved – everyone
- 1st step is **commitment and involvement**
- **How do you as architects handle waste management?**

Northeast Ohio Vinyl Siding Recycling Coalition Collector Site Information *"Do's & Don'ts"*

HOW TO RECYCLE VINYL SIDING

✓ Distributor

Used, new and unused vinyl and other polymeric products are designed for irreconcilability. The recycled products can go right back into the manufacturing process to be ground down and reused to create new building materials.

Start collecting vinyl siding today. Contact your local recycling Center to begin a valuable sustainability program.

1 **GATHER VINYL SIDING SCRAP**
Contractors and other customers who purchased vinyl siding can collect clean vinyl siding scraps free of dirt, fasteners and other contaminants and return them to the distribution center.

2 **DISTRIBUTORS RECEIVE VINYL SIDING SCRAP**
By creating partnerships with either municipal or private recycling centers, vinyl scraps can be delivered to, or picked up by, the centers in bulk.

Transportation organized by Distributor Collection Location

3 **RECYCLED VINYL SIDING IS PROCESSED**
The scrap is cleaned and ground into fine granules which can be melted down to create new products.

4 **PROCESSED VINYL CREATES NEW PRODUCTS**
Manufacturers and brokers purchase the plastic to make new products including cladding, decking and flooring—some of which may make its way to your showroom and inventory.

5-4670

VINYL SIDING INSTIT

Commitment, Logistics and Involvement

File Attachments for Item:

ER-4 Understanding the UL Online Directories with Concentration on Wood-Framed Construction (Conference, National Gypsum)

All certifications except ESI and RIUI (2 hours)

Staff Notes: AIA approved, recommend approval for all certifications.

Committee Recommendation:

Continuing Education Program Summary
Provider: National Gypsum Company | J299

Course: **Understanding the Online UL Fire Directories & Various Wood Book 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 21st Edition of the Fire Resistance and Sound Control Design Manual. Used in conjunction with the Wook Book 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; 21st Edition Fire Resistance and Sound Control Design Manual; National Gypsum Wood Book, 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

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.

[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: Thad Goodman
(Contact Name)
Organization: National Gypsum Company
(Organization/Company)
Address: 484 Loop Rd. NW
(Include Room Number, Suite, etc.)
City: Somerset State: OH Zip: 43783
E-Mail: thadg@nationalgypsum.com
Telephone: 614-214-5666 Fax:
Course Sponsor: Ohio Building Officials Association

COURSE INFORMATION:

Course Title: Understanding the UL Online Directories with concentration on Wood Framed Construction

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

Purpose and Objective: To lead to greater understanding about UL online navigation
Provide real world solutions to common wood framed field questions.
Introduce newly tested solutions with UL approvals for wood framed construction
Review Fire rated assemblies for compliance with 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 ☒
Master Plans Examiner ☒
Plumbing Plans Exam. ☒
Electrical Plans Exam. ☒
Mechanical Plans Exam. ☒
Building Inspector ☒
Fire Protection Inspector ☒
Mechanical Inspector ☒
Plumbing Inspector ☒
Non-Res IU Inspector ☒

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

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

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:		Check Off
Course Submitter:	Name of contact person and their certification numbers, organization, address, fax, phone	x
Course Sponsor: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:	Copy of quizzes or tests to be given	N/A
Completed Application:		

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

Understanding the UL Fire Resistance Directories 101

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Thad Goodman
thad@nationalgypsum.com
614-214-5666
@GoodmanThad

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National Gypsum Company is a Registered Provider with The American Institute of Architects Continuing Education Systems (AIA/CES). Credit earned on completion of this program will be reported to CES Records for AIA members. Certificates of Completion for non-AIA members available on request.

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

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Learning Objectives

- Review the UL Online Directories Access with Instructional Tutorial for use
- Wood Book Chapter Review/Application Compliance with Gypsum Association publication GA-600-15
- Wood Book Chapter Review/ Application Compliance with Gypsum Association publication GA-216-16
- Content complies with 2017 Ohio Building Code UL 263 2011

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UL Fire Resistance Directories

All volumes available on the UL website:

- http://www.ul.com/

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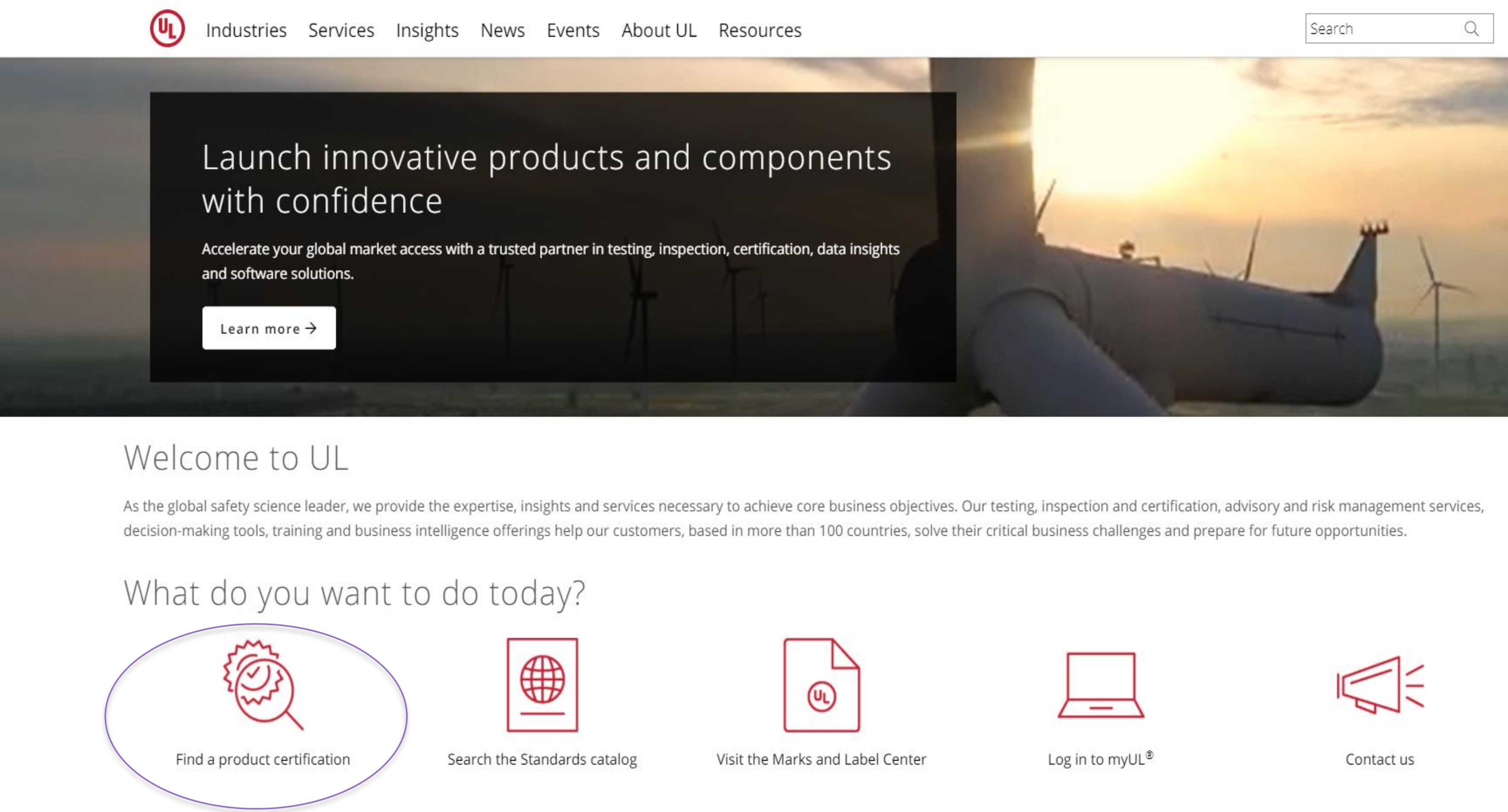

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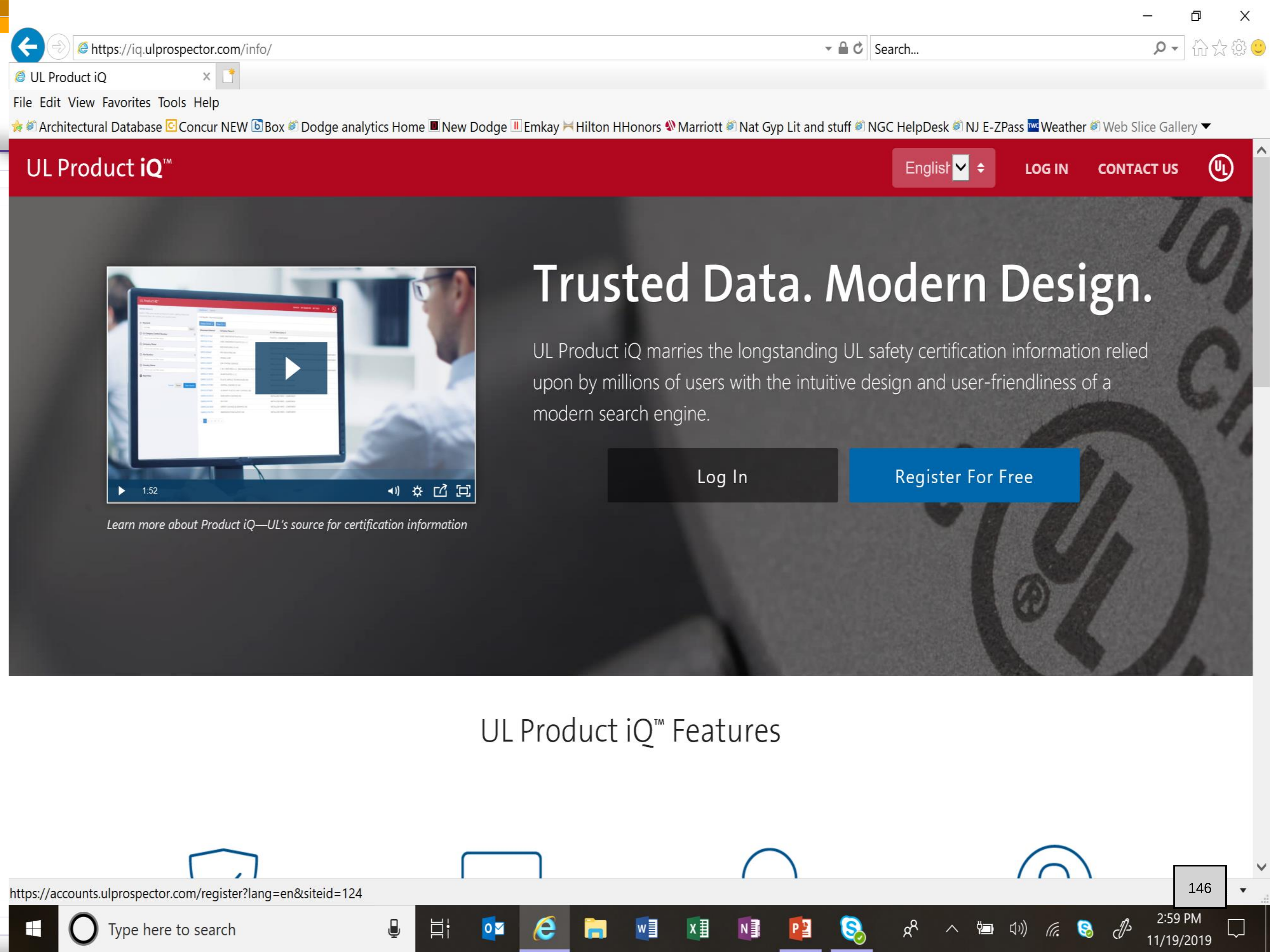

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UL Product iQ™ Features

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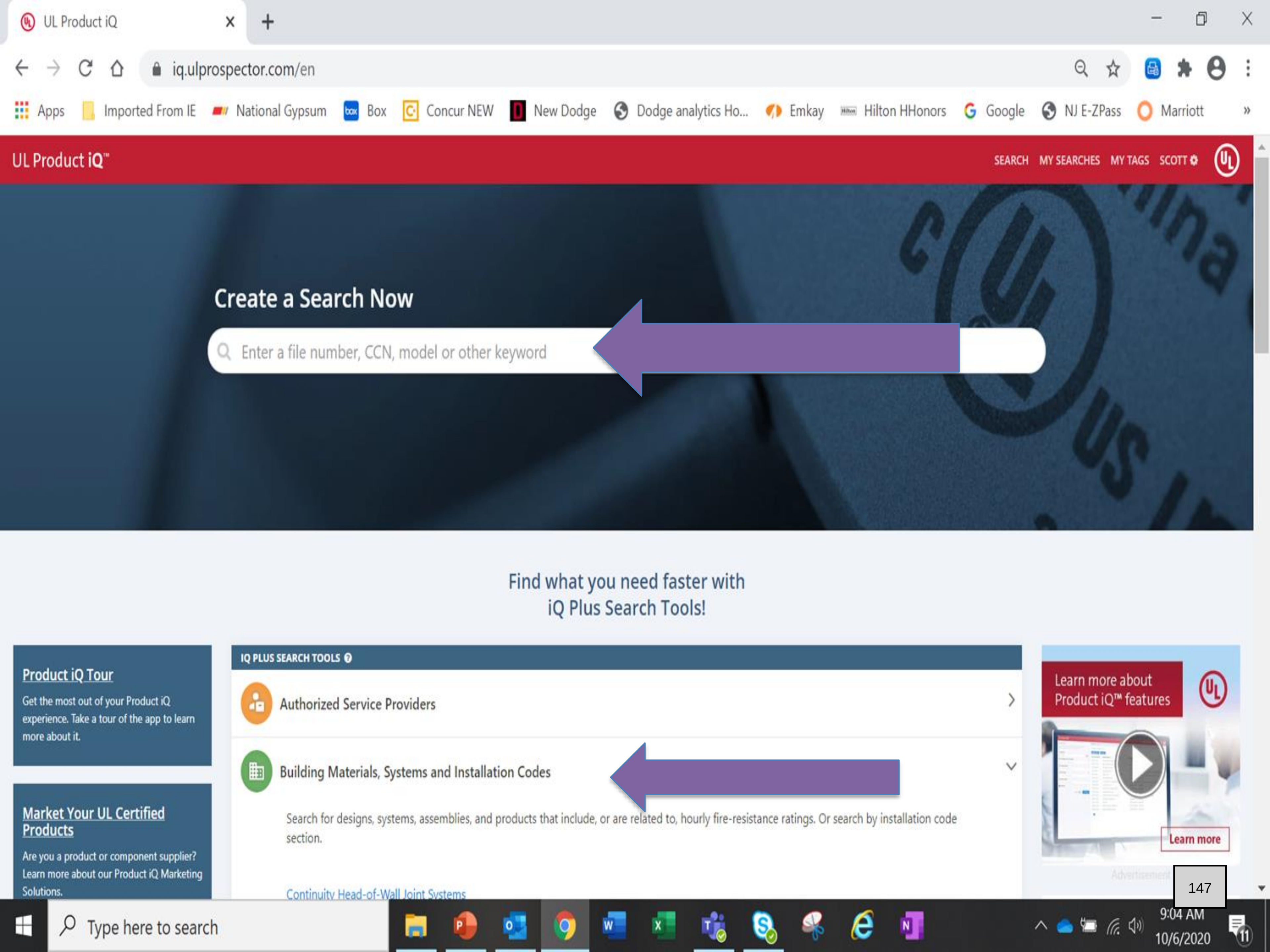

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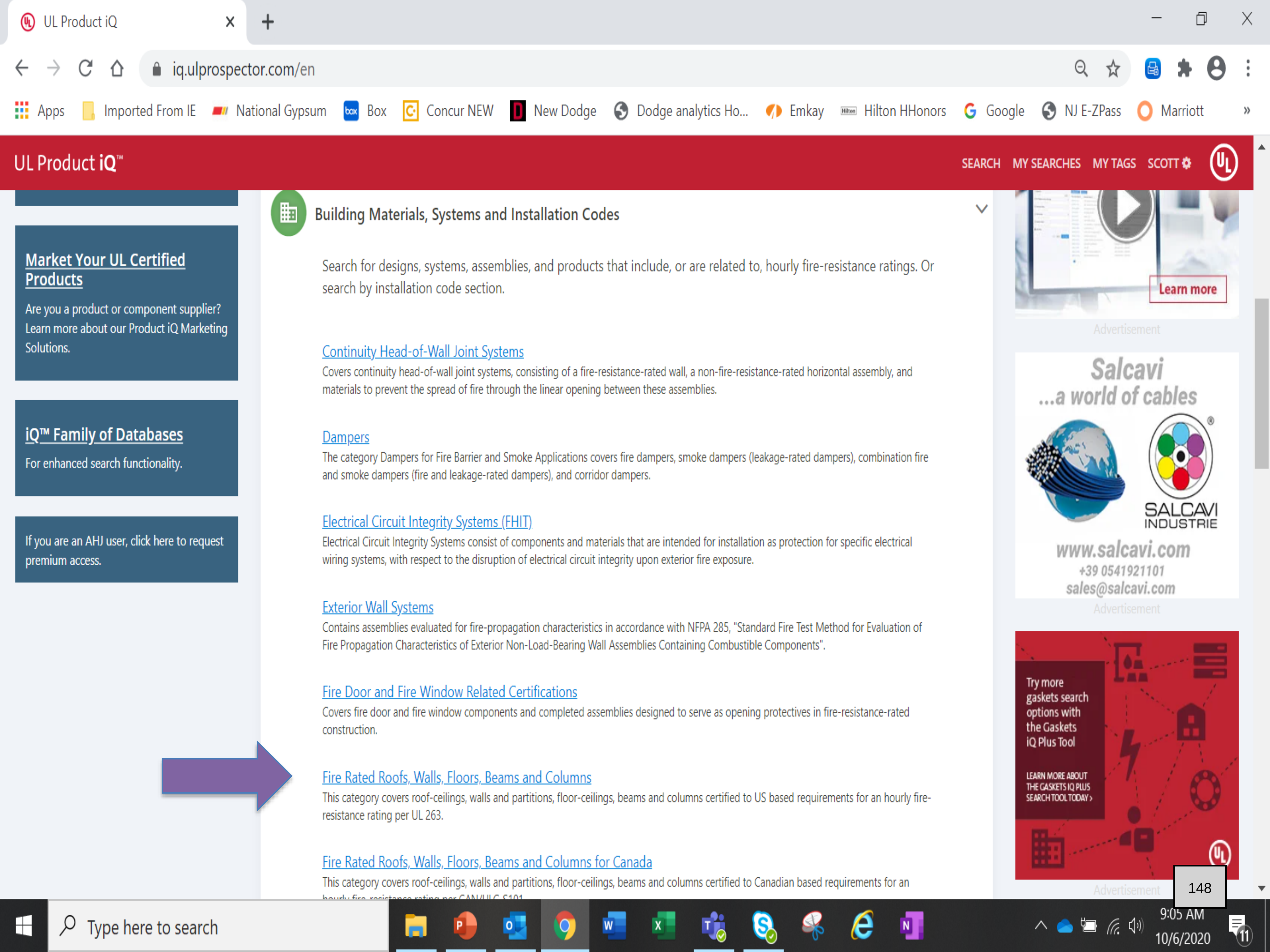
Search for designs, systems, assemblies, and products that include, or are related to, hourly fire-resistance ratings. Or search by installation code section.

Continuity Head-of-Wall Joint Systems

Learn more about Product iQ™ features

Learn more



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Building Materials, Systems and Installation Codes

Search for designs, systems, assemblies, and products that include, or are related to, hourly fire-resistance ratings. Or search by installation code section.

Continuity Head-of-Wall Joint Systems

Covers continuity head-of-wall joint systems, consisting of a fire-resistance-rated wall, a non-fire-resistance-rated horizontal assembly, and materials to prevent the spread of fire through the linear opening between these assemblies.

Dampers

The category Dampers for Fire Barrier and Smoke Applications covers fire dampers, smoke dampers (leakage-rated dampers), combination fire and smoke dampers (fire and leakage-rated dampers), and corridor dampers.

Electrical Circuit Integrity Systems (FHIT)

Electrical Circuit Integrity Systems consist of components and materials that are intended for installation as protection for specific electrical wiring systems, with respect to the disruption of electrical circuit integrity upon exterior fire exposure.

Exterior Wall Systems

Contains assemblies evaluated for fire-propagation characteristics in accordance with NFPA 285, "Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components".

Fire Door and Fire Window Related Certifications

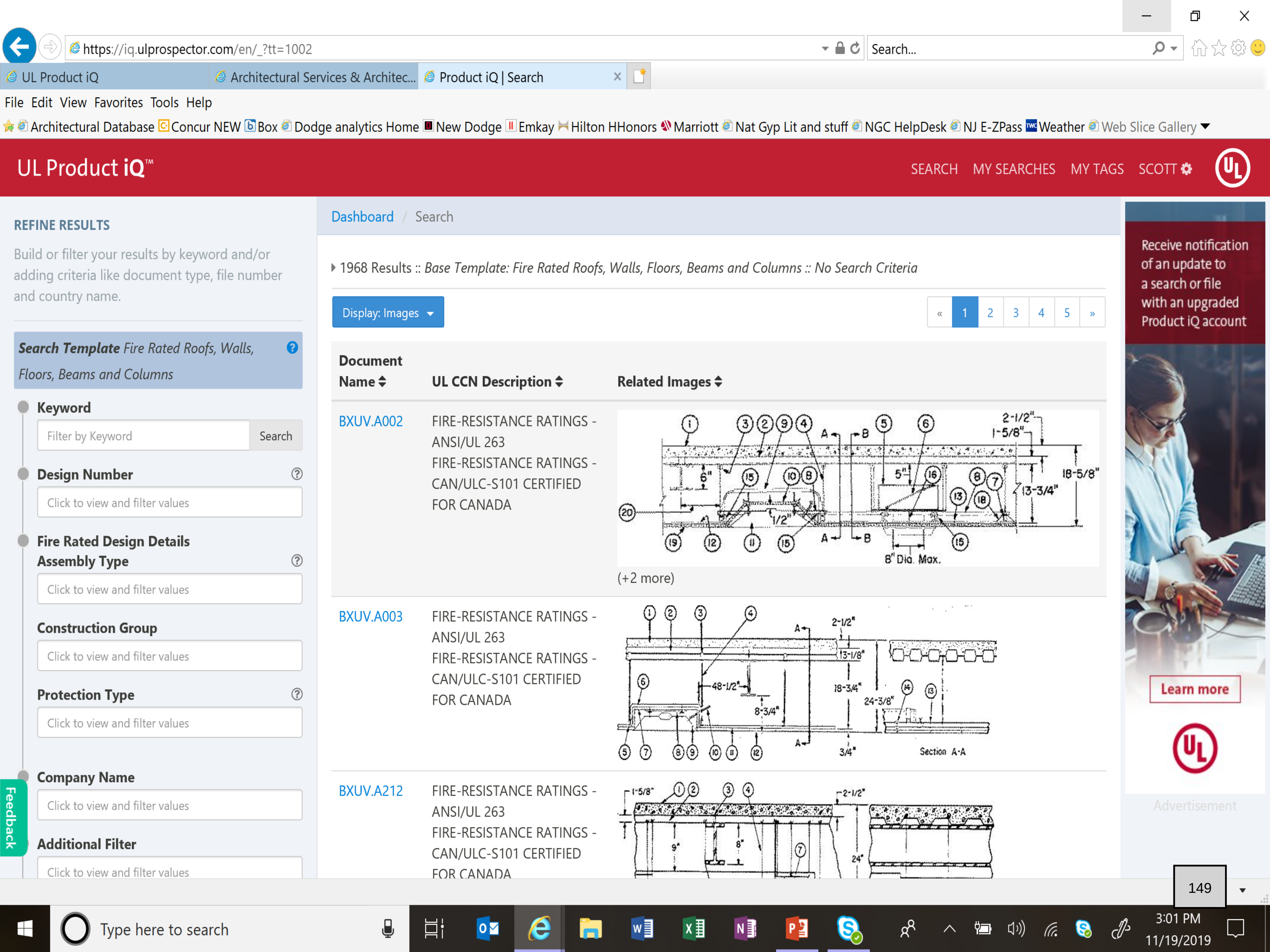
Covers fire door and fire window components and completed assemblies designed to serve as opening protectives in fire-resistance-rated construction.

Fire Rated Roofs, Walls, Floors, Beams and Columns

This category covers roof-ceilings, walls and partitions, floor-ceilings, beams and columns certified to US based requirements for an hourly fire-resistance rating per UL 263.

Fire Rated Roofs, Walls, Floors, Beams and Columns for Canada

This category covers roof-ceilings, walls and partitions, floor-ceilings, beams and columns certified to Canadian based requirements for an



REFINE RESULTS

Build or filter your results by keyword and/or adding criteria like document type, file number and country name.

Search Template *Fire Rated Roofs, Walls, Floors, Beams and Columns*

Keyword

Filter by Keyword | Search

Design Number

Click to view and filter values

Fire Rated Design Details Assembly Type

Click to view and filter values

Construction Group

Click to view and filter values

Protection Type

Click to view and filter values

Company Name

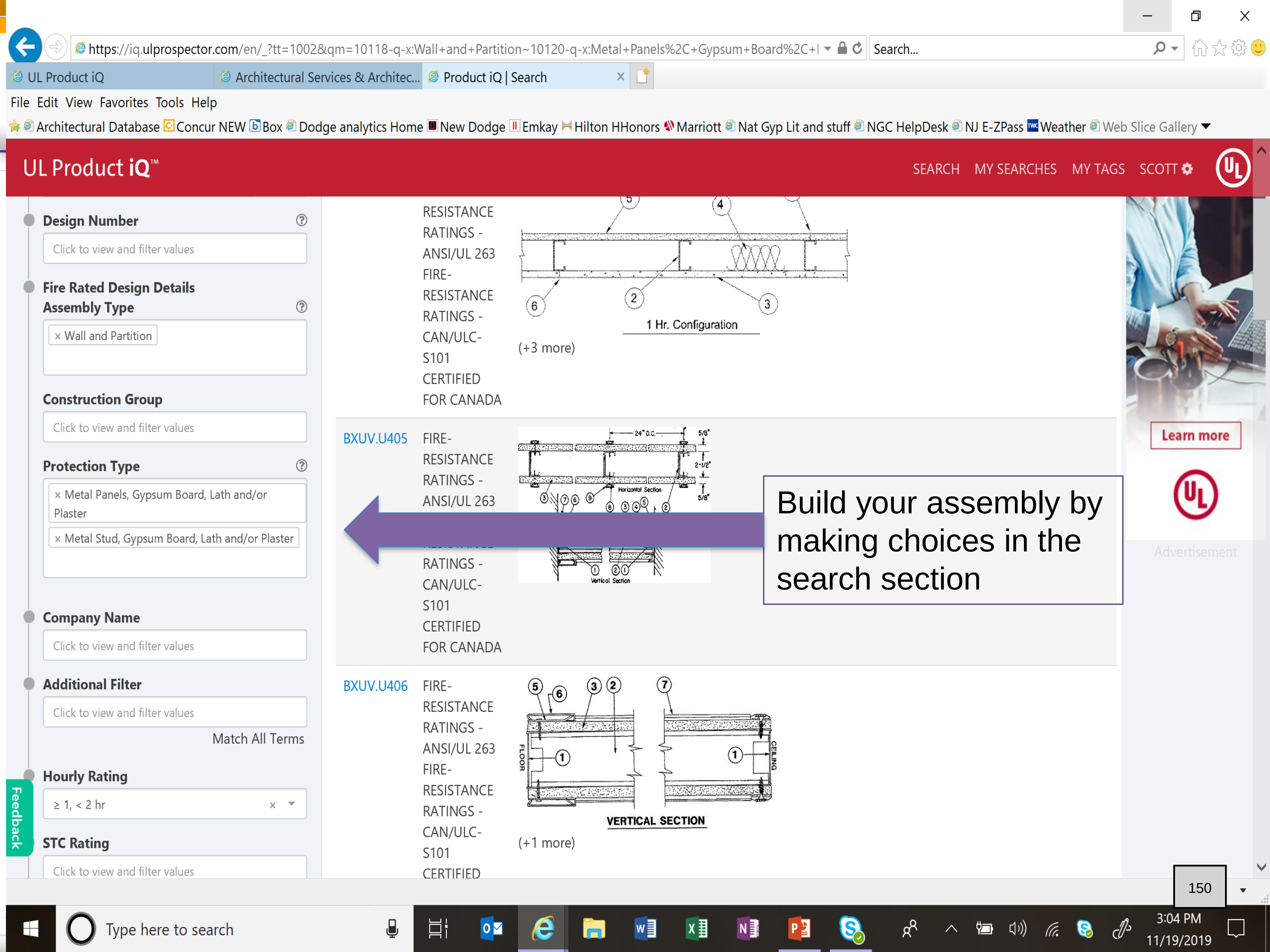
Click to view and filter values

Additional Filter

Click to view and filter values

1968 Results :: *Base Template: Fire Rated Roofs, Walls, Floors, Beams and Columns :: No Search Criteria*

Document Name	UL CCN Description	Related Images
BXUV.A002	FIRE-RESISTANCE RATINGS - ANSI/UL 263 FIRE-RESISTANCE RATINGS - CAN/ULC-S101 CERTIFIED FOR CANADA	(+2 more)
BXUV.A003	FIRE-RESISTANCE RATINGS - ANSI/UL 263 FIRE-RESISTANCE RATINGS - CAN/ULC-S101 CERTIFIED FOR CANADA	
BXUV.A212	FIRE-RESISTANCE RATINGS - ANSI/UL 263 FIRE-RESISTANCE RATINGS - CAN/ULC-S101 CERTIFIED FOR CANADA	



Design Number

Click to view and filter values

Fire Rated Design Details Assembly Type

× Wall and Partition

Construction Group

Click to view and filter values

Protection Type

× Metal Panels, Gypsum Board, Lath and/or Plaster

× Metal Stud, Gypsum Board, Lath and/or Plaster

Company Name

Click to view and filter values

Additional Filter

Click to view and filter values

Match All Terms

Hourly Rating

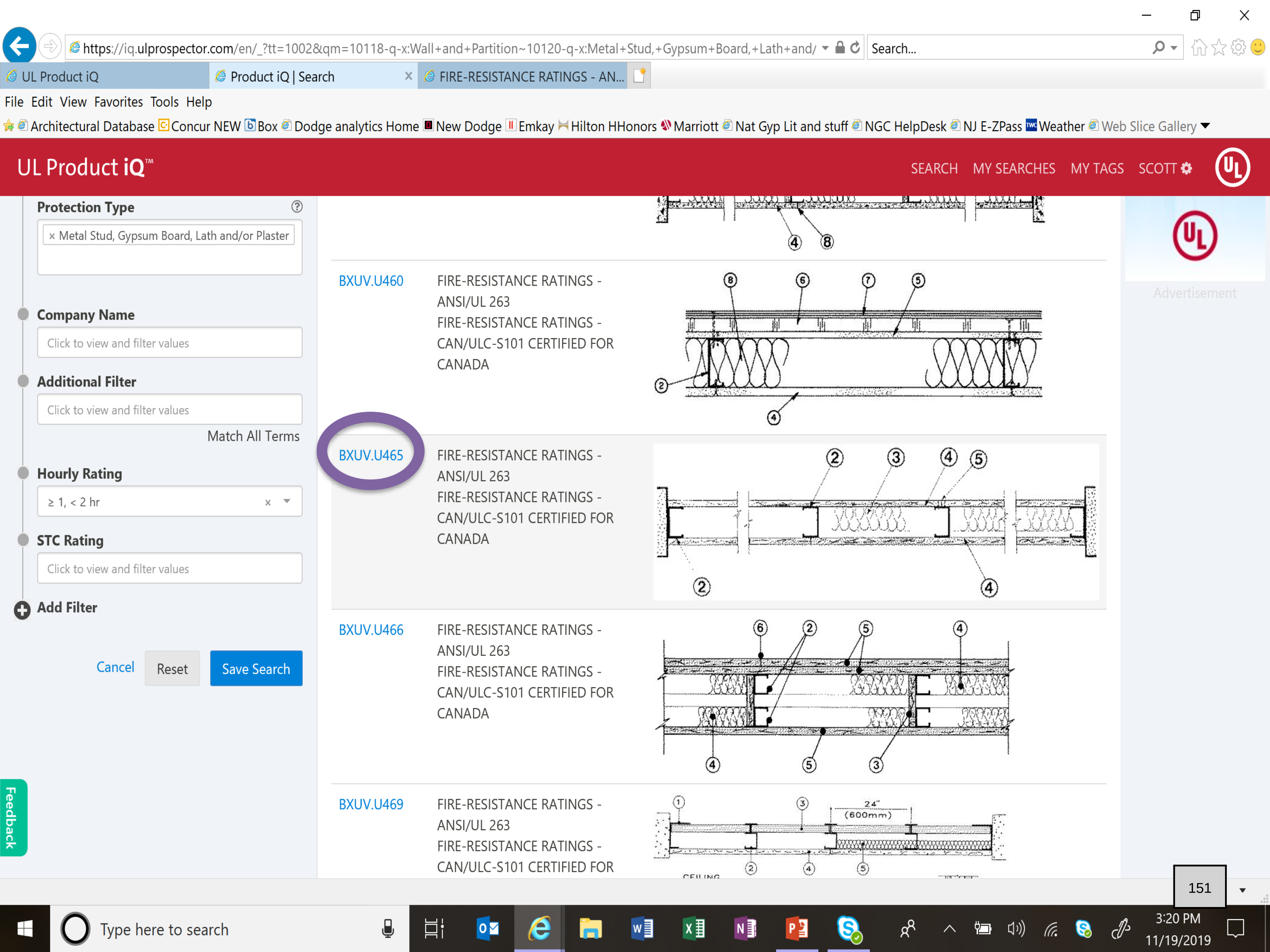
≥ 1, < 2 hr

STC Rating

Click to view and filter values

	RESISTANCE RATINGS - ANSI/UL 263 FIRE-RESISTANCE RATINGS - CAN/ULC-S101 CERTIFIED FOR CANADA	1 Hr. Configuration (+3 more)
BXUV.U405	FIRE-RESISTANCE RATINGS - ANSI/UL 263 … RATINGS - CAN/ULC-S101 CERTIFIED FOR CANADA	Horizontal Section Vertical Section
BXUV.U406	FIRE-RESISTANCE RATINGS - ANSI/UL 263 FIRE-RESISTANCE RATINGS - CAN/ULC-S101 CERTIFIED	VERTICAL SECTION (+1 more)

Build your assembly by making choices in the search section



Protection Type

× Metal Stud, Gypsum Board, Lath and/or Plaster

Company Name

Click to view and filter values

Additional Filter

Click to view and filter values

Hourly Rating

≥ 1, < 2 hr

STC Rating

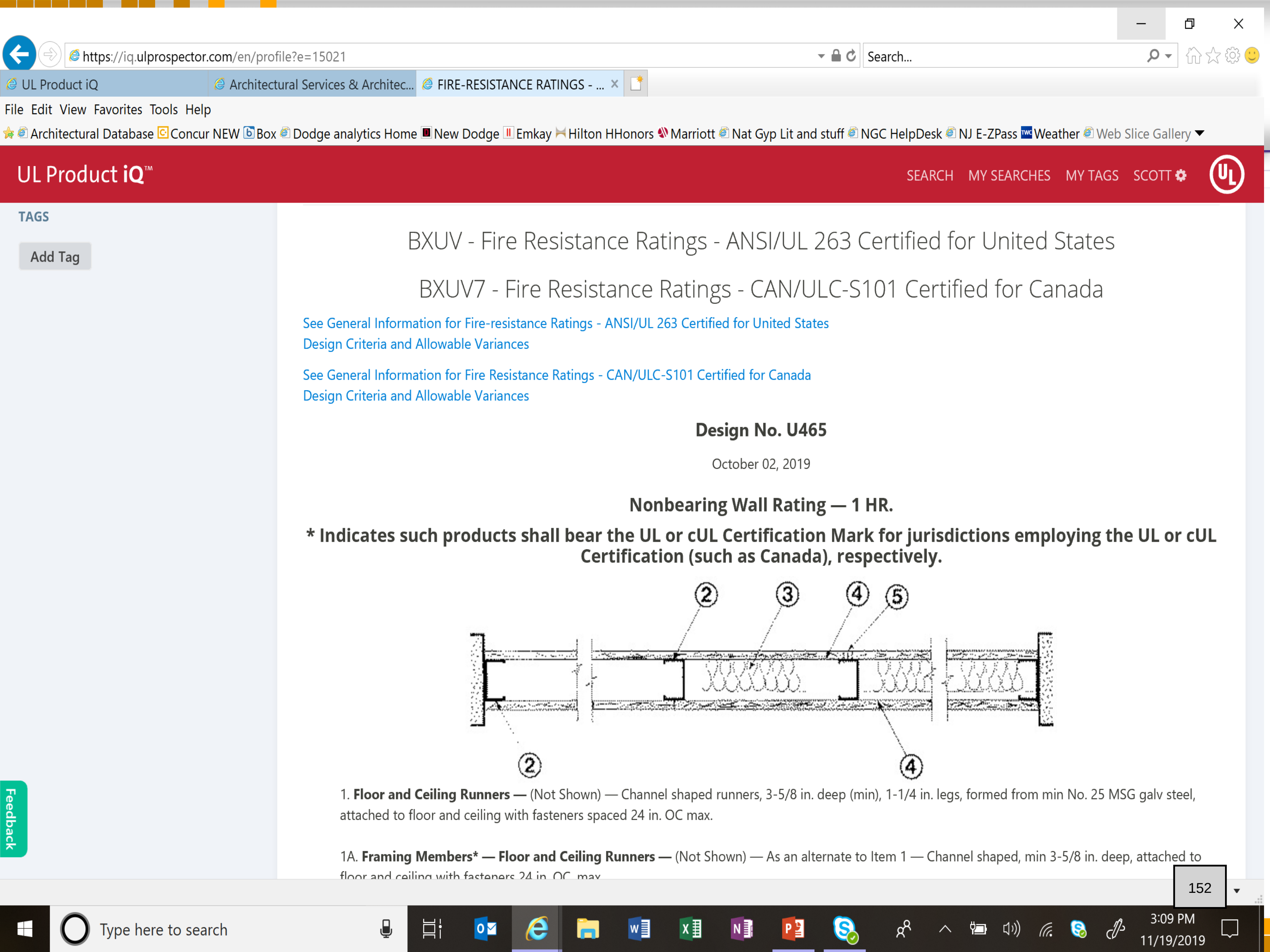
Click to view and filter values

BXUV.U460
FIRE-RESISTANCE RATINGS - ANSI/UL 263
FIRE-RESISTANCE RATINGS - CAN/ULC-S101 CERTIFIED FOR CANADA

BXUV.U465
FIRE-RESISTANCE RATINGS - ANSI/UL 263
FIRE-RESISTANCE RATINGS - CAN/ULC-S101 CERTIFIED FOR CANADA

BXUV.U466
FIRE-RESISTANCE RATINGS - ANSI/UL 263
FIRE-RESISTANCE RATINGS - CAN/ULC-S101 CERTIFIED FOR CANADA

BXUV.U469
FIRE-RESISTANCE RATINGS - ANSI/UL 263
FIRE-RESISTANCE RATINGS - CAN/ULC-S101 CERTIFIED FOR



BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States
Design Criteria and Allowable Variances

See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada
Design Criteria and Allowable Variances

Design No. U465

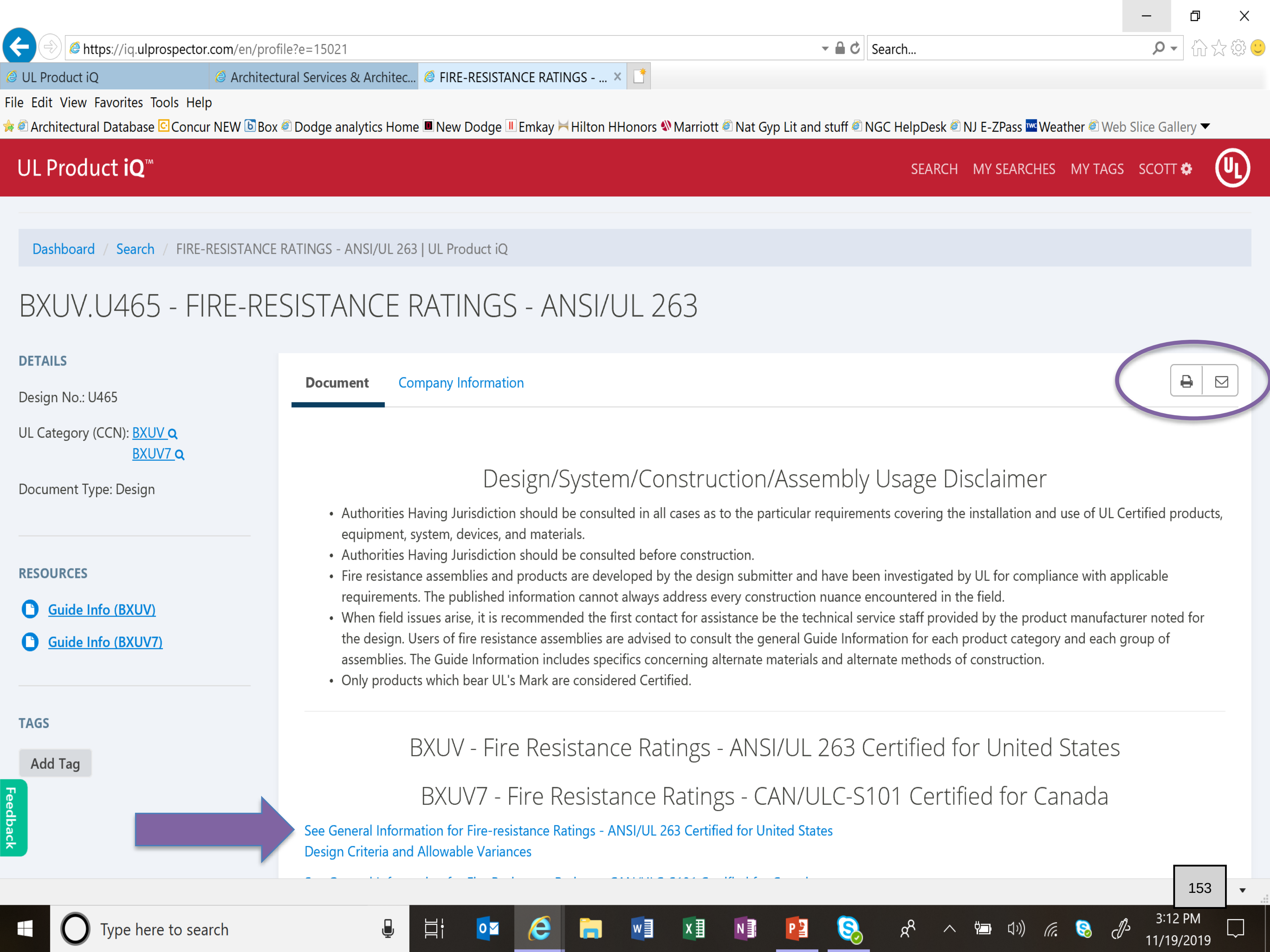
October 02, 2019

Nonbearing Wall Rating — 1 HR.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

1. **Floor and Ceiling Runners —** (Not Shown) — Channel shaped runners, 3-5/8 in. deep (min), 1-1/4 in. legs, formed from min No. 25 MSG galv steel, attached to floor and ceiling with fasteners spaced 24 in. OC max.

1A. **Framing Members* — Floor and Ceiling Runners —** (Not Shown) — As an alternate to Item 1 — Channel shaped, min 3-5/8 in. deep, attached to floor and ceiling with fasteners 24 in. OC max.



Dashboard / Search / FIRE-RESISTANCE RATINGS - ANSI/UL 263 | UL Product iQ

BXUV.U465 - FIRE-RESISTANCE RATINGS - ANSI/UL 263

DETAILS

Design No.: U465

UL Category (CCN): BXUV
BXUV7

Document Type: Design

RESOURCES

Guide Info (BXUV)

Guide Info (BXUV7)

TAGS

Add Tag

Document Company Information

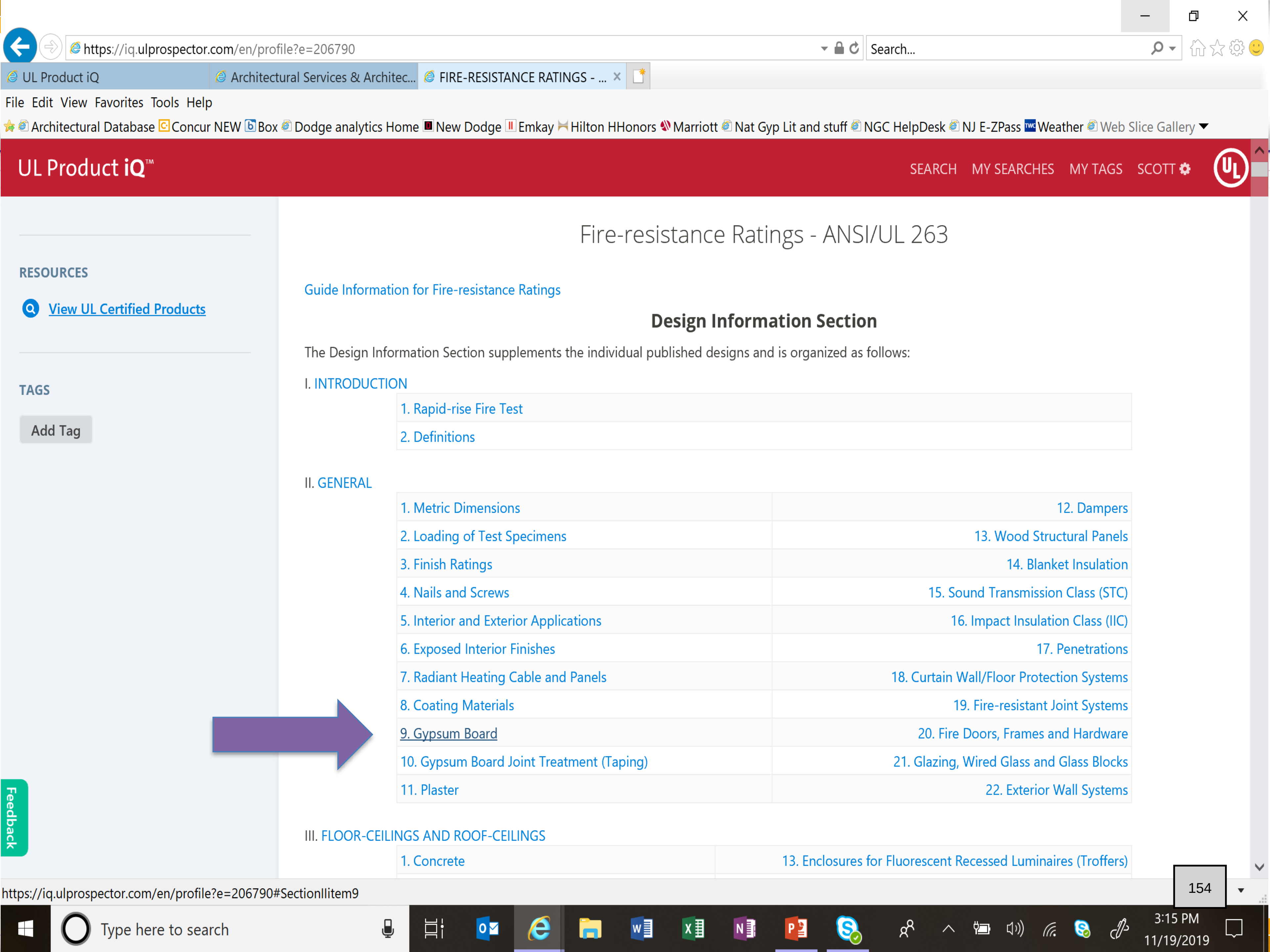
Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States
Design Criteria and Allowable Variances



Fire-resistance Ratings - ANSI/UL 263

Guide Information for Fire-resistance Ratings

Design Information Section

The Design Information Section supplements the individual published designs and is organized as follows:

I. INTRODUCTION

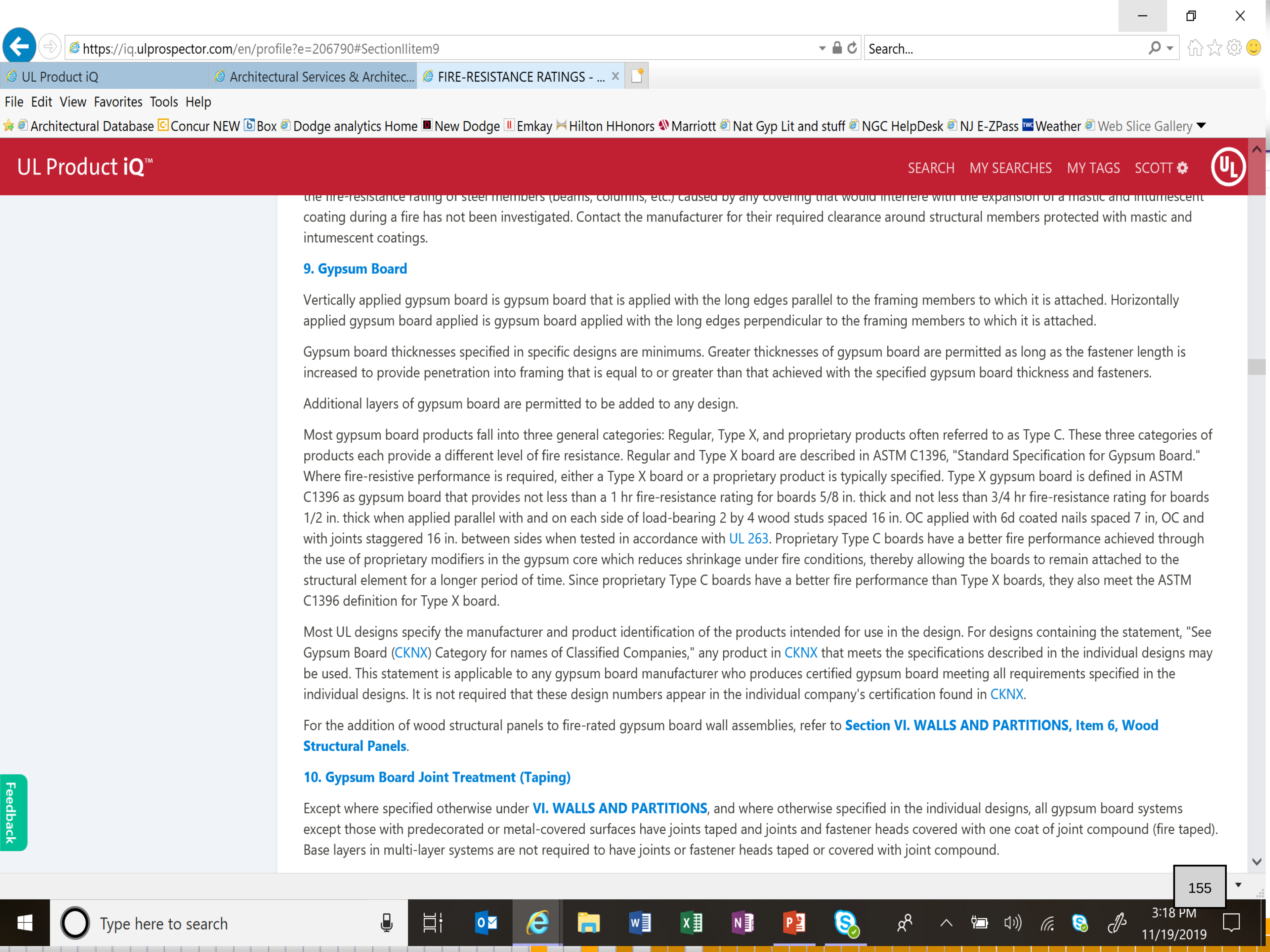
- 1. Rapid-rise Fire Test
- 2. Definitions

II. GENERAL

- 1. Metric Dimensions
- 2. Loading of Test Specimens
- 3. Finish Ratings
- 4. Nails and Screws
- 5. Interior and Exterior Applications
- 6. Exposed Interior Finishes
- 7. Radiant Heating Cable and Panels
- 8. Coating Materials
- 9. Gypsum Board
- 10. Gypsum Board Joint Treatment (Taping)
- 11. Plaster
- 12. Dampers
- 13. Wood Structural Panels
- 14. Blanket Insulation
- 15. Sound Transmission Class (STC)
- 16. Impact Insulation Class (IIC)
- 17. Penetrations
- 18. Curtain Wall/Floor Protection Systems
- 19. Fire-resistant Joint Systems
- 20. Fire Doors, Frames and Hardware
- 21. Glazing, Wired Glass and Glass Blocks
- 22. Exterior Wall Systems

III. FLOOR-CEILINGS AND ROOF-CEILINGS

- 1. Concrete
- 13. Enclosures for Fluorescent Recessed Luminaires (Troffers)



the fire-resistance rating of steel members (beams, columns, etc.) caused by any covering that would interfere with the expansion of a mastic and intumescent coating during a fire has not been investigated. Contact the manufacturer for their required clearance around structural members protected with mastic and intumescent coatings.

9. Gypsum Board

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.

Gypsum board thicknesses specified in specific designs are minimums. Greater thicknesses of gypsum board are permitted as long as the fastener length is increased to provide penetration into framing that is equal to or greater than that achieved with the specified gypsum board thickness and fasteners.

Additional layers of gypsum board are permitted to be added to any design.

Most gypsum board products fall into three general categories: Regular, Type X, and proprietary products often referred to as Type C. These three categories of products each provide a different level of fire resistance. Regular and Type X board are described in ASTM C1396, "Standard Specification for Gypsum Board." Where fire-resistive performance is required, either a Type X board or a proprietary product is typically specified. Type X gypsum board is defined in ASTM C1396 as gypsum board that provides not less than a 1 hr fire-resistance rating for boards 5/8 in. thick and not less than 3/4 hr fire-resistance rating for boards 1/2 in. thick when applied parallel with and on each side of load-bearing 2 by 4 wood studs spaced 16 in. OC applied with 6d coated nails spaced 7 in, OC and with joints staggered 16 in. between sides when tested in accordance with UL 263. Proprietary Type C boards have a better fire performance achieved through the use of proprietary modifiers in the gypsum core which reduces shrinkage under fire conditions, thereby allowing the boards to remain attached to the structural element for a longer period of time. Since proprietary Type C boards have a better fire performance than Type X boards, they also meet the ASTM C1396 definition for Type X board.

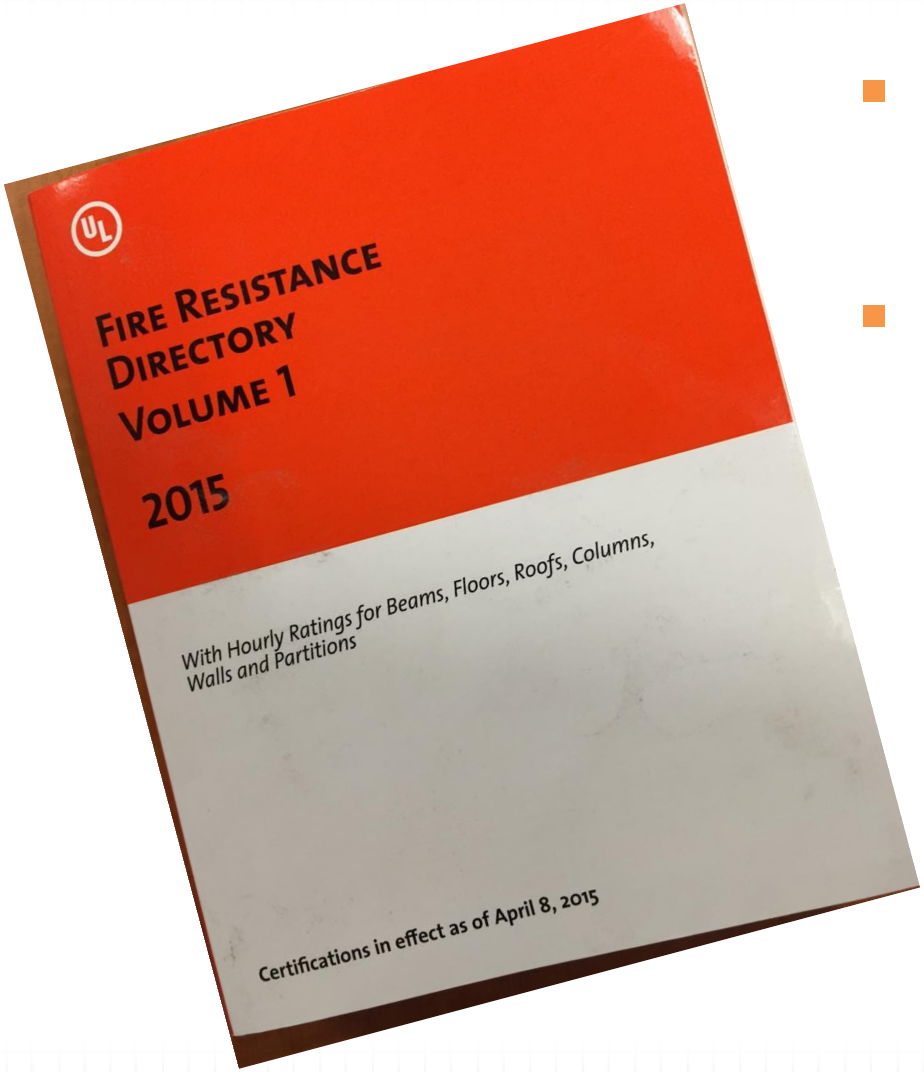
Most UL designs specify the manufacturer and product identification of the products intended for use in the design. For designs containing the statement, "See Gypsum Board (CKNX) Category for names of Classified Companies," any product in CKNX that meets the specifications described in the individual designs may be used. This statement is applicable to any gypsum board manufacturer who produces certified gypsum board meeting all requirements specified in the individual designs. It is not required that these design numbers appear in the individual company's certification found in CKNX.

For the addition of wood structural panels to fire-rated gypsum board wall assemblies, refer to **Section VI. WALLS AND PARTITIONS, Item 6, Wood Structural Panels**.

10. Gypsum Board Joint Treatment (Taping)

Except where specified otherwise under **VI. WALLS AND PARTITIONS**, and where otherwise specified in the individual designs, 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.

Volume 1



FIRE RESISTANCE
DIRECTORY
VOLUME 1

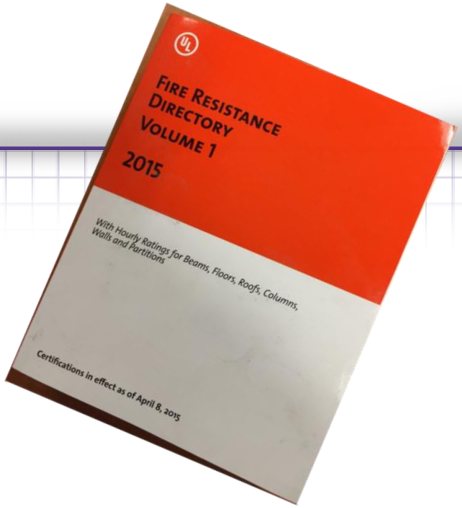
2015

With Hourly Ratings for Beams, Floors, Roofs, Columns, Walls and Partitions

Certifications in effect as of April 8, 2015

- First 10 pages (most important)
- Table on page 1

Important Key Passages



FIRE RESISTANCE DIRECTORY
VOLUME 1
2015

With Hourly Ratings for Beams, Floors, Roofs, Columns, Walls and Partitions

Certifications in effect as of April 8, 2015

- Nails vs. screws
- Gypsum board orientation
- Gypsum board joint treatment (fire taping)
- Blanket insulation
- Wall and Partition Assemblies

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.

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.

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).

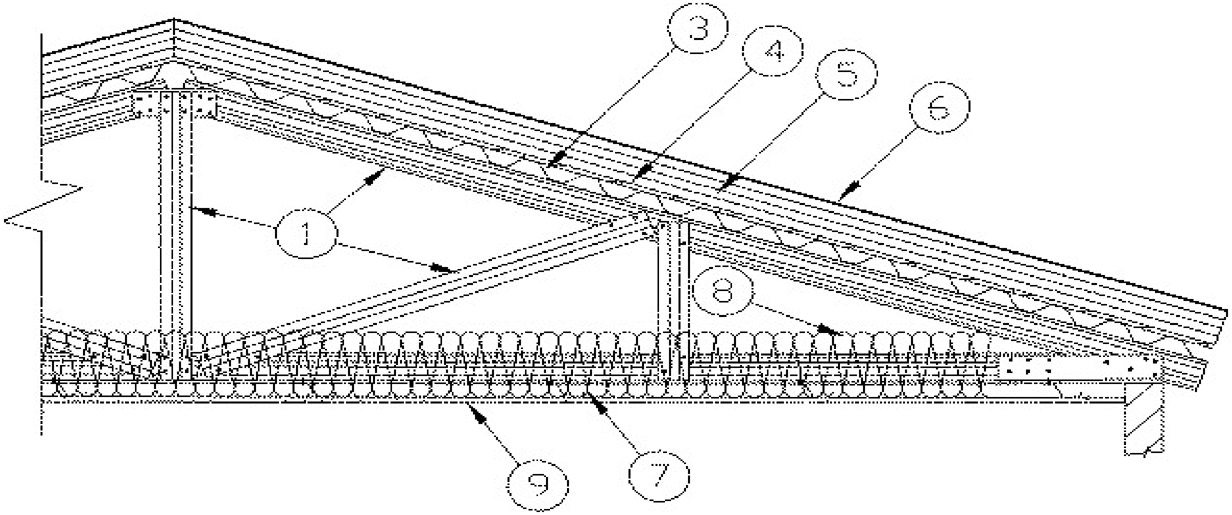
- Base layers in multi layer systems are not required to have joints or fastener heads taped or covered with joint compound.

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.

Pg 15 - Blanket Insulation

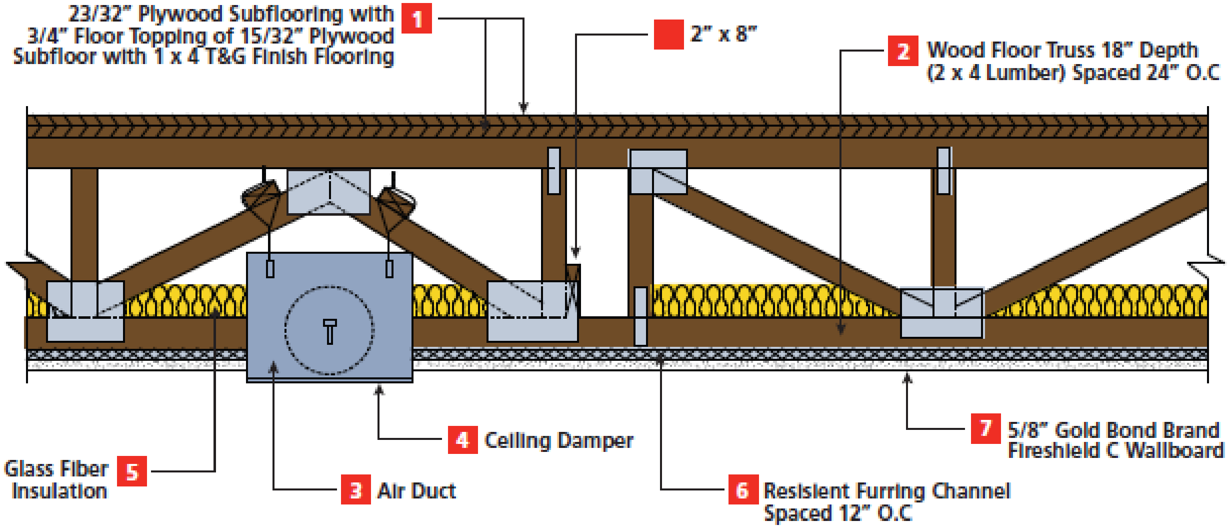
Unless specifically described in a design, the addition of insulation in the concealed space between the ceiling membrane and the floor or roof structure may reduce the hourly rating of an assembly by causing premature disruption of the ceiling membrane and/or higher temperatures on structural components under fire exposure conditions.



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**

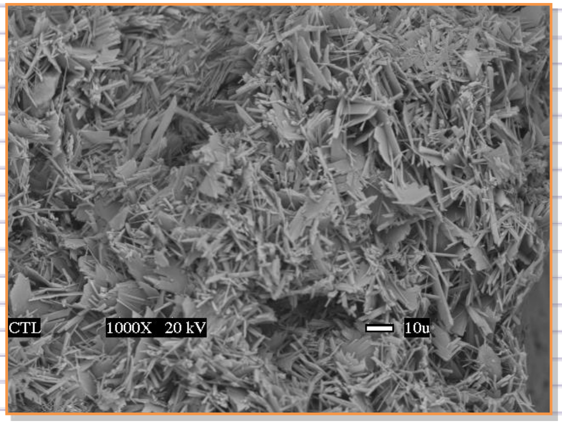
Floor/Ceiling Assembly

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.

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



$CaSO_4 \cdot 2H_2O$

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.

Gypsum Association Fire Design Manual-2015

21st Edition
GA-600-2015

GYPSUM ASSOCIATION

FIRE
RESISTANCE
DESIGN MANUAL

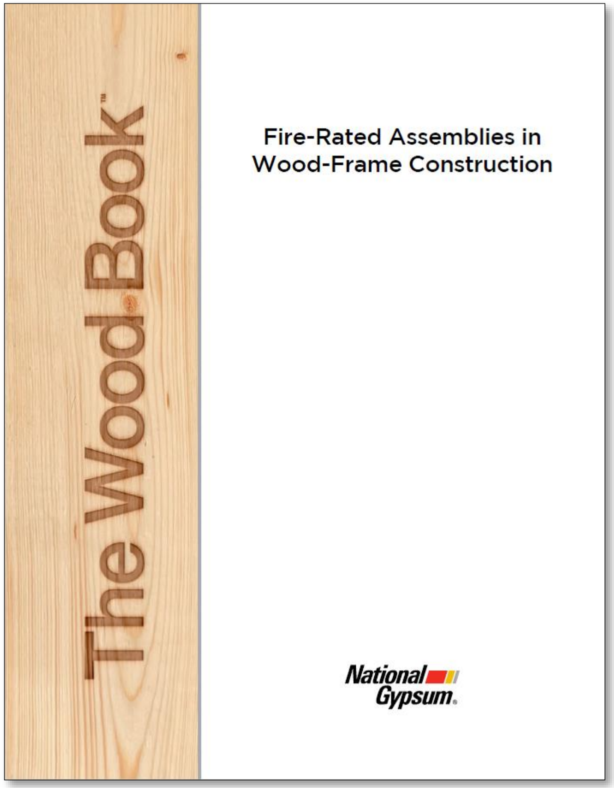
SOUND CONTROL

GYPSUM
SYSTEMS

National Gypsum

GYPSUM ASSOCIATION
JUNE 2015
GYPSUM DRYWALL

Technical resources | The Wood Book



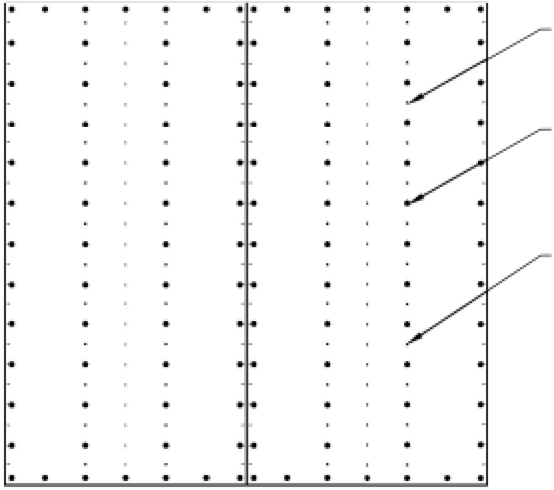
The Wood Book™ highlights include:

- Fire-rated UL designs for all wood-frame walls, floor-ceiling, and roof-ceiling assemblies
- Head-of-wall and rim joist details for the intersections of walls and floor-ceiling assemblies
- Multiple design options for mechanical, elevator, and stair shaft enclosures
- New area separation wall details including egress door installations

Wood Book includes:

- Detailed, fire-rated UL designs for wood-frame walls as well as floor-ceiling and roof-ceiling assemblies
- Head-of-wall and rim joist details for the intersections of walls and floor-ceiling assemblies
- Multiple design options for mechanical, elevator and stair shaft enclosures
- Area separation wall details including egress door installations

4



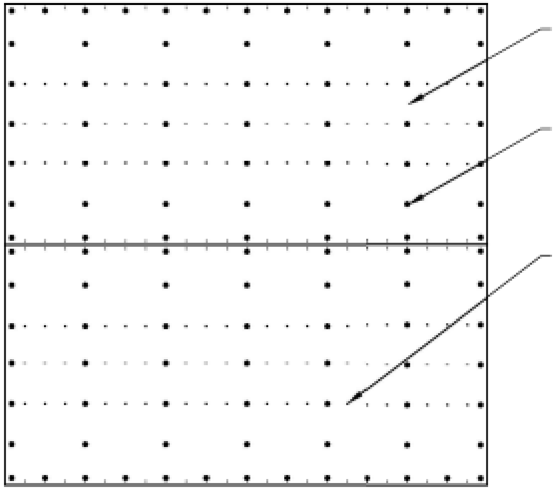
5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD
(FSW, FSW-C, FSW-6, eXP-C, SBWB, FSK, FSK-C)

1 1/4" TYPE W SCREWS 8" O.C. AT PERIMETER, FIELD, AND TOP AND BOTTOM PLATES

GRIDMARX PREPRINTED FASTENING GUIDE

GRIDMARX PREPRINTED GUIDE MARKS RUN THE LENGTH OF THE BOARD IN FOUR-INCH INCREMENTS ALONG BOTH LONG EDGES AND AT 16", 24", AND 32". GRIDMARX SERVE AS GUIDE MARKS TO IDENTIFY THE LOCATION OF FRAMING MEMBERS BEHIND THE GYPSUM BOARD AND AS A GUIDE FOR THE SPACING OF FASTENERS.

VERTICAL APPLICATION



5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD
(FSW, FSW-C, FSW-6, eXP-C, SBWB, FSK, FSK-C)

1 1/4" TYPE W SCREWS 8" O.C. AT PERIMETER, FIELD, AND TOP AND BOTTOM PLATES

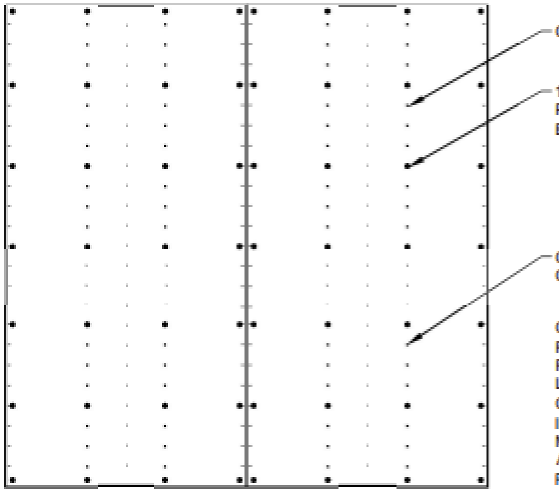
GRIDMARX PREPRINTED FASTENING GUIDE

<u>1 HOUR WOOD STUD WALLS</u>
UL DESIGNS: U305, U309, U340, U341, U344, U356

HORIZONTAL APPLICATION

DATE: 01/13/22	GRIDMARX FASTENER GUIDE FOR 1 HOUR WALLS	National Gypsum
SCALE: 1/2"=1'-0"	WOOD STUD FRAMING 16" O.C. - DETAIL: GM 101	

5



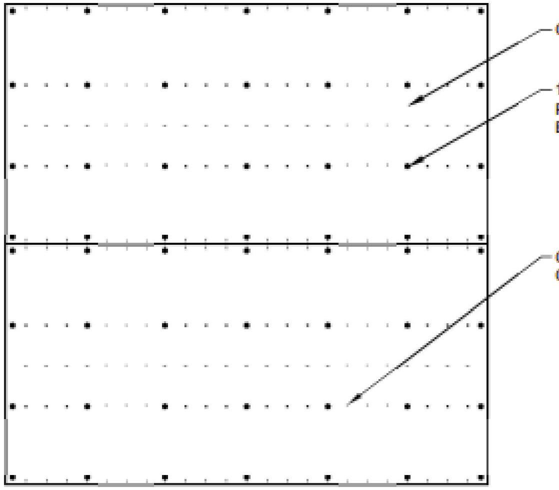
GOLD BOND GYPSUM BOARD

1 1/4" TYPE W SCREWS 16" O.C. AT PERIMETER, FIELD, AND TOP AND BOTTOM PLATES

GRIDMARX PREPRINTED FASTENING GUIDE

GRIDMARX PREPRINTED GUIDE MARKS RUN THE LENGTH OF THE BOARD IN FOUR-INCH INCREMENTS ALONG BOTH LONG EDGES AND AT 16", 24", AND 32". GRIDMARX SERVE AS GUIDE MARKS TO IDENTIFY THE LOCATION OF FRAMING MEMBERS BEHIND THE GYPSUM BOARD AND AS A GUIDE FOR THE SPACING OF FASTENERS.

VERTICAL APPLICATION



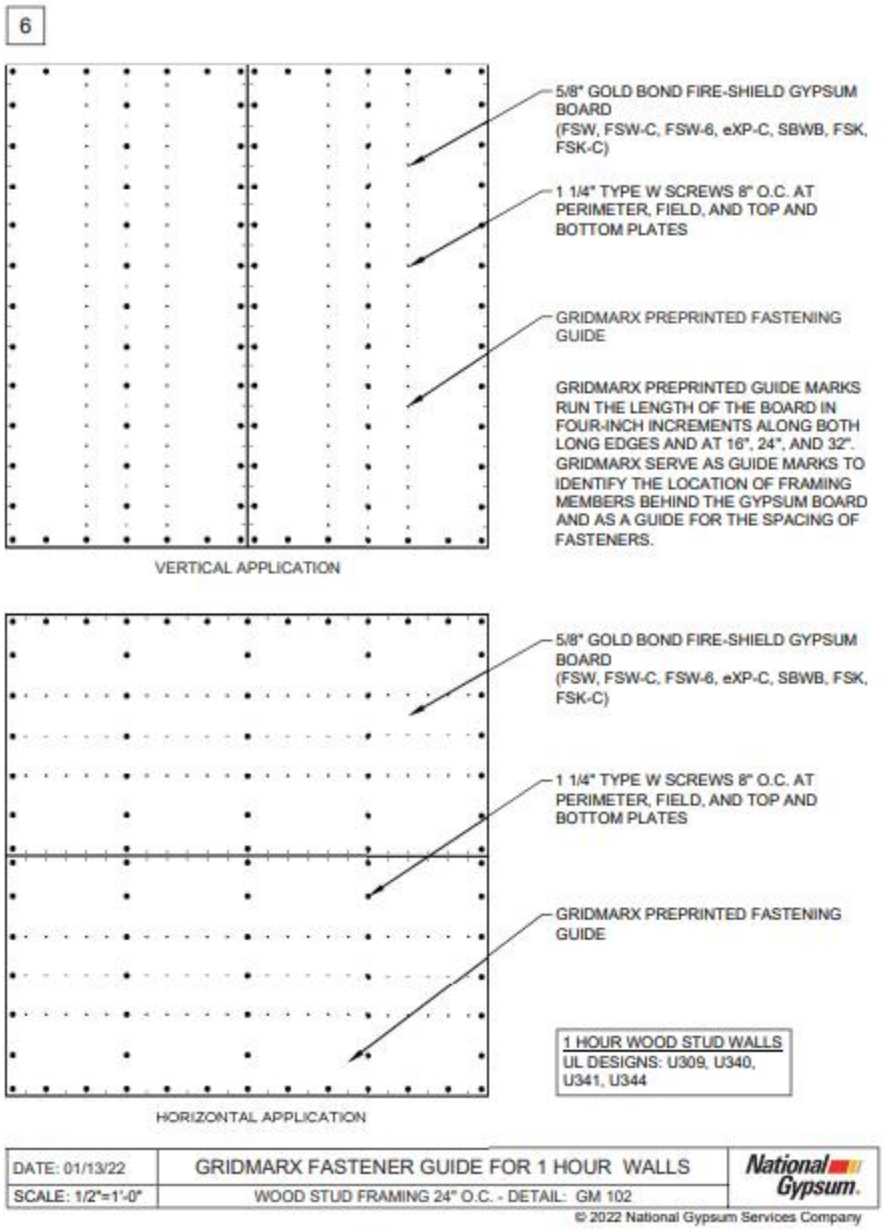
GOLD BOND GYPSUM BOARD

1 1/4" TYPE W SCREWS 16" O.C. AT PERIMETER, FIELD, AND TOP AND BOTTOM PLATES

GRIDMARX PREPRINTED FASTENING GUIDE

HORIZONTAL APPLICATION

DATE: 01/13/22	GRIDMARX FASTENER GUIDE FOR UNRATED WALLS	National Gypsum
SCALE: 1/2"=1'-0"	WOOD STUD FRAMING 16" O.C. - DETAIL: GM 001	



6

5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD
(FSW, FSW-C, FSW-6, eXP-C, SBWB, FSK, FSK-C)

1 1/4" TYPE W SCREWS 8" O.C. AT PERIMETER, FIELD, AND TOP AND BOTTOM PLATES

GRIDMARX PREPRINTED FASTENING GUIDE

GRIDMARX PREPRINTED GUIDE MARKS RUN THE LENGTH OF THE BOARD IN FOUR-INCH INCREMENTS ALONG BOTH LONG EDGES AND AT 16", 24", AND 32". GRIDMARX SERVE AS GUIDE MARKS TO IDENTIFY THE LOCATION OF FRAMING MEMBERS BEHIND THE GYPSUM BOARD AND AS A GUIDE FOR THE SPACING OF FASTENERS.

VERTICAL APPLICATION

5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD
(FSW, FSW-C, FSW-6, eXP-C, SBWB, FSK, FSK-C)

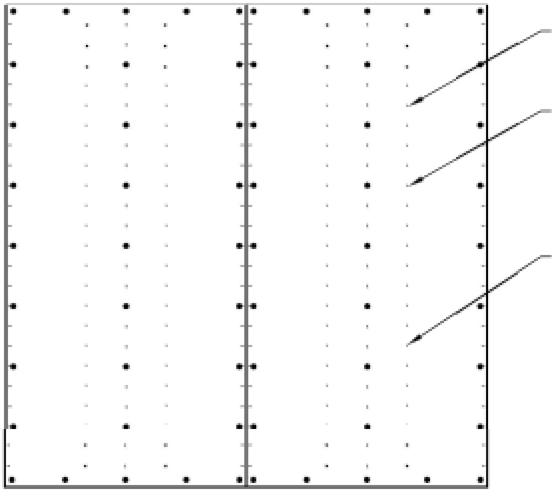
1 1/4" TYPE W SCREWS 8" O.C. AT PERIMETER, FIELD, AND TOP AND BOTTOM PLATES

GRIDMARX PREPRINTED FASTENING GUIDE

1 HOUR WOOD STUD WALLS
UL DESIGNS: U309, U340, U341, U344

HORIZONTAL APPLICATION

DATE: 01/13/22
SCALE: 1/2"=1'-0"
GRIDMARX FASTENER GUIDE FOR 1 HOUR WALLS
WOOD STUD FRAMING 24" O.C. - DETAIL: GM 102
National Gypsum



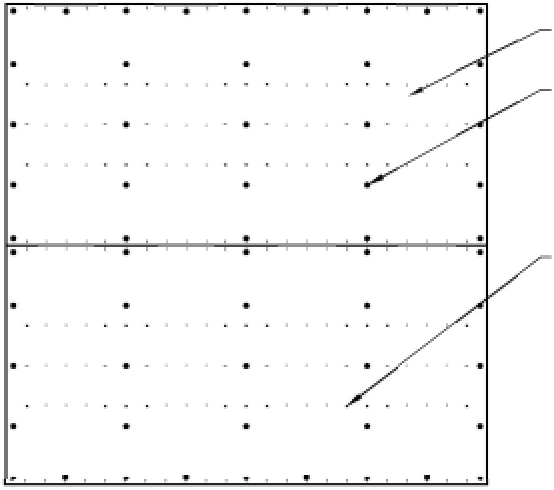
GOLD BOND GYPSUM BOARD

1 1/4" TYPE W SCREWS 12" O.C. AT PERIMETER, FIELD, AND TOP AND BOTTOM PLATES

GRIDMARX PREPRINTED FASTENING GUIDE

GRIDMARX PREPRINTED GUIDE MARKS RUN THE LENGTH OF THE BOARD IN FOUR-INCH INCREMENTS ALONG BOTH LONG EDGES AND AT 16", 24", AND 32". GRIDMARX SERVE AS GUIDE MARKS TO IDENTIFY THE LOCATION OF FRAMING MEMBERS BEHIND THE GYPSUM BOARD AND AS A GUIDE FOR THE SPACING OF FASTENERS.

VERTICAL APPLICATION



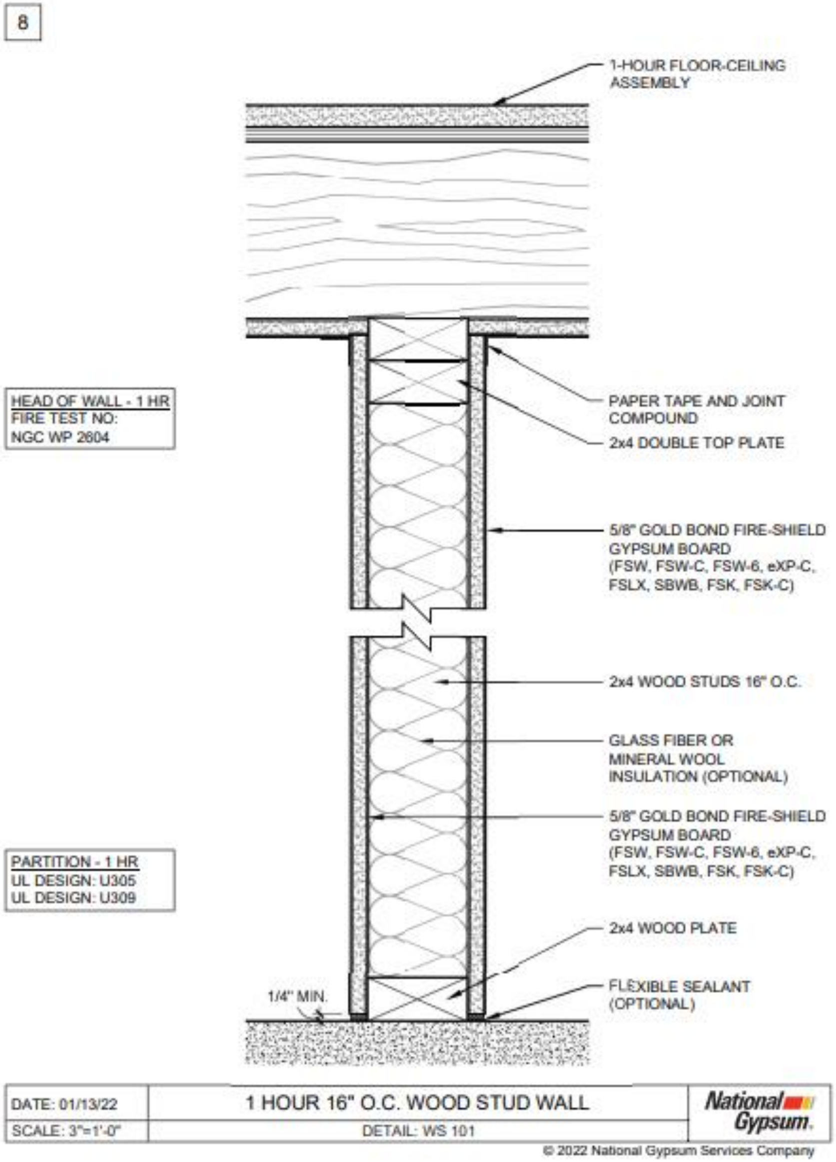
GOLD BOND GYPSUM BOARD

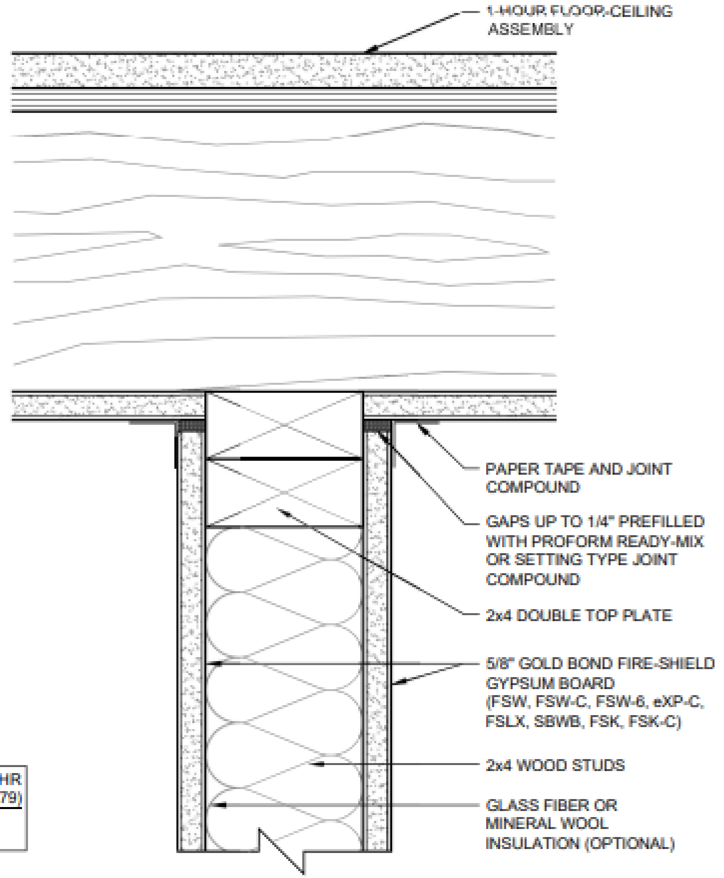
1 1/4" TYPE W SCREWS 12" O.C. AT PERIMETER, FIELD, AND TOP AND BOTTOM PLATES

GRIDMARX PREPRINTED FASTENING GUIDE

HORIZONTAL APPLICATION

DATE: 01/13/22	GRIDMARX FASTENER GUIDE FOR UNRATED WALLS	National Gypsum.
SCALE: 1/2"=1'-0"	WOOD STUD FRAMING 24" O.C. - DETAIL: GM 002	


8
1-HOUR FLOOR-CEILING ASSEMBLY
HEAD OF WALL - 1 HR
FIRE TEST NO:
NGC WP 2604
PAPER TAPE AND JOINT COMPOUND
2x4 DOUBLE TOP PLATE
5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C)
2x4 WOOD STUDS 16" O.C.
GLASS FIBER OR MINERAL WOOL INSULATION (OPTIONAL)
PARTITION - 1 HR
UL DESIGN: U305
UL DESIGN: U309
5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C)
2x4 WOOD PLATE
1/4" MIN.
FLEXIBLE SEALANT (OPTIONAL)
DATE: 01/13/22
SCALE: 3"=1'-0"
1 HOUR 16" O.C. WOOD STUD WALL
DETAIL: WS 101
National Gypsum
© 2022 National Gypsum Services Company

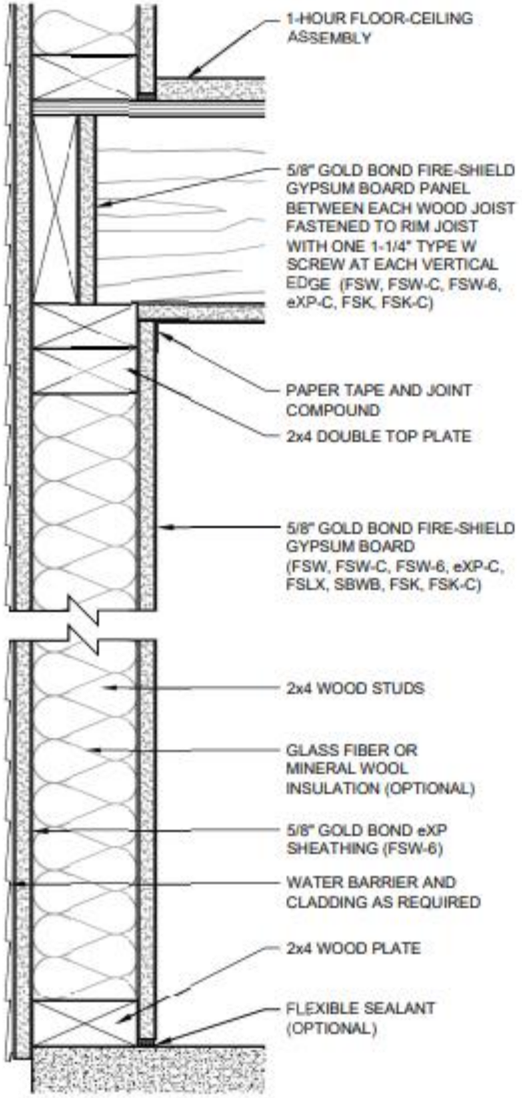


HEAD OF WALL - 1 HR
(ASTM E1966/UL 2079)
FIRE TEST NO:
NGC WP 2604

DATE: 01/13/22	1 HOUR WOOD STUD HEAD OF WALL - NGC WP 2604	National Gypsum
SCALE: NTS	DETAIL: WS 102	

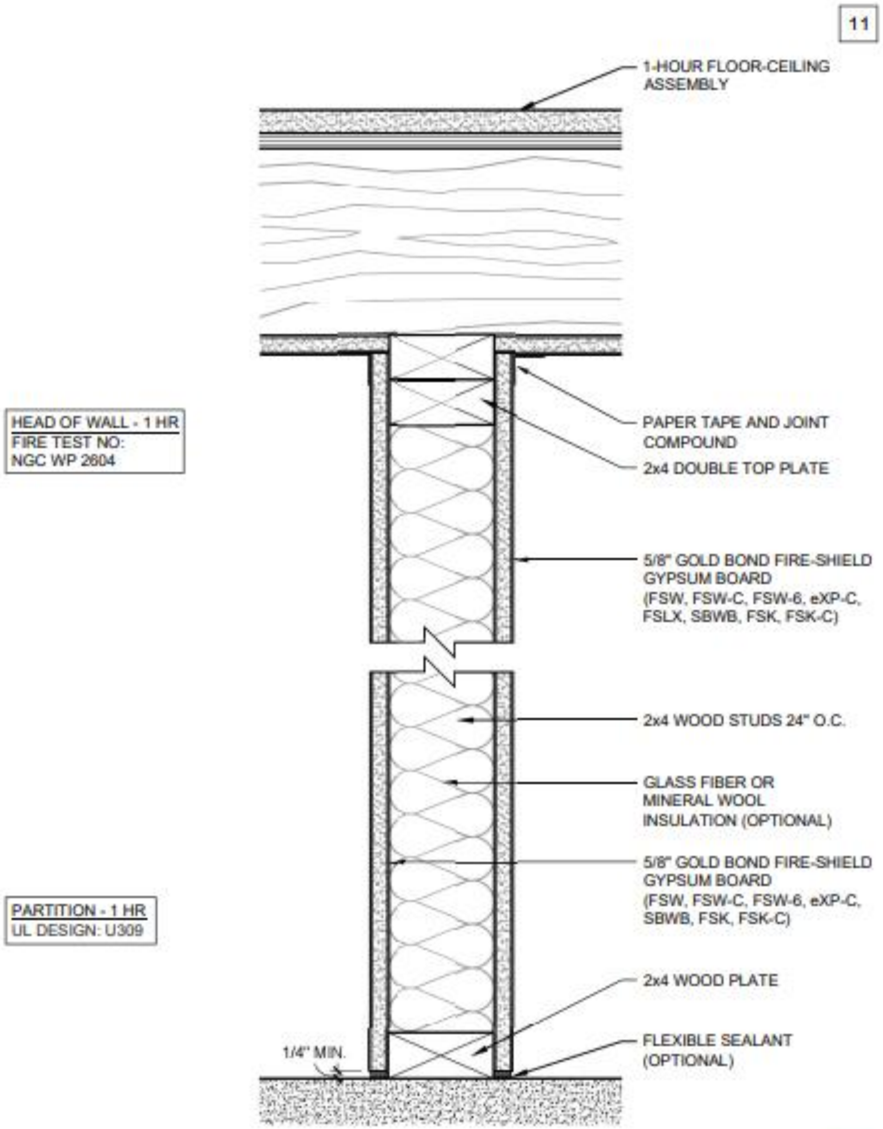
10

RIM JOIST - 1 HR
FIRE TEST NO:
NGC WP 2454



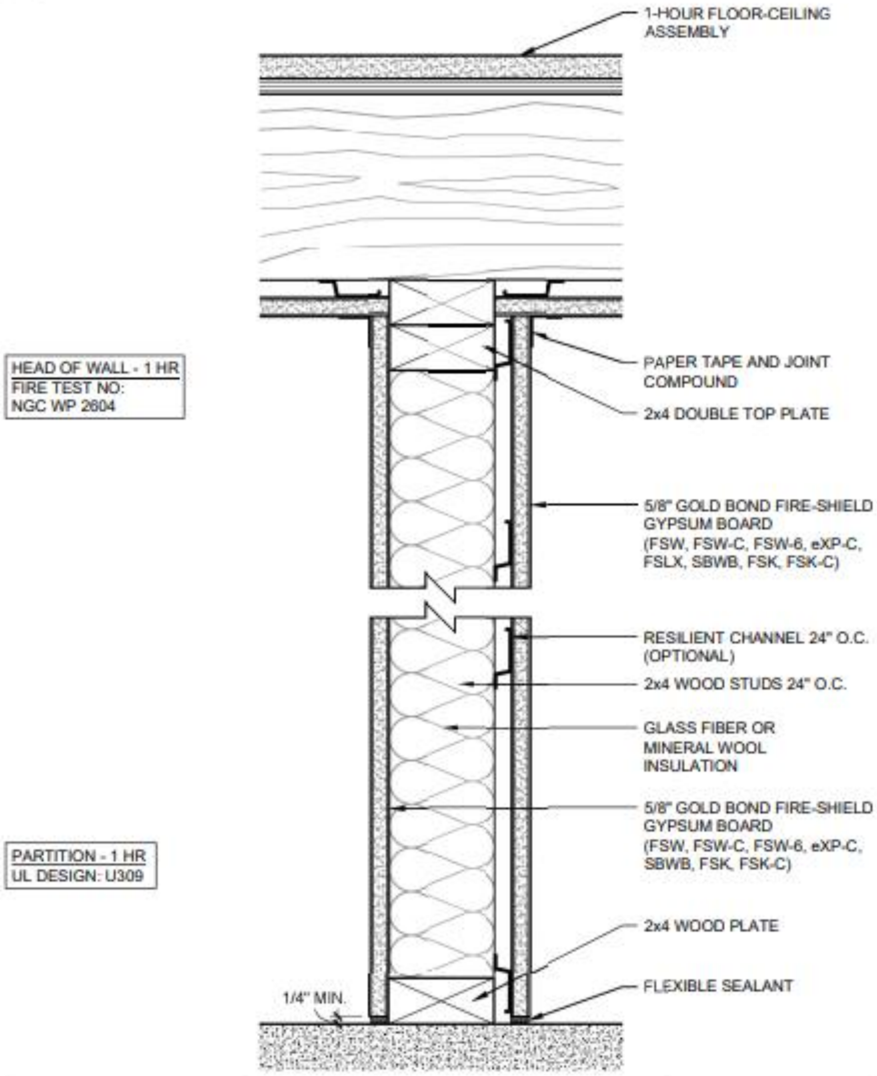
PARTITION - 1 HR
UL DESIGNS:
U305, U309, U340,
U341, U344, U356

DATE: 01/13/22	1 HOUR WALL WITH RIM JOIST - NGC WP 2454	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 103	

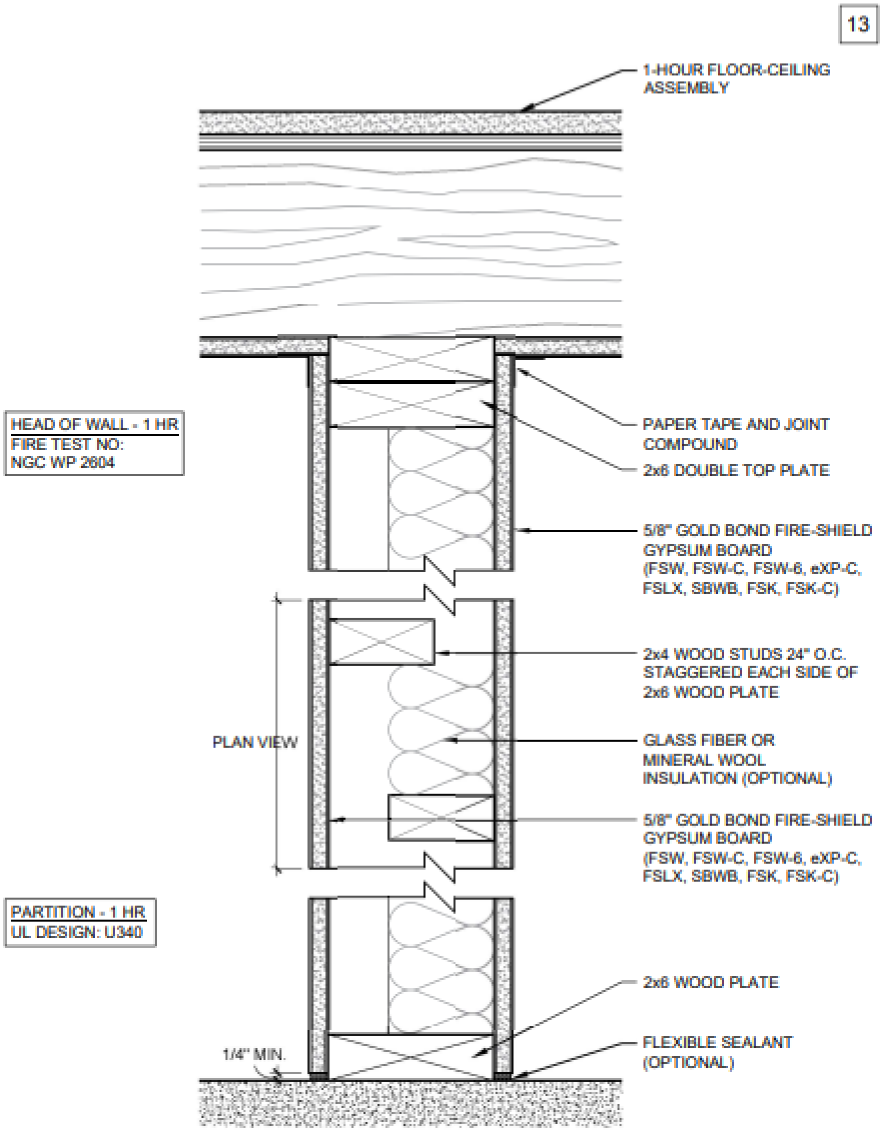


DATE: 01/13/22	1 HOUR 24" O.C. WOOD STUD WALL	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 104	

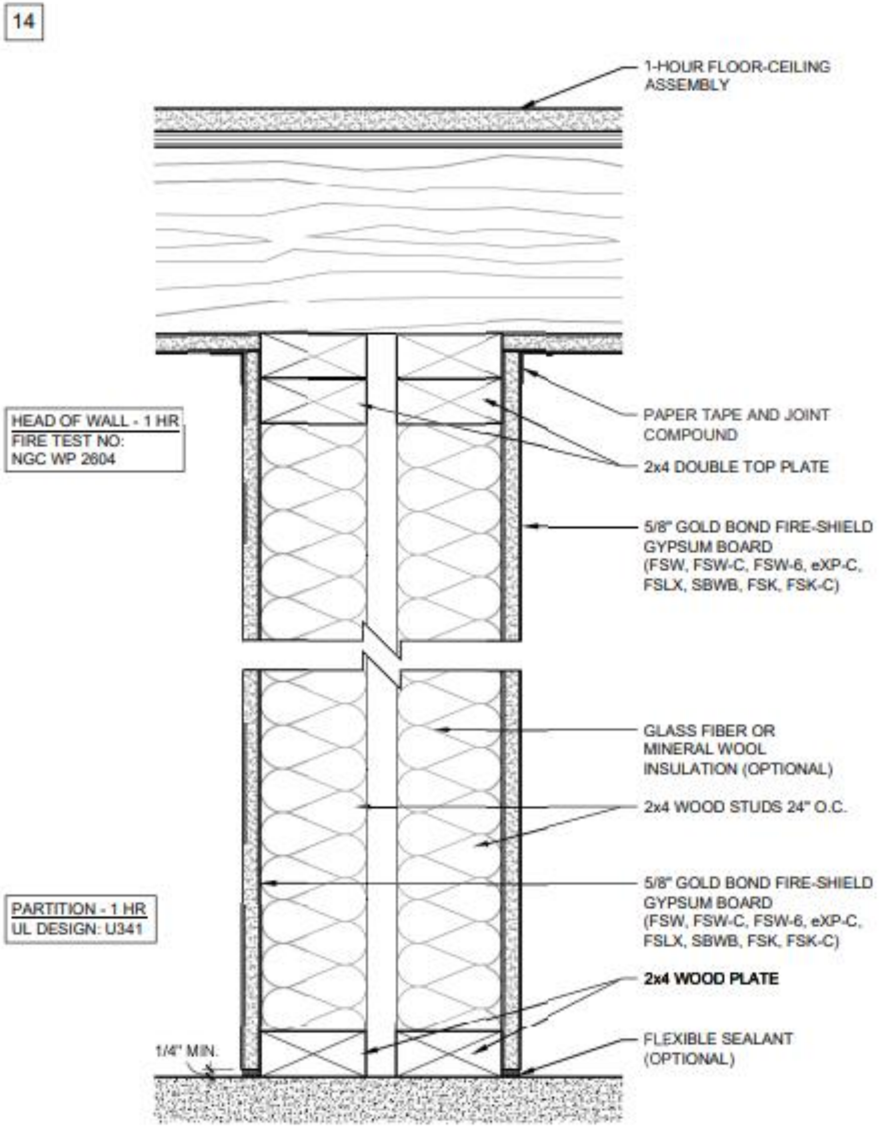
12



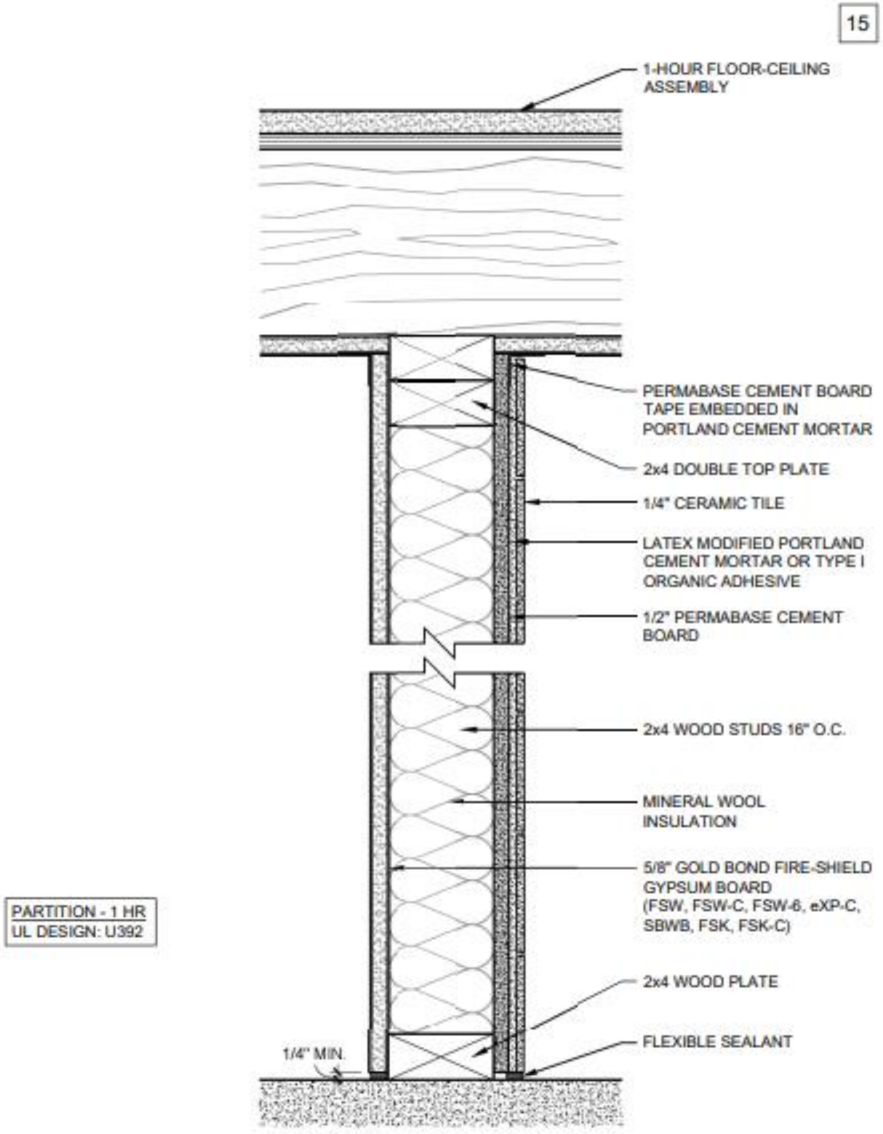
DATE: 01/13/22	1 HOUR WALL WITH RESILIENT CHANNELS	National Gypsum.
SCALE: 3"=1'-0"	DETAIL: WS 105	



DATE: 01/13/22	1 HOUR WALL WITH STAGGERED STUDS	National Gypsum.
SCALE: 3"=1'-0"	DETAIL: WS 106	

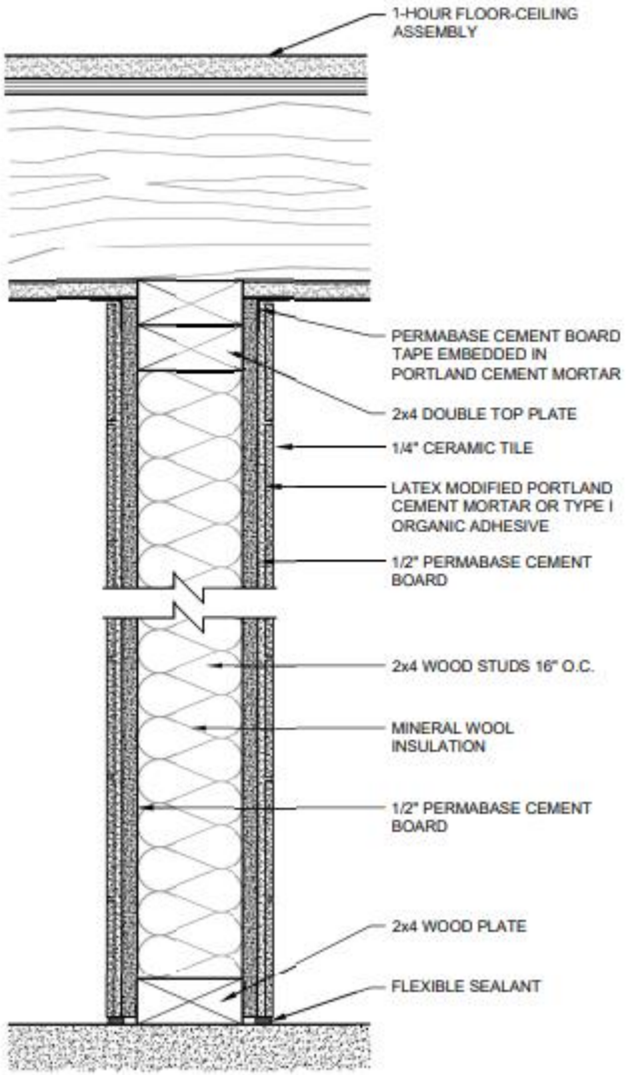


DATE: 01/13/22	1 HOUR WALL WITH DOUBLE ROW OF STUDS	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 107	



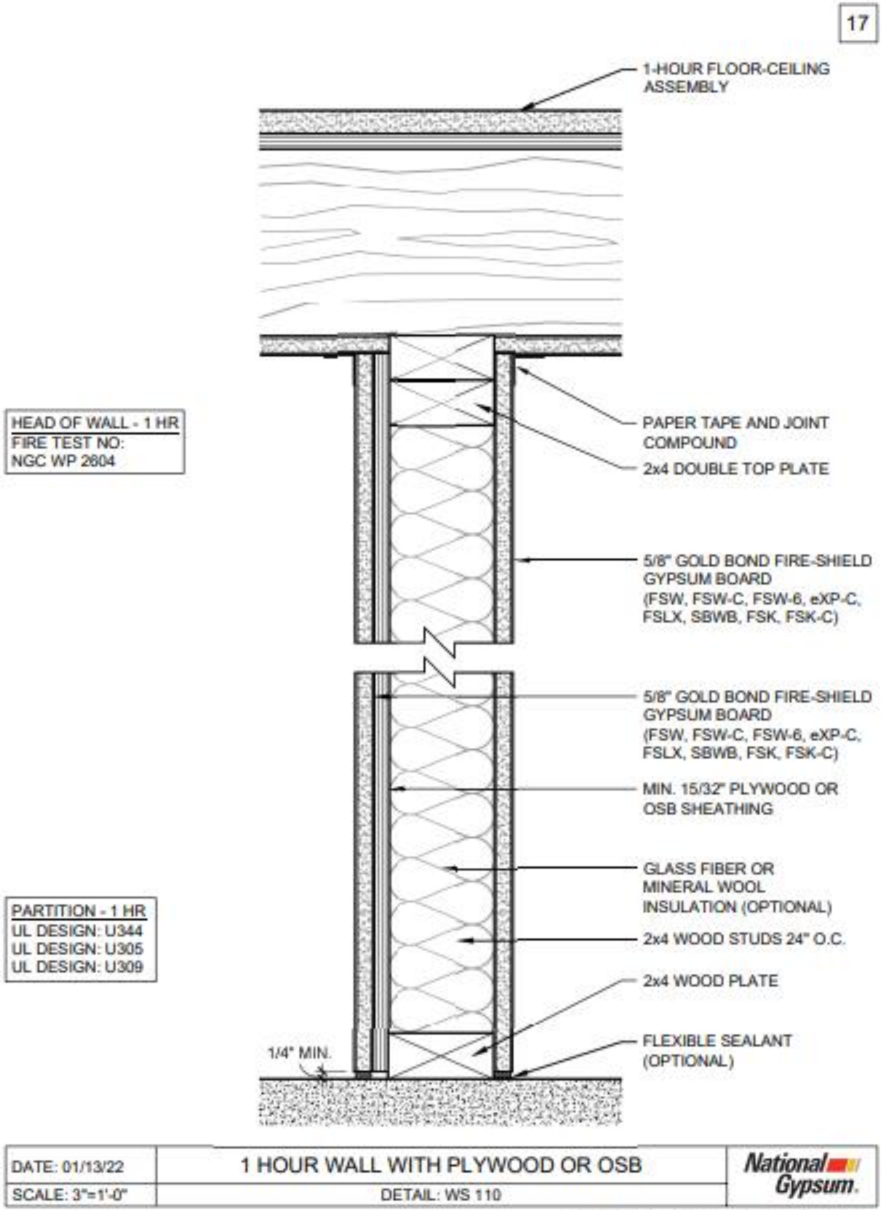
DATE: 01/13/22	1 HOUR WALL WITH PERMABASE AND TILE	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 108	

16

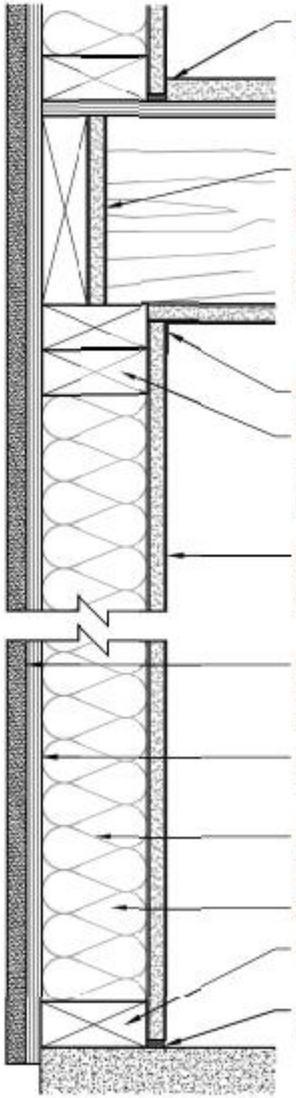


PARTITION - 1 HR
UL DESIGN: U392

DATE: 01/13/22	1 HOUR WALL WITH PERMABASE AND TILE	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 109	



DATE: 01/13/22	1 HOUR WALL WITH PLYWOOD OR OSB	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 110	



18

RIM JOIST - 1 HR
FIRE TEST NO:
NGC WP 2454

PARTITION - 1 HR
UL DESIGN: U356

1-HOUR FLOOR-CEILING ASSEMBLY

5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD PANEL BETWEEN EACH WOOD JOIST FASTENED TO RIM JOIST WITH ONE 1-1/4" TYPE W SCREW AT EACH VERTICAL EDGE (FSW, FSW-C, FSW-6, eXP-C, FSLX, FSK, FSK-C)

PAPER TAPE AND JOINT COMPOUND

2x4 DOUBLE TOP PLATE

FIRE SIDE

5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C)

STUCCO, EIFS, OR SIDING (WOOD, VINYL, FIBER CEMENT, PARTICLE BOARD, OR ALUMINUM)

MIN. 15/32" PLYWOOD OR OSB SHEATHING

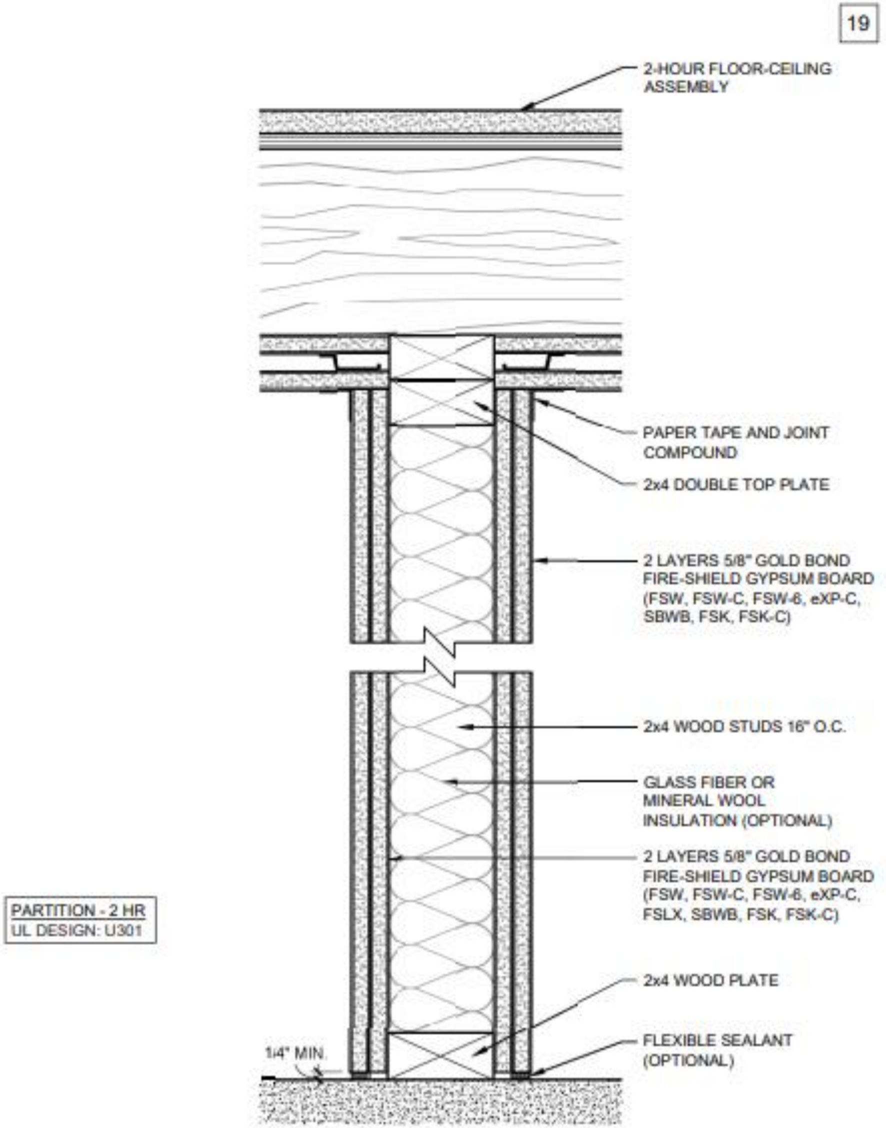
GLASS FIBER OR MINERAL WOOL INSULATION (OPTIONAL)

2x4 WOOD STUDS 24" O.C.

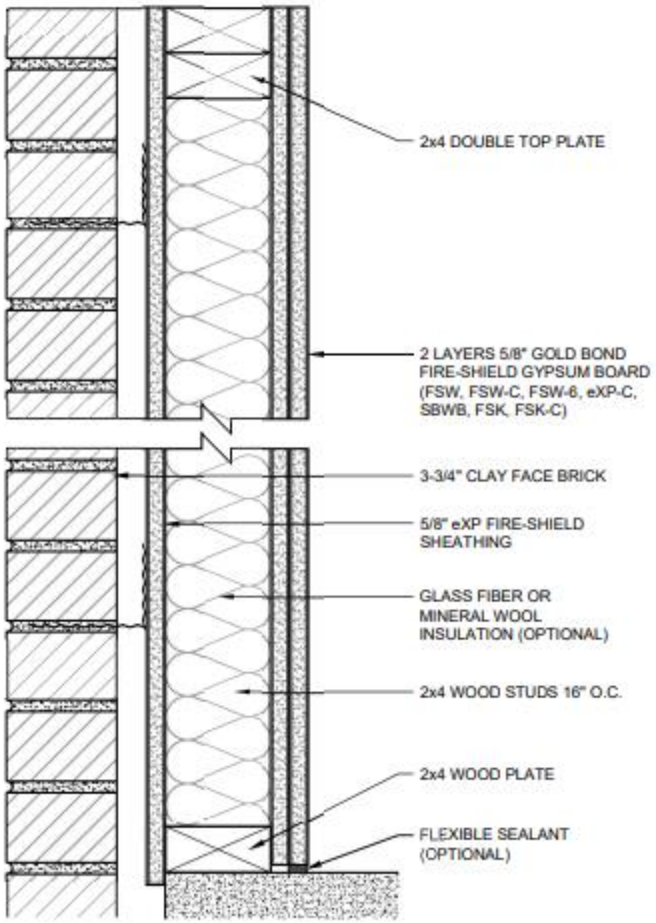
2x4 WOOD PLATE

FLEXIBLE SEALANT (OPTIONAL)

DATE: 01/13/22	1 HOUR EXTERIOR WALL WITH CLADDING	National Gypsum.
SCALE: 3"=1'-0"	DETAIL: WS 111	



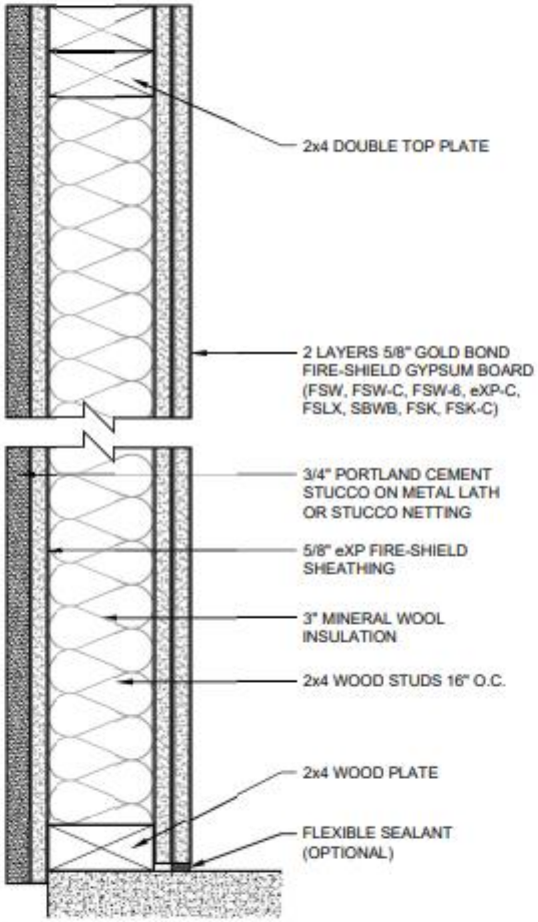
DATE: 01/13/22	2 HOUR WOOD STUD WALL	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 201	



PARTITION - 2 HR
UL DESIGN: U302

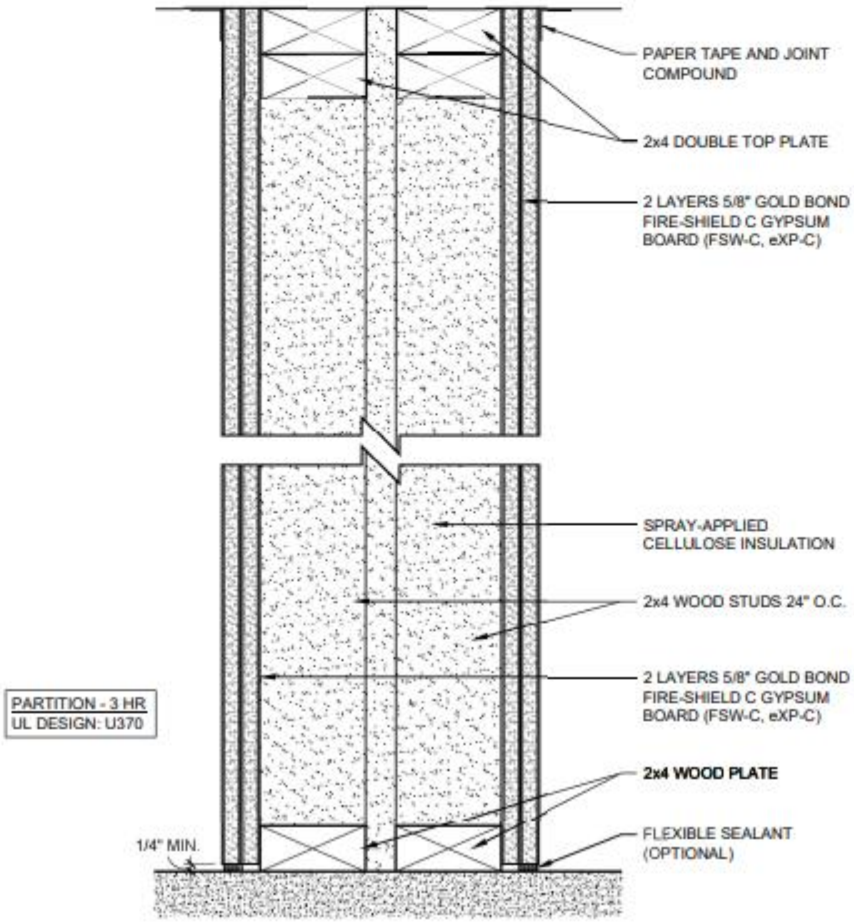
DATE: 01/13/22	2 HOUR WALL WITH BRICK VENEER	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 202	

21



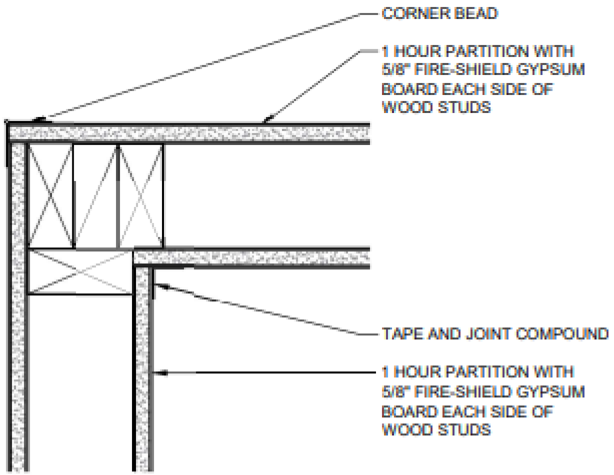
PARTITION - 2 HR
UL DESIGN: U371

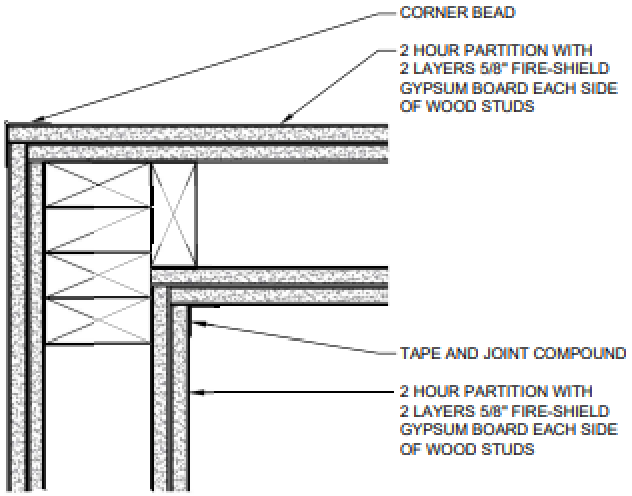
DATE: 01/13/22	2 HOUR WOOD STUD WALL WITH CEMENT STUCCO	National Gypsum.
SCALE: 3"=1'-0"	DETAIL: WS 203	



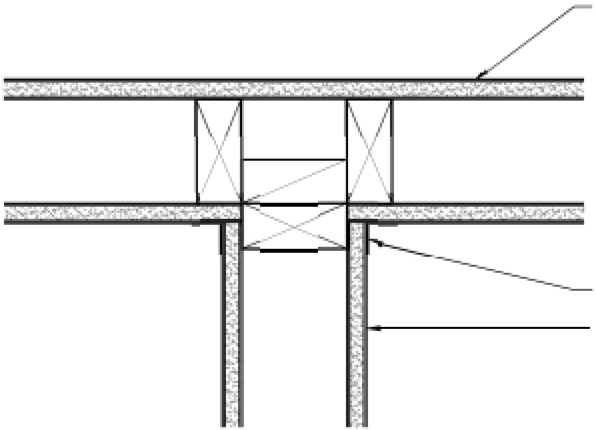
DATE: 01/13/22	3 HOUR WALL WITH DOUBLE ROW OF STUDS	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 301	

23





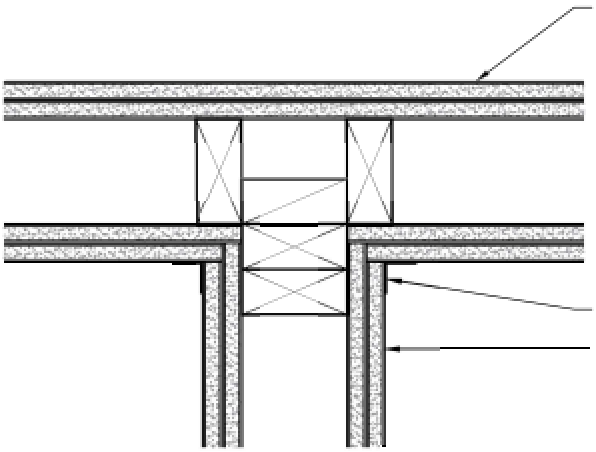
DATE: 01/13/22	INTERSECTIONS OF RATED PARTITIONS	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 501	



1 HOUR PARTITION WITH 5/8" FIRE-SHIELD GYPSUM BOARD EACH SIDE OF WOOD STUDS

TAPE AND JOINT COMPOUND

1 HOUR PARTITION WITH 5/8" FIRE-SHIELD GYPSUM BOARD EACH SIDE OF WOOD STUDS

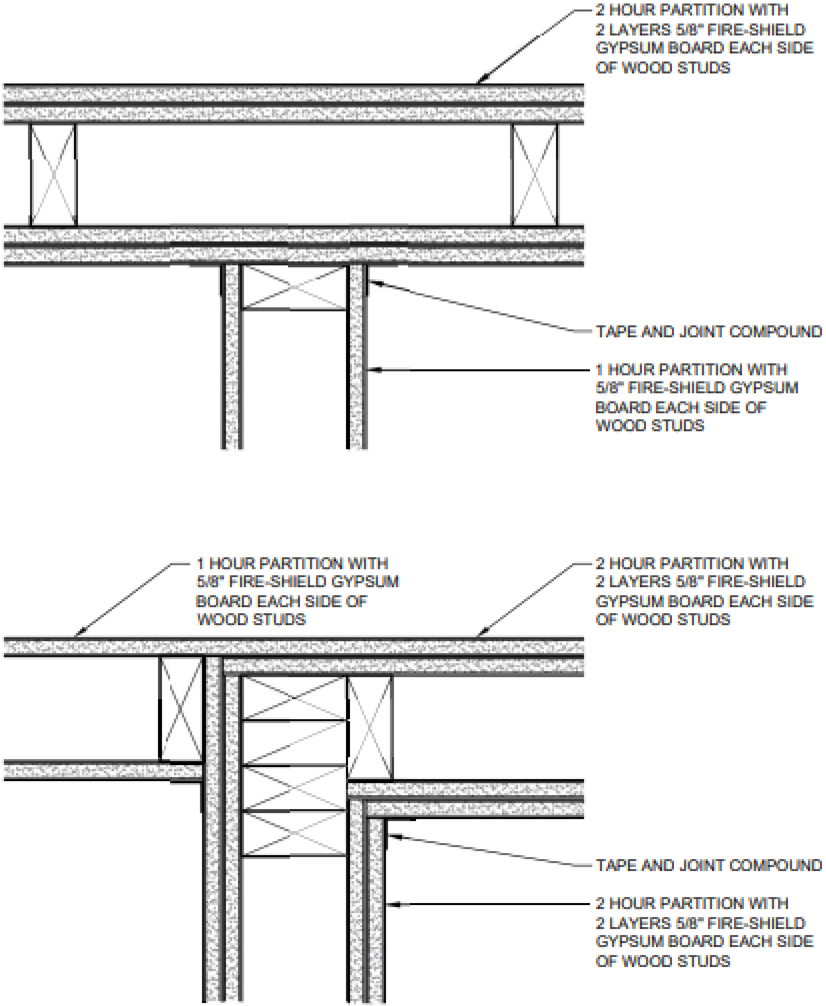


2 HOUR PARTITION WITH 2 LAYERS 5/8" FIRE-SHIELD GYPSUM BOARD EACH SIDE OF WOOD STUDS

TAPE AND JOINT COMPOUND

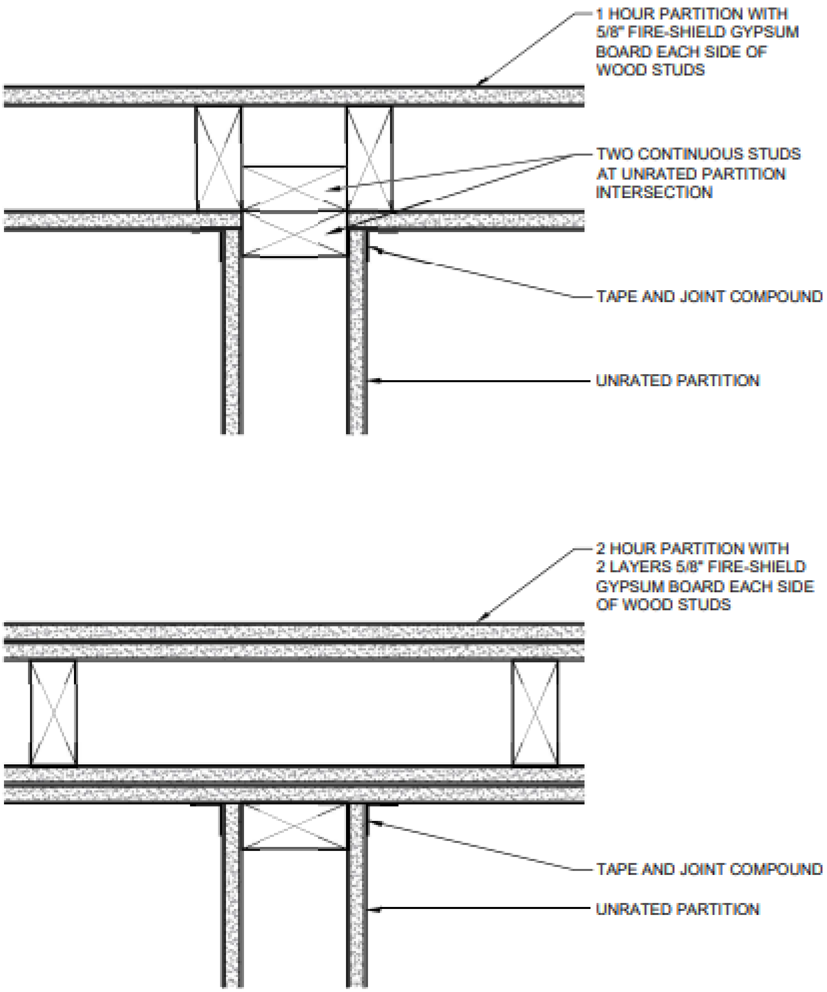
2 HOUR PARTITION WITH 2 LAYERS 5/8" FIRE-SHIELD GYPSUM BOARD EACH SIDE OF WOOD STUDS

DATE: 01/13/22	INTERSECTIONS OF RATED PARTITIONS	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 502	



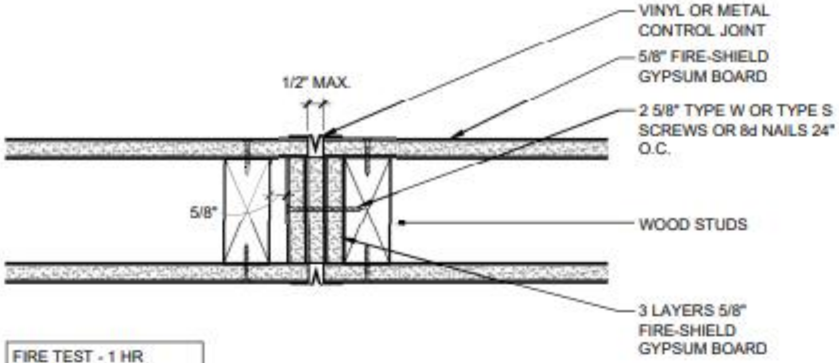
DATE: 01/13/22	INTERSECTIONS OF RATED PARTITIONS	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 503	

26

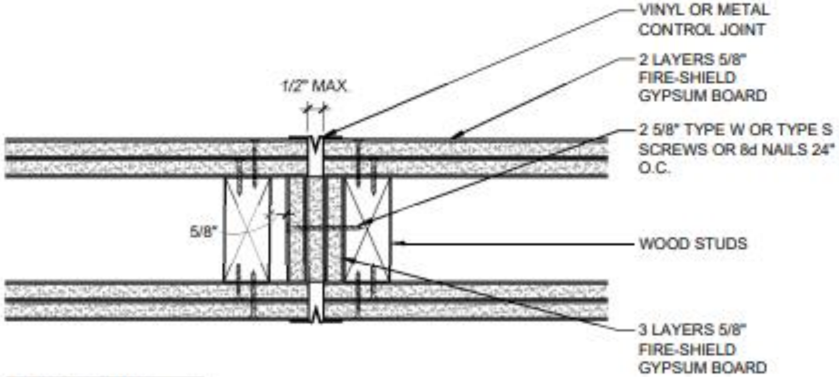


DATE: 01/13/22	INTERSECTIONS OF RATED PARTITIONS	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 504	

27



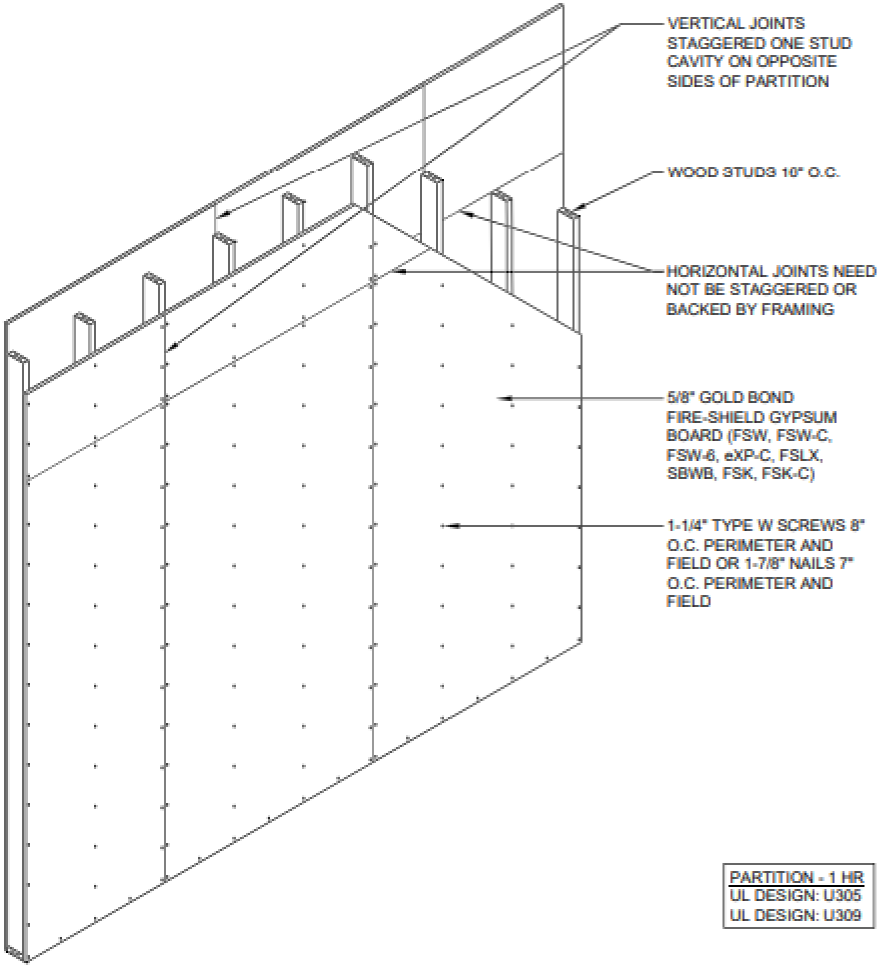
FIRE TEST - 1 HR
WHI-647-3024



FIRE TEST - 2 HR
WHI-647-3024

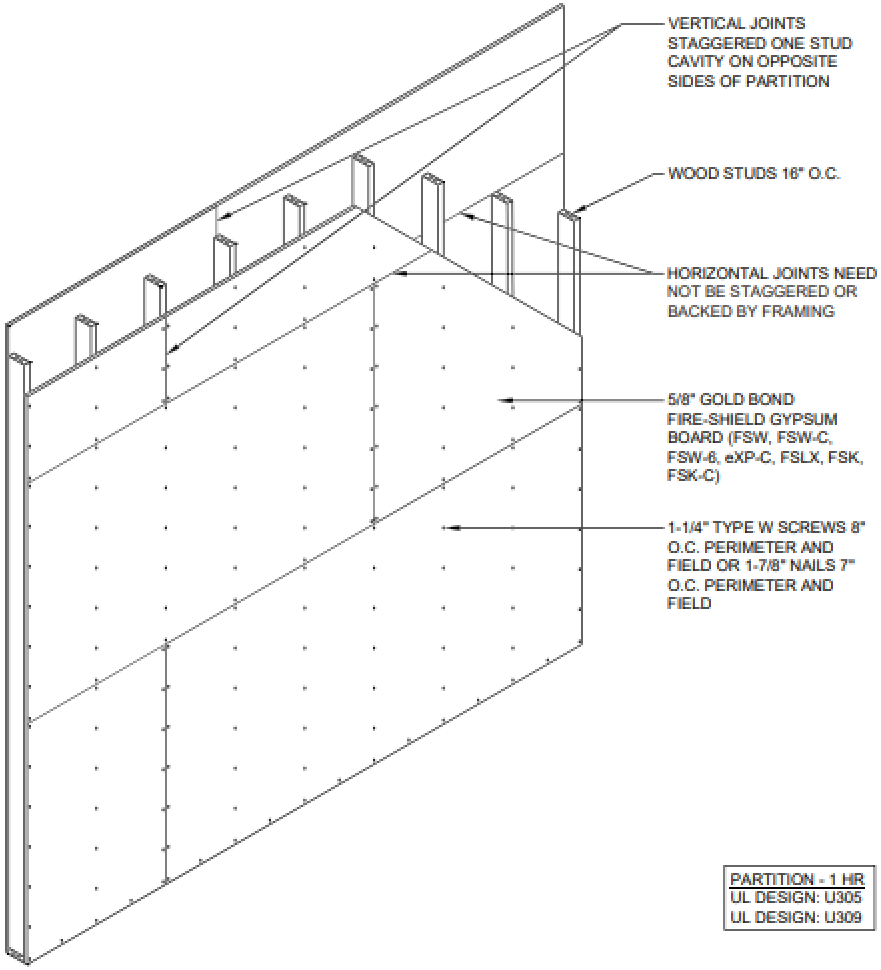
DATE: 01/13/22	CONTROL JOINTS FOR FIRE-RATED WALLS	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WS 505	

28



PARTITION - 1 HR
UL DESIGN: U305
UL DESIGN: U309

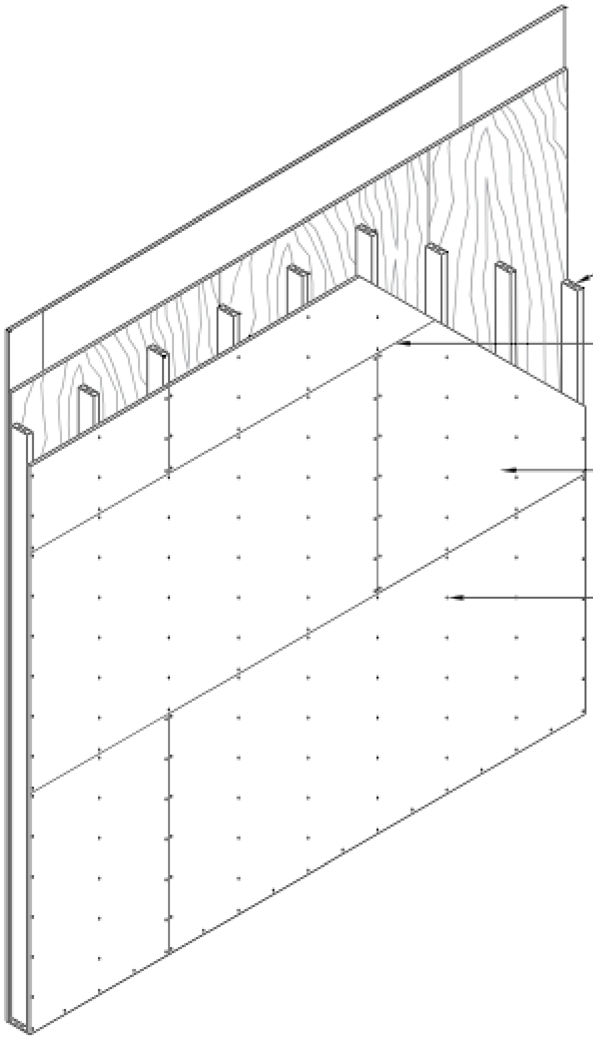
DATE: 01/13/22	1 HR PARTITION JOINT STAGGERING REQUIREMENTS	National Gypsum
SCALE: 1/2"=1'-0"	DETAIL: WS 601	



PARTITION - 1 HR
UL DESIGN: U305
UL DESIGN: U309

DATE: 01/13/22	1 HR PARTITION JOINT STAGGERING REQUIREMENTS	National Gypsum
SCALE: 1/2"=1'-0"	DETAIL: WS 602	

30



WOOD STUDS 16" O.C.

HORIZONTAL JOINTS NEED NOT BE STAGGERED OR BACKED BY FRAMING

5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, FSK, FSK-C)

1-1/4" TYPE W SCREWS 8" O.C. PERIMETER AND FIELD OR 1-7/8" NAILS 7" O.C. PERIMETER AND FIELD

PARTITION - 1 HR
UL DESIGN: U344
UL DESIGN: U305
UL DESIGN: U309

DATE: 01/13/22	1 HR PARTITION JOINT STAGGERING REQUIREMENTS	National Gypsum
SCALE: 1/2"=1'-0"	DETAIL: WS 603	

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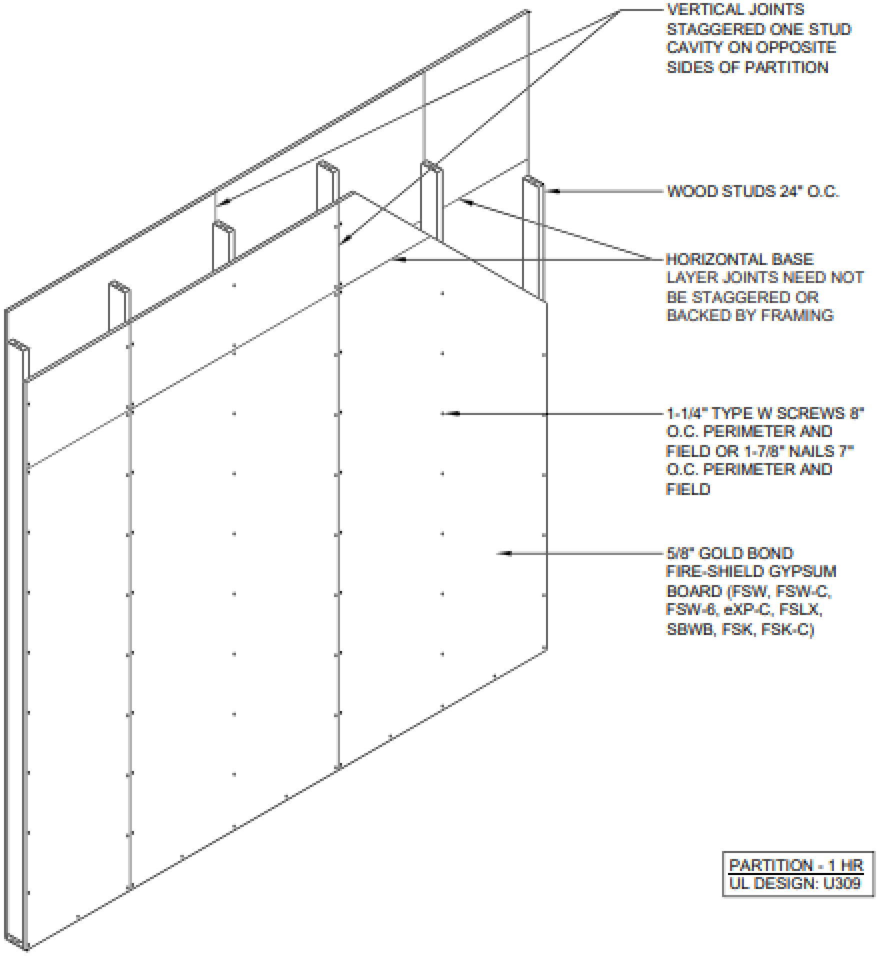
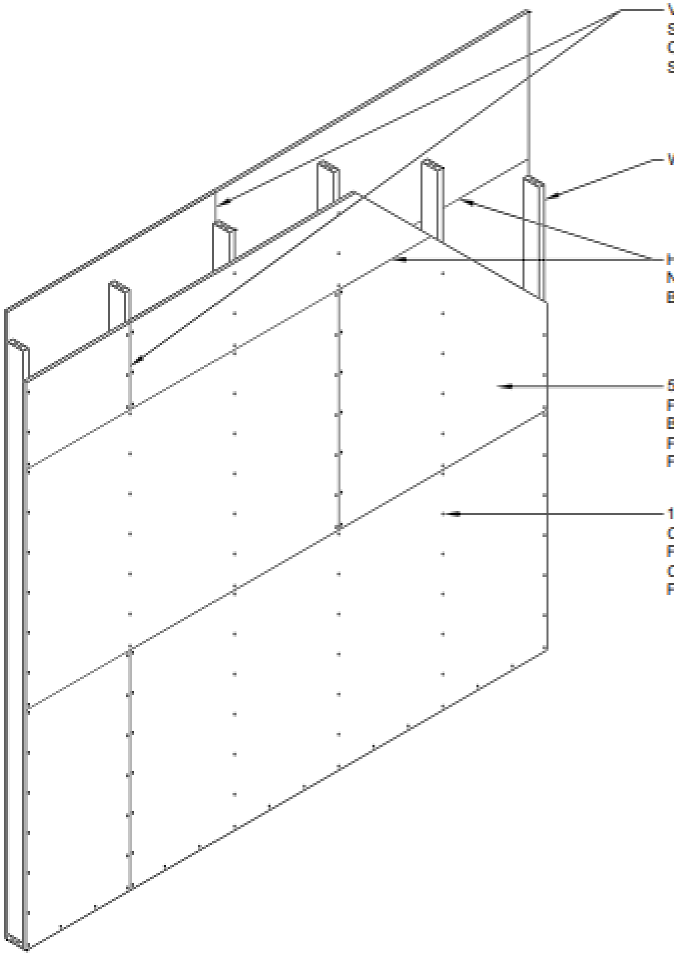


DATE: 01/13/22	1 HR PARTITION JOINT STAGGERING REQUIREMENTS	National Gypsum.
SCALE: 1/2"=1'-0"	DETAIL: WS 604	



VERTICAL JOINTS STAGGERED ONE STUD CAVITY ON OPPOSITE SIDES OF PARTITION

WOOD STUDS 24" O.C.

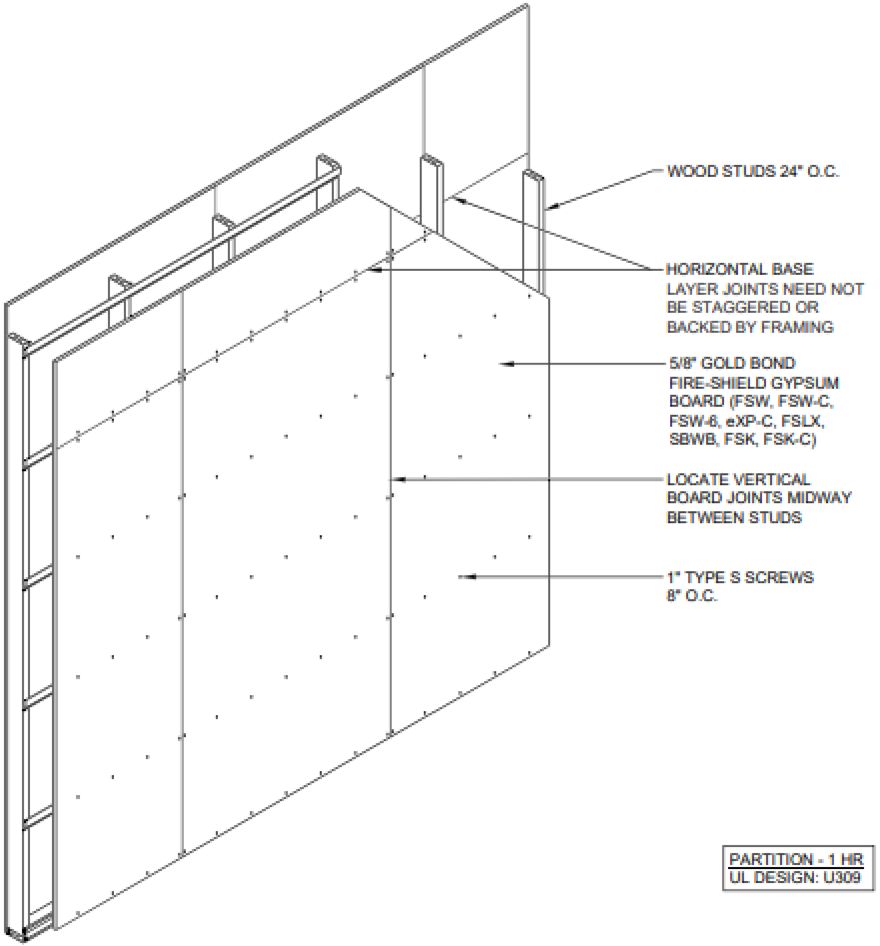
HORIZONTAL JOINTS NEED NOT BE STAGGERED OR BACKED BY FRAMING

5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, FSK, FSK-C)

1-1/4" TYPE W SCREWS 8" O.C. PERIMETER AND FIELD OR 1-7/8" NAILS 7" O.C. PERIMETER AND FIELD

PARTITION - 1 HR
UL DESIGN: U309

DATE: 01/13/22	1 HR PARTITION JOINT STAGGERING REQUIREMENTS	National Gypsum
SCALE: 1/2"=1'-0"	DETAIL: WS 605	



PARTITION - 1 HR
UL DESIGN: U309

DATE: 01/13/22	1 HR PARTITION JOINT STAGGERING REQUIREMENTS	National Gypsum
SCALE: 1/2"=1'-0"	DETAIL: WS 606	

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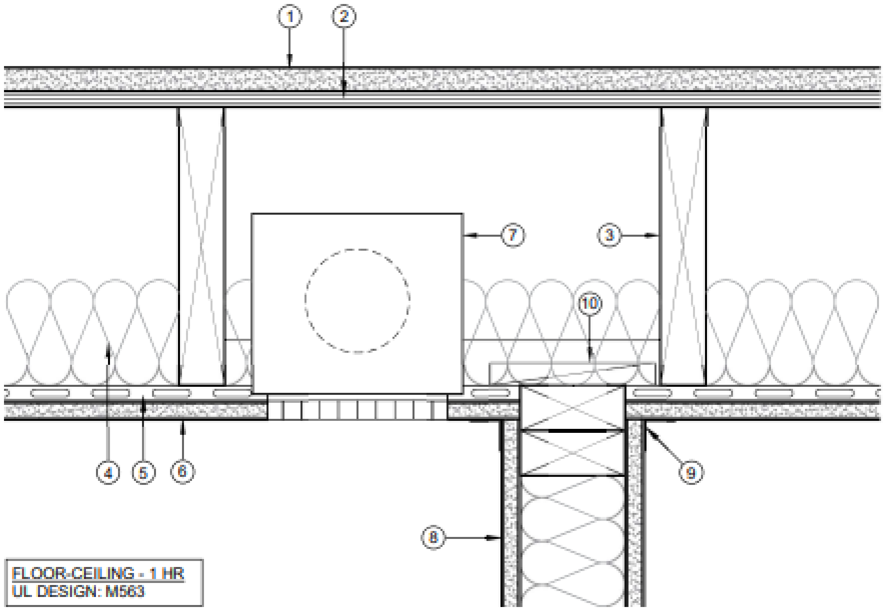
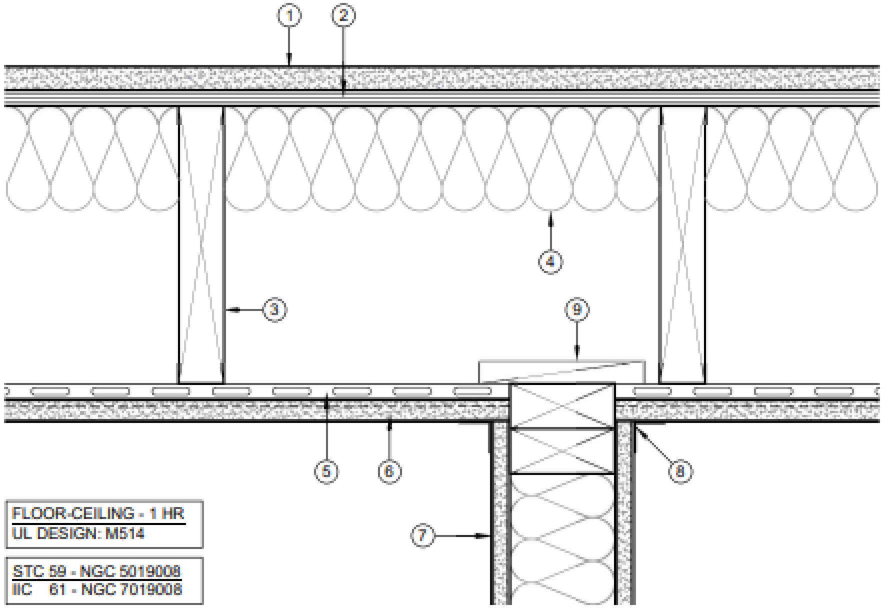


1. FLOOR TOPPING MIXTURE (THICKNESS VARIES BY PRODUCT), 1x4 T&G LUMBER PERPENDICULAR TO JOISTS OR 15/32" WOOD STRUCTURAL PANEL FINISH FLOOR
2. MIN. 15/32" WOOD STRUCTURAL PANEL SUBFLOOR
3. MIN. 2x10 WOOD JOISTS 16" O.C.
4. MIN. 3-1/2" GLASS FIBER OR MINERAL WOOL INSULATION
5. RESILIENT CHANNELS 24" O.C. WITH NO INSULATION, 16" O.C. WITH 3-1/2" OF INSULATION SECURED TO UNDERSIDE OF SUBFLOOR, OR 12" O.C. WITH UNLIMITED INSULATION DRAPED OVER RESILIENT CHANNELS
6. **5/8" FIRE-SHIELD C OR 5/8" HIGH STRENGTH FIRE-SHIELD 60 GYPSUM BOARD (FSW-C, FSK-C, eXP-C, FSLX)**
7. CEILING DAMPER AND GRILLE (OPTIONAL)
8. PARTITION INTERSECTION WITH 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C) EACH SIDE (2018 IBC 714.4.2 EXCEPTION 7)
9. TAPE AND JOINT COMPOUND
10. BLOCKING AS REQUIRED FOR ATTACHMENT OF RESILIENT CHANNELS

DATE: 01/13/22	1 HOUR WOOD JOIST FLOOR-CEILING ASSEMBLY	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WJ 101	



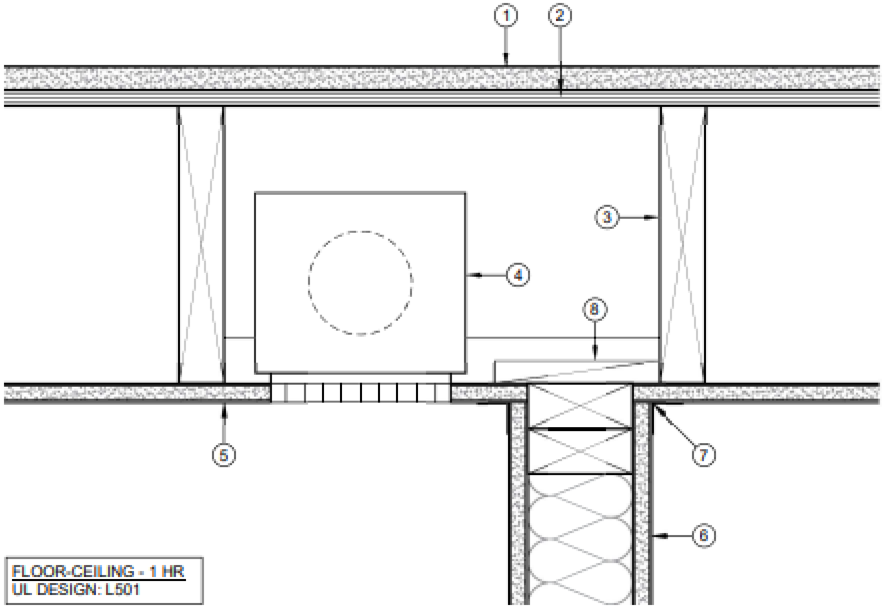
FLOOR-CEILING - 1 HR
UL DESIGN: M514

STC 59 - NGC 5019008
IIC 61 - NGC 7019008

1. FLOOR TOPPING MIXTURE (THICKNESS VARIES BY PRODUCT), MIN. 1x4 T&G LUMBER PERPENDICULAR TO JOISTS OR 19/32" WOOD STRUCTURAL PANEL FINISH FLOOR
2. MIN. 15/32" WOOD STRUCTURAL PANEL SUBFLOOR
3. MIN. 2x10 WOOD JOISTS 16" O.C.
4. MAX. 3-1/2" GLASS FIBER OR MINERAL WOOL INSULATION SECURED TO UNDERSIDE OF SUBFLOOR
5. RESILIENT CHANNELS 24" O.C.
6. **3/4" SOUNDBREAK CEILING BOARD (SBCB)**
7. PARTITION INTERSECTION WITH 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C) EACH SIDE (2018 IBC 714.4.2 EXCEPTION 7)
8. TAPE AND JOINT COMPOUND
9. BLOCKING AS REQUIRED FOR ATTACHMENT OF RESILIENT CHANNELS

DATE: 01/13/22	1 HOUR WOOD JOIST FLOOR-CEILING ASSEMBLY	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WJ 102	

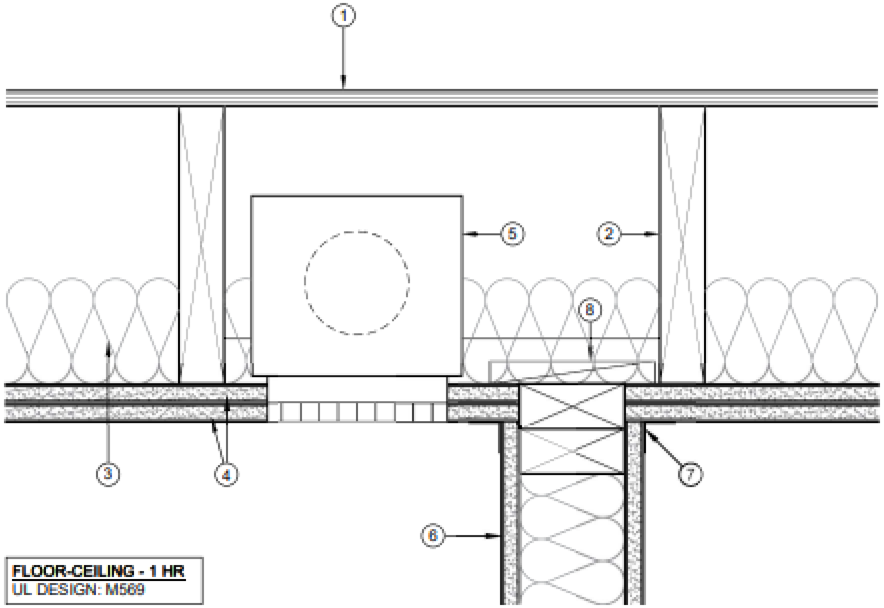
36



FLOOR-CEILING - 1 HR
UL DESIGN: L501

1. FLOOR TOPPING MIXTURE (THICKNESS VARIES BY PRODUCT), MIN. 1x4 T&G LUMBER PERPENDICULAR TO JOISTS OR 19/32" WOOD STRUCTURAL PANEL FINISH FLOOR
2. MIN. 1x6 T&G DIAGONAL LUMBER, 15/32" PLYWOOD, OR 7/16" OSB WOOD STRUCTURAL PANEL SUBFLOOR
3. MIN. 2x10 WOOD JOISTS 16" O.C.
4. CEILING DAMPER AND GRILLE (OPTIONAL)
5. **5/8" FIRE-SHIELD GYPSUM BOARD (FSW, FSK, FSW-6, FSW-C, FSK-C, eXP-C)**
6. PARTITION INTERSECTION WITH 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C) EACH SIDE (2018 IBC 714.4.2 EXCEPTION 7)
7. TAPE AND JOINT COMPOUND
8. BLOCKING AS REQUIRED FOR ATTACHMENT OF GYPSUM BOARD

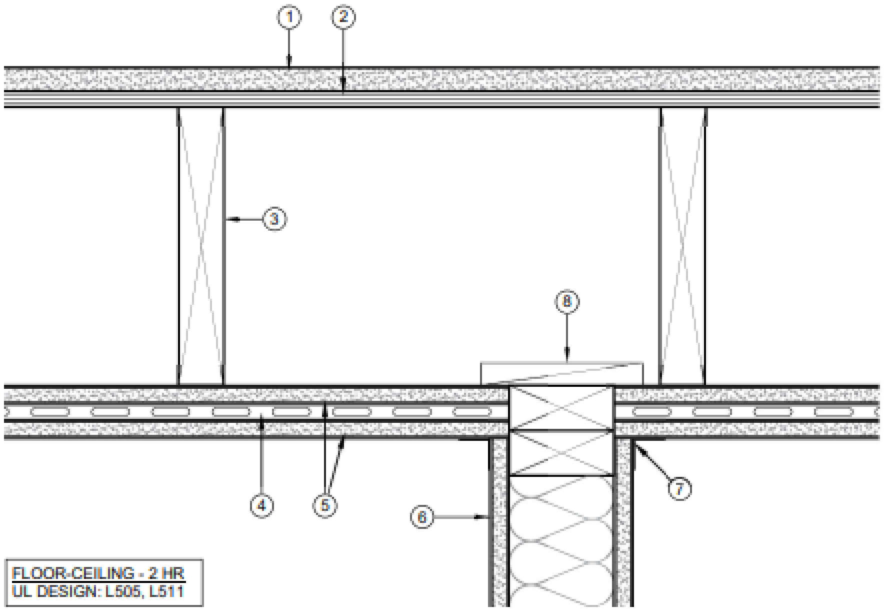
DATE: 01/13/22	1 HOUR WOOD JOIST FLOOR-CEILING ASSEMBLY	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WJ 103	



FLOOR-CEILING - 1 HR
UL DESIGN: M569

1. MIN. 19/32" WOOD STRUCTURAL PANEL SUBFLOOR (FINISH FLOOR OPTIONAL)
2. MIN. 2x10 WOOD JOISTS 16" O.C.
3. MIN. 3-1/2" GLASS FIBER OR MINERAL WOOL INSULATION
4. **5/8" FIRE-SHIELD GYPSUM BOARD (FSW, FSK, FSW-6, FSW-C, FSK-C, eXP-C)**
5. CEILING DAMPER AND GRILLE (OPTIONAL)
6. PARTITION INTERSECTION WITH 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C,
7. FSLX, SBWB, FSK, FSK-C) EACH SIDE (2018 IBC 714.4.2 EXCEPTION 7)
   TAPE AND JOINT COMPOUND
8. BLOCKING AS REQUIRED FOR ATTACHMENT OF GYPSUM BOARD

DATE: 01/13/22	1 HOUR WOOD JOIST FLOOR-CEILING ASSEMBLY	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WJ 104	



FLOOR-CEILING - 2 HR
UL DESIGN: L505, L511

1. FLOOR TOPPING MIXTURE (THICKNESS VARIES BY PRODUCT), MIN. 1x4 T&G LUMBER PERPENDICULAR TO JOISTS OR 19/32" WOOD STRUCTURAL PANEL FINISH FLOOR
2. MIN. 1x6 T&G DIAGONAL LUMBER, 15/32" PLYWOOD, OR 7/16" OSB WOOD STRUCTURAL PANEL SUBFLOOR
3. MIN. 2x10 WOOD JOISTS 16" O.C.
4. RESILIENT CHANNELS 24" O.C.
5. 1/2" FIRE-SHIELD C GYPSUM BOARD (FSW-C, FSK-C, eXP-C)
6. PARTITION INTERSECTION WITH 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C) EACH SIDE (2018 IBC 714.4.2 EXCEPTION 7)
7. TAPE AND JOINT COMPOUND
8. BLOCKING AS REQUIRED FOR ATTACHMENT OF GYPSUM BOARD AND RESILIENT CHANNELS

DATE: 01/13/22	2 HOUR WOOD JOIST FLOOR-CEILING ASSEMBLY	National Gypsum.
SCALE: 3"=1'-0"	DETAIL: WJ 201	

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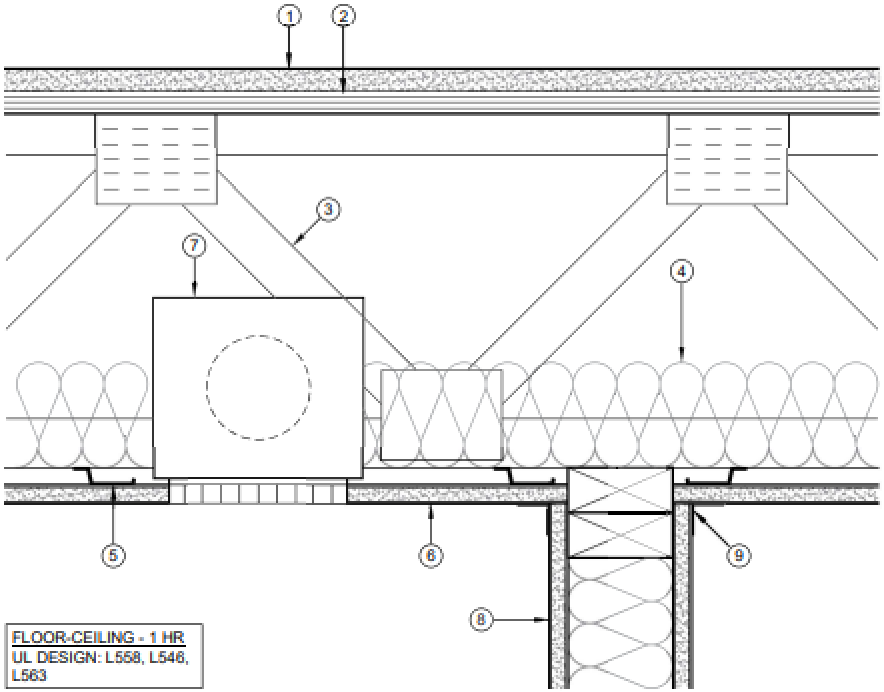
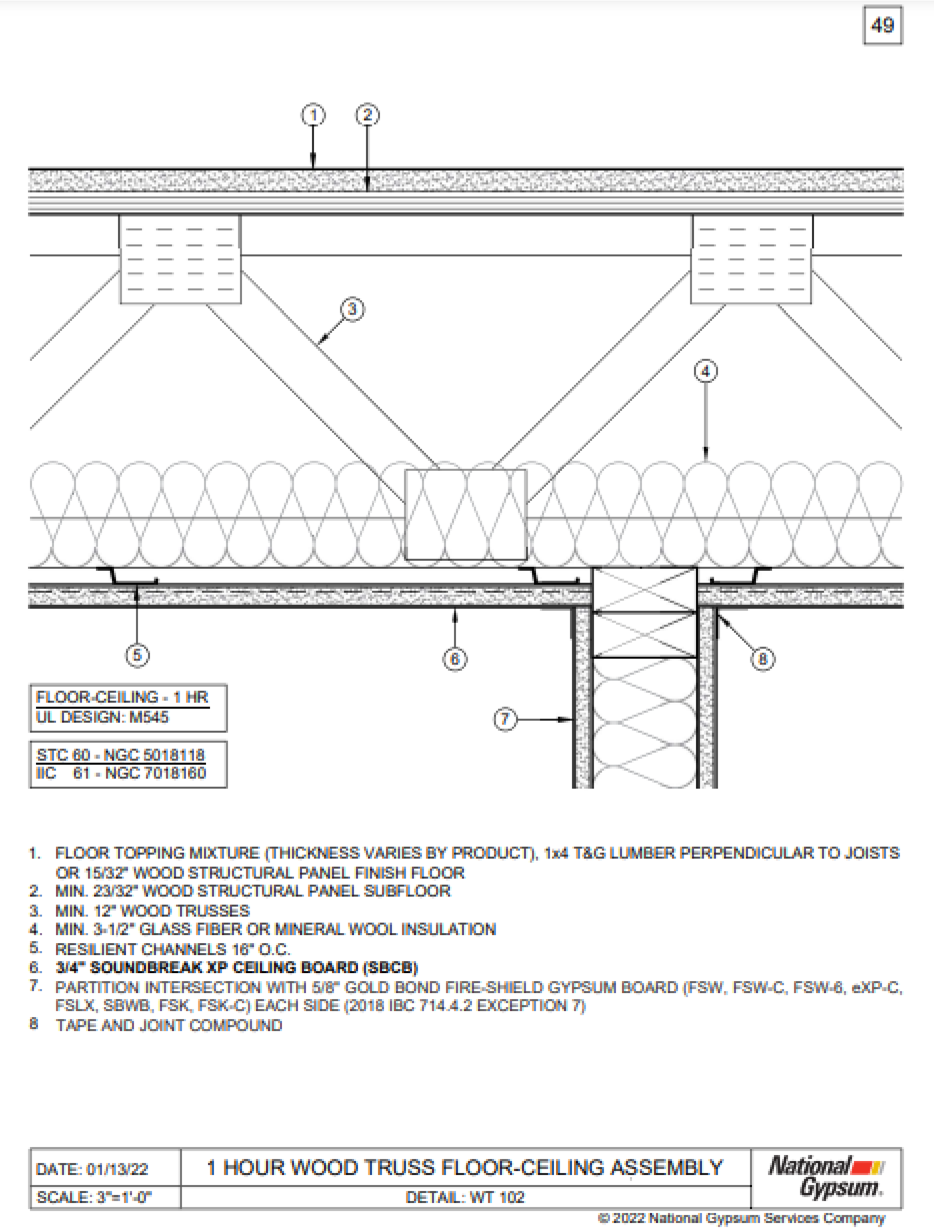


FLOOR-CEILING - 1 HR
UL DESIGN: L558, L546, L563

1. FLOOR TOPPING MIXTURE (THICKNESS VARIES BY PRODUCT), 1x4 T&G LUMBER PERPENDICULAR TO JOISTS OR 15/32" WOOD STRUCTURAL PANEL FINISH FLOOR
2. MIN. 23/32" WOOD STRUCTURAL PANEL SUBFLOOR
3. MIN. 12" WOOD TRUSSES 24" O.C (MIN. 18" WITH DAMPERS)
4. GLASS FIBER OR MINERAL WOOL INSULATION (OPTIONAL)
5. RESILIENT CHANNELS 24" O.C. WITH NO INSULATION, 16" O.C. WITH 3-1/2" OF INSULATION STAPLED TO SUBFLOOR, OR 12" O.C. WITH UNLIMITED INSULATION DRAPED OVER RESILIENT CHANNELS
6. **5/8" FIRE-SHIELD C OR 5/8" HIGH STRENGTH FIRE-SHIELD 60 GYPSUM BOARD (FSW-C, FSK-C, eXP-C, FSLX)**
7. CEILING DAMPER AND GRILLE (OPTIONAL)
8. PARTITION INTERSECTION WITH 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C) EACH SIDE (2018 IBC 714.4.2 EXCEPTION 7)
9. TAPE AND JOINT COMPOUND

DATE: 01/13/22	1 HOUR WOOD TRUSS FLOOR-CEILING ASSEMBLY	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WT 101	

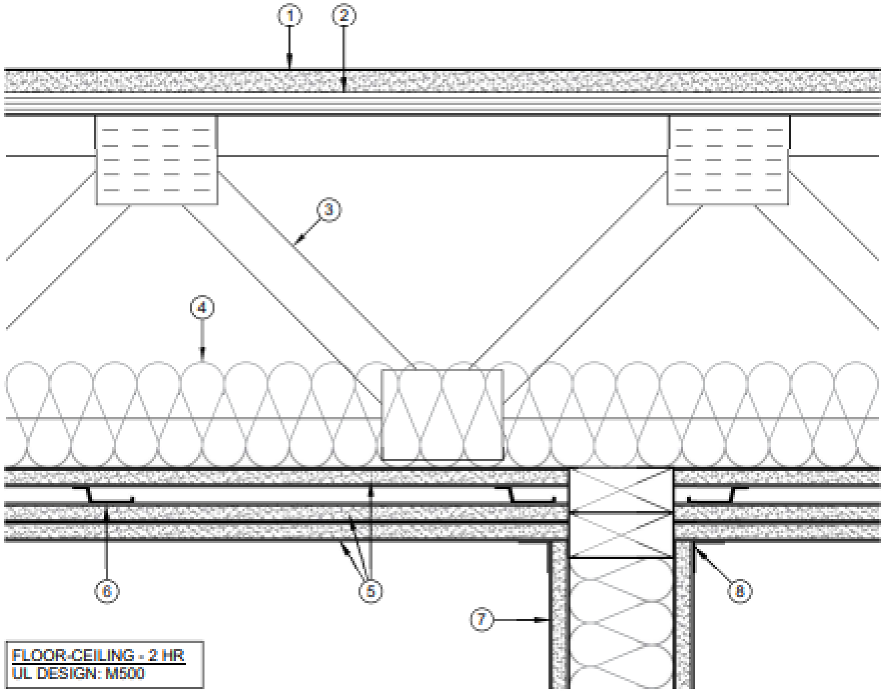


FLOOR-CEILING - 1 HR
UL DESIGN: M545

STC 60 - NGC 5018118
IIC 61 - NGC 7018160

1. FLOOR TOPPING MIXTURE (THICKNESS VARIES BY PRODUCT), 1x4 T&G LUMBER PERPENDICULAR TO JOISTS OR 15/32" WOOD STRUCTURAL PANEL FINISH FLOOR
2. MIN. 23/32" WOOD STRUCTURAL PANEL SUBFLOOR
3. MIN. 12" WOOD TRUSSES
4. MIN. 3-1/2" GLASS FIBER OR MINERAL WOOL INSULATION
5. RESILIENT CHANNELS 16" O.C.
6. **3/4" SOUNDBREAK XP CEILING BOARD (SBCB)**
7. PARTITION INTERSECTION WITH 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C) EACH SIDE (2018 IBC 714.4.2 EXCEPTION 7)
8. TAPE AND JOINT COMPOUND

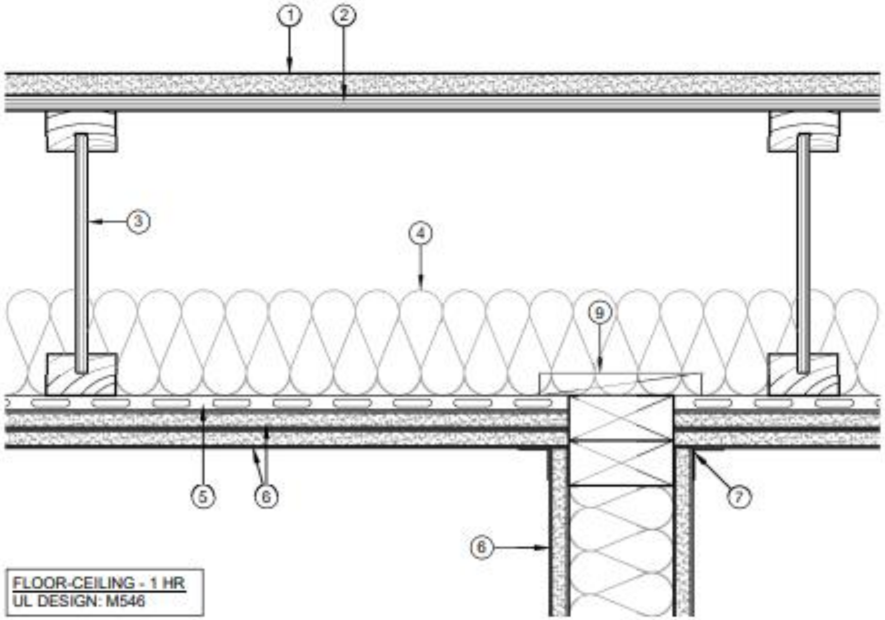
DATE: 01/13/22	1 HOUR WOOD TRUSS FLOOR-CEILING ASSEMBLY	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WT 102	



FLOOR-CEILING - 2 HR
UL DESIGN: M500

1. FLOOR TOPPING MIXTURE (THICKNESS VARIES BY PRODUCT)
2. MIN. 23/32" WOOD STRUCTURAL PANEL SUBFLOOR
3. MIN. 12" WOOD TRUSSES 24" O.C.
4. INSULATION (OPTIONAL, NO LIMIT ON THICKNESS)
5. **5/8" FIRE-SHIELD C GYPSUM BOARD (FSW-C, FSK-C, eXP-C)**
6. RESILIENT CHANNELS 12" O.C.
7. PARTITION INTERSECTION WITH 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C) EACH SIDE (2018 IBC 714.4.2 EXCEPTION 7)
8. TAPE AND JOINT COMPOUND

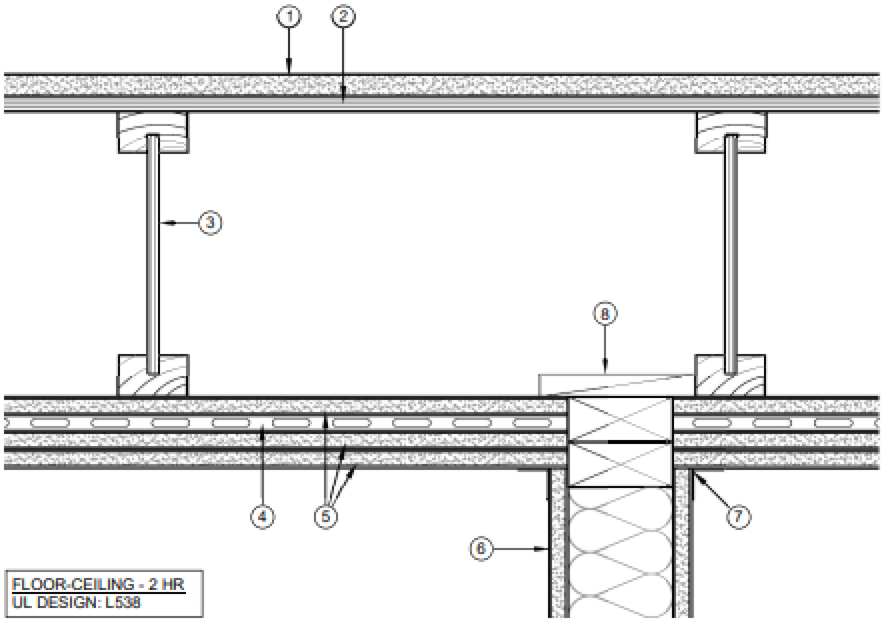
DATE: 01/13/22	2 HOUR WOOD TRUSS FLOOR-CEILING ASSEMBLY
SCALE: 3"=1'-0"	DETAIL: WT 201



1. FLOOR TOPPING MIXTURE (THICKNESS VARIES BY PRODUCT), 1x4 T&G LUMBER PERPENDICULAR TO JOISTS OR 15/32" WOOD STRUCTURAL PANEL FINISH FLOOR
2. MIN. 19/32" WOOD STRUCTURAL PANEL SUBFLOOR
3. MIN. 9-1/2" WOOD I-JOISTS 24" O.C.
4. MIN. 3-1/2" GLASS FIBER OR MINERAL WOOL INSULATION. NO MAXIMUM THICKNESS.
5. RESILIENT CHANNELS 16" O.C.
6. **1/2" OR 5/8" FIRE-SHIELD C GYPSUM BOARD (FSW-C, FSK-C, eXP-C)**
7. PARTITION INTERSECTION WITH 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C) EACH SIDE (2018 IBC 714.4.2 EXCEPTION 7)
8. TAPE AND JOINT COMPOUND
9. BLOCKING AS REQUIRED FOR ATTACHMENT OF RESILIENT CHANNELS

DATE: 01/13/22	1 HOUR I-JOIST FLOOR-CEILING ASSEMBLY	National Gypsum
SCALE: 3"=1'-0"	DETAIL: WI 101	

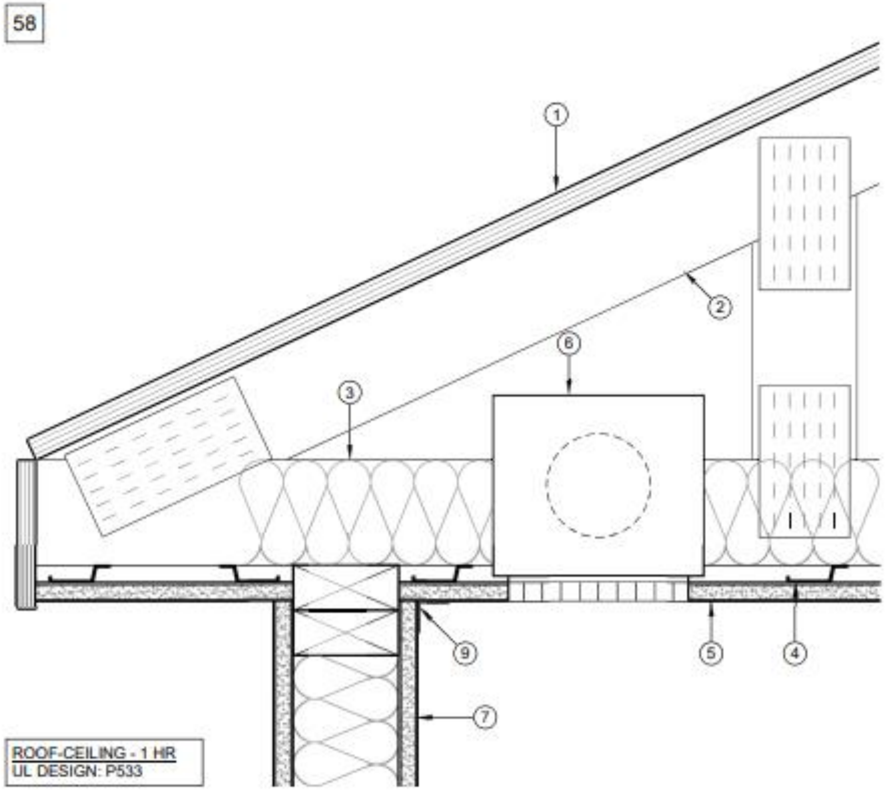
56



FLOOR-CEILING - 2 HR
UL DESIGN: L538

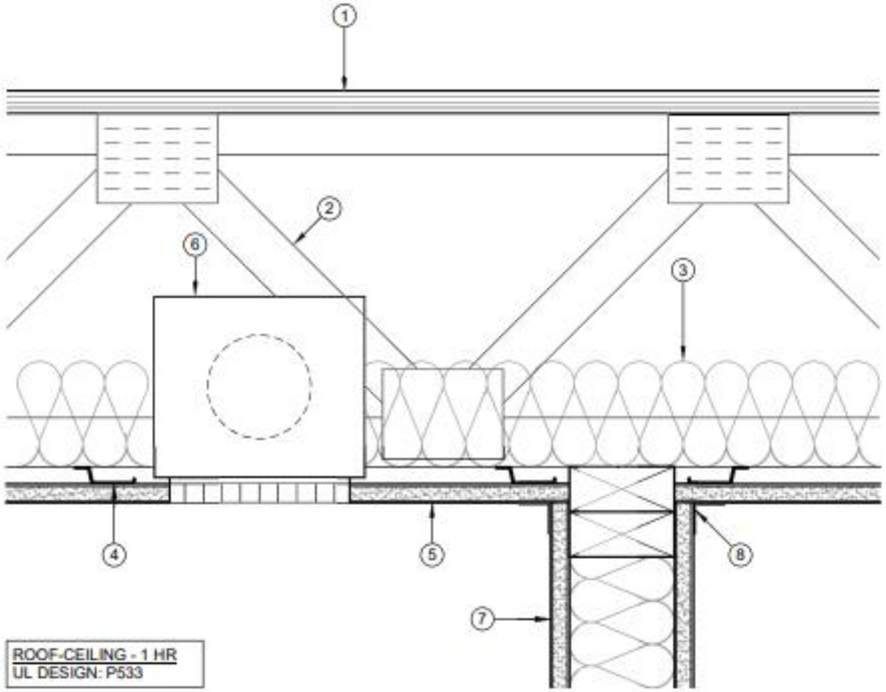
1. OPTIONAL FINISH FLOOR
2. 5/8" WOOD STRUCTURAL PANEL SUBFLOOR
3. MIN. 9-1/2" WOOD I-JOISTS 19.2" O.C.
4. RESILIENT CHANNELS OR RIGID FURRING CHANNELS 16" O.C.
5. **5/8" FIRE-SHIELD C GYPSUM BOARD (FSW-C, FSK-C, eXP-C)**
6. PARTITION INTERSECTION WITH 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C) EACH SIDE (2018 IBC 714.4.2 EXCEPTION 7)
7. TAPE AND JOINT COMPOUND
8. BLOCKING AS REQUIRED FOR ATTACHMENT OF GYPSUM BOARD AND RESILIENT CHANNELS

DATE: 01/13/22
SCALE: 3"=1'-0"
2 HOUR I-JOIST FLOOR-CEILING ASSEMBLY
DETAIL: WI 201
National Gypsum



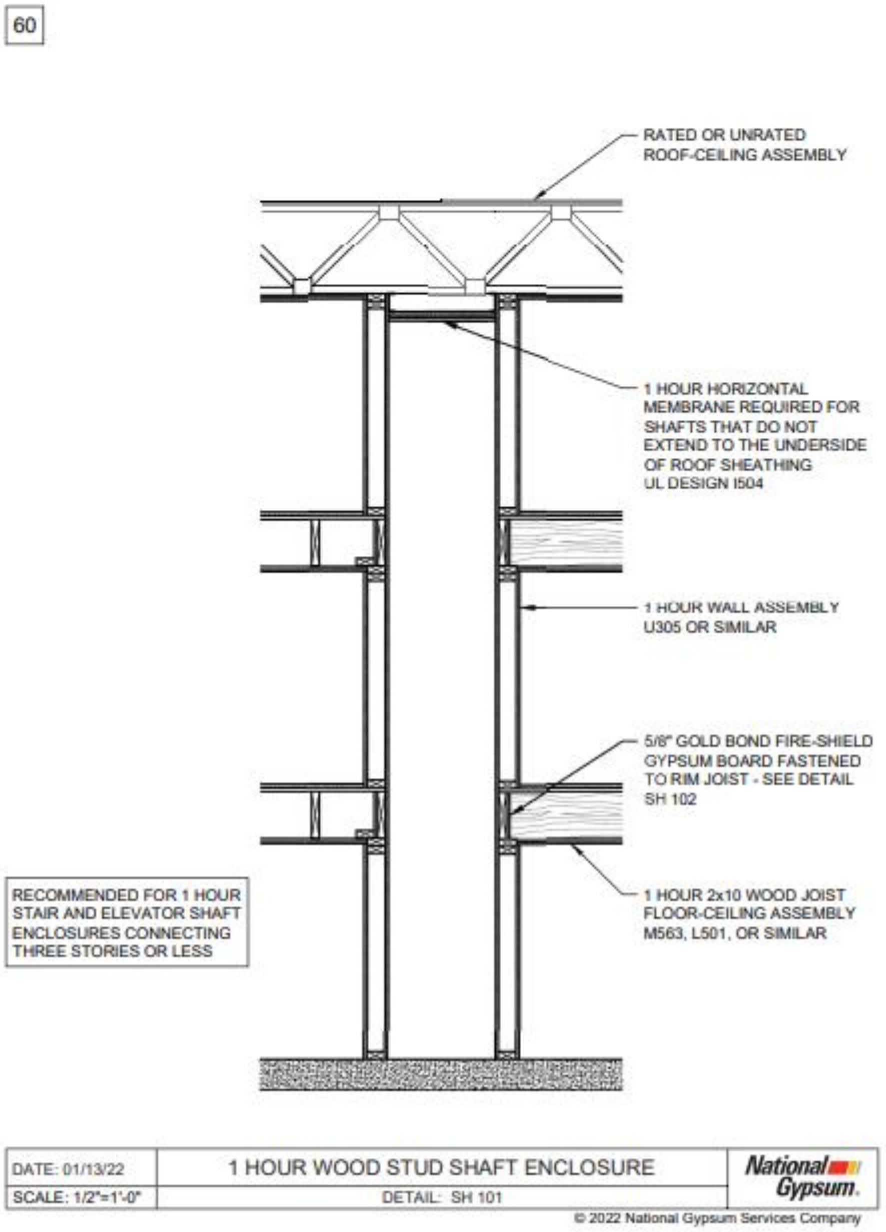
1. 15/32" WOOD STRUCTURAL PANEL ROOF SHEATHING
2. PITCHED OR PARALLEL CHORD ROOF TRUSSES 24" O.C. MAX.
3. GLASS FIBER OR MINERAL WOOL INSULATION (OPTIONAL)
4. RESILIENT CHANNELS 16" O.C. WITH NO INSULATION OR 12" O.C. WITH INSULATION
5. **5/8" FIRE-SHIELD C OR 5/8" HIGH STRENGTH FIRE-SHIELD 60 GYPSUM BOARD (FSW-C, FSK-C, eXP-C, FSLX)**
6. CEILING DAMPER AND GRILLE (OPTIONAL)
7. PARTITION INTERSECTION WITH 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C) ON INTERIOR AND 5/8" eXP SHEATHING (FSW-6) ON THE EXTERIOR (2018 IBC 714.4.2 EXCEPTION 7)
8. TAPE AND JOINT COMPOUND

DATE: 01/13/22	1 HOUR WOOD TRUSS FLOOR-CEILING ASSEMBLY	National Gypsum
SCALE: 3"=1'-0"	DETAIL: RT 101	

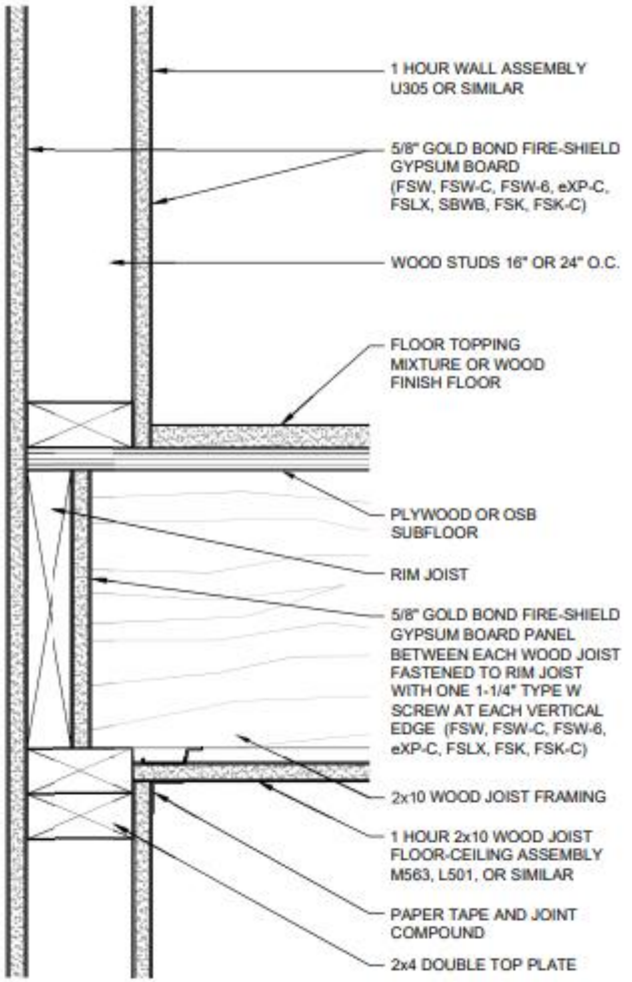


1. 15/32" WOOD STRUCTURAL PANEL ROOF SHEATHING
2. PITCHED OR PARALLEL CHORD ROOF TRUSSES 24" O.C. MAX.
3. GLASS FIBER OR MINERAL WOOL INSULATION (OPTIONAL)
4. RESILIENT CHANNELS 16" O.C. WITH NO INSULATION OR 12" O.C. WITH INSULATION
5. **5/8" FIRE-SHIELD C OR 5/8" HIGH STRENGTH FIRE-SHIELD 60 GYPSUM BOARD (FSW-C, FSK-C, eXP-C, FSLX)**
6. CEILING DAMPER AND GRILLE (OPTIONAL)
7. PARTITION INTERSECTION WITH 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-C, FSW-6, eXP-C, FSLX, SBWB, FSK, FSK-C) ON INTERIOR AND 5/8" eXP SHEATHING (FSW-6) ON THE EXTERIOR (2018 IBC 714.4.2 EXCEPTION 7)
8. TAPE AND JOINT COMPOUND

DATE: 01/13/22	1 HOUR WOOD TRUSS FLOOR-CEILING ASSEMBLY	National Gypsum.
SCALE: 3"=1'-0"	DETAIL: RT 102	



DATE: 01/13/22	1 HOUR WOOD STUD SHAFT ENCLOSURE
SCALE: 1/2"=1'-0"	DETAIL: SH 101

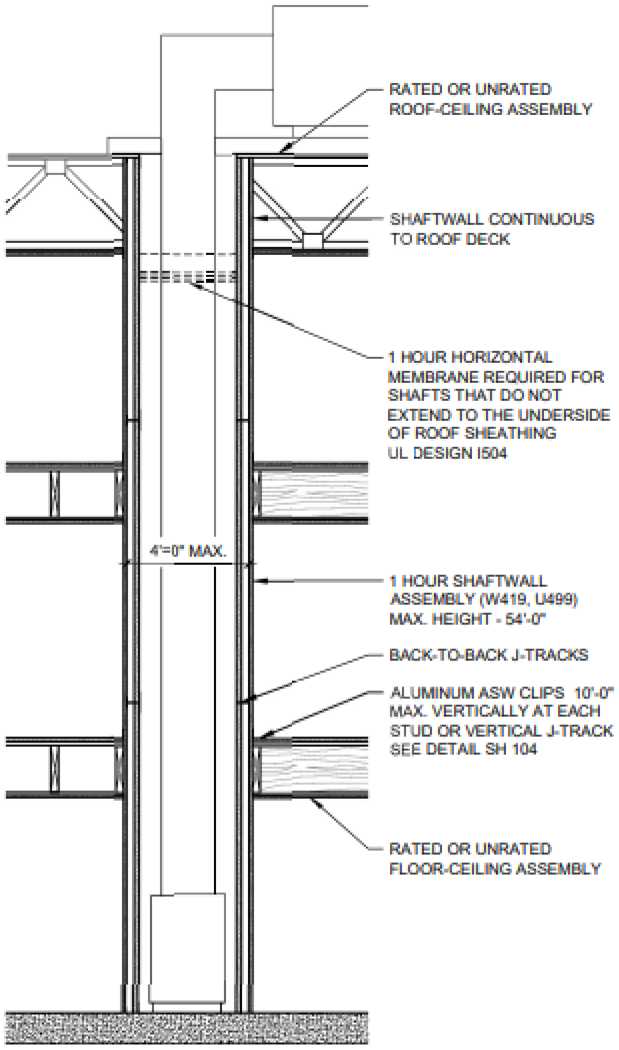


RIM JOIST - 1 HR
FIRE TEST NO:
NGC WP 2454

PARTITION - 1 HR
UL DESIGNS:
U305, U309, U340,
U341, U344, U356

DATE: 01/13/22	1 HOUR WOOD STUD WALL AT FLOOR ASSEMBLY	National Gypsum
SCALE: 3"=1'-0"	DETAIL: SH 102	

62



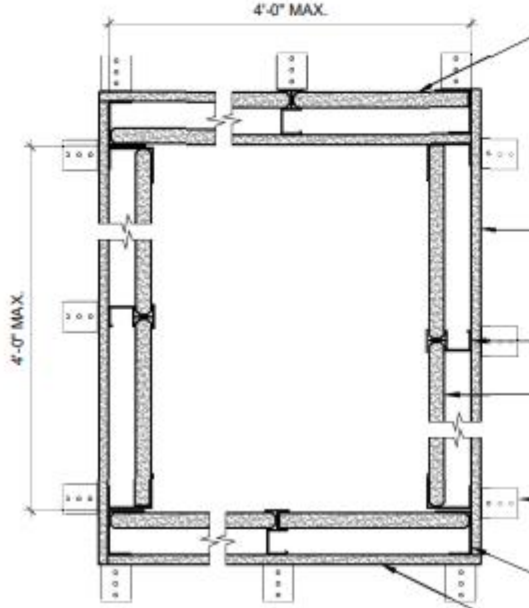
RECOMMENDED FOR 1 HOUR
WASTE OR LINEN CHUTE OR
MECHANICAL DUCT SHAFT
ENCLOSURES CONNECTING
THREE STORIES OR LESS

DATE: 01/13/22
SCALE: 1/2"=1'-0"

1 HOUR CAVITY SHAFTWALL ENCLOSURE
FOR WASTE/LINEN CHUTES AND MECHANICAL DUCTS - DETAIL: SH 103

National Gypsum.

63



INVERT CAVITY SHAFTWALLS
AS REQUIRED FOR
ACCESSIBILITY. SEE DETAILS
SH 109, SH 110, AND SH 111
FOR CORNER DETAILS

5/8" GOLD BOND FIRE-SHIELD
GYPSUM BOARD
(FSW, FSW-C, FSW-6, eXP-C,
FSLX, SBWB, FSK, FSK-C)

CT, CH OR I STUDS 24" O.C.

1" XP OR eXP SHAFTLINER
PANEL (FSW, FSW-7)

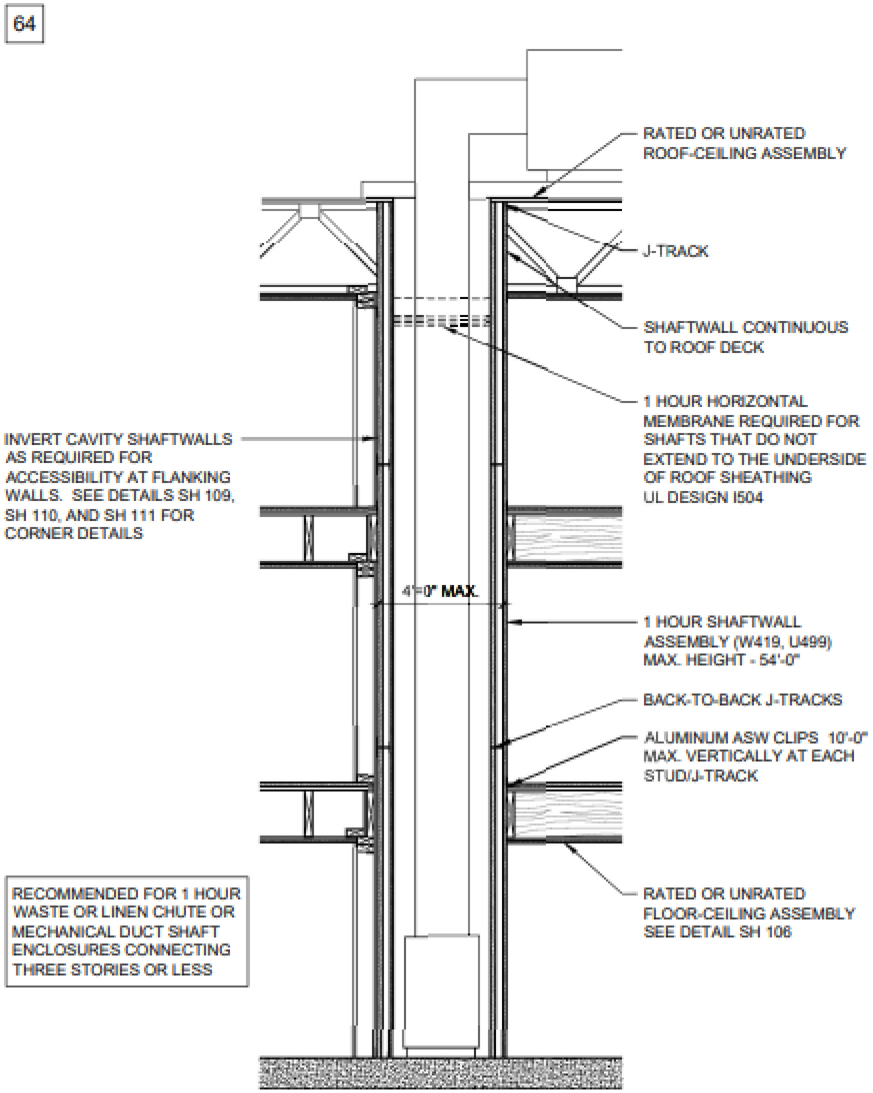
ALUMINUM ASW CLIP AT
EACH STUD/J-TRACK

J-TRACKS FASTENED
24" O.C.

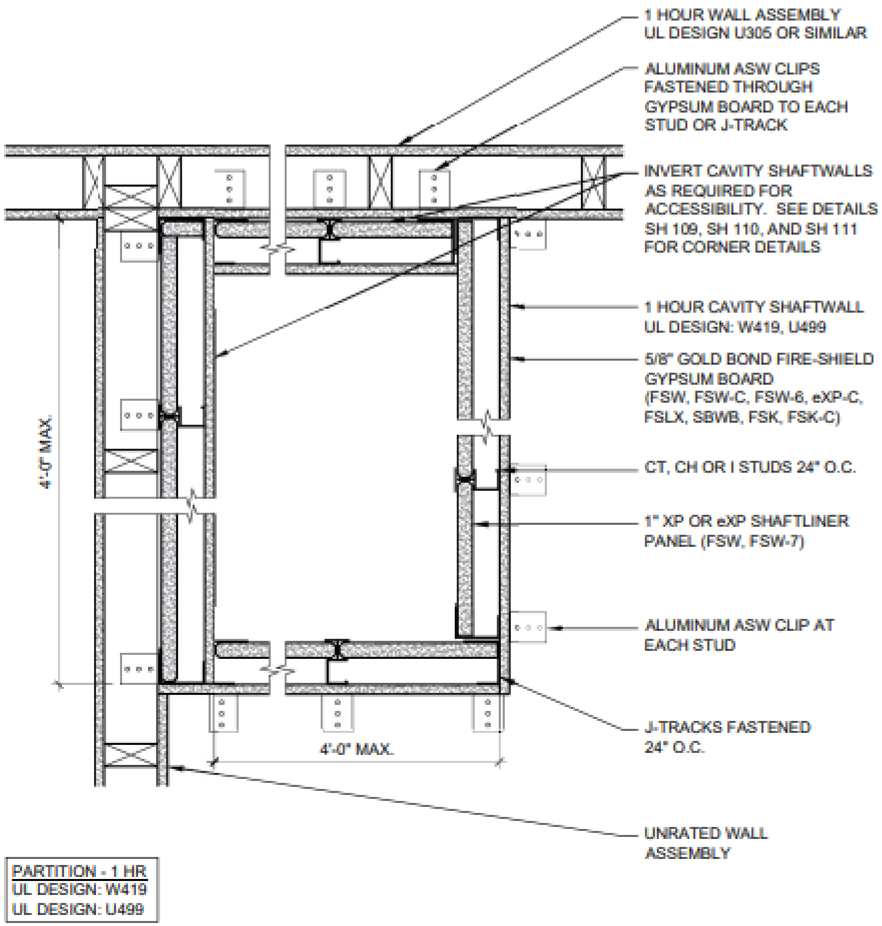
1 HOUR CAVITY SHAFTWALL
UL DESIGN: W419, U499
CONTINUOUSLY STACKED
MAXIMUM HEIGHT 54'-0"
SEE DETAIL SH 103

PARTITION - 1 HR
UL DESIGN: W419
UL DESIGN: U499

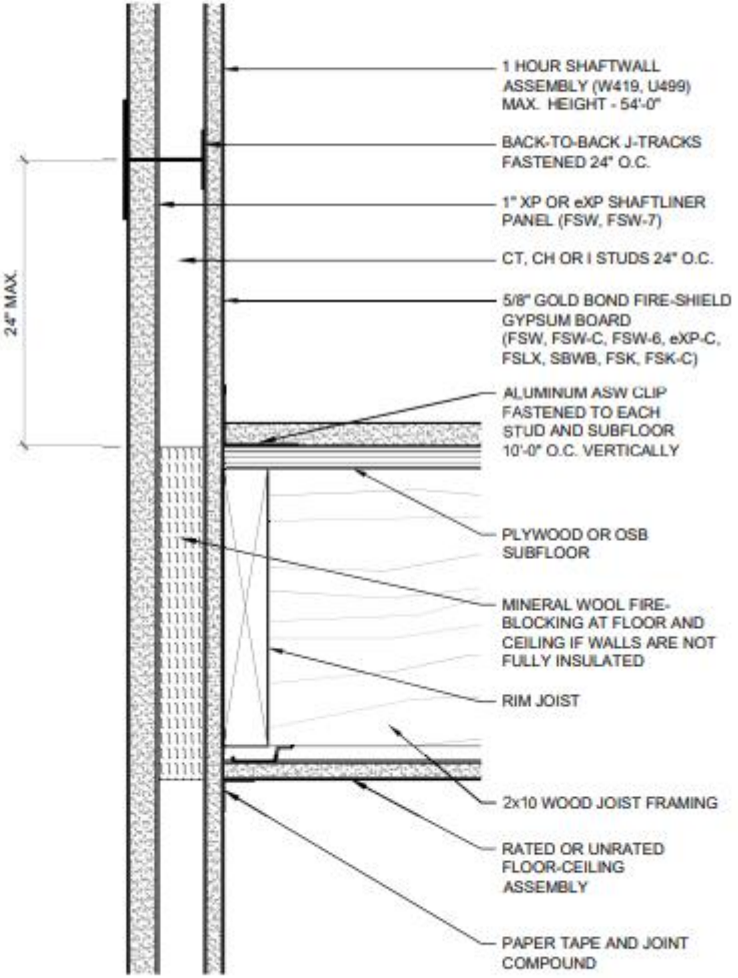
DATE: 01/13/22	1 HOUR CAVITY SHAFTWALL ENCLOSURE PLAN	National Gypsum.
SCALE: 1 1/2"=1'-0"	DETAIL: SH 104	



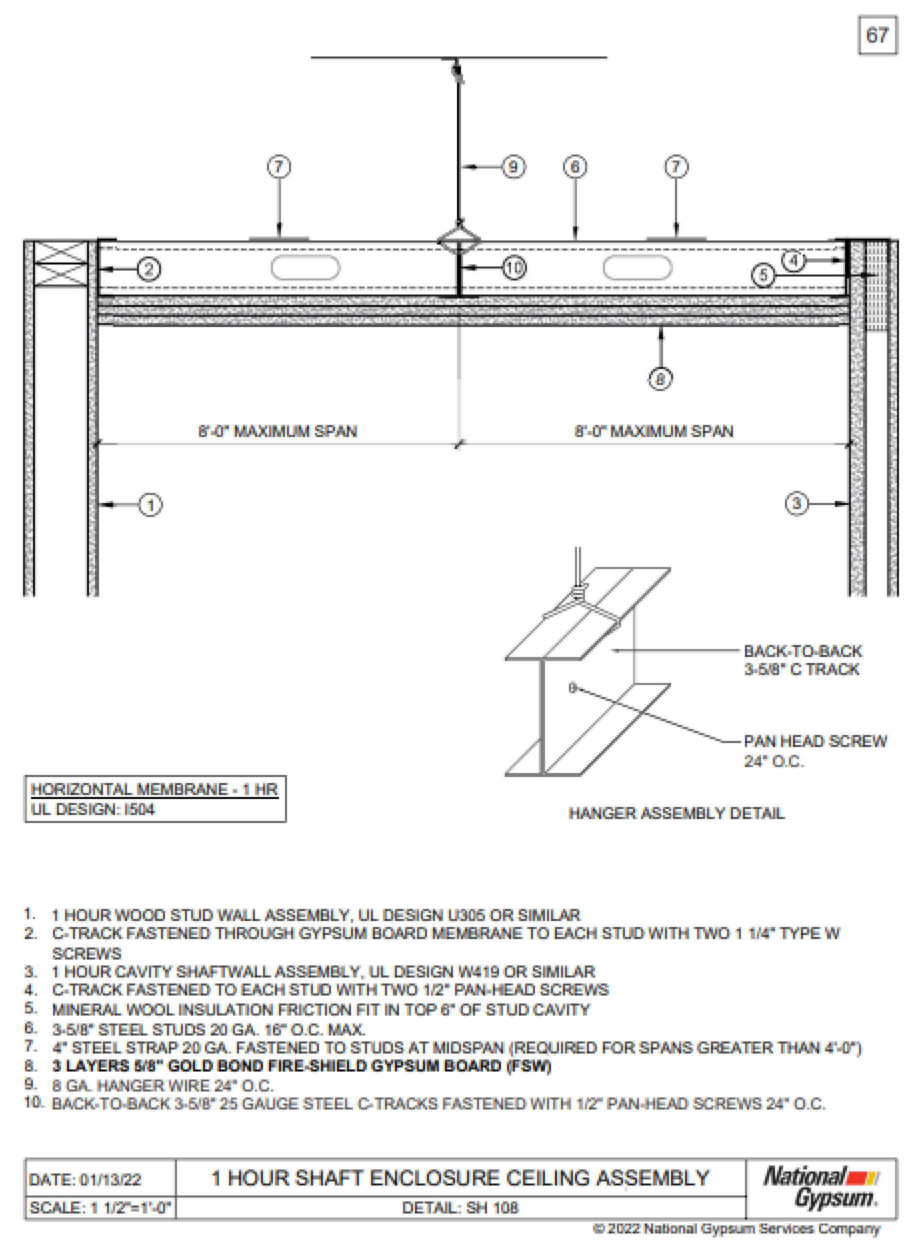
DATE: 01/13/22	1 HOUR SHAFT ENCLOSURE WITH FLANKING WALLS	National Gypsum
SCALE: 1/2"=1'-0"	FOR WASTE/LINEN CHUTES AND MECHANICAL DUCTS - DETAIL: SH 105	



DATE: 01/13/22	1 HOUR CAVITY SHAFTWALL ENCLOSURE PLAN	National Gypsum
SCALE: 1 1/2"=1'-0"	DETAIL: SH 106	



DATE: 01/13/22	1 HR CAVITY SHAFTWALL AT FLOOR ASSEMBLY	National Gypsum
SCALE: 3"=1'-0"	DETAIL: SH 107	



HORIZONTAL MEMBRANE - 1 HR
UL DESIGN: I504

HANGER ASSEMBLY DETAIL

1. 1 HOUR WOOD STUD WALL ASSEMBLY, UL DESIGN U305 OR SIMILAR
2. C-TRACK FASTENED THROUGH GYPSUM BOARD MEMBRANE TO EACH STUD WITH TWO 1 1/4" TYPE W SCREWS
3. 1 HOUR CAVITY SHAFTWALL ASSEMBLY, UL DESIGN W419 OR SIMILAR
4. C-TRACK FASTENED TO EACH STUD WITH TWO 1/2" PAN-HEAD SCREWS
5. MINERAL WOOL INSULATION FRICTION FIT IN TOP 6" OF STUD CAVITY
6. 3-5/8" STEEL STUDS 20 GA. 16" O.C. MAX.
7. 4" STEEL STRAP 20 GA. FASTENED TO STUDS AT MIDSPAN (REQUIRED FOR SPANS GREATER THAN 4'-0")
8. **3 LAYERS 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW)**
9. 8 GA. HANGER WIRE 24" O.C.
10. BACK-TO-BACK 3-5/8" 25 GAUGE STEEL C-TRACKS FASTENED WITH 1/2" PAN-HEAD SCREWS 24" O.C.

DATE: 01/13/22	1 HOUR SHAFT ENCLOSURE CEILING ASSEMBLY	National Gypsum
SCALE: 1 1/2"=1'-0"	DETAIL: SH 108	

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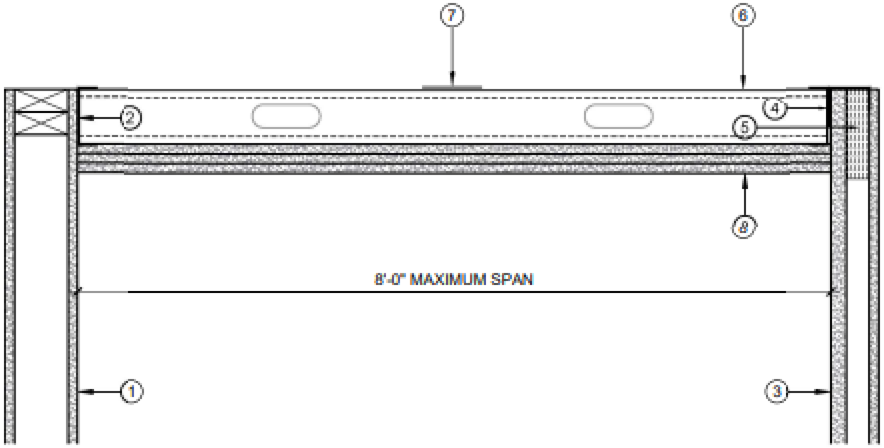
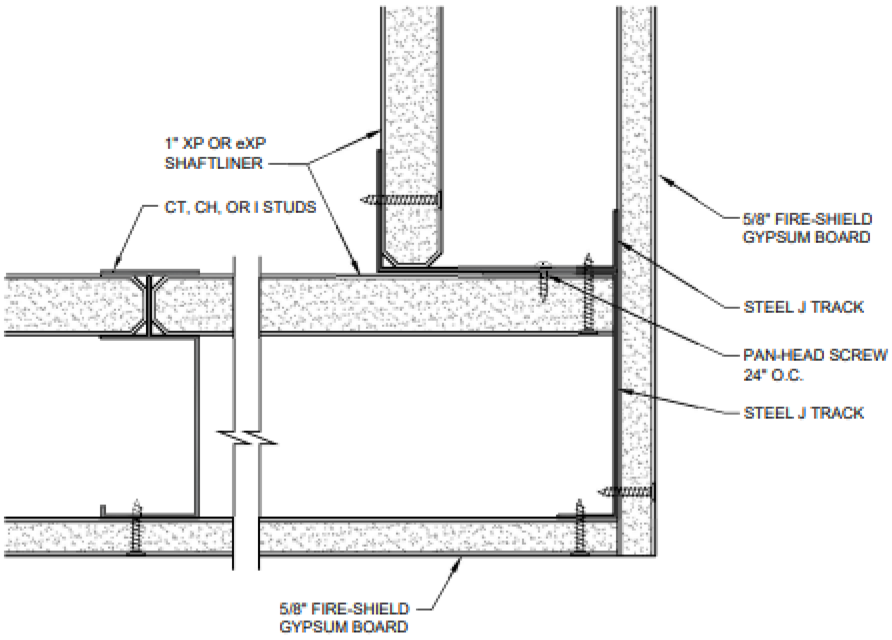


HORIZONTAL MEMBRANE - 1 HR
UL DESIGN: I504

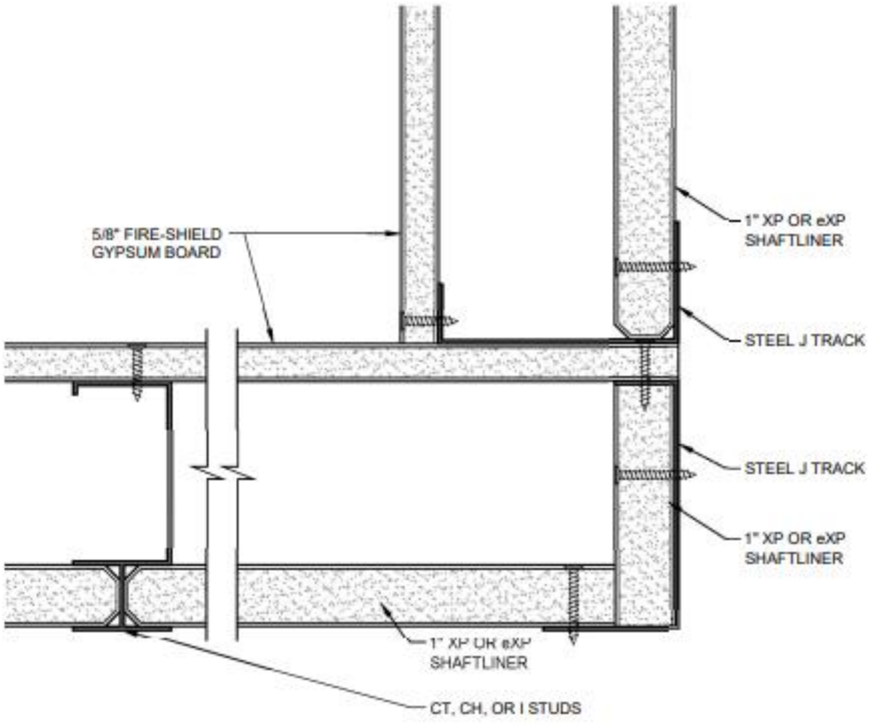
1. 1 HOUR WOOD STUD WALL ASSEMBLY, UL DESIGN U305 OR SIMILAR
2. C-TRACK FASTENED THROUGH GYPSUM BOARD MEMBRANE TO EACH STUD WITH TWO 1 1/4" TYPE W SCREWS
3. 1 HOUR CAVITY SHAFTWALL ASSEMBLY, UL DESIGN W419 OR SIMILAR
4. C-TRACK FASTENED TO EACH STUD WITH TWO 1/2" PAN-HEAD SCREWS
5. MINERAL WOOL INSULATION FRICTION FIT IN TOP 6" OF STUD CAVITY
6. 3-5/8" STEEL STUDS 20 GA. 16" O.C. MAX.
7. 4" STEEL STRAP 20 GA. FASTENED TO STUDS AT MIDSPAN (REQUIRED FOR SPANS GREATER THAN 4'-0")
8. **3 LAYERS 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW)**

DATE: 01/13/22	1 HOUR SHAFT ENCLOSURE CEILING ASSEMBLY	National Gypsum.
SCALE: 1 1/2"=1'-0"	DETAIL: SH 109	

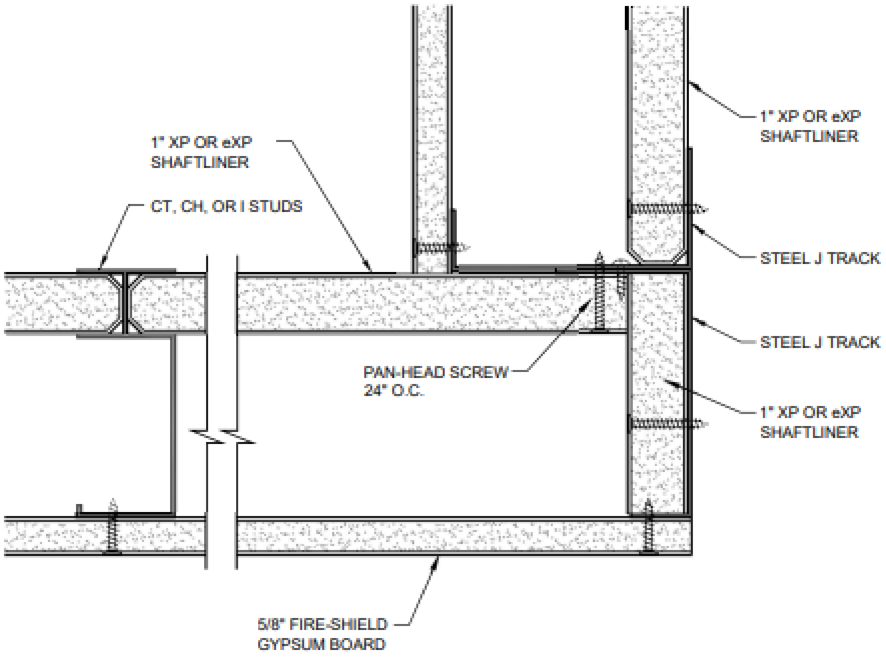


DATE: 01/13/22	1 HOUR SHAFTWALL CORNER DETAIL	National Gypsum.
SCALE: 6"=1'-0"	DETAIL: SH 110	

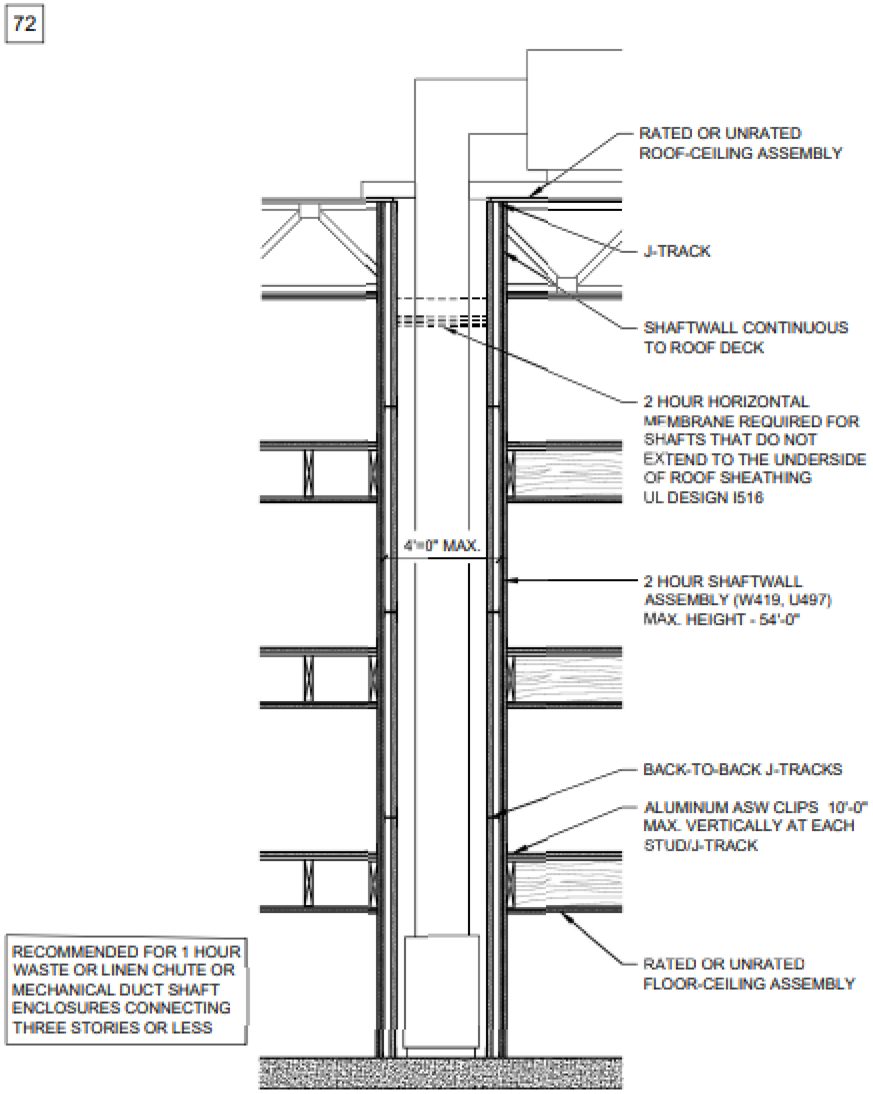
70



DATE: 01/13/22	1 HOUR SHAFTWALL CORNER DETAIL	National Gypsum
SCALE: 6"=1'-0"	DETAIL: SH 111	

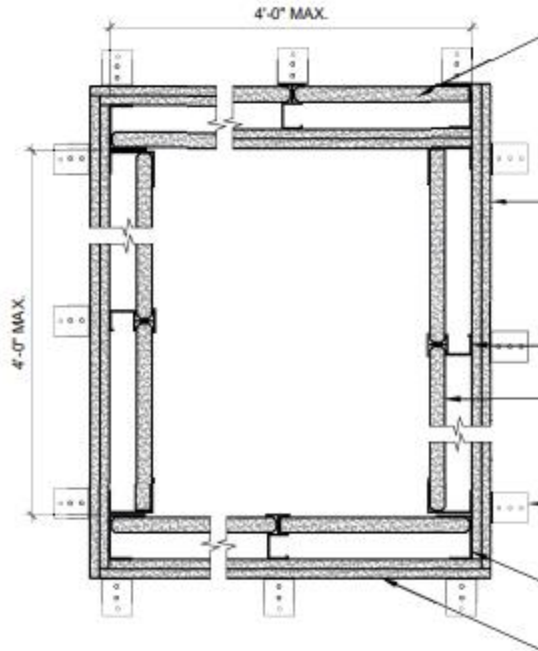


DATE: 01/13/22	1 HOUR SHAFTWALL CORNER DETAIL	National Gypsum
SCALE: 6"=1'-0"	DETAIL: SH 112	



RECOMMENDED FOR 1 HOUR WASTE OR LINEN CHUTE OR MECHANICAL DUCT SHAFT ENCLOSURES CONNECTING THREE STORIES OR LESS

DATE: 01/13/22	2 HOUR CAVITY SHAFTWALL ENCLOSURE	National Gypsum.
SCALE: 1/2"=1'-0"	FOR WASTE/LINEN CHUTES AND MECHANICAL DUCTS - DETAIL: SH 201	



INVERT CAVITY SHAFTWALLS AS REQUIRED FOR ACCESSIBILITY. SEE DETAILS SH 209, SH 210, AND SH 211 FOR CORNER DETAILS

2 LAYERS 5/8" GOLD BOND FIRE-SHIELD GYPSUM BOARD (FSW, FSW-6, SBWB, FSK) OR 2 LAYERS 1/2" FIRE-SHIELD C GYPSUM BOARD (FSW-C, eXP-C, FSK-C)

CT, CH OR I STUDS 24" O.C.

1" XP OR eXP SHAFTLINER PANEL (FSW, FSW-7)

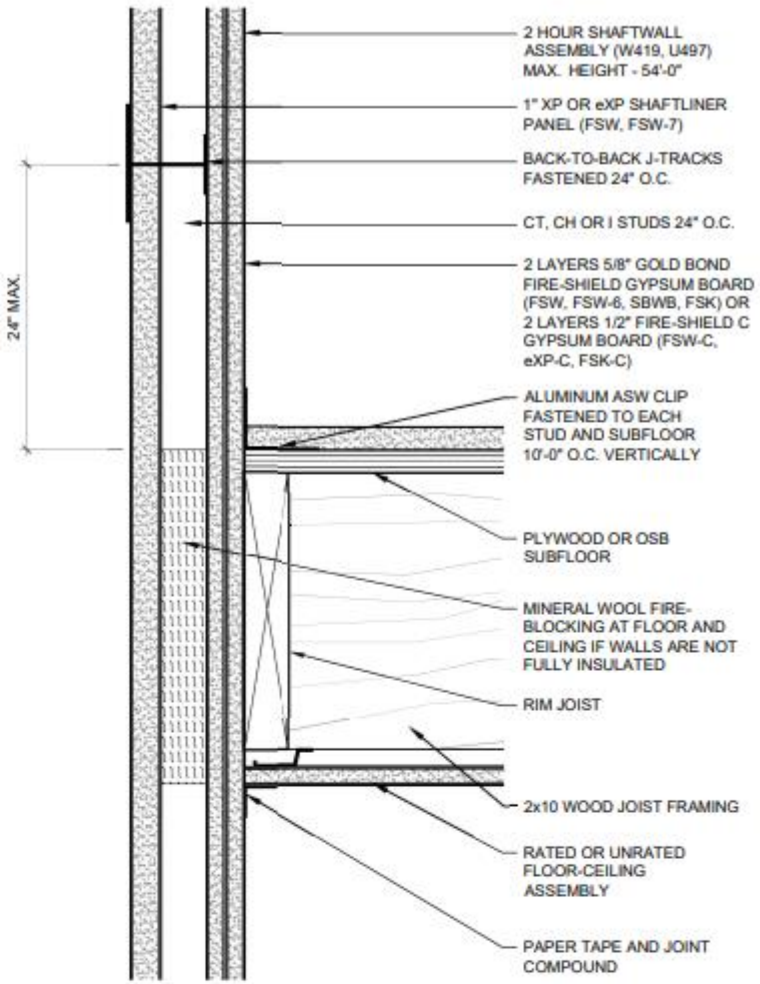
ALUMINUM ASW CLIP AT EACH STUD/J-TRACK VERTICALLY 10'-0" O.C. MAX.

J-TRACKS FASTENED 24" O.C.

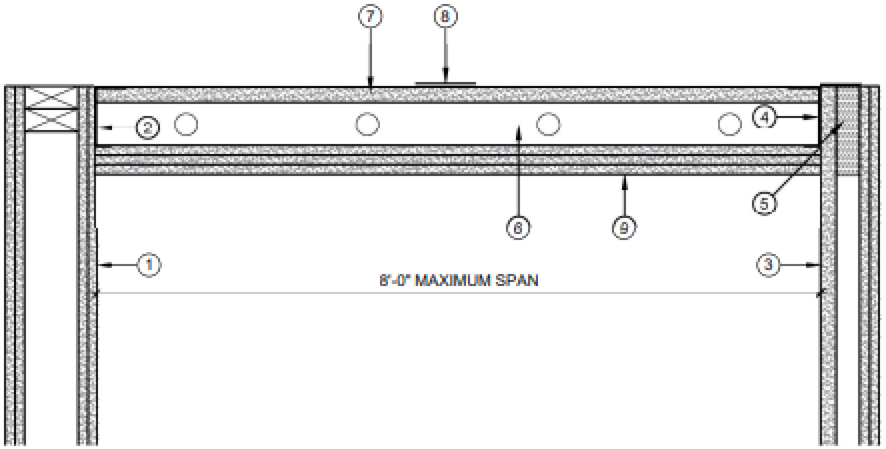
2 HOUR CAVITY SHAFTWALL
UL DESIGN: W419, U497
CONTINUOUSLY STACKED
MAXIMUM HEIGHT 54'-0"
SEE DETAIL SH 201

PARTITION - 2 HR
UL DESIGN: W419
UL DESIGN: U497

DATE: 01/13/22	2 HOUR CAVITY SHAFTWALL ENCLOSURE PLAN	National Gypsum
SCALE: 1 1/2"=1'-0"	DETAIL: SH 202	



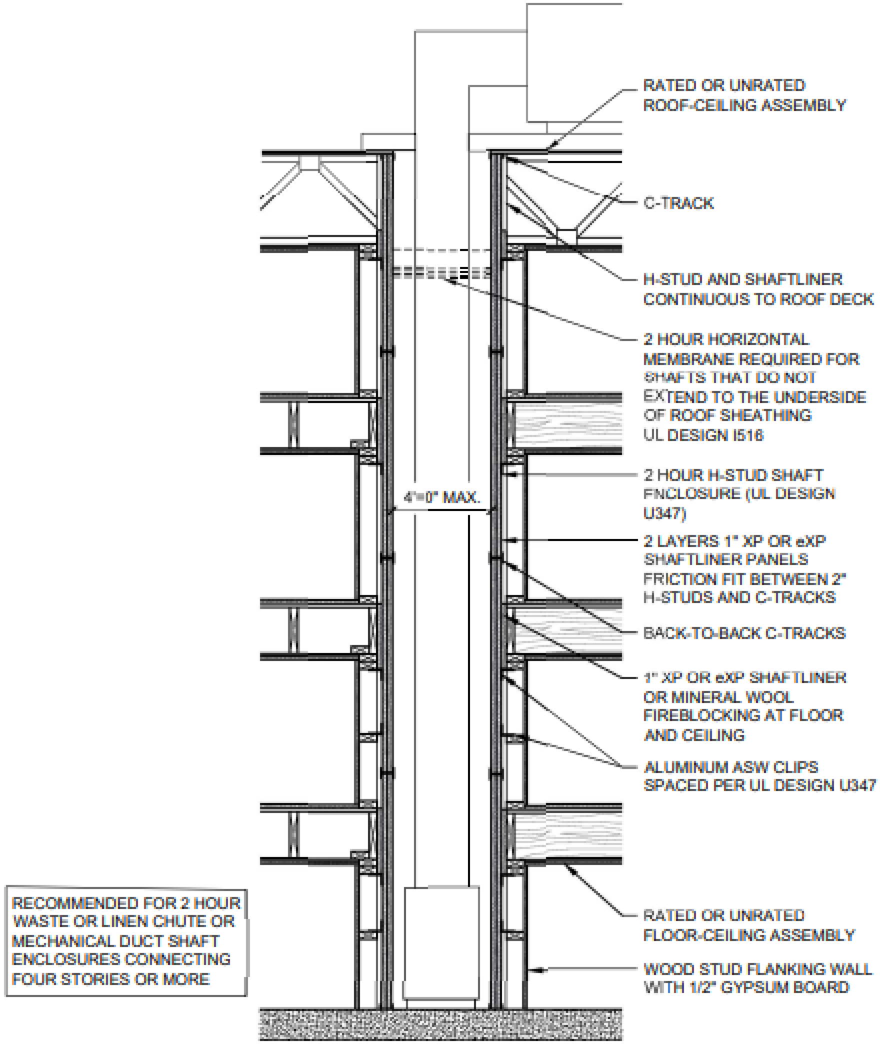
DATE: 01/13/22	2 HR CAVITY SHAFTWALL AT FLOOR ASSEMBLY	National Gypsum
SCALE: 3"=1'-0"	DETAIL: SH 203	



HORIZONTAL MEMBRANE - 2 HR
UL DESIGN: I516

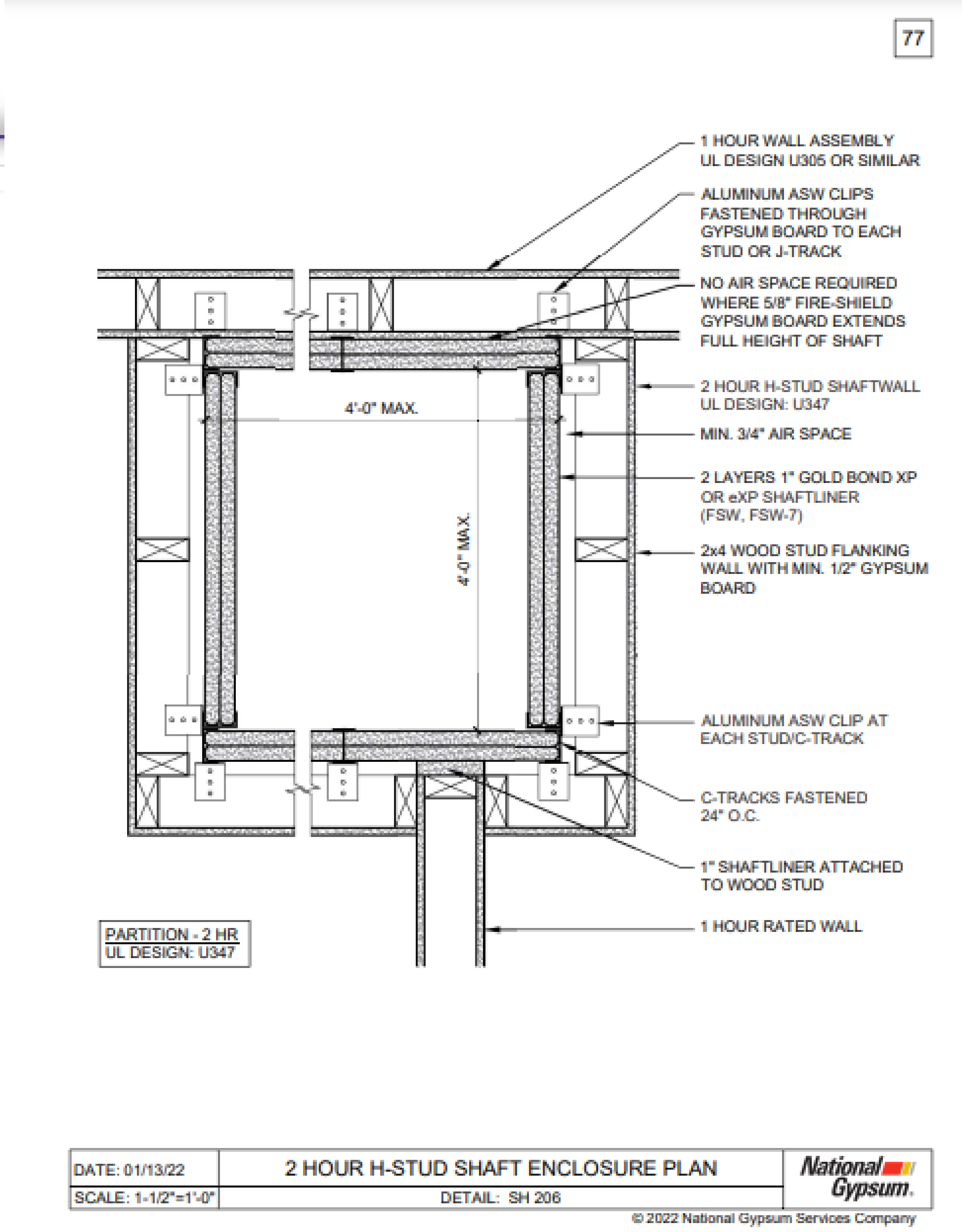
1. 2 HOUR WOOD STUD WALL ASSEMBLY, UL DESIGN U301 OR SIMILAR
2. J-TRACK FASTENED THROUGH GYPSUM BOARD MEMBRANE TO EACH STUD WITH TWO 1 1/4" TYPE W SCREWS
3. 2 HOUR CAVITY SHAFTWALL ASSEMBLY, UL DESIGN W419 OR SIMILAR
4. J-TRACK FASTENED TO EACH STUD WITH TWO 1/2" PAN-HEAD SCREWS
5. MINERAL WOOL INSULATION FRICTION FIT IN TOP 6" OF STUD CAVITY
6. 4" CT STUDS 20 GA. 24" O.C. MAX.
7. **1" XP OR eXP SHAFTLINER PANEL (FSW, FSW-7)**
8. 4" STEEL STRAP 20 GA. FASTENED TO STUDS AT MIDSPAN (REQUIRED FOR SPANS GREATER THAN 4'-0")
9. **3 LAYERS 5/8" GOLD BOND FIRE-SHIELD C GYPSUM BOARD (FSW-C)**

DATE: 01/13/22	2 HOUR SHAFT ENCLOSURE CEILING ASSEMBLY	National Gypsum
SCALE: 1 1/2"=1'-0"	DETAIL: SH 204	



RECOMMENDED FOR 2 HOUR WASTE OR LINEN CHUTE OR MECHANICAL DUCT SHAFT ENCLOSURES CONNECTING FOUR STORIES OR MORE

DATE: 01/13/22	2 HOUR H-STUD SHAFT ENCLOSURE	National Gypsum.
SCALE: 1/2"=1'-0"	FOR WASTE/LINEN CHUTES AND MECHANICAL DUCTS DETAIL: SH 205	



1 HOUR WALL ASSEMBLY
UL DESIGN U305 OR SIMILAR

ALUMINUM ASW CLIPS
FASTENED THROUGH
GYPSUM BOARD TO EACH
STUD OR J-TRACK

NO AIR SPACE REQUIRED
WHERE 5/8" FIRE-SHIELD
GYPSUM BOARD EXTENDS
FULL HEIGHT OF SHAFT

2 HOUR H-STUD SHAFTWALL
UL DESIGN: U347

MIN. 3/4" AIR SPACE

2 LAYERS 1" GOLD BOND XP
OR eXP SHAFTLINER
(FSW, FSW-7)

2x4 WOOD STUD FLANKING
WALL WITH MIN. 1/2" GYPSUM
BOARD

ALUMINUM ASW CLIP AT
EACH STUD/C-TRACK

C-TRACKS FASTENED
24" O.C.

1" SHAFTLINER ATTACHED
TO WOOD STUD

1 HOUR RATED WALL

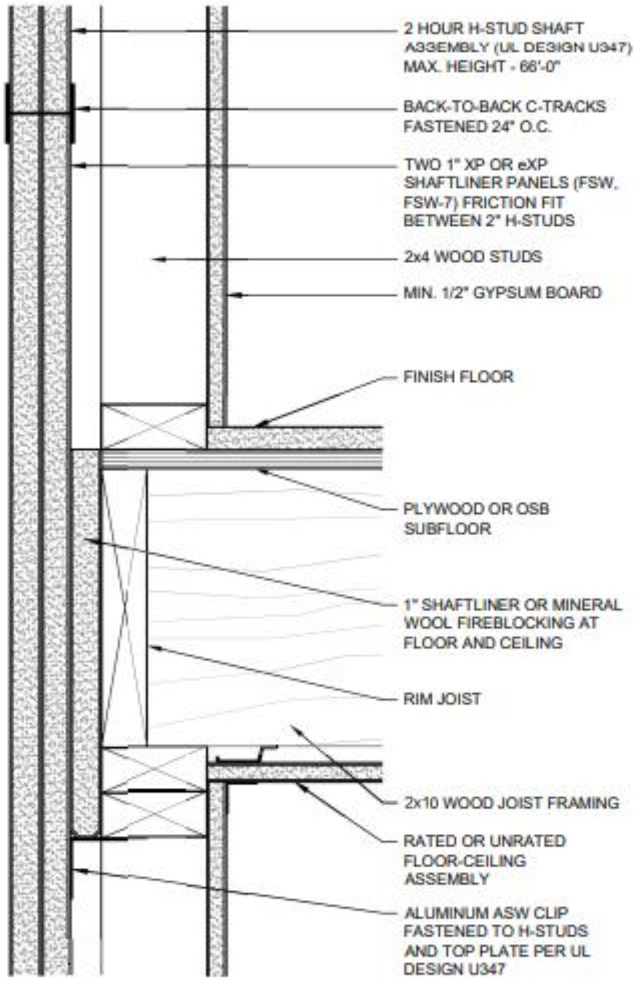
PARTITION - 2 HR
UL DESIGN: U347

DATE: 01/13/22
SCALE: 1-1/2"=1'-0"

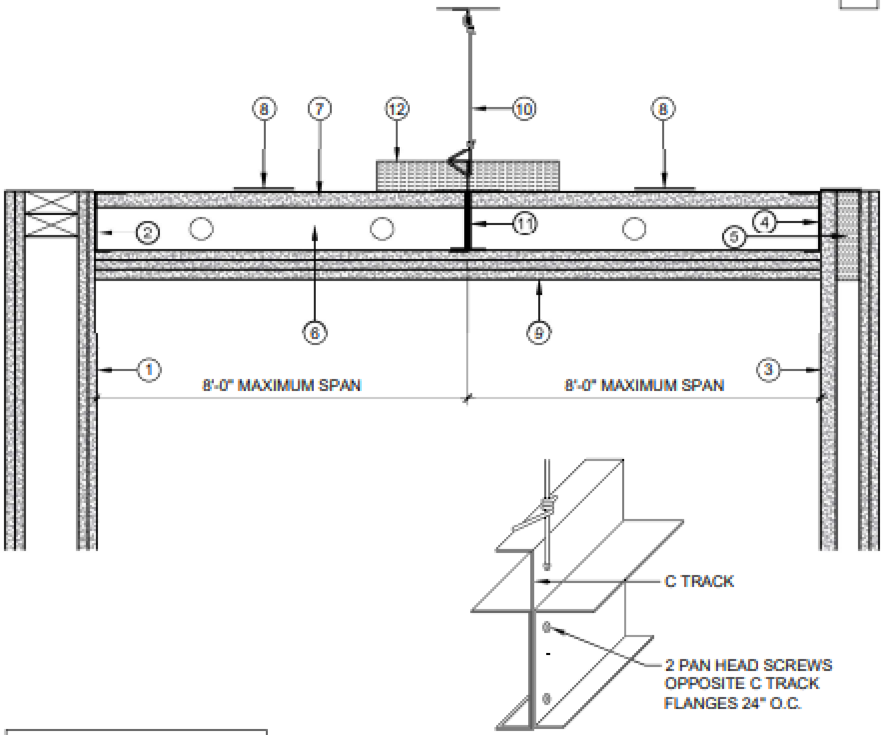
2 HOUR H-STUD SHAFT ENCLOSURE PLAN

DETAIL: SH 206

National Gypsum.



DATE: 01/13/22	2 HR H-STUD SHAFT AT FLOOR ASSEMBLY	National Gypsum.
SCALE: 3"=1'-0"	DETAIL: SH 207	

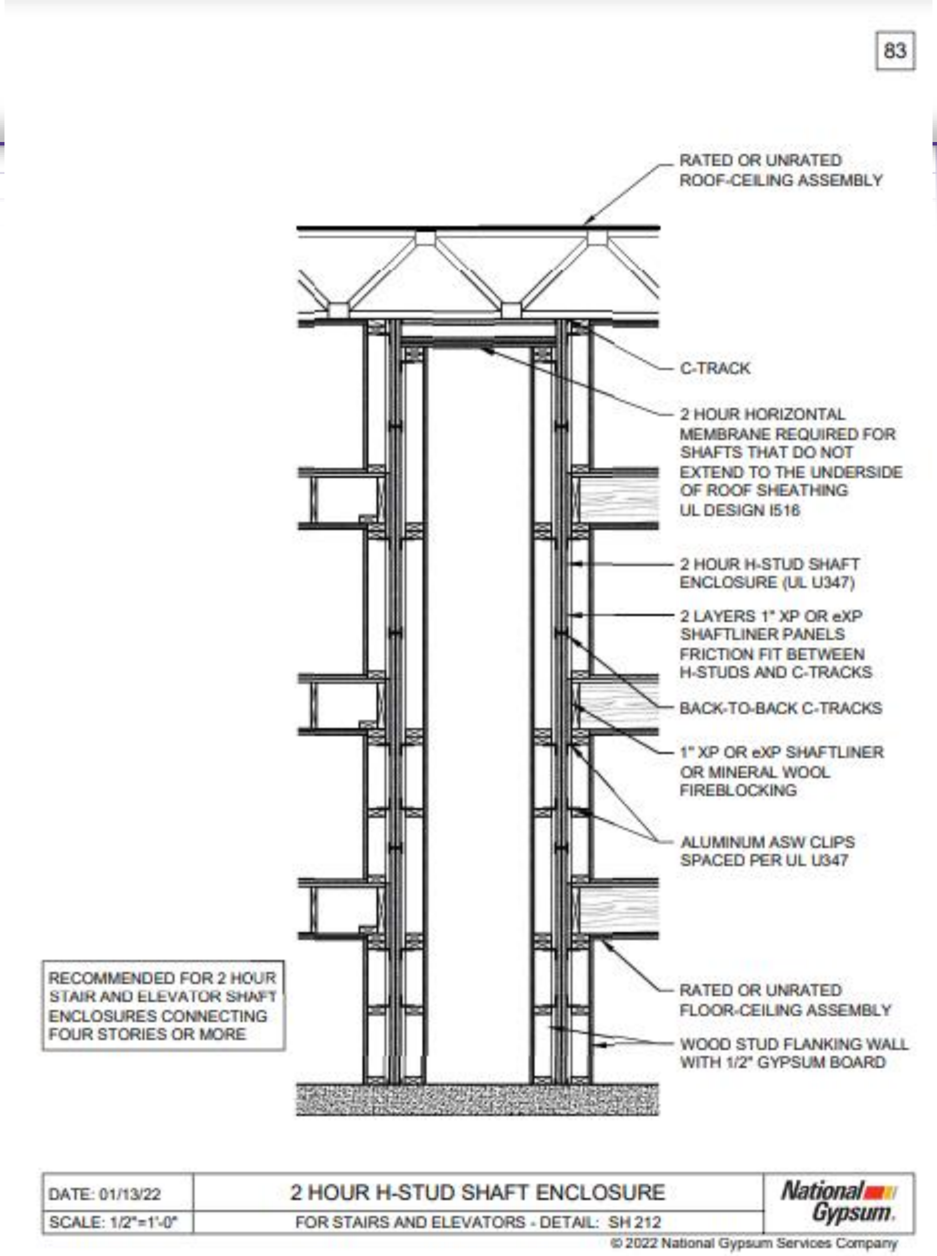


HORIZONTAL MEMBRANE - 2 HR
UL DESIGN: I516

HANGER ASSEMBLY DETAIL

1. 2 HOUR WOOD STUD WALL ASSEMBLY, UL DESIGN U301 OR SIMILAR
2. J-TRACK FASTENED THROUGH GYPSUM BOARD MEMBRANE TO EACH STUD WITH TWO 1 1/4" TYPE W SCREWS
3. 2 HOUR CAVITY SHAFTWALL ASSEMBLY, UL DESIGN W419 OR SIMILAR
4. J-TRACK FASTENED TO EACH STUD WITH TWO 1/2" PAN-HEAD SCREWS
5. MINERAL WOOL INSULATION FRICTION FIT IN TOP 6" OF STUD CAVITY
6. 4" CT STUDS 20 GA. 24" O.C. MAX.
7. **1" XP OR eXP SHAFTLINER PANEL (FSW, FSW-7)**
8. 4" STEEL STRAP 20 GA. FASTENED TO STUDS AT MIDSPAN (REQUIRED FOR SPANS GREATER THAN 4'-0")
9. **3 LAYERS 5/8" GOLD BOND FIRE-SHIELD C GYPSUM BOARD (FSW-C)**
10. 8 GA. HANGER WIRE 24" O.C.
11. 4" 25 GAUGE J-TRACKS FASTENED TO EACH SIDE OF 6" C-TRACK WITH TWO 1/2" PAN-HEAD SCREWS 24" O.C.
12. 2" x 6" MINERAL WOOL GLUED TO GYPSUM BOARD FULL LENGTH OF C-TRACK

DATE: 01/13/22	2 HOUR SHAFT ENCLOSURE CEILING ASSEMBLY	National Gypsum
SCALE: 1 1/2"=1'-0"	DETAIL: SH 208	



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RATED OR UNRATED
ROOF-CEILING ASSEMBLY

C-TRACK

2 HOUR HORIZONTAL
MEMBRANE REQUIRED FOR
SHAFTS THAT DO NOT
EXTEND TO THE UNDERSIDE
OF ROOF SHEATHING
UL DESIGN I516

2 HOUR H-STUD SHAFT
ENCLOSURE (UL U347)

2 LAYERS 1" XP OR eXP
SHAFTLINER PANELS
FRICTION FIT BETWEEN
H-STUDS AND C-TRACKS

BACK-TO-BACK C-TRACKS

1" XP OR eXP SHAFTLINER
OR MINERAL WOOL
FIREBLOCKING

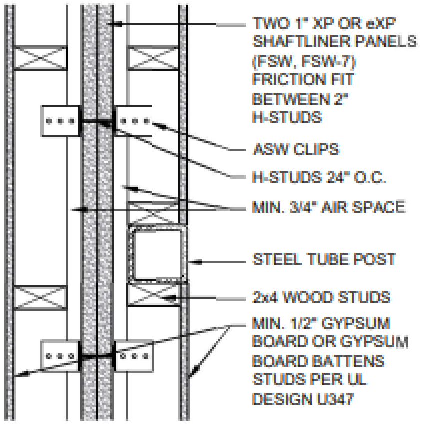
ALUMINUM ASW CLIPS
SPACED PER UL U347

RATED OR UNRATED
FLOOR-CEILING ASSEMBLY

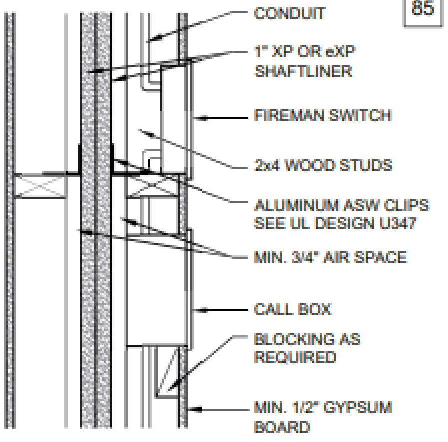
WOOD STUD FLANKING WALL
WITH 1/2" GYPSUM BOARD

RECOMMENDED FOR 2 HOUR
STAIR AND ELEVATOR SHAFT
ENCLOSURES CONNECTING
FOUR STORIES OR MORE

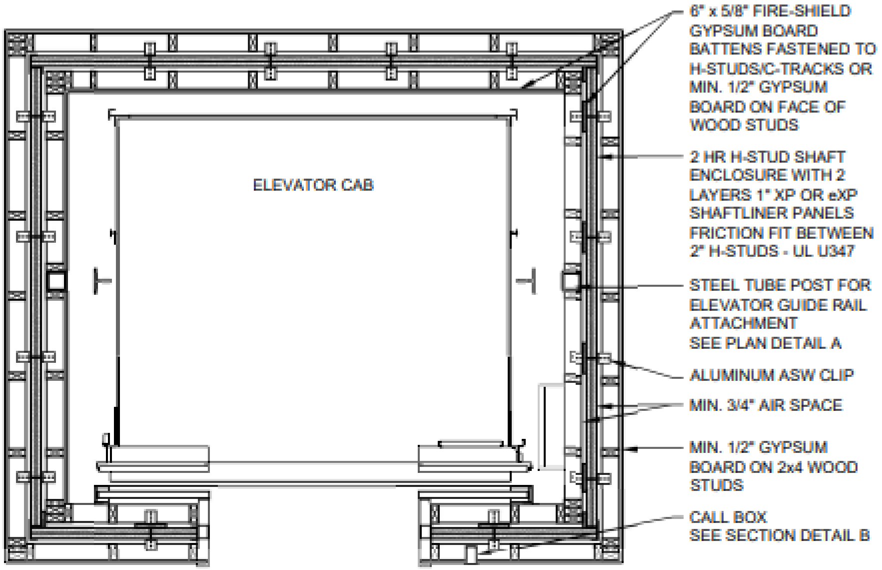
DATE: 01/13/22	2 HOUR H-STUD SHAFT ENCLOSURE	National Gypsum.
SCALE: 1/2"=1'-0"	FOR STAIRS AND ELEVATORS - DETAIL: SH 212	



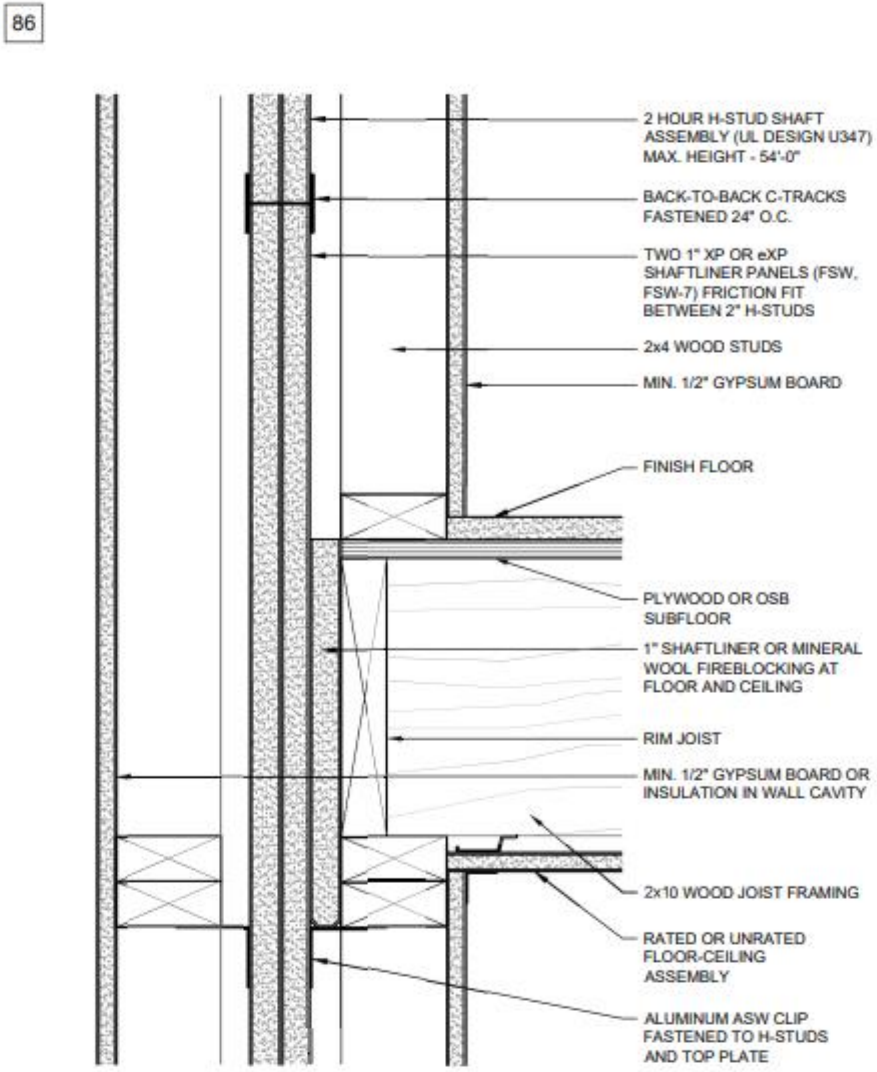
PLAN DETAIL A
STEEL TUBE POST



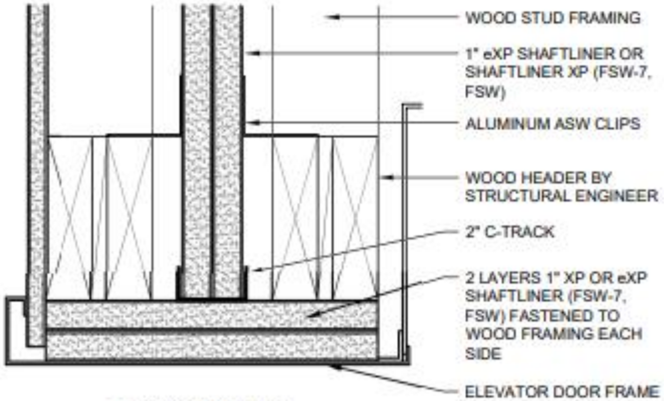
SECTION DETAIL B
CALL BOX



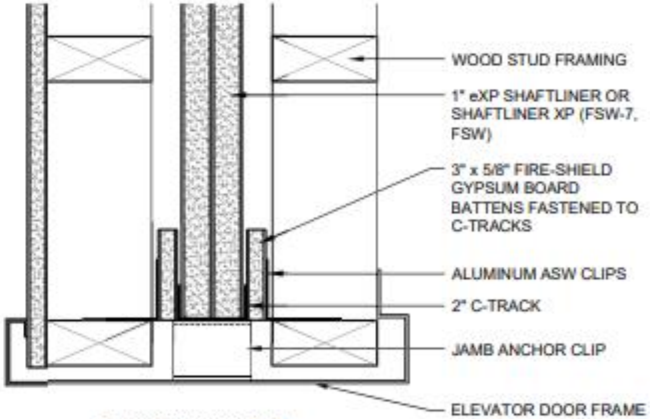
DATE: 01/13/22	ELEVATOR SHAFT ENCLOSURE PLAN	National Gypsum
SCALE: 1/2"=1'-0"	DETAIL: SH 214	



DATE: 01/13/22	2 HR H-STUD SHAFT AT FLOOR ASSEMBLY	National Gypsum.
SCALE: 3"=1'-0"	DETAIL: SH 215	



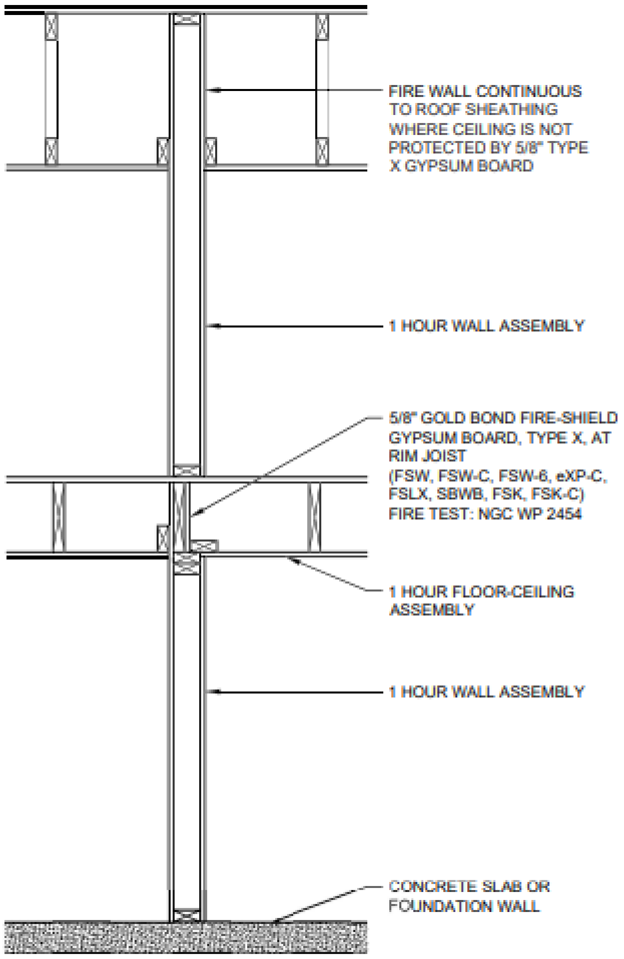
ELEVATOR DOOR HEAD



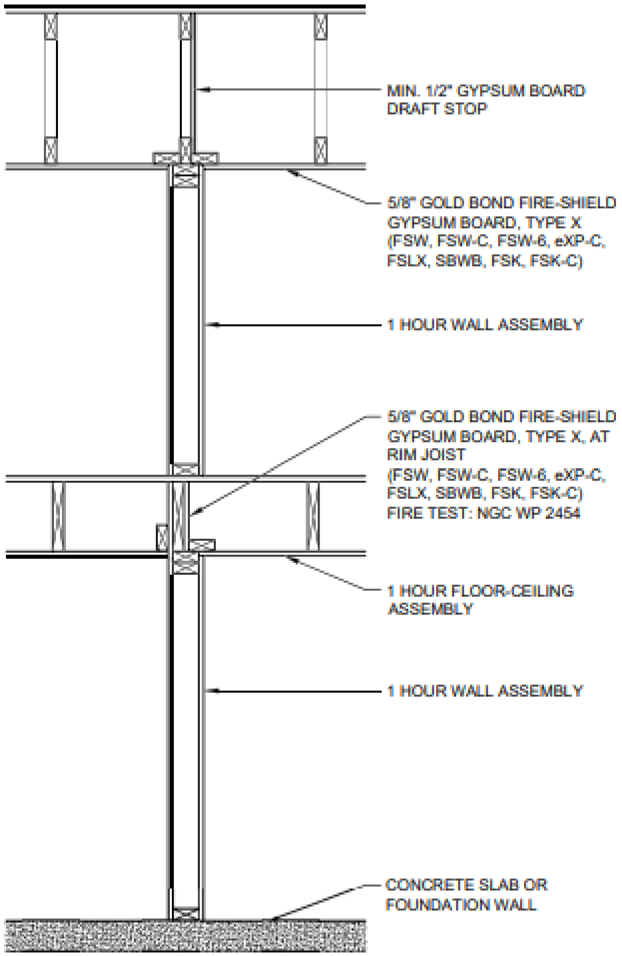
ELEVATOR DOOR JAMB

DATE: 01/13/22	ELEVATOR SHAFTWALL HEAD AND JAMB DETAILS	National Gypsum.
SCALE: 3"=1'-0"	DETAIL: SH 216	

88

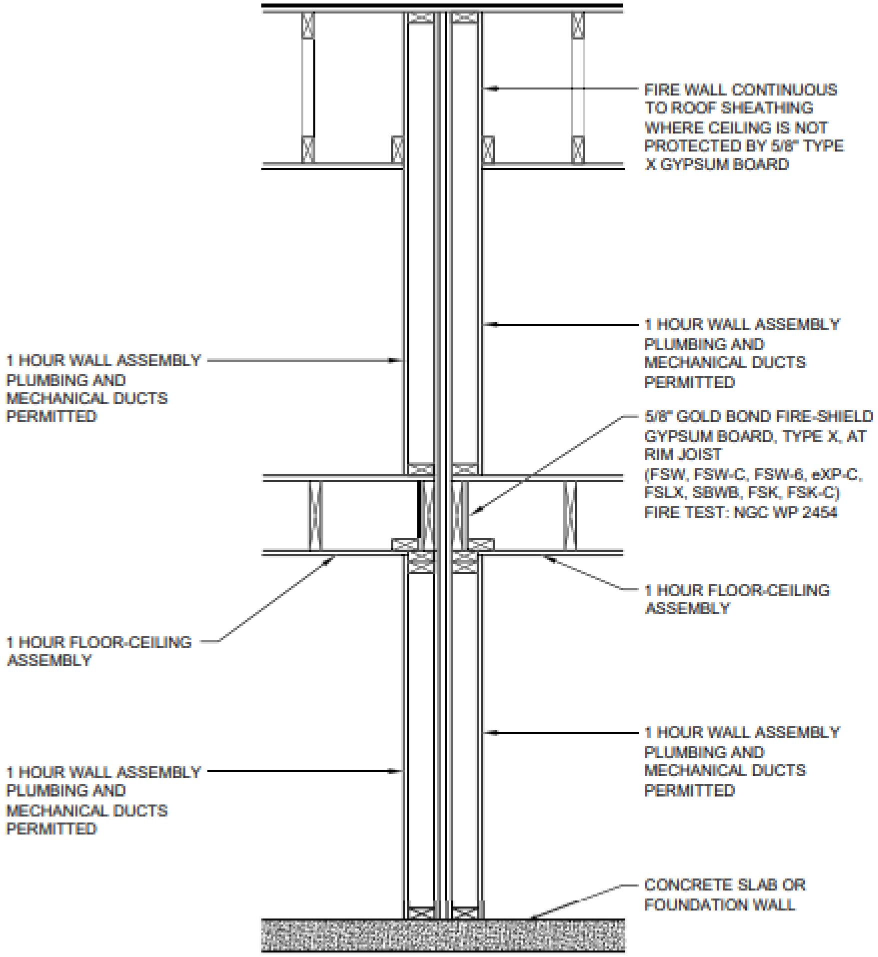


DATE: 01/13/22	1 HOUR TWO-FAMILY DWELLING SEPARATION	National Gypsum
SCALE: 3/4"=1'-0"	DETAIL: TF 101	



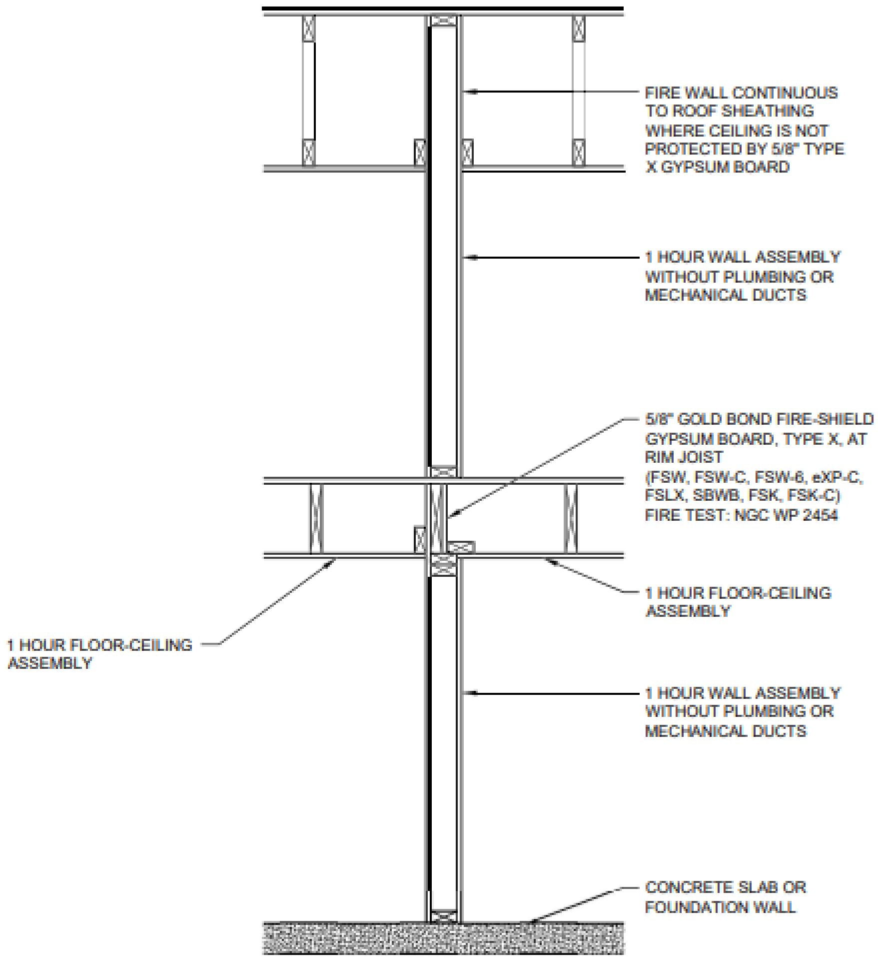
DATE: 01/13/22	1 HOUR TWO-FAMILY DWELLING SEPARATION	National Gypsum
SCALE: 3/4"=1'-0"	DETAIL: TF 102	

92

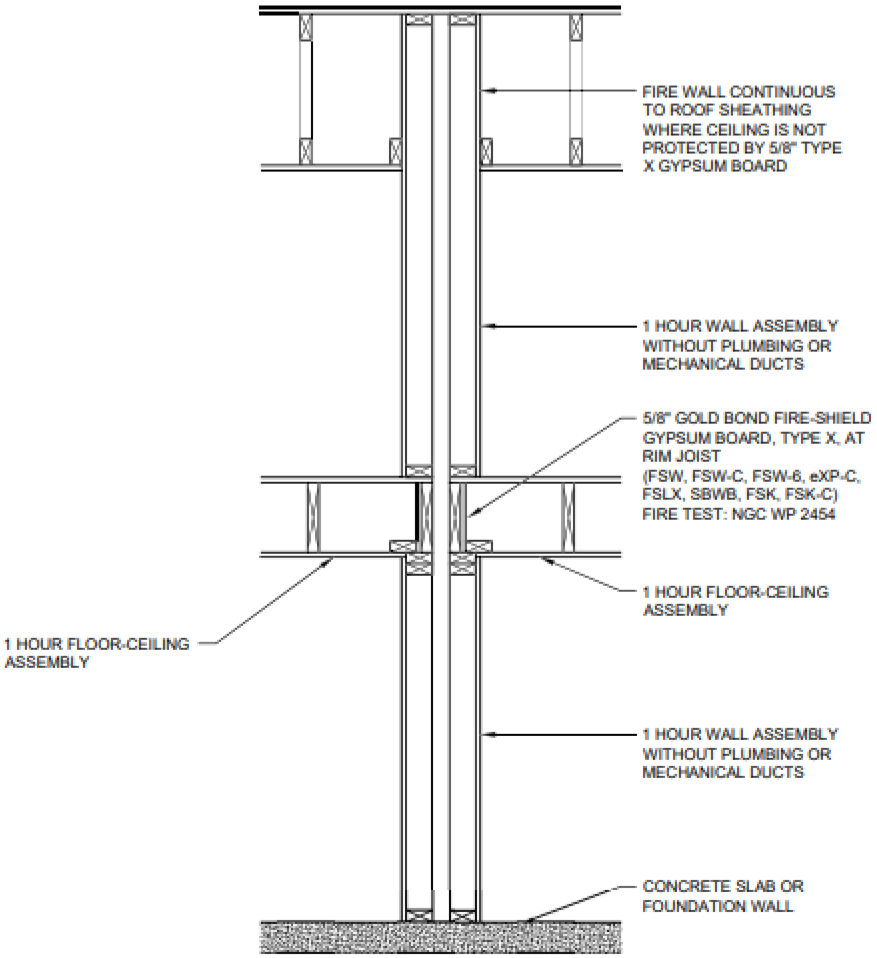


DATE: 01/13/22	DOUBLE 1 HOUR TOWNHOUSE SEPARATION WALL	National Gypsum
SCALE: 3/4"=1'-0"	DETAIL: TH 101	

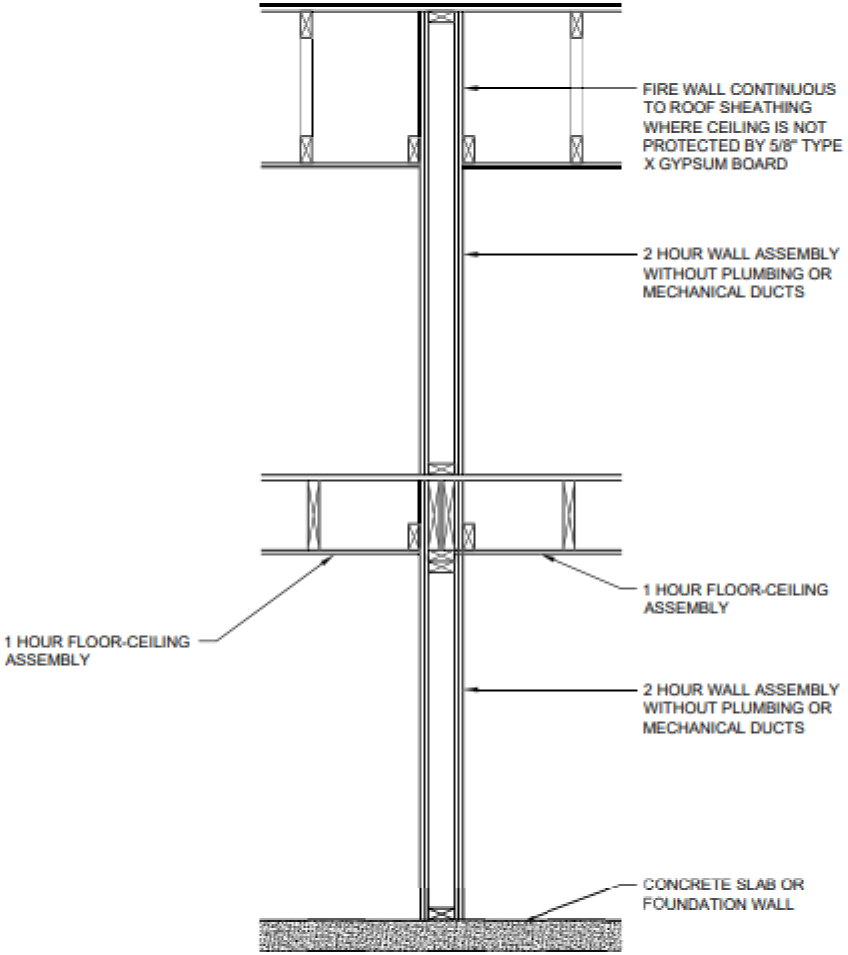
93



DATE: 01/13/22	1 HOUR TOWNHOUSE SEPARATION - COMMON WALL	National Gypsum
SCALE: 3/4"=1'-0"	DETAIL: TH 102	

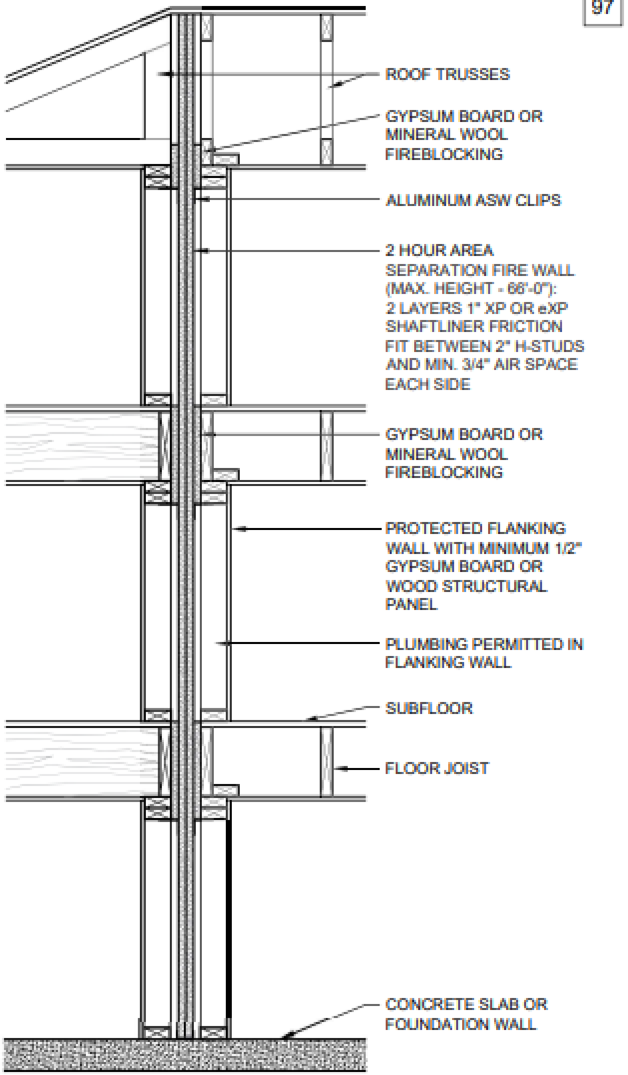


DATE: 01/13/22	1 HOUR TOWNHOUSE SEPARATION - COMMON WALL	National Gypsum
SCALE: 3/4"=1'-0"	DETAIL: TH 104	

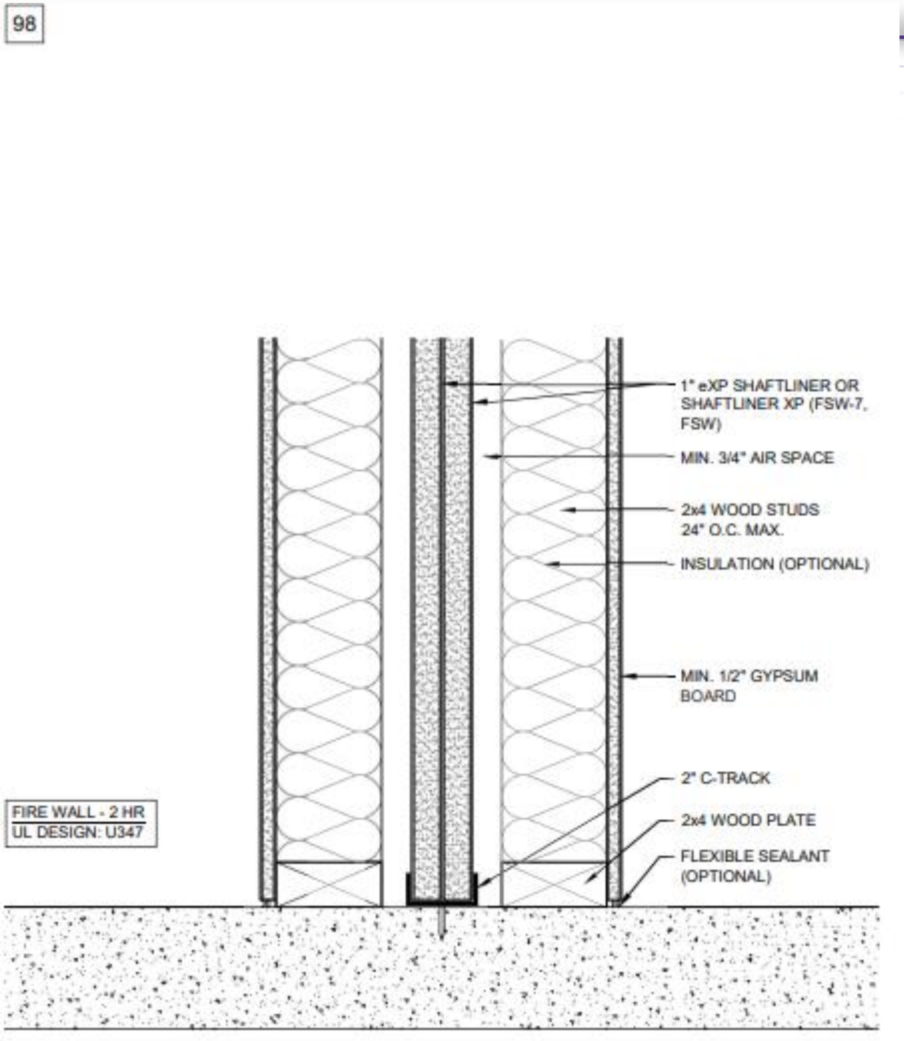


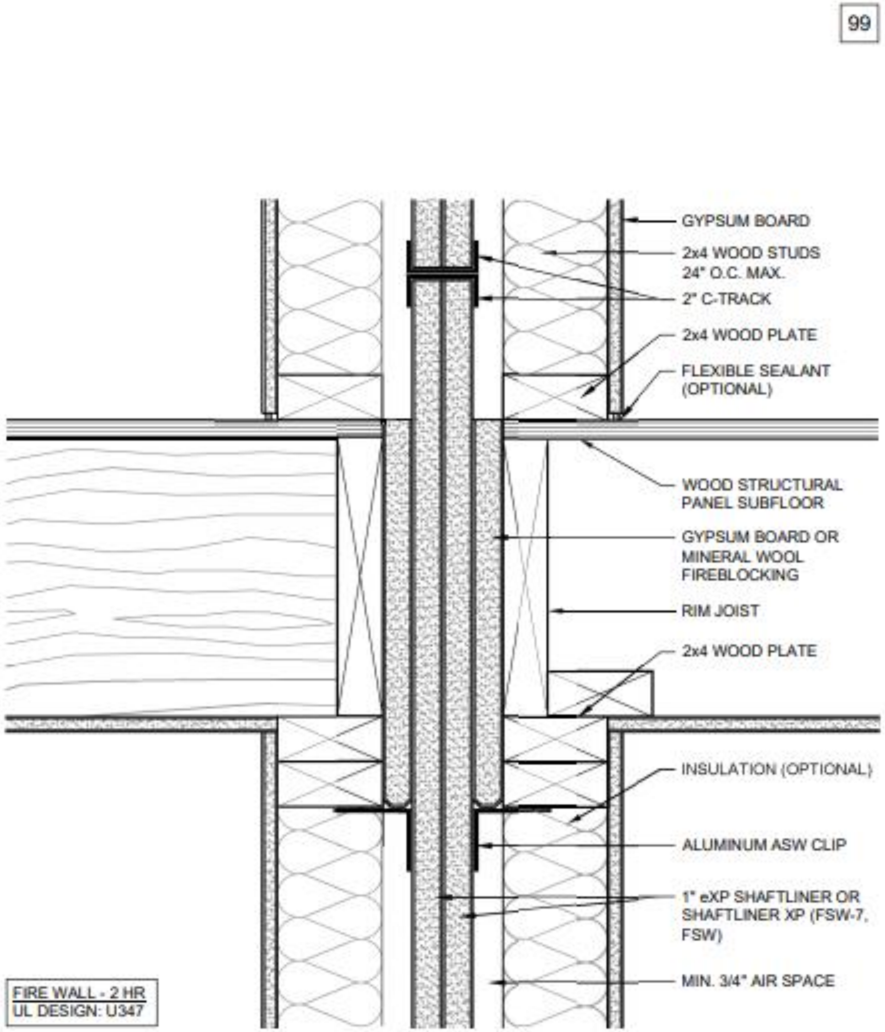
DATE: 01/13/22	2 HOUR TOWNHOUSE SEPARATION - COMMON WALL	National Gypsum
SCALE: 3/4"=1'-0"	DETAIL: TH 201	

97

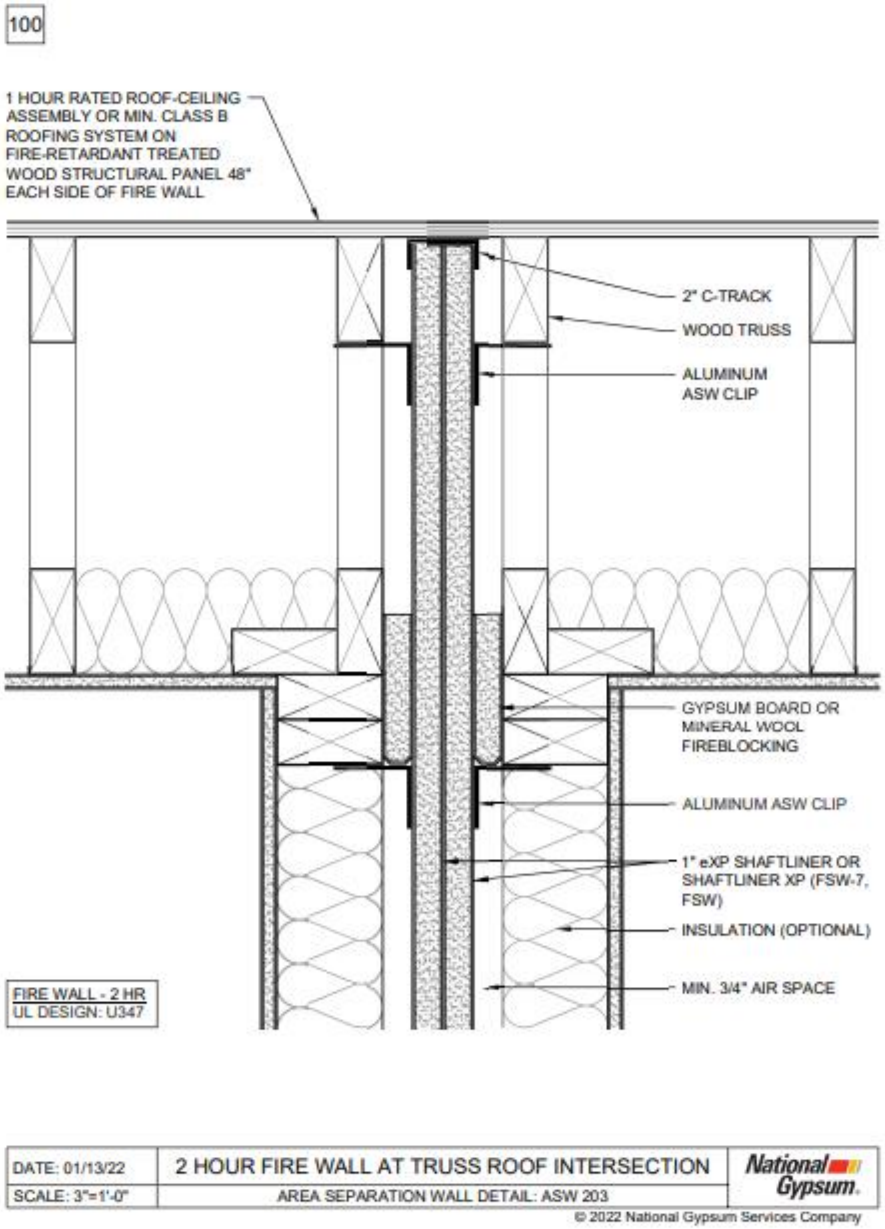


DATE: 01/13/22	2 HOUR AREA SEPARATION FIRE WALL	National Gypsum
SCALE: 3/4"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 200	


98
1" eXP SHAFTLINER OR SHAFTLINER XP (FSW-7, FSW)
MIN. 3/4" AIR SPACE
2x4 WOOD STUDS 24" O.C. MAX.
INSULATION (OPTIONAL)
MIN. 1/2" GYPSUM BOARD
2" C-TRACK
2x4 WOOD PLATE
FLEXIBLE SEALANT (OPTIONAL)
FIRE WALL - 2 HR
UL DESIGN: U347



DATE: 01/13/22	2 HOUR FIRE WALL AT FLOOR INTERSECTION	National Gypsum
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 202	

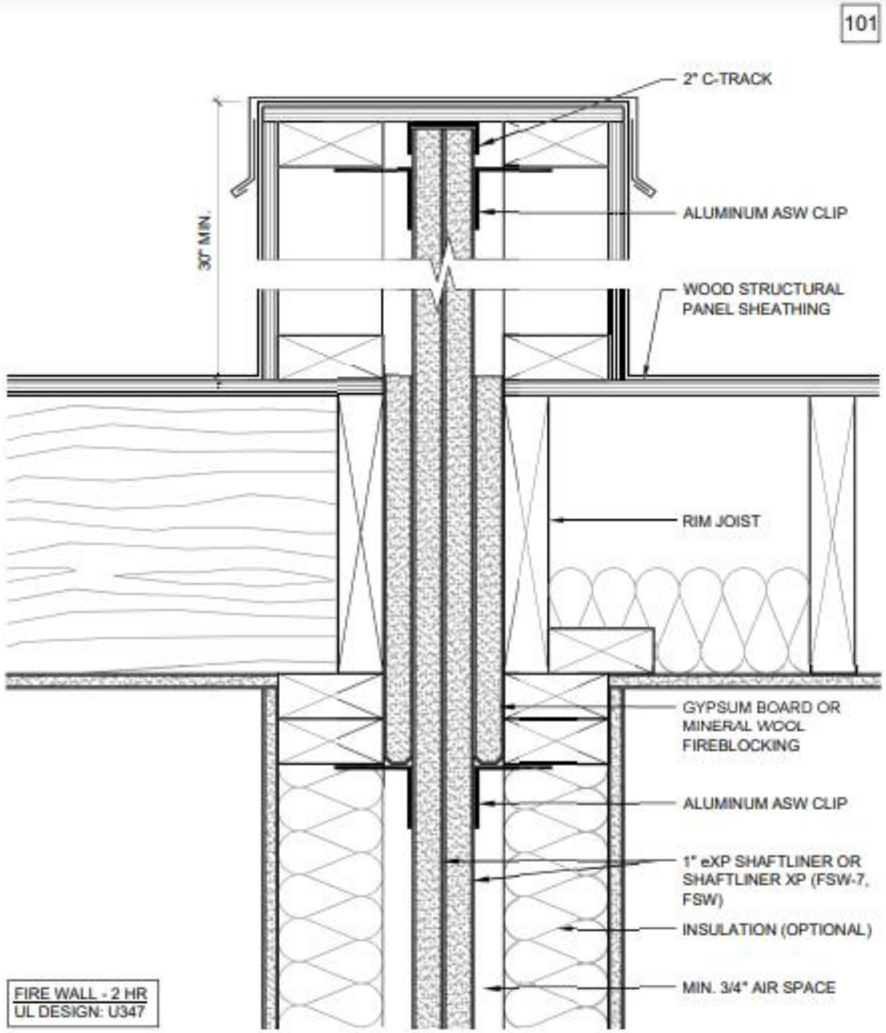


DATE: 01/13/22

SCALE: 3"=1'-0"

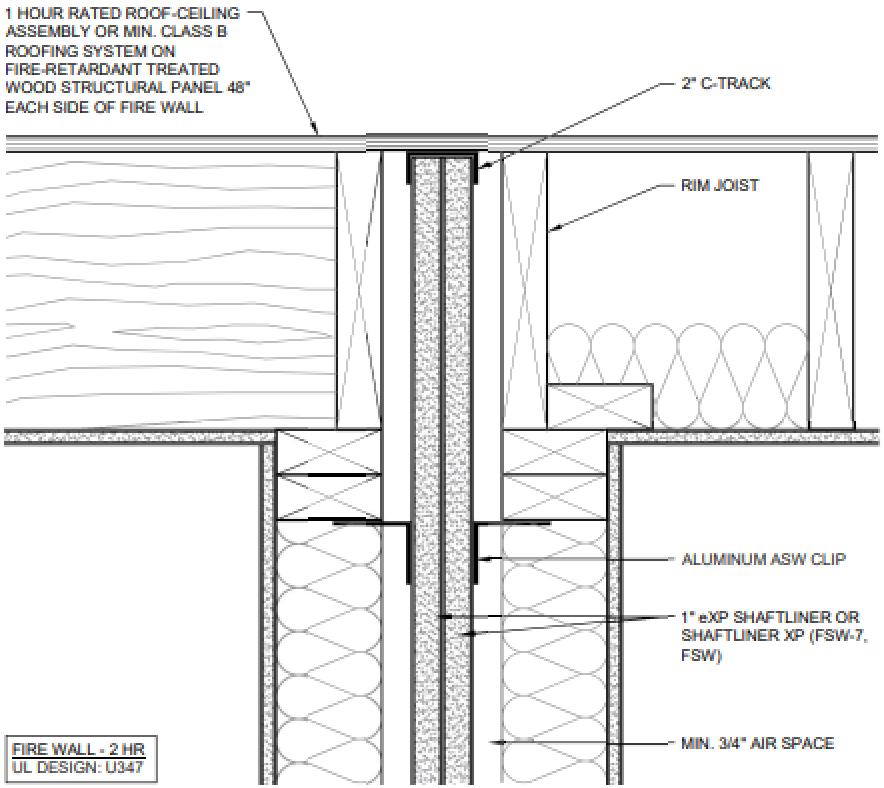
2 HOUR FIRE WALL AT TRUSS ROOF INTERSECTION

AREA SEPARATION WALL DETAIL: ASW 203



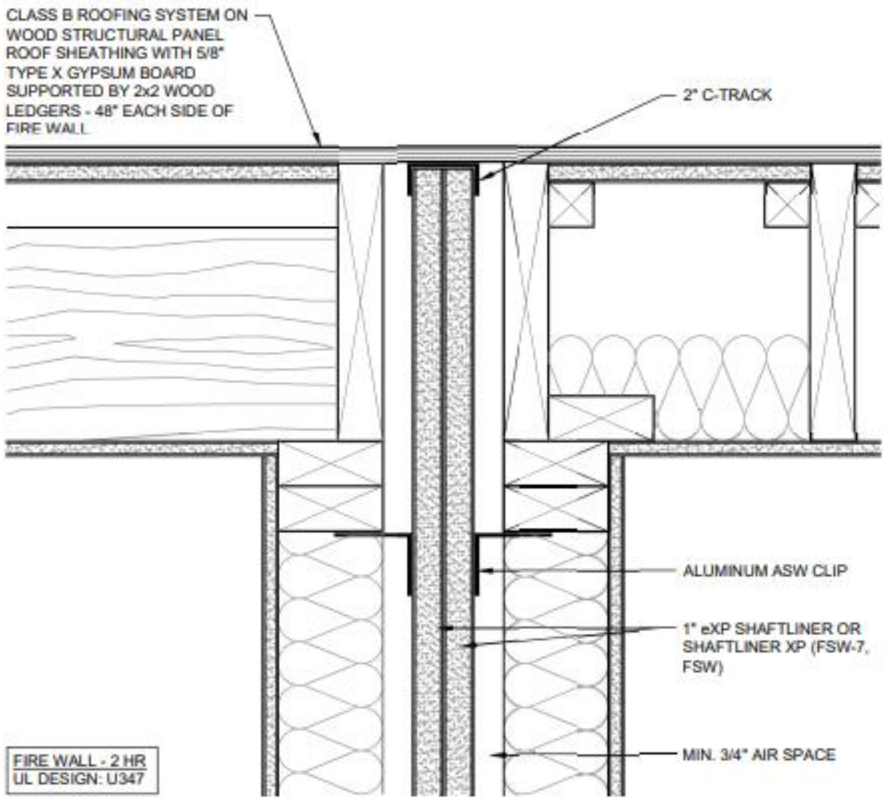
DATE: 01/13/22	2 HOUR FIRE WALL AT ROOF INTERSECTION	National Gypsum
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 204	

102



DATE: 01/13/22	2 HOUR FIRE WALL AT ROOF INTERSECTION	National Gypsum.
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 205	

103



CLASS B ROOFING SYSTEM ON WOOD STRUCTURAL PANEL ROOF SHEATHING WITH 5/8" TYPE X GYPSUM BOARD SUPPORTED BY 2x2 WOOD LEDGERS - 48" EACH SIDE OF FIRE WALL

2" C-TRACK

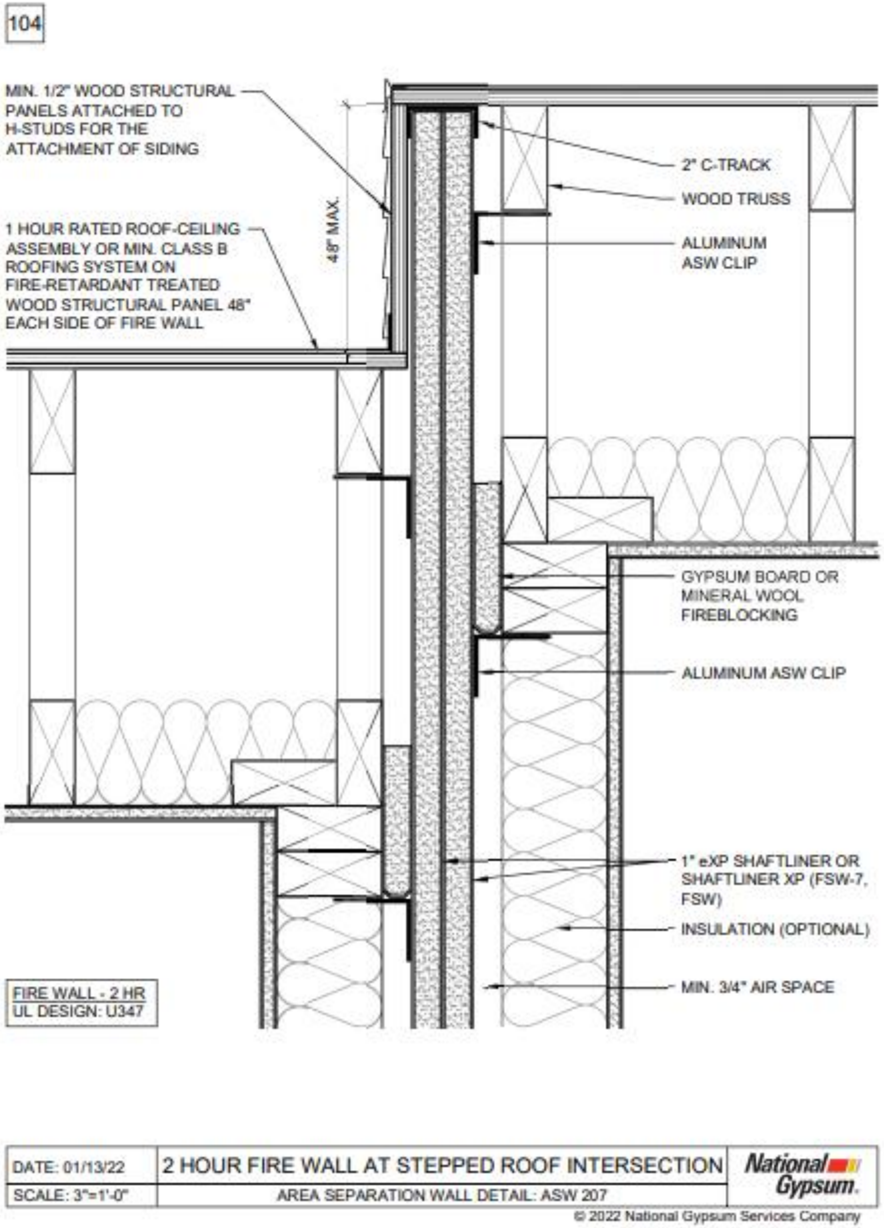
ALUMINUM ASW CLIP

1" eXP SHAFTLINER OR SHAFTLINER XP (FSW-7, FSW)

MIN. 3/4" AIR SPACE

FIRE WALL - 2 HR
UL DESIGN: U347

DATE: 01/13/22	2 HOUR FIRE WALL AT ROOF INTERSECTION	National Gypsum
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 206	



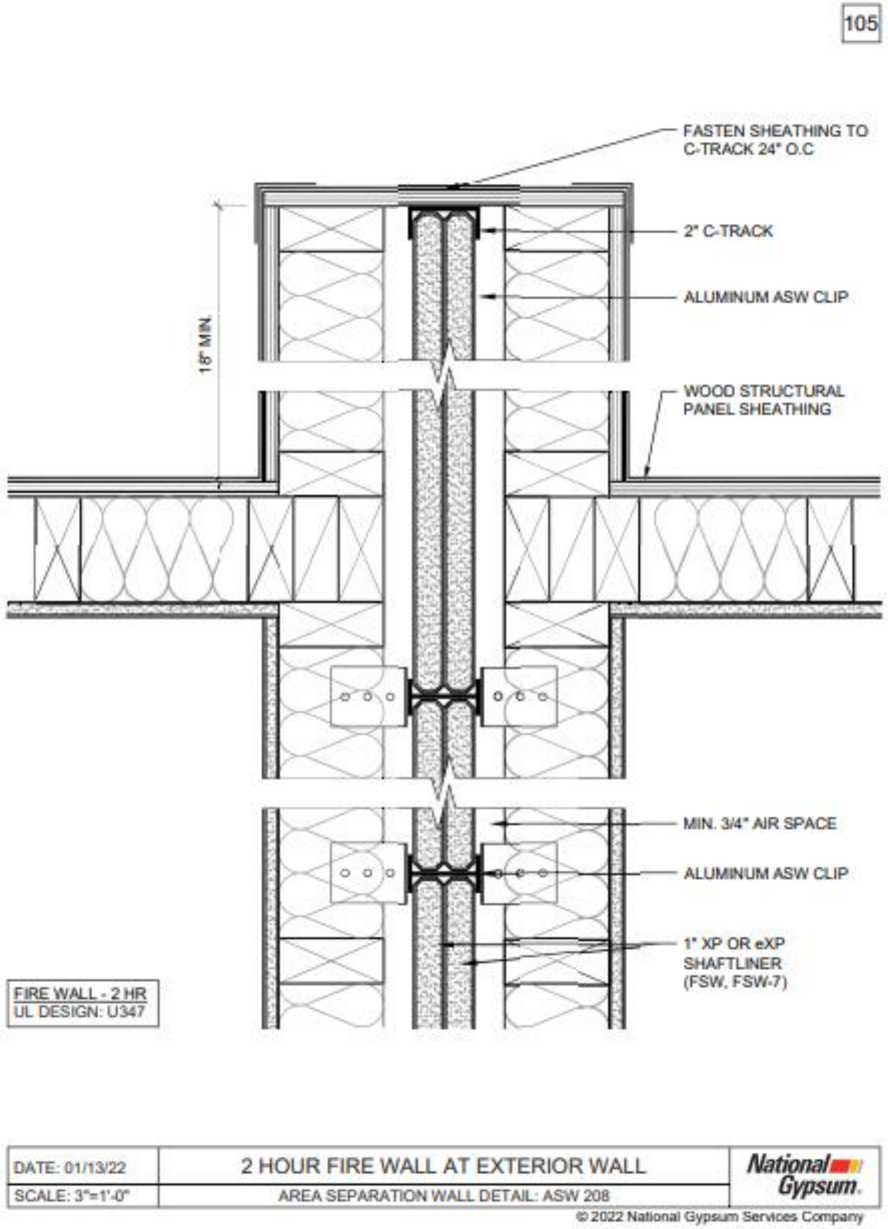
DATE: 01/13/22

SCALE: 3"=1'-0"

2 HOUR FIRE WALL AT STEPPED ROOF INTERSECTION

AREA SEPARATION WALL DETAIL: ASW 207

National Gypsum

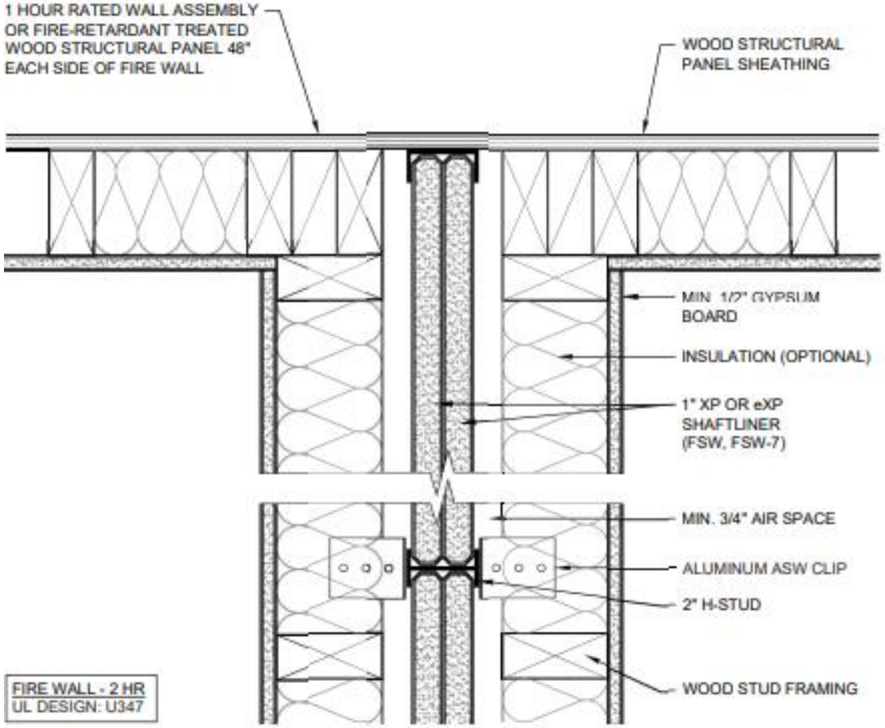


DATE: 01/13/22

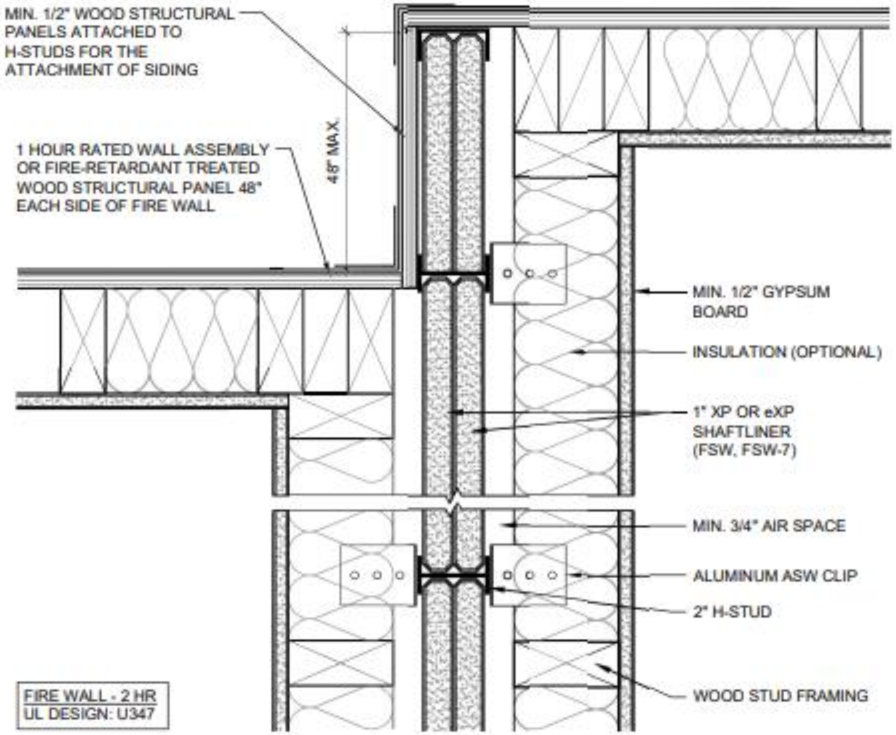
SCALE: 3"=1'-0"

2 HOUR FIRE WALL AT EXTERIOR WALL

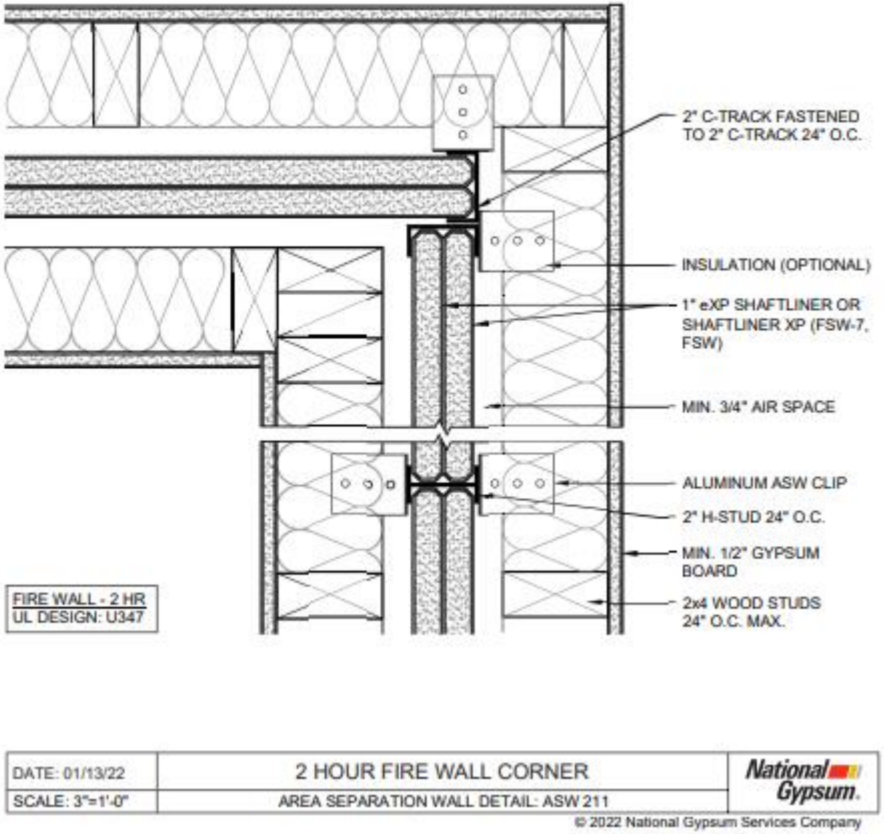
AREA SEPARATION WALL DETAIL: ASW 208



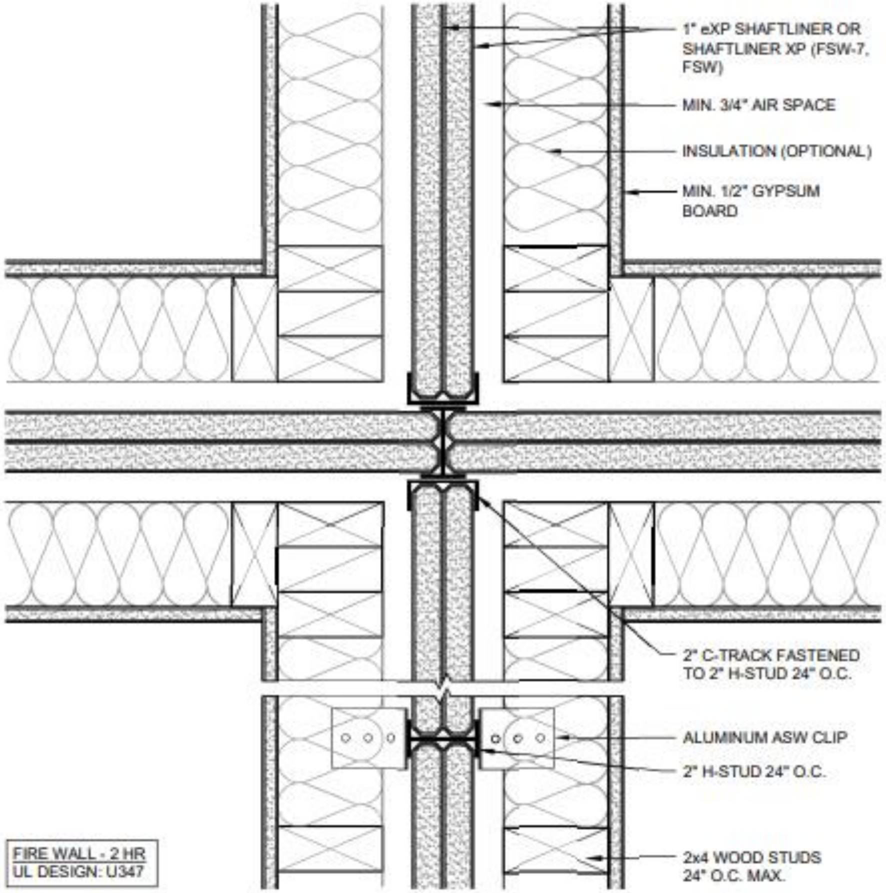
DATE: 01/13/22	2 HOUR FIRE WALL AT EXTERIOR WALL	National Gypsum
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 209	



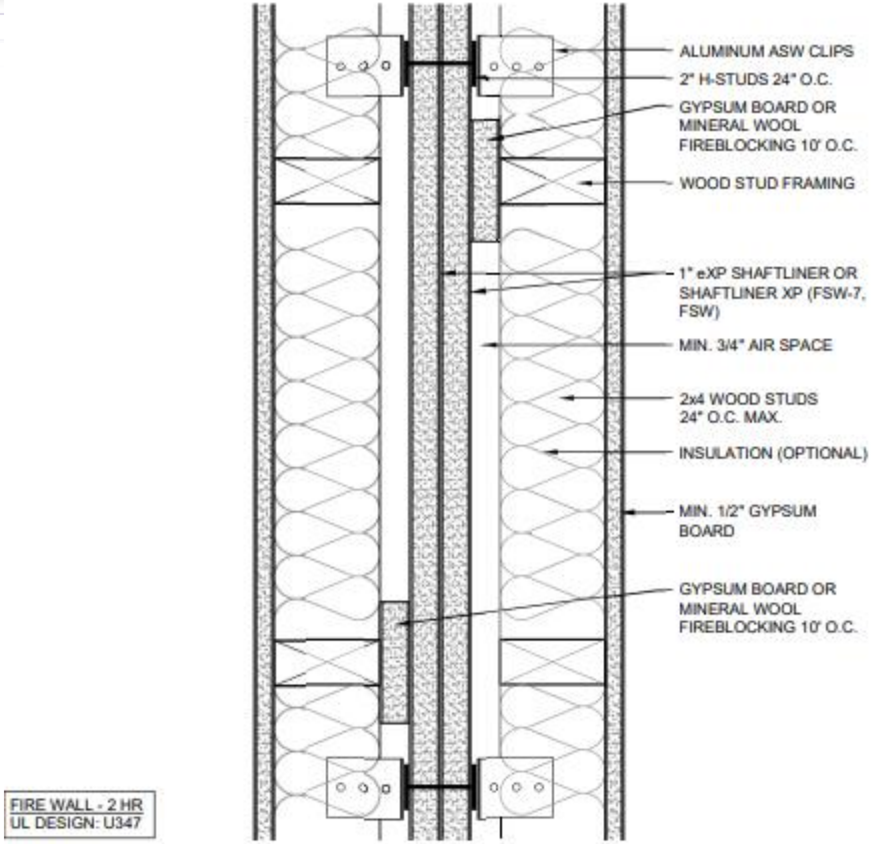
DATE: 01/13/22	2 HOUR FIRE WALL AT OFFSET EXTERIOR WALL	National Gypsum
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 210	



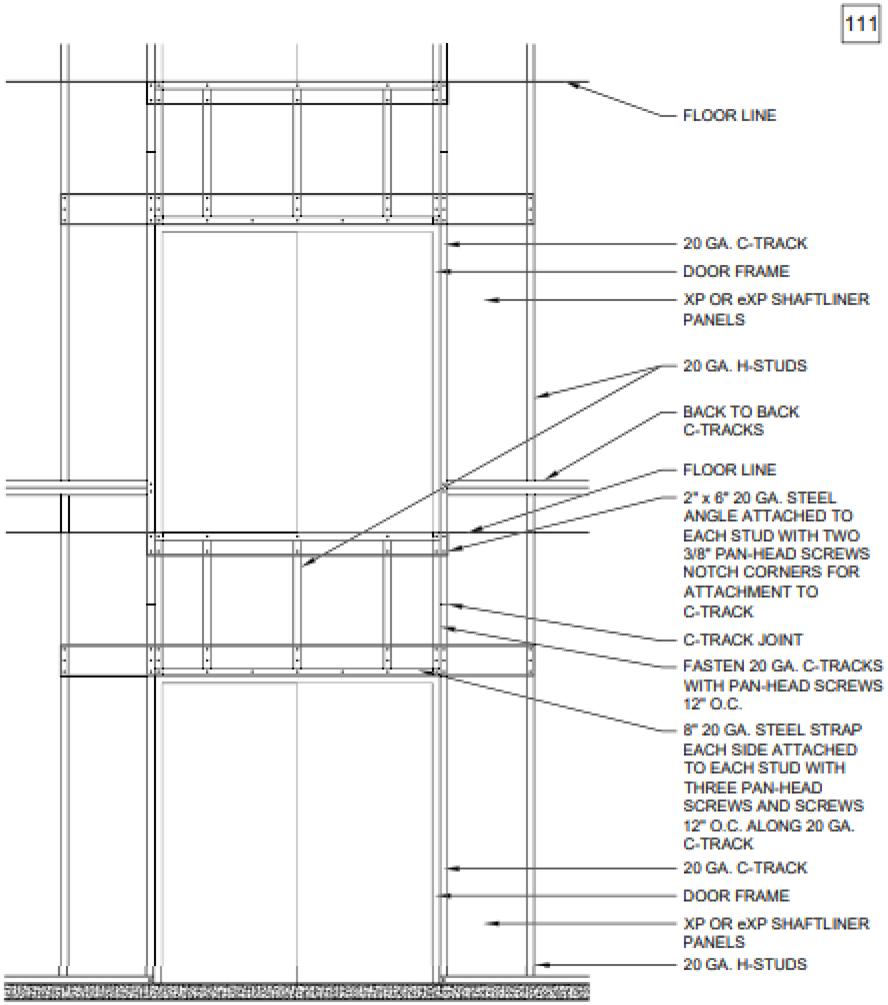
DATE: 01/13/22	2 HOUR FIRE WALL CORNER
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 211



DATE: 01/13/22	2 HOUR FIRE WALL INTERSECTION	National Gypsum
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 212	



DATE: 01/13/22	2 HOUR FIRE WALL FIREBLOCKING PLAN	National Gypsum
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 213	



DATE: 01/13/22

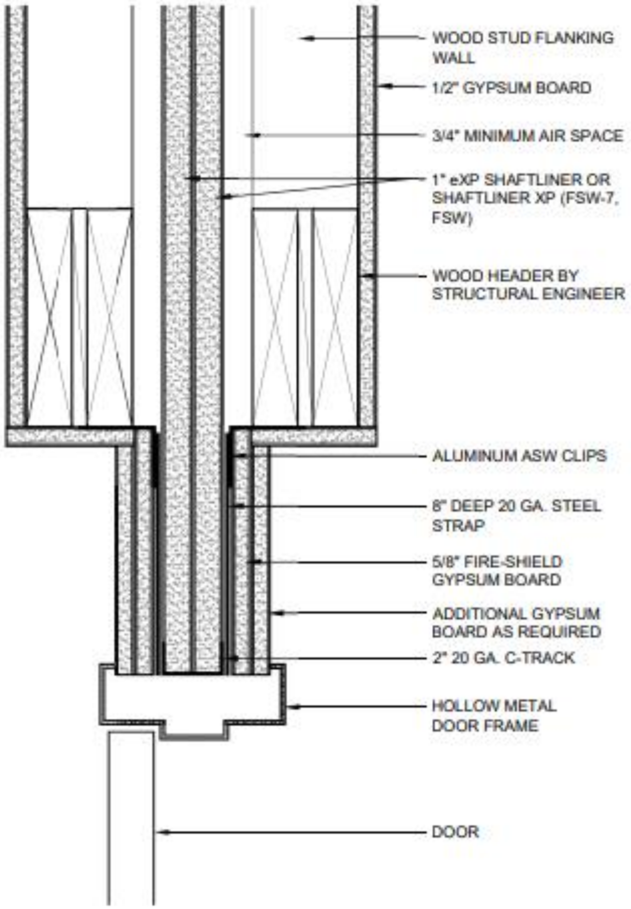
SCALE: 3/8"=1'-0"

AREA SEPARATION WALL FRAMING AT DOORS

UL DESIGN U347 - DETAIL: ASW 214

National Gypsum

112



FIRE WALL - 2 HR
UL DESIGN: U347

DATE: 01/13/22	2 HOUR FIRE WALL AT DOOR HEAD	National Gypsum
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 215	

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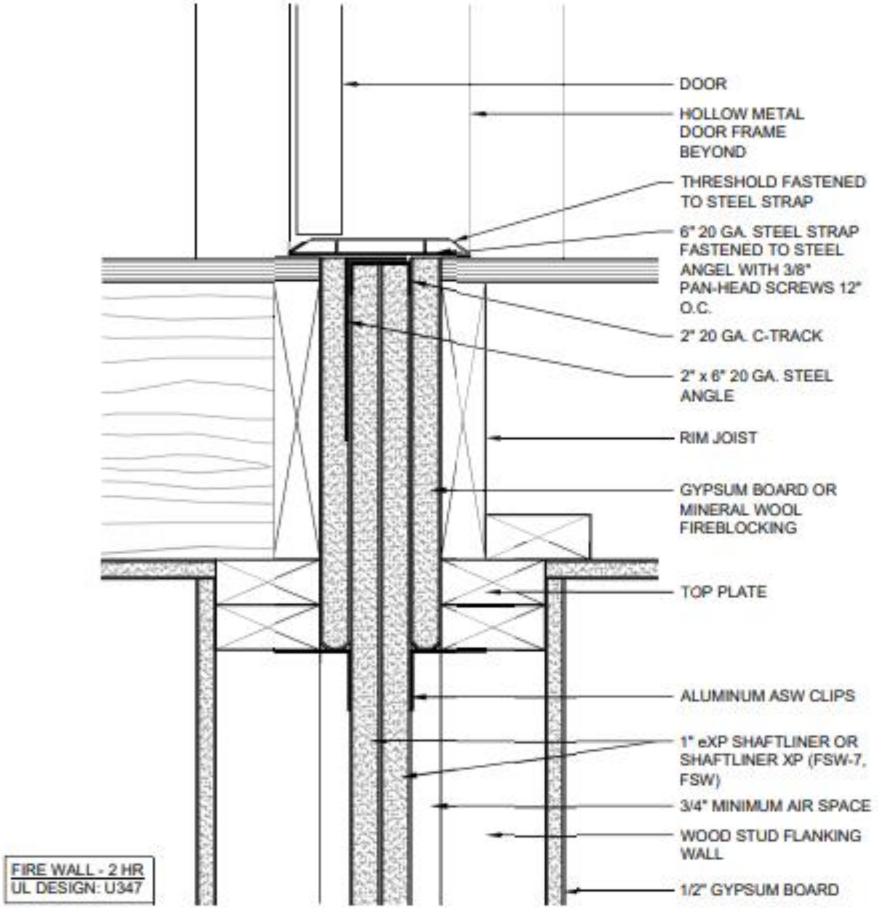


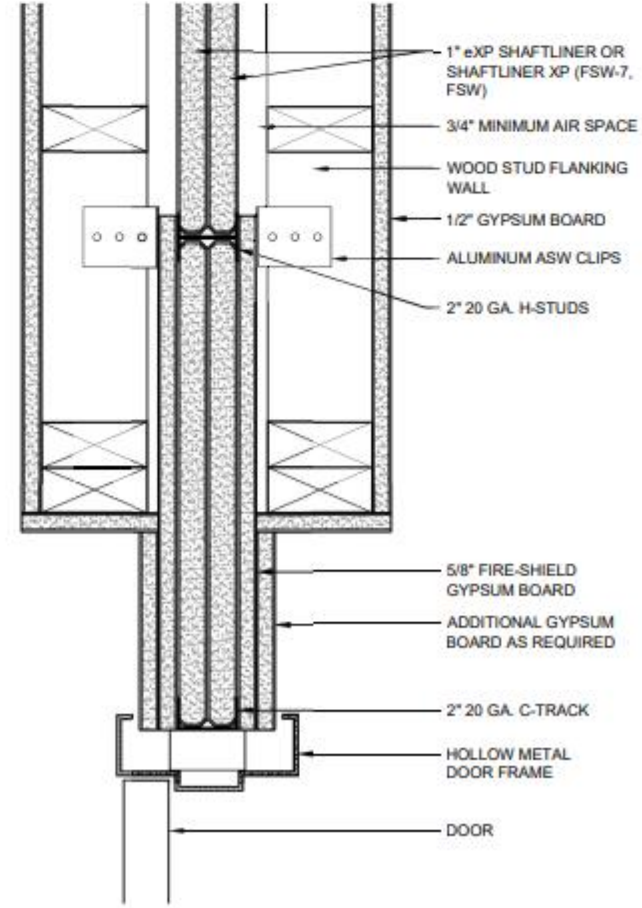
DATE: 01/13/22
SCALE: 3"=1'-0"

2 HOUR FIRE WALL AT DOOR SILL

AREA SEPARATION WALL DETAIL: ASW 216

National Gypsum

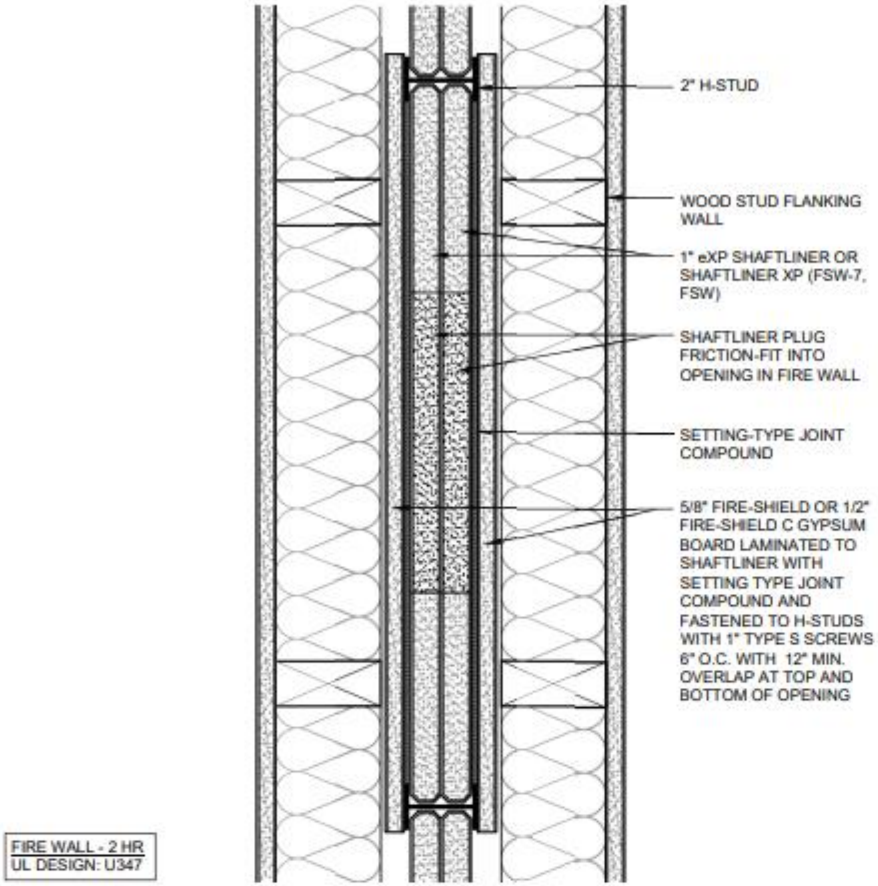
114



FIRE WALL - 2 HR
UL DESIGN: U347

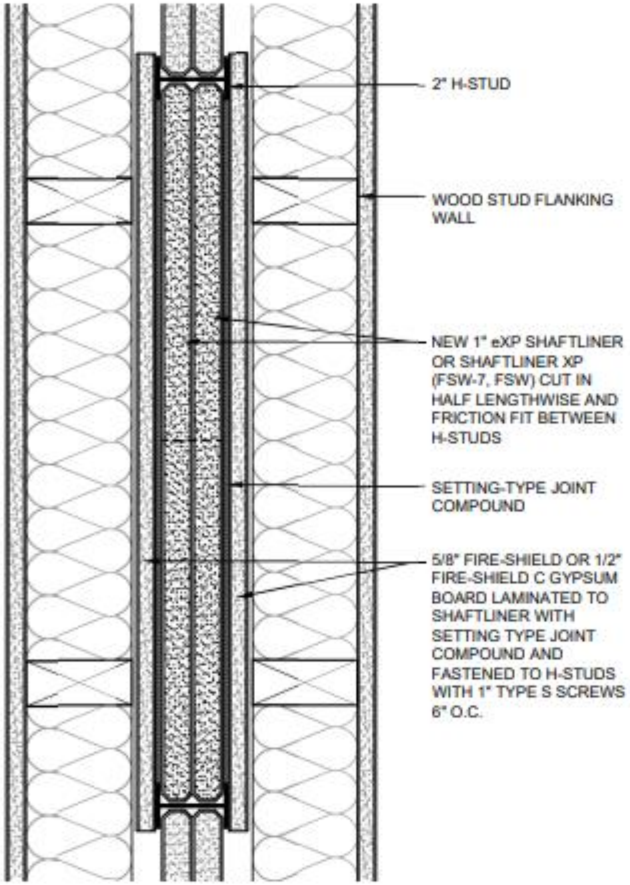
DATE: 01/13/22	2 HOUR FIRE WALL AT DOOR JAMB	National Gypsum.
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 217	

115



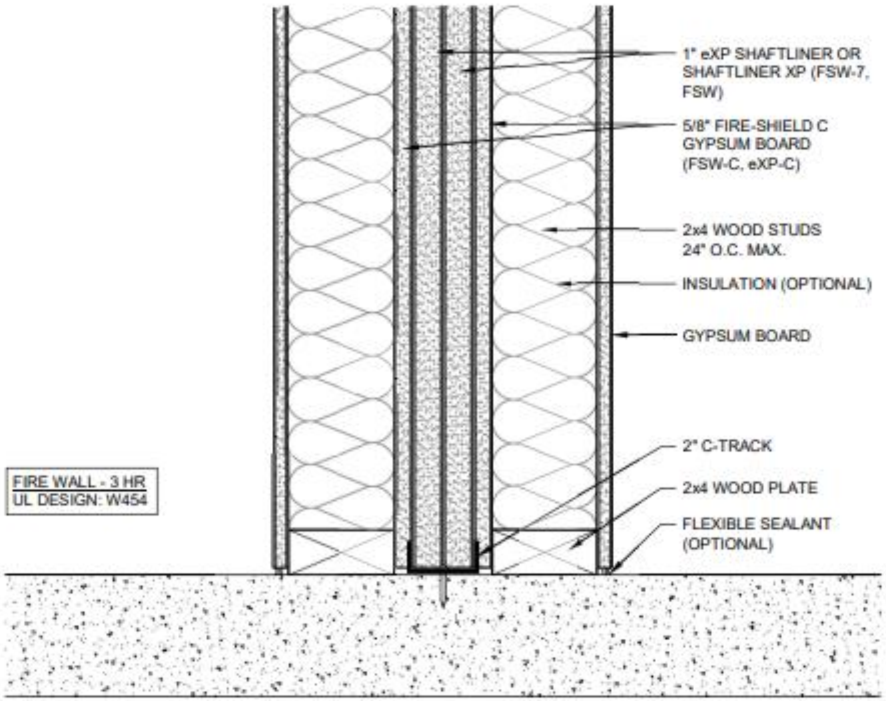
DATE: 01/13/22	2 HOUR FIRE WALL HOLE REPAIR	National Gypsum
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 218	

116

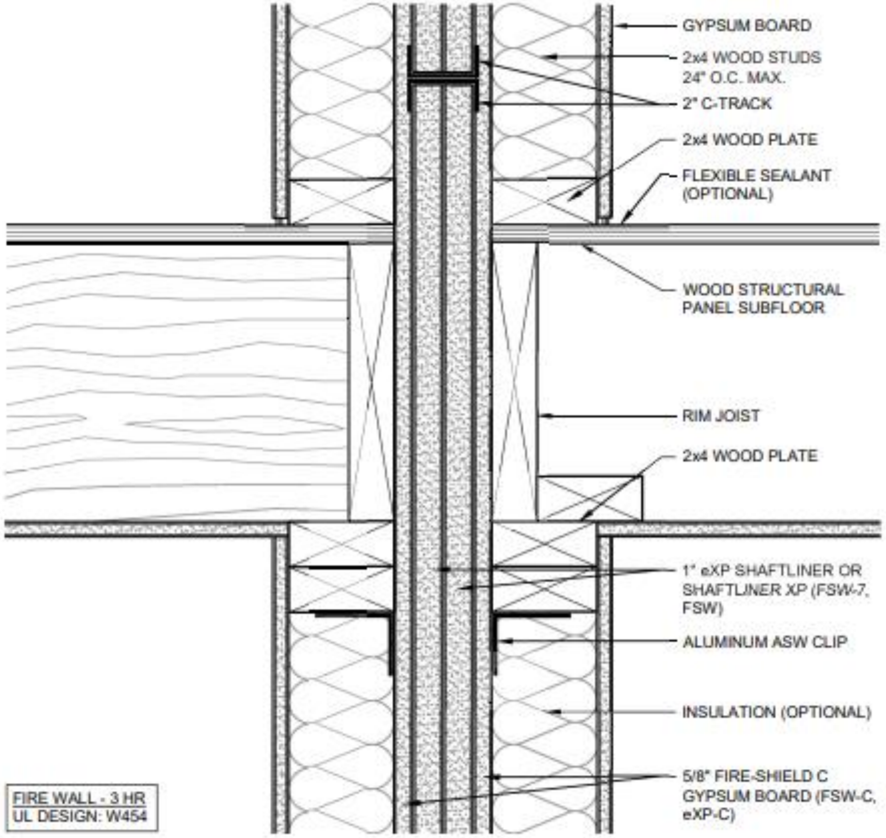


FIRE WALL - 2 HR
UL DESIGN: U347

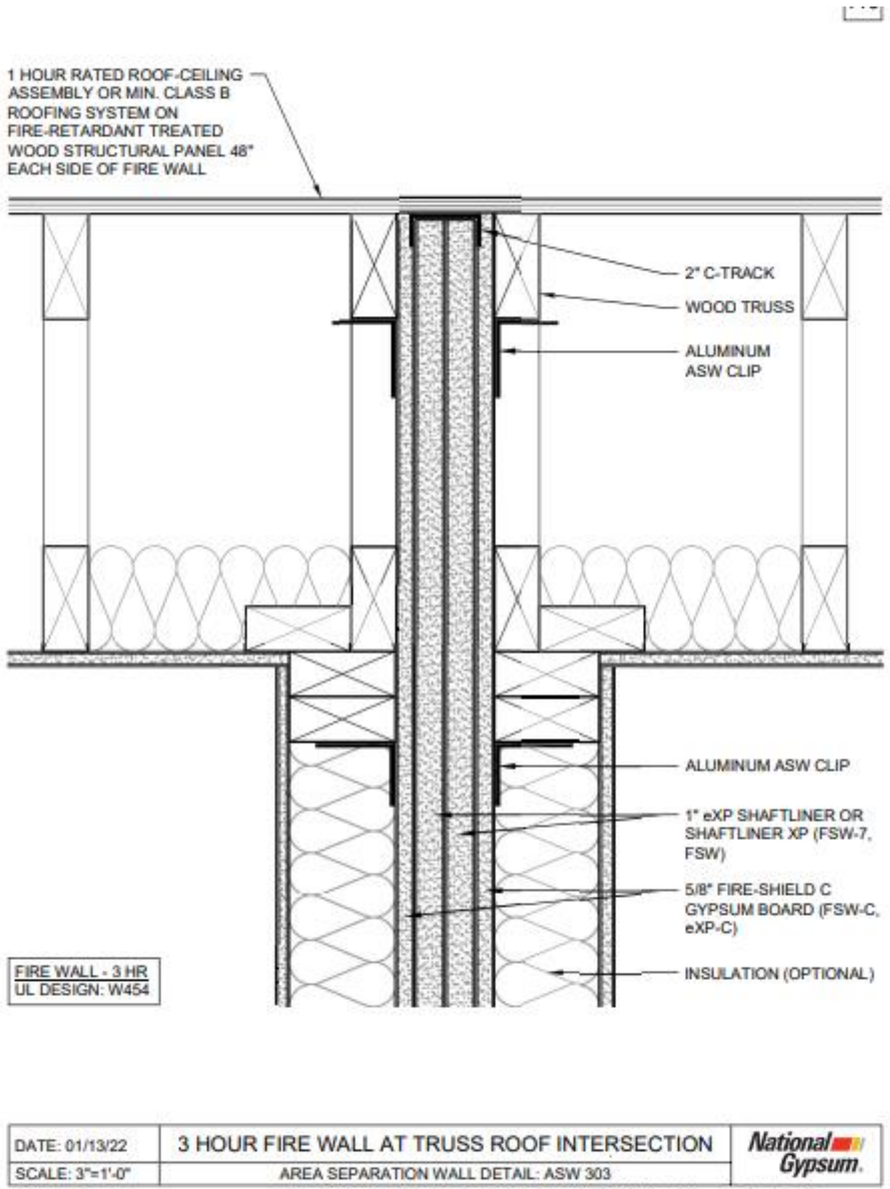
DATE: 01/13/22	2 HOUR FIRE WALL SHAFTLINER REPLACEMENT	National Gypsum
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 219	



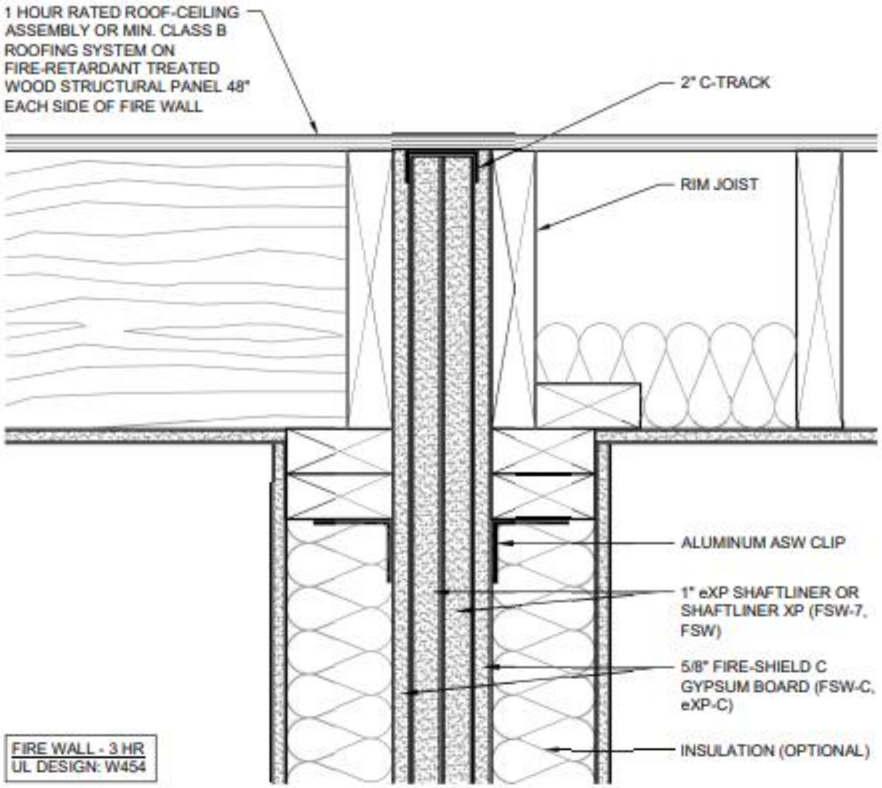
DATE: 01/13/22	3 HOUR FIRE WALL AT FOUNDATION	National Gypsum.
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 301	



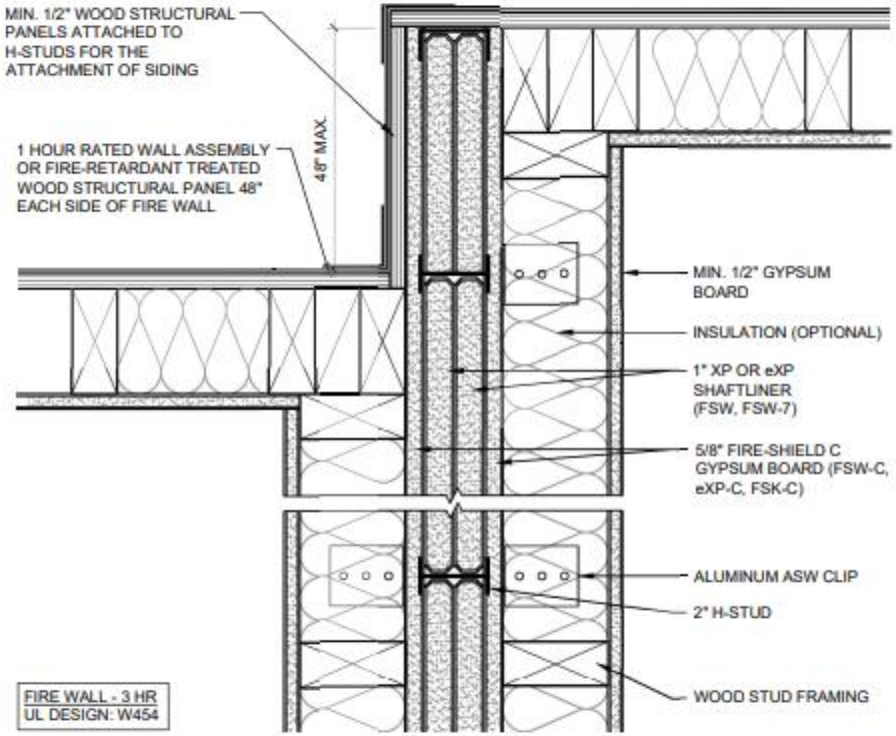
DATE: 01/13/22	3 HOUR FIRE WALL AT FLOOR INTERSECTION	National Gypsum
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 302	



DATE: 01/13/22	3 HOUR FIRE WALL AT TRUSS ROOF INTERSECTION
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 303



DATE: 01/13/22	3 HOUR FIRE WALL AT ROOF INTERSECTION	National Gypsum.
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 305	



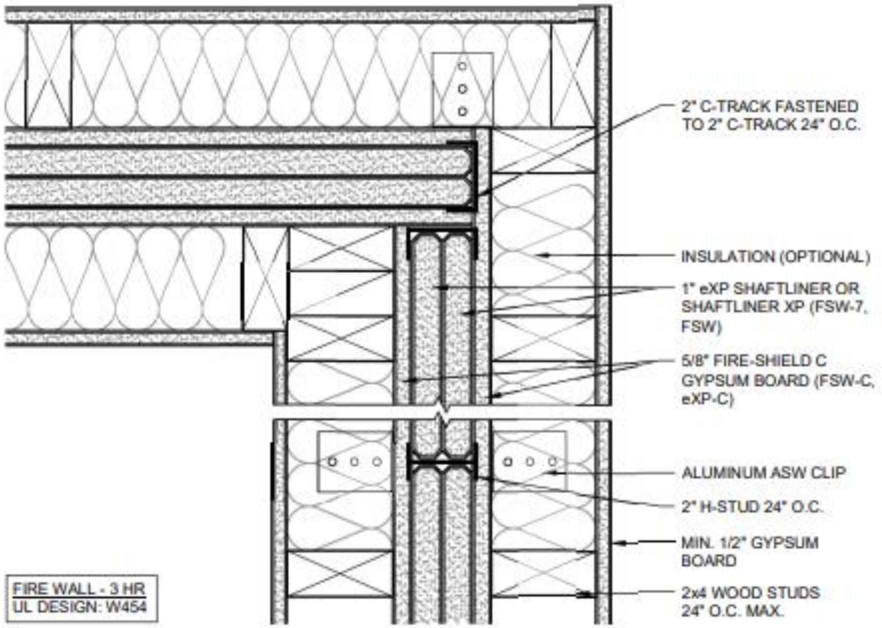
DATE: 01/13/22

SCALE: 3"=1'-0"

3 HOUR FIRE WALL AT OFFSET EXTERIOR WALL

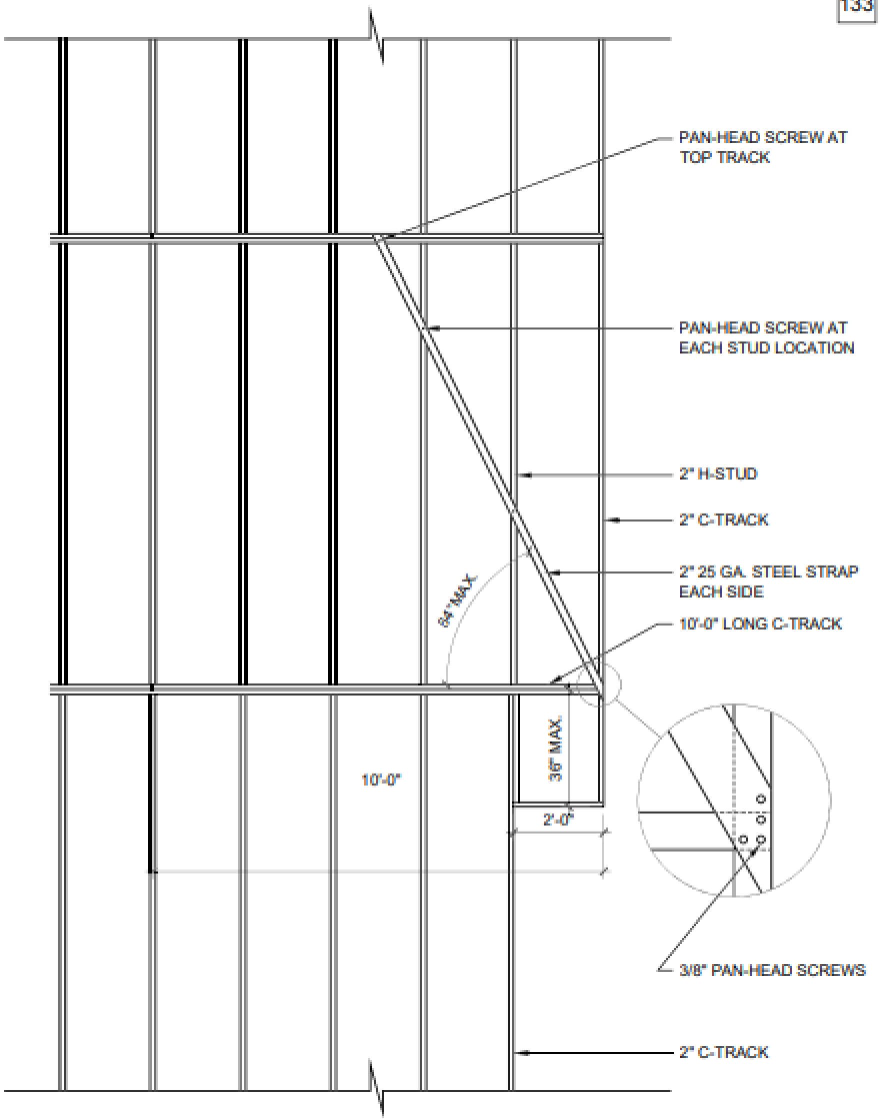
AREA SEPARATION WALL DETAIL: ASW 310

National Gypsum.



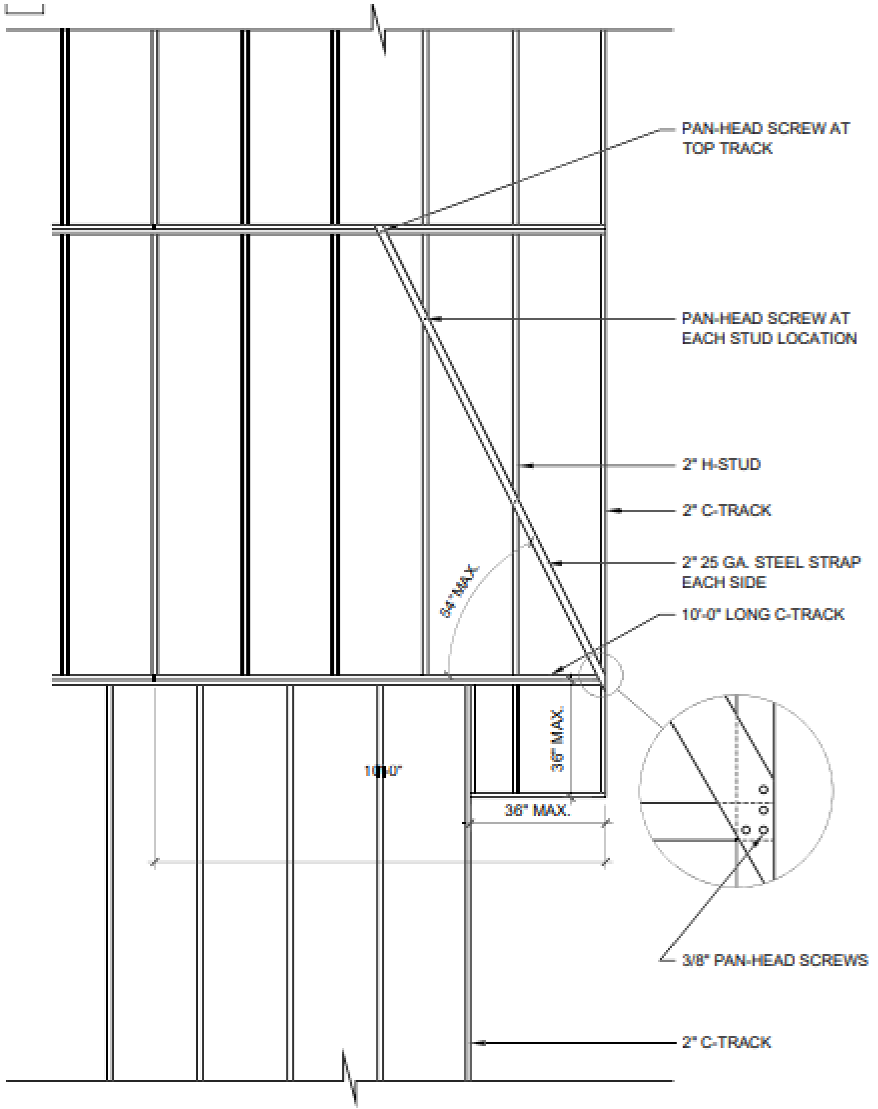
DATE: 01/13/22	3 HOUR FIRE WALL CORNER	National Gypsum
SCALE: 3"=1'-0"	AREA SEPARATION WALL DETAIL: ASW 311	

133



DATE: 01/13/22	24" AREA SEPARATION WALL CANTILEVER DETAIL
SCALE: 3/8"=1'-0"	UL DESIGNS U347 AND W454 - DETAIL: ASW 501

National Gypsum.



DATE: 01/13/22	36" AREA SEPARATION WALL CANTILEVER DETAIL	National Gypsum
SCALE: 3/8"=1'-0"	UL DESIGNS U347 AND W454 - DETAIL: ASW 501	

Gold Bond®
Building Products

PermaBASE®
Building Products

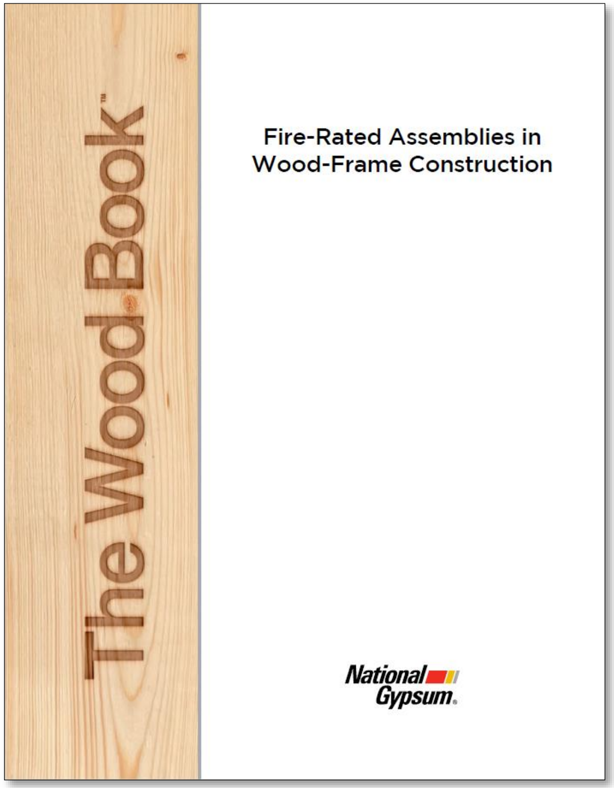
National
Gypsum®

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.

Technical resources | The Wood Book



The Wood Book™ highlights include:

- Fire-rated UL designs for all wood-frame walls, floor-ceiling, and roof-ceiling assemblies
- Head-of-wall and rim joist details for the intersections of walls and floor-ceiling assemblies
- Multiple design options for mechanical, elevator, and stair shaft enclosures
- New area separation wall details including egress door installations

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

UPDATED Fire Rated
Assemblies
→ UL Designs

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

File Attachments for Item:

ER-5 Ohio Automatic Sprinkler and Standpipe Systems (new version, Fire Tech Productions)

All commercial certifications except PPE, PI, and MI (12.5 hours)

Staff Notes: Recommend expanded references to 2017 OBC Chapter 9, inclusion of PPE, PI and MI.

Committee Recommendation:

Fire Tech Productions - Ohio Course Submission

Included in this document: Course Outline, Instructor resume(s)

Course: Ohio Automatic Sprinkler & Standpipe Systems - SSOH 102 2016

Course Outline:

1. Welcome
2. Ohio Sprinkler Introduction
3. Classification of Occupancies
4. Types of Sprinkler Systems and Sprinklers
5. Sprinkler System Components
6. Sprinkler Installation Requirements
7. Sprinkler Design and Acceptance Testing
8. Residential Scope and Definitions
9. NFPA 13D Requirements
10. NFPA 13R Requirements
11. Standpipe Terms and Definitions
12. Standpipe Components
13. Standpipe Installation & Design
14. ITM of Fire Protection Systems, Obstructions, Impairments
15. ITM Valves
16. Ohio Fire Codes for Sprinklers and Standpipes
17. Glossary

Instructor Resume: Tom Doty

THOMAS DOTY
21 Meadowcrest Dr.
Franklin, OH 45005
937-434-3473
tom@firetech.com

Seasoned fire protection professional following strong adherence to the codes and top-notch attention to customer service.

Certifications include: Sprinkler/Standpipe • Fire Alarm and Detection Systems • Fire Pumps • Fire Service Mains • Portable Fire Extinguishers • Pre-Engineered Extinguishers – OTW • State of Kentucky Certified

PROFESSIONAL EXPERIENCE

- CertaSite, 2801 Thunderhawk Court, Dayton, Ohio 45414
  Installation Manager - 2021- Present

- Fire Tech Productions, Inc., 7986B Clyo Rd., Centerville, Ohio 45459
  President - 2015 - 2022

Instructor/Developer - 2015 - Present

- Craynon Fire Protection Inc., 2801 Thunderhawk Court, Dayton, Ohio 45414
  Partner/Vice-President – 2011 – 2021
  Operations Manager -- 12/11/2005 – 2021

- Guardian Fire Protection, 480 Randy Lane, Monroe, Ohio 45050
  Owner – 11/30/2003 – 12/11/2005

- Sprinkler Inspection Services, Inc., 8 Perkins Drive, Alexandria, KY 41001
  Superintendent / Operations Manager – 10/07/1995 – 11/30/2003

- Bestol Plumbing Company, P.O. Box 4192, Branson, MO
  Foreman – 2/1995 – 10/1995

- Grinnell Fire Protection Systems, Inc., San Diego, CA
  Service Foreman – 8/1993 – 2/1995

- Advanced Fire Protection Company, 1657 Monte Vista Drive, Vista, CA 92084
  Owner – 10/1990 – 8/1993

- Ryan Automatic Sprinkler Company, San Marcos, CA
  Superintendent – 4/1988 – 10/1990

- Vanguard Fire Protection, Carlsbad, CA
  Foreman – 3/1985 – 4/1988

- Sentinel Fire Protection, San Diego, CA -- 8/1983 – 3/1985
- Local Union 669 – 5/1981 – 8/1983
- Local #821, Central Florida – 4/1980 – 5/1981
- American Automatic Fire Protection – 1/1979 – 4/1980
- Illinois Central Gulf Railroad – 4/1978 – 12/1978
- Orlando Automatic Sprinkler Company – 10/1976 – 3/1978

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.

[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: Julie Miller
(Contact Name)
Organization: Fire Tech Productions
(Organization/Company)
Address: 7976 Clyo Rd.
(Include Room Number, Suite, etc.)
City: Centerville State: OH Zip: 45459
E-Mail: julie@firetech.com
Telephone: 937.434.3473 Fax: NA
Course Sponsor:

COURSE INFORMATION:

Course Title: Ohio Automatic Sprinkler & Standpipe Systems - SSOH 102 2016

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

Purpose and Objective: This Automatic Sprinkler & Standpipe online self paced course provides training for the state of Ohio's Automatic Sprinkler & Standpipe Certification exam so you can pass your test on the first attempt! Based on NFPA 13 2016, NFPA 13D and 13R 2016, NFPA 14 2016 and NFPA 25 2014, as well as the Ohio Fire Code 2017.

Number of Instructional Contact Hours that can be obtained upon completion: 12.5

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	
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.

Ohio Automatic Sprinkler & Standpipe Systems - Introduction

Welcome!
This introduction provides a brief overview of what will be covered in the course.

You can come back to this module and reference this information anytime in your menu.

Topics that are covered in this introduction are as follows:

- Key references
- Preparing for the Exam
- Study Tips
- ***NFPA*** 13 2016 Definitions

When you are ready to begin, click on the button above to start the course.

Overview

Glossary

Lesson 1 of 2

Overview

Welcome

Please review this introduction before getting started on the course.

We will look at key references and study tips. In addition, we will highlight key vocabulary terms in the glossary.

REFERENCES

Key References

As you work through this course, it is important to refer to your standards as the following references will be discussed.

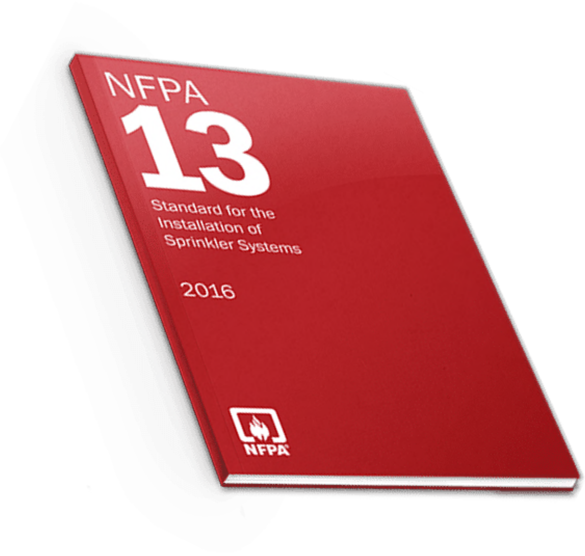
OHIO FIRE CODE
NFPA 13
NFPA 13D
NFPA 13R

The **Ohio Fire Code, 2017**, establishes state fire marshal rules for the administration and enforcement of authorities. These rules govern the occupancy and maintenance of all structures and premises for precautions against fire and the spread of fire and general requirements of fire safety.

The Ohio Fire Code can be accessed through this link: https://codes.iccsafe.org/content/OHFCJAN2019E/ohio-administrative-code-1301-7-7-09-fire-protection-systems

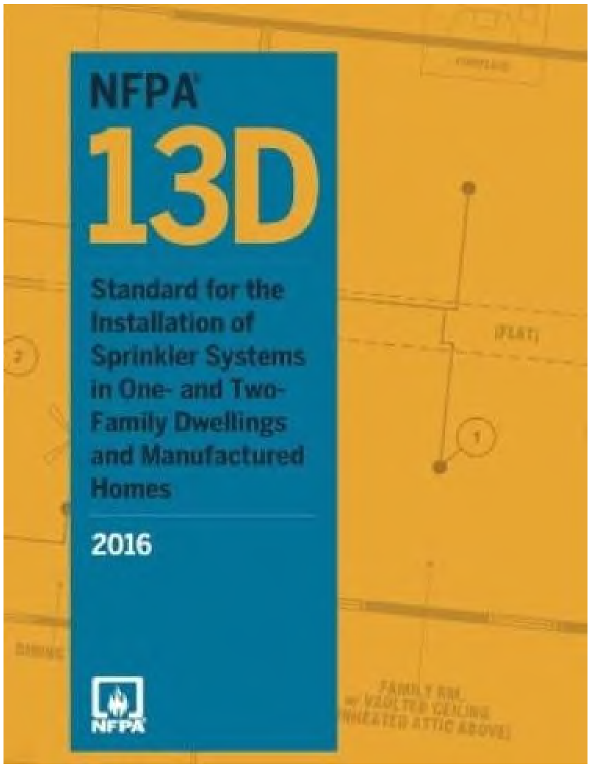
OHIO FIRE CODE NFPA 13 NFPA 13D NFPA 13R

NFPA **13 2016:** ***Standard for the Installation of Sprinkler Systems*** provides the minimum requirements for the design and installation of automatic fire sprinkler systems and exposure protection sprinkler systems covered within this standard.



OHIO FIRE CODE NFPA 13 NFPA 13D NFPA 13R

NFPA **13D 2016:** ***Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*** covers the design, installation, and maintenance of automatic sprinkler systems for protection against fire hazards in one- and two-family dwellings and manufactured homes.

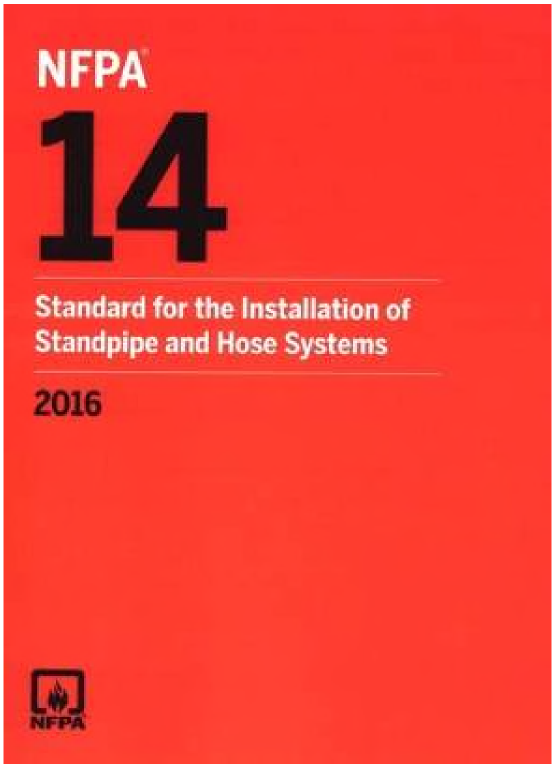


OHIO FIRE CODE | NFPA 13 | NFPA 13D | NFPA 13R

NFPA **13R 2016:** ***Standard for the Installation of Sprinkler Systems In Low-Rise Residential Occupancies*** cover the design and installation of automatic sprinkler systems for protection against fire hazards in residential occupancies up to and including four stories in height in buildings not exceeding 60 ft (18 m) in height above grade plane.

OHIO FIRE CODE
NFPA 13
NFPA 13D
NFPA 13R

NFPA* 14 2016: *Standard for the Installation of Standpipe and Hose Systems covers the minimum requirements for the installation of standpipes and hose systems.



NFPA
14
Standard for the Installation of
Standpipe and Hose Systems
2016

OHIO FIRE CODE

NFPA 13

NFPA 13D

NFPA 13R

NFPA* 25 2014: *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems establishes the minimum requirements for the periodic inspection, testing, and maintenance of water-based fire protection systems and the actions to undertake when changes in occupancy, use, process, materials, hazard, or water supply that potentially impact the performance of the water-based system are planned or identified.

The *NFPA* standards contain several Annexes with valuable examples and information. It is recommended you study this material as well.

OHIO CODES

Ohio Codes

The Ohio Building Code has a lot of information in it. However, only a relatively small portion of the code pertains to fire sprinkler systems. It ***does*** give the State Fire Marshal the responsibility for administration and enforcement of any matter related to the installation, repair, modification or removal of fire protection equipment.

The Ohio Fire Code states that automatic sprinkler and standpipe systems shall be installed, inspected, tested, and maintained per *NFPA* 13 2016 and *NFPA* 25 2014. The code also defines specific rules for Ohio as well as reinforce some of the *NFPA* 13 2016 requirements.

- One of these requirements is to be certified and licensed by the state of Ohio.
- The only exception is for a provisional person in an approved formal apprenticeship program. They are permitted to work under the constant supervision of a certified person. The certified person is only allowed to supervise one provisional person.

CONTINUE

Additional Resources

Below is additional information and resources for the Ohio exam.

Ohio Department of Commerce – Division of State Fire Marshal:

Ohio Department of Commerce

To access the Ohio Department of Commerce – Division of State Fire Marshal, click on this "Click Here" button.

CLICK HERE

Ohio Department of Commerce phone: **(614) 752-7126**

The following downloadable PDF is for the Fire Protection Exam Application through the Ohio Department of Commerce:

PDF

FireProtectionExamApplication.pdf
548.9 KB

PSI Candidate Information Bulletin

A very important source of information is the PSI Candidate Information Bulletin from PSI Services LLC. Take time to read it below in its **ENTIRETY**.

PDF

OhioCertificationExaminationBulletin.pdf
230.9 KB

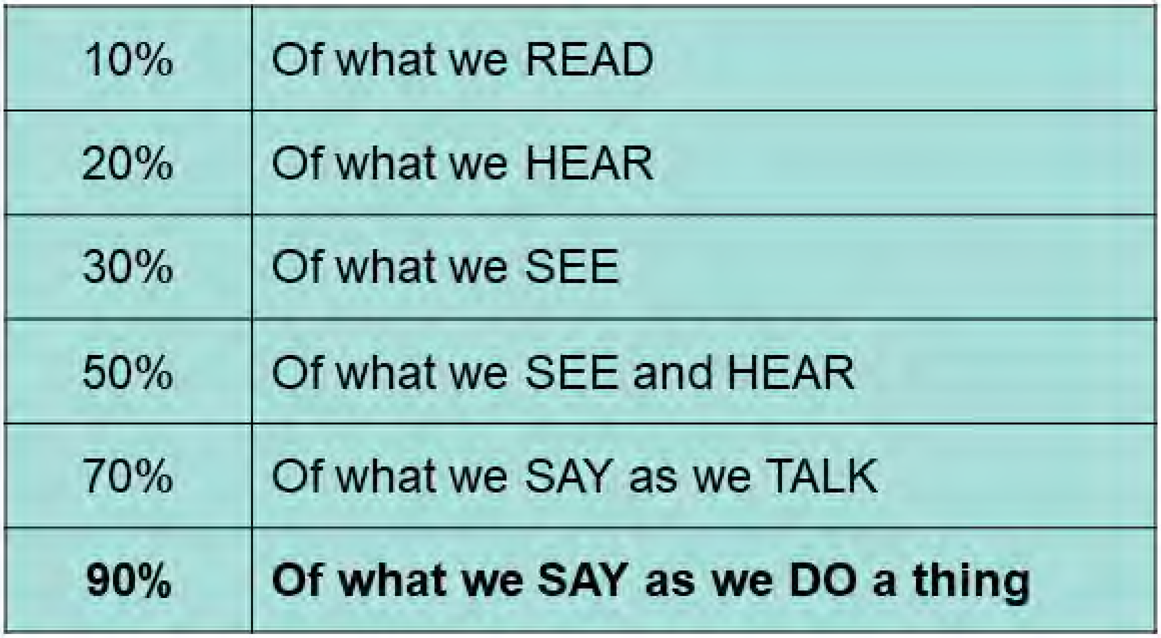
PSI Online Exams

To check for the most updated information on PSI Services, visit their website by clicking on this "Click Here" button.

CLICK HERE

HOW WE LEARN

Thinking about How We Learn



10%	Of what we READ
20%	Of what we HEAR
30%	Of what we SEE
50%	Of what we SEE and HEAR
70%	Of what we SAY as we TALK
90%	**Of what we SAY as we DO a thing**

Source: ***Skill With People*** by Les Giblin

Different people learn in different ways.

It is important to discover what works **best for you** and use your strengths to ensure you retain the material.

TRAINING MODULES

Training Modules

As you are studying, be prepared to **refer to your copy of the referenced *NFPA* standards constantly** throughout these modules. Be comfortable with the technical material.

Each training module is carefully planned and designed to **highlight areas of the standards that you need to know in order to increase your chances of success on the exam.** The goal of these training modules is to help you become knowledgeable of important areas of the standards and to gain a working understanding of how to apply these requirements on the job.

Take notes as you are studying, and **highlight** areas of the standards that are important to know.

The more familiar you are with the requirements, tables, and figures, the better your chances of success on the exam.

QUIZZES

The Quizzes

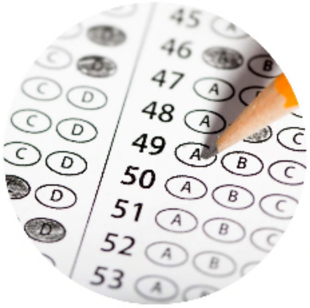
Fire Tech provides a practice quiz associated with each training module, which should be taken following completion of the module. As you take each practice quiz, use your copy of the referenced *NFPA* standards to **look up every answer to each quiz question**. This will assist you in **becoming more familiar with the requirements and where they are located** in each of the codes and standards.

You will achieve the highest chances of success by **learning and understanding the training material.**

Fire Tech ***does not*** recommend that you solely attempt to memorize practice quiz questions. These questions are examples only and do not reflect actual test questions.

Additionally, **read each question carefully**. Sift through what is pertinent to the question and what is irrelevant information that may be included as a distractor.

You will achieve the highest chances of success by learning and understanding the training material. Fire Tech does **not** recommend that you solely attempt to memorize practice quiz questions.



KNOWLEDGE CHECKS

Knowledge Checks

To help you apply course material and prepare for the quizzes, **knowledge checks** are sprinkled throughout each course.

Completing these knowledge checks is **required** to proceed further in the lesson. If you're stuck on a question, refer to previous lesson material and use your NFPA standard to find the answer.

Knowledge checks will help you apply course material and prepare for course quizzes.

○ True

○ False

SUBMIT

Complete the knowledge check above before moving on.

Practice Exams

Once you have read all of the lessons in this course and passed all of the quizzes, you will be ready to take the **Practice Exam**.

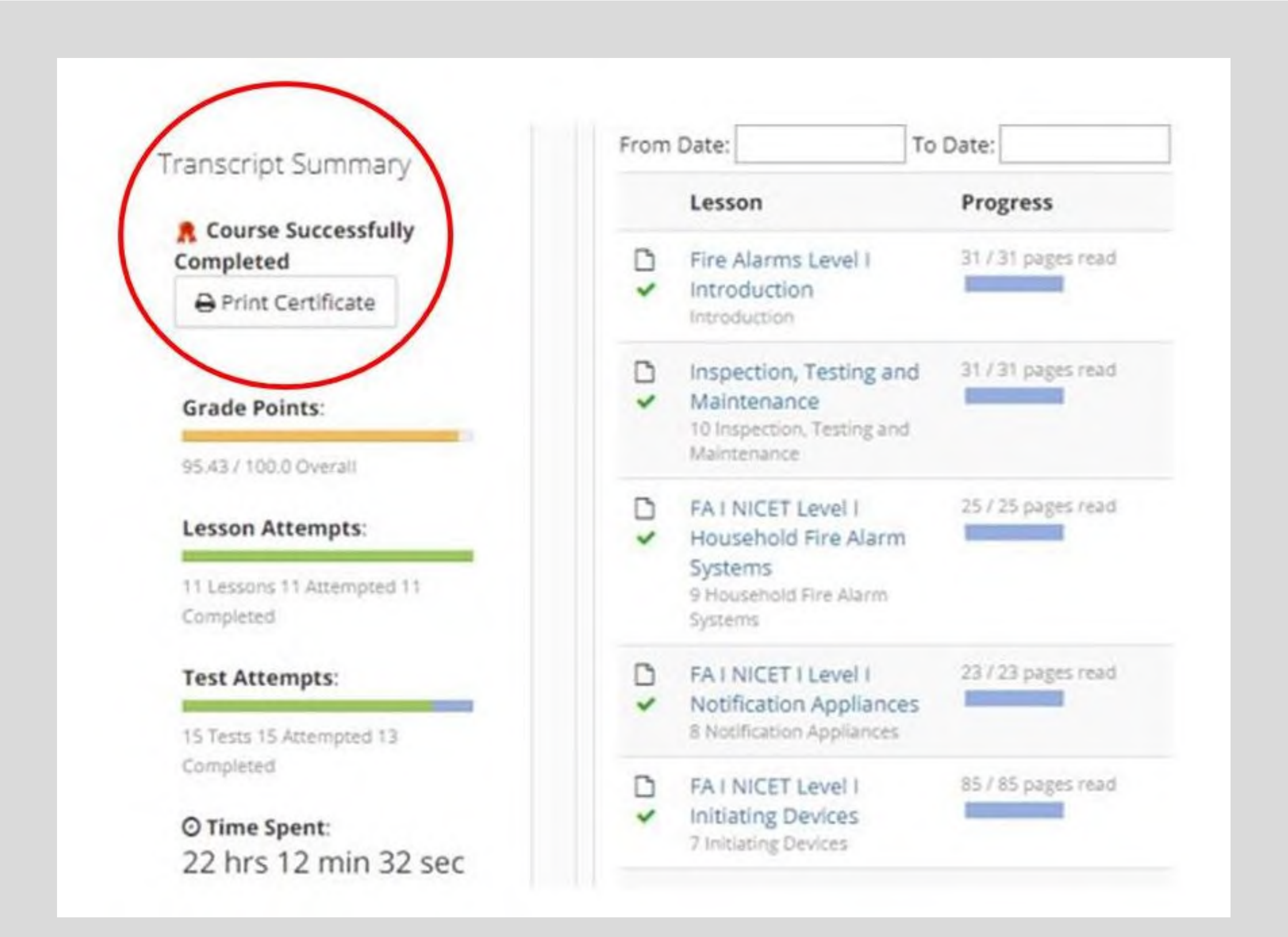
The Practice Exam consists of questions from the quizzes and are presented in a randomized manner. Fire Tech highly recommends that you take each of these practice exams.

Three practice exams are offered:

- Exam #1 is **required** to pass the course
- Exams #2 and #3 are **optional** and are not required to pass the course.

CONTINUE

Course Completion



Transcript Summary

Course Successfully Completed

Grade Points:

95.43 / 100.0 Overall

Lesson Attempts:

11 Lessons 11 Attempted 11 Completed

Test Attempts:

15 Tests 15 Attempted 13 Completed

Time Spent:

22 hrs 12 min 32 sec

From Date: To Date:

Lesson	Progress
✓ Fire Alarms Level I Introduction Introduction	31 / 31 pages read
✓ Inspection, Testing and Maintenance 10 Inspection, Testing and Maintenance	31 / 31 pages read
✓ FA I NICET Level I Household Fire Alarm Systems 9 Household Fire Alarm Systems	25 / 25 pages read
✓ FA I NICET I Level I Notification Appliances 8 Notification Appliances	23 / 23 pages read
✓ FA I NICET Level I Initiating Devices 7 Initiating Devices	85 / 85 pages read

Upon successful completion of the Practice Exam #1, you can download your **course completion certificate**, as shown in the transcript summary.

GLOSSARY

Lesson 2 of 2

Glossary

Lesson Goals

By the end of this lesson, you will be able to do the following:

☐ Define key terms associated with sprinkler systems.

Key References

- *NFPA* 13 - *Standard for the Installation of Sprinkler Systems*, 2016

LET'S BEGIN

Key Terms

NFPA 13 2016, Chapter 3

Below are key glossary terms that will be highlighted throughout this course. Click on each **+** symbol to see the definition for each word below.

Authority Having Jurisdiction (AHJ)

An organization, office, or individual responsible for enforcing requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure. (*NFPA* 13 2016, Section 3.2.2)

Automatic Sprinklers

A fire suppression or control device that operates automatically when its heat-activated element is heated to its thermal rating or above, allowing water to discharge over a specified area. (*NFPA* 13 2016, Section 3.3.1)

High-Piled Storage

Solid-piled, palletized, rack storage, bin box, and shelf storage in excess of 12 ft. in height. (*NFPA* 13 2016, Section 3.9.1.16)

Inspection

A visual examination of a system or portion thereof to verify that it appears to be in operating condition and is free of physical damage. (*NFPA* 25 2014, Section 3.3.23)

Limited-Combustible Material

A building construction material that does not comply with the definition of non-combustible material. (*NFPA* 13 2016, Section 3.3.16)

Listed

Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose. (*NFPA* 13 2016, Section 3.2.3)

Low-Piled Storage

Solid-piled, palletized, rack storage, bin box, and shelf storage up to 12 ft. in height. (*NFPA* 13 2016, Section 3.9.1.17)

Miscellaneous Storage

Storage that does not exceed 12 ft. in height, is incidental to another occupancy use group, does not constitute more than 10% of the building area or 4000 ft^2 of the sprinklered area, whichever is greater, does not exceed 1000 ft^2 in one pipe or area, and is separated from other storage areas by at least 25 ft. (*NFPA* 13 2016, Section 3.9.1.18)

Non-Combustible Material

A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. (*NFPA* 13 2016, Section

3.3.17)

Obstructed Construction

Panel construction and other construction where beams, trusses, or other members impede heat flow or water distribution in a manner that materially affects the ability of sprinklers to control or suppress a fire. (*NFPA* 13 2016, Section 3.7.1)

The Annex provides many examples and figures of obstructed and unobstructed construction found in Figures A.3.7.1 and A.3.7.2. Take some time to review these examples.

Shall

Indicates a mandatory requirement. (*NFPA* 13 2016, Section 3.2.4)

Shop-Welded

Shop in the term shop-welded means either:

1. A sprinkler contractor's or fabricator's premise or
2. An area specifically designed or authorized for welding, such as a detached outside location, maintenance shop, or other areas (either temporary or permanent) of noncombustible or fire-resistive construction free of combustible and flammable contents and suitably segregated from adjacent areas. (*NFPA* 13 2016, Section 3.3.20)

Should

Indicates a recommendation or that which is advised but not required. (*NFPA* 13 2016, Section 3.2.5)

Small Room

A compartment of light hazard occupancy classification having unobstructed construction and a floor area not exceeding 800 ft^2. (*NFPA* 13 2016, Section 3.3.22)

Refer to NFPA 13 2016, Figure A.8.6.3.2.4(a) Small Room Provision – One Sprinkler

Sprinkler System

A system that consists of an integrated network of piping designed in accordance with fire protection engineering standards that includes a water supply source, a water control valve, a waterflow alarm, and a drain. (*NFPA* 13 2016, Section 3.3.23)

The portion of the sprinkler system above ground is a network of specifically sized or hydraulically designed piping installed in a building, structure, or area, generally overhead, and to which sprinklers are attached in a systematic pattern. The system is commonly activated by heat from a fire and discharges water over the fire area.

System Working Pressure

The maximum anticipated static (non-flowing) or flowing pressure applied to sprinkler system components exclusive of surge pressures and exclusive of pressure from the fire department connection. (*NFPA* 13 2016, Section 3.3.24)

Testing

A procedure used to determine the operational status of a component or system by conducting periodic physical checks, such as waterflow tests, fire pump tests, alarm tests, and trip tests of dry pipe, deluge, or preaction valves. (*NFPA* 25 2014, Section 3.3.47)

Unobstructed Construction

Construction where beams, trusses, or other members do not impede heat flow or water distribution in a manner that materially affects the ability of sprinklers to control or suppress a fire. (*NFPA* 13 2016, Section 3.7.2)

Unobstructed construction has horizontal structural members that are not solid, where the openings are at least 70% of the cross-section area, and the depth of the member does not exceed the least dimension of the openings, or all construction types, with the exception of panel construction, where the spacing of structural members exceeds 7.5 ft. on center.

CONTINUE

Click on the “Next” arrow up on the right-hand corner of the screen to continue to the quiz.

Ohio Automatic Sprinkler & Standpipe Systems - Ohio Fire Code

This module will provide information on SOME of the Ohio Fire Code requirements for automatic sprinkler and standpipe systems.

It is not meant as a Fire Code course, but to familiarize you with a few of the requirements.

Many of the requirements are the same or very similar to requirements from *NFPA* 13, The Standard for the Installation of Sprinkler Systems, 2016 edition.

In other instances, the Ohio Fire Code will refer you back to *NFPA* 13D 2016, *NFPA* 13R 2016, *NFPA* 14 2016, and *NFPA* 25 2014 for the necessary requirements, inspection, testing, and maintenance of sprinkler and standpipe systems.

You can reference the Ohio Fire Code at: http://codes.ohio.gov/oac/1301:7-7-09.
Key Reference for this module:

- Ohio Fire Code - Fire Protection Systems
    - https://codes.iccsafe.org/content/OHFCJAN2019E/ohio-administrative-code-1301-7-7-09-fire-protection-systems

Section 903 – Automatic Sprinkler Systems

Section 905 – Standpipe Systems

Lesson 1 of 2

Section 903 – Automatic Sprinkler Systems

Lesson Goals

By the end of this lesson, you will be able to do the following:

☐ Gain a working knowledge of Ohio Fire Alarm Code requirements for automatic sprinkler systems.

☐ Compare the installation requirements of sprinkler systems for different locations.

☐ Follow the supervision and monitoring requirements for sprinkler systems.

INTRODUCTION

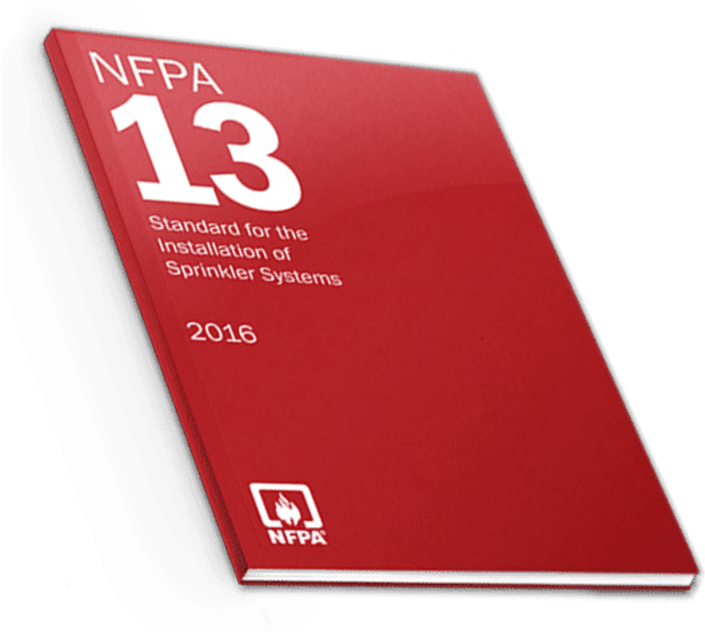
Introduction

This module will provide information on **some** of the Ohio Fire Code requirements for **automatic** **sprinkler** **and** **standpipe systems**.

It is not meant as a Fire Code course, but to **familiarize** you with a few of the requirements.

Many of the requirements are the **same or very similar** to requirements from *NFPA* 13, The Standard for the Installation of Sprinkler Systems, 2016 edition.

In other instances, the Ohio Fire Code will refer you back to *NFPA* 13D 2016, *NFPA* 13R 2016, *NFPA* 14 2016, and *NFPA* 25 2014 for the necessary requirements, inspection, testing, and maintenance of sprinkler and standpipe systems.



Fire Protection Systems portion

You can reference the Ohio Fire Code and use this button to take you to the fire protection systems portion of the Fire Code

CLICK HERE

CONTINUE

The Ohio Fire Code lists all the sections that deal with sprinkler systems in Section 1301:7-7-80, Referenced Standards.

Referenced Standards Table

You can take a look at the table by clicking on this button.
The information we are looking for is on the *NFPA* table under the "Standard Reference Number" column and titled "13-16."

CLICK HERE

Per the *NFPA* table, the sections of the building code covering automatic sprinkler systems are:

- Section 903.3
- Section 904.12

- Section 905.3.4
- Section 907.6.4
- Section 914.3.2
- Section 1019.3
- Section 1103.4.8
- Section 3201.1
- Section 3204.2

We will not cover every section listed above but will provide information so that you **get a feel for what the Ohio Fire Code entails**.

SECTION 903.1: GENERAL

Ohio Fire Code, Section 903

Section 903, Automatic Sprinkler Systems, of the Ohio Fire Code outlines the requirements with which automatic sprinkler systems must comply.

Throughout this module, we'll dive into information on the installation requirements, location and placement requirements, water supply, and supervision and monitoring of sprinkler systems as discussed in this section of the Code.

> ⓘ **Subsections of Section 903.2 outline additional requirements and exceptions for automatic sprinkler systems in terms of location and occupancy.**

SECTION 903.3: INSTALLATION REQUIREMENTS

Installation Requirements, Section 903.3

Section 903.3 discusses the requirements for the design and **installation** of automatic sprinkler systems.

Exempt Locations, Section 903.3.1.1.1

Sprinkler systems are **required to be installed per *NFPA* 13 2016** requirements but are **not required** in rooms or areas protected with automatic fire detection systems that respond to visible or invisible particles of combustion.

Sprinklers are **not permitted to be omitted** from a room because it is damp, consists of fire-resistance-rated construction, or contains electrical equipment.

CONTINUE

Bathrooms, Section 903.3.1.1.2

Sprinkler systems are **not required in bathrooms of Group R** occupancies (with the **exception of Group R-4**). These bathrooms must be no larger than 55 ft^2, located within individual dwelling units or sleeping units, with walls and ceilings made of non-combustible or limited-combustible materials with a 15-minute thermal barrier rating.

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CONTINUE

NFPA 13R Systems, Section 903.3.1.2

Automatic sprinkler systems in **Groups I-1, I-4, and R occupancies are permitted to be installed per *NFPA* 13R 2016 requirements**, which pertains to residential occupancies up to and including four stories in height in buildings not exceeding 60 ft. in height above grade plane.

Sprinkler protection is **required** for exterior balconies, decks, and ground floor patios of dwelling units and sleeping units in buildings of Type V construction, if there is a roof or deck above.

If sidewall sprinklers are used to protect these areas, they are to be located with their deflectors within **1-6 in. below the structural members**, with a **maximum distance of 14 in. below** the deck of exterior balconies and decks that are constructed of open wood joist construction.

Sprinkler protection is **required** in open-ended corridors and associated exterior stairways and ramps.

CONTINUE

NFPA 13D Systems, Section 903.3.1.3

Automatic sprinkler systems installed in buildings of **Groups I-1, R-3, R-4 Condition 1, and townhouses are permitted to be installed per *NFPA* 13D 2016** requirements.

LET'S REVIEW

Based on the Ohio Fire Code and *NFPA* 13 2016, decide if each room/area requires a sprinkler system or not.

Not Required

Area with fire detection systems that respond to visible or invisible particles

Bathrooms of Group R occupancies

Required

Room that consists of fire-resistance-rated construction

Area that contains electrical equipment

If sidewall sprinklers are used to protect the ground floor patio of a dwelling unit, they can be located with their deflectors 4 in. below the structural members.

○ True

○ False

SUBMIT

Complete the knowledge checks above before moving on.

Quick-Response and Residential Sprinklers, Section 903.3.2

In areas where sprinkler systems are required by the Ohio Fire Code, quick-response or residential sprinklers are to be **installed in each of the following areas**:

- All spaces within a smoke compartment containing **care recipient sleeping units** in Group I-2 occupancies
- All spaces within a smoke compartment containing **treatment rooms in ambulatory care facilities**
- **Dwelling units** and **sleeping units** in Group I-1 and R occupancies
- **Light hazard occupancies** as defined in *NFPA* 13 2016

CONTINUE

Obstructions, Section 903.3.3

Obstructions can potentially delay sprinkler activation or impede the water spray from the sprinklers. **Location and placement** of sprinklers are important considerations to **avoid this problem**.

Additional sprinkler protection is **required** in or under covered kiosks, displays, booths, concession stands, or equipment that **exceeds 4 ft. in width**.

The **minimum clearance permitted** between automatic sprinklers and the top of storage is **3 ft**.

CONTINUE

Water Supplies, Section 903.3.5

The water supply used for a sprinkler system is required to be **protected from backflow contamination**. If the sprinkler system is connected to a public waterworks system, any **water supply tests** used for system design purposes are permitted to be adjusted to **account for seasonal and daily pressure fluctuations**.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

For dwelling units and sleeping units in Group I-1 and R occupancies, which of the following are permitted to be installed per the Ohio Fire Code? (Check all that apply)

☐ Upright sprinklers

☐ Quick-response sprinklers

☐ Dry sprinklers

☐ Extended coverage sprinklers

☐ Residential sprinklers

SUBMIT

Complete the knowledge check above before moving on.

Sprinkler System Supervision and Alarms, Section 903.4

Valves controlling the water supply for the following are **required to be electronically supervised** by a **listed fire alarm control unit**:

- Automatic sprinkler systems
- Pumps
- Tanks
- Water levels and temperatures
- Critical air pressures
- Waterflow switches

Note the exceptions include:

☐ Limited area systems

☐ *NFPA* 13R 2016 systems that have a common supply main for both domestic water and the automatic sprinkler system, but no separate shutoff valve for the sprinkler system

☐ Valves that are sealed or locked in the open position:

  - Jockey pump control valves
  - Control valves for commercial kitchen hoods, paint spray booths, or dip tanks
  - Valves controlling the fuel supply to fire pump engines
  - Trim valves to pressure switches in dry, preaction, and deluge sprinkler systems

CONTINUE

Monitoring, Section 903.4.1

Alarm, supervisory, and trouble signals are required to be **distinct from each other** and also automatically transmit to an approved supervising station or sound an audible alarm at a constantly attended location (if approved).

Approved audible devices are required to be connected to each sprinkler system and located on the exterior of the building in an approved location. These waterflow alarm devices are required to actuate when the waterflow equals the flow of a single sprinkler with the smallest orifice size in the system.

If a fire alarm system is installed, sprinkler system activation is **required** to also actuate the fire alarm system.

Floor control valves are required at the point of connection to the **riser** on each floor in high-rise buildings.

TESTING AND MAINTENANCE

Testing and Maintenance, Section 903.5

Sprinkler systems are to be **tested and maintained** per the Ohio Fire Code and *NFPA* 25 2014 requirements.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

If a valve is controlling the water supply for a tank, it is required to be electronically supervised by a ___.

○ check valve

○ backflow preventer

○ fire alarm control unit

○ waterflow alarm device

SUBMIT

Waterflow alarm devices are required to actuate when the waterflow ____ the flow of a single sprinkler with the smallest orifice size in the system.

○ is less than

○ equals

○ is greater than

SUBMIT

Complete the knowledge checks above before moving on.

Lesson 2 of 2

Section 905 – Standpipe Systems

Lesson Goals

By the end of this lesson, you will be able to do the following:

- ☐ Gain a working knowledge of Ohio Fire Alarm Code requirements for standpipe systems.
- ☐ Incorporate installation requirements based on building height and type.
- ☐ Differentiate between the three Classes of standpipe connections.

LET'S BEGIN

The Ohio Fire Code lists all the sections that deal with **standpipe systems** in Section 1301:7-7-80, Referenced Standards.

Referenced Standards Table

You can take a look at the table by clicking on this button.

The information we are looking for is on the *NFPA* table under the "Standard Reference Number" column and titled "14-16."

CLICK HERE

Per the *NFPA* table, the sections of the building code covering standpipe systems are:

- Section 905.2
- Section 905.3.4
- Section 905.4.2
- Section 905.6.2
- Section 905.8

We will not cover every section listed above but will provide information so that you **get a feel for what the Ohio Fire Code entails**.

SECTION 905.1: GENERAL

Ohio Fire Code, Section 905

Section 905, Automatic Sprinkler Systems, of the Ohio Fire Code outlines the requirements with which standpipe systems must comply.

Installation Standard, Section 905.2

Standpipe systems are **required in all new buildings and structures**, in accordance with *NFPA* 14 2016 requirements.

Combined sprinkler/standpipe systems are **permitted**.

Standpipe systems are **not required in Group R-3** occupancies.

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SECTION 905.3: REQUIRED INSTALLATIONS

Required Installations, Section 905.3

Height, Section 905.3.1

Class III standpipe systems are required in buildings where the floor level of the highest story is greater than 30 ft. above the lowest level of the fire department vehicle access, or where the floor level of the lowest story is located more than 30 ft. below the highest level of fire department vehicle access.

There are **exceptions that allow Class I standpipes systems**:

☐ Buildings with automatic sprinkler systems installed

☐ Open parking garages that have the highest floor located no more than 150 ft. above the lowest level of fire department access (Class I manual standpipes are permitted)

☐ Open parking garages in areas subject to freezing (Class I manual dry standpipes are permitted), if the hose connections are located per Class II requirements

☐ Basements equipped with automatic sprinkler systems

CONTINUE

Group A, Section 905.3.2

Non-sprinklered Group A buildings with an occupant load greater than 1,000 are **required** to have **Class I automatic wet standpipe systems**. There are two **exceptions**:

☐ Open-air-seating spaces without enclosed spaces

☐ Class I automatic dry and semiautomatic dry standpipes or manual wet standpipes are permitted in non-high-rise buildings

LET'S REVIEW

Let's do a quick check about what has been covered so far.

Section 905.3.1 requires Class III standpipe systems in buildings with specific heights for the floor levels related to fire department vehicle access. Some exceptions for these buildings are permitted, including basements equipped with an automatic sprinkler system which allow a Class __ standpipe system.

○ I

○ II

○ III

SUBMIT

Complete the knowledge check above before moving on.

Covered and Open Mall Buildings, Section 905.3.3

Covered mall and open mall buildings are **required to have standpipe systems**, as defined in Section 905.3.1.

Mall buildings that are not required to have standpipe systems are required to have **Class I hose connections connected to the sprinkler system**, sized to deliver 250 gallons/minute at the most hydraulically remote connection, while still meeting the sprinkler system demand.

Pressure loss **cannot exceed 50 psi residual pressure** with a flow of 250 gallons/minute from the fire department connection to the hydraulically most remote hose connection.

Hose connections are required at the following locations:

- Within the mall entrance to each exit passageway or corridor
- At each floor-level landing within interior exit stairways opening directly on the mall
- At exterior public entrances to the mall of a covered mall building
- At public entrances at the perimeter line of an open mall building
- At other locations as needed, so the distance to reach all portions of the tenant space does not exceed 200 ft. from a hose connection

CONTINUE

Stages, Section 905.3.4

Stages larger than 1000 ft^2 are required to have a **Class III wet standpipe system** with 1 ½ in. and 2 ½ in. hose connections **on each side of the stage**. If the building or area has an automatic sprinkler system, a 1 ½ in. hose connection is **required for Class II or III standpipes**.

The hose at these connections needs to be long enough to protect the stage area. Hose connections are to be **mounted in a cabinet or on a rack** and have an **adjustable fog** **nozzle**.

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CONTINUE

Underground Buildings, Section 905.3.5

Underground buildings are required to have **Class I** **automatic wet** **or** **manual wet standpipe systems** throughout the building.

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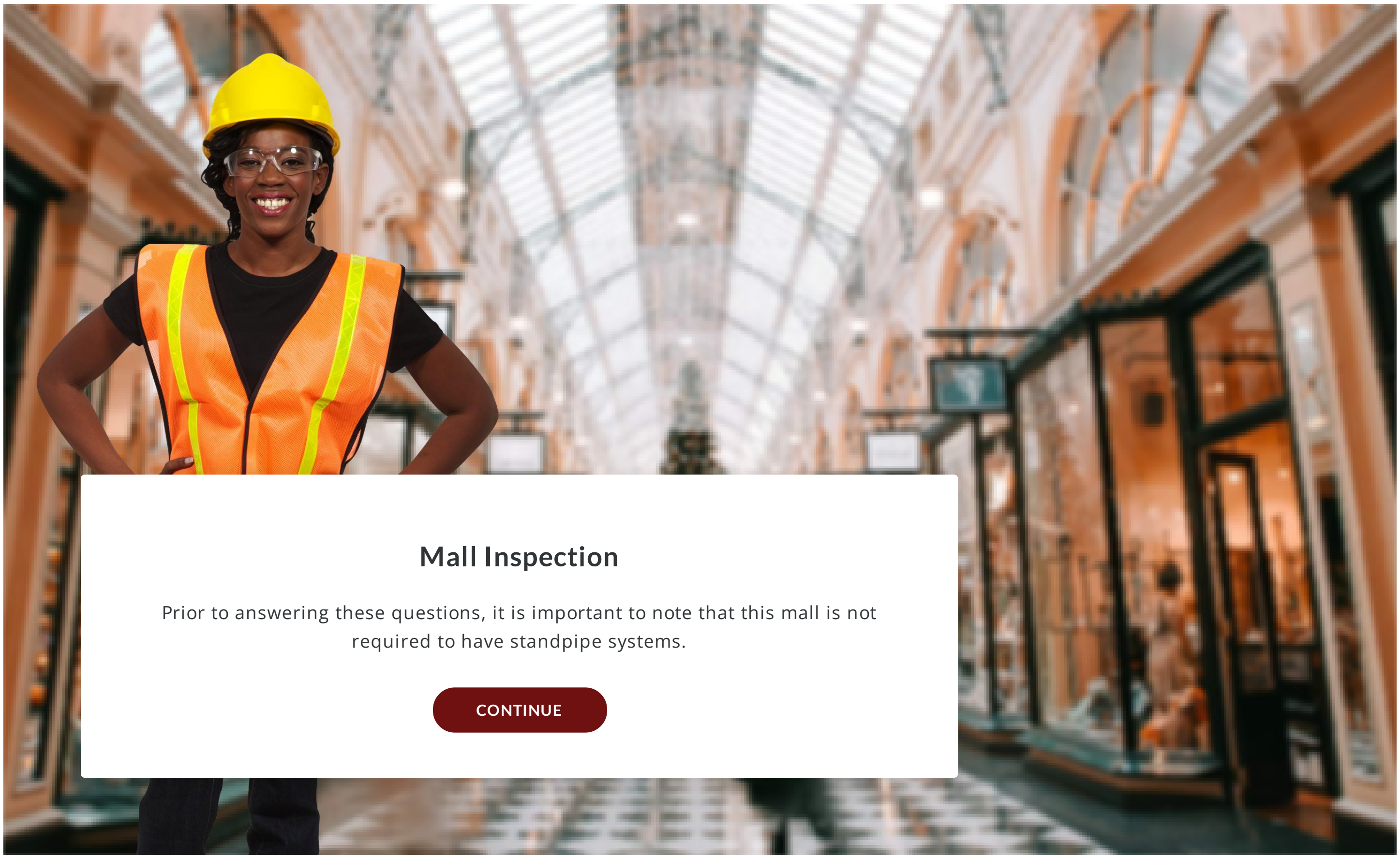
CONTINUE

You and Kayla are inspecting the standpipe systems in a mall in Ohio. To get a better understanding of the Ohio Fire Code, let's work through the following scenario.

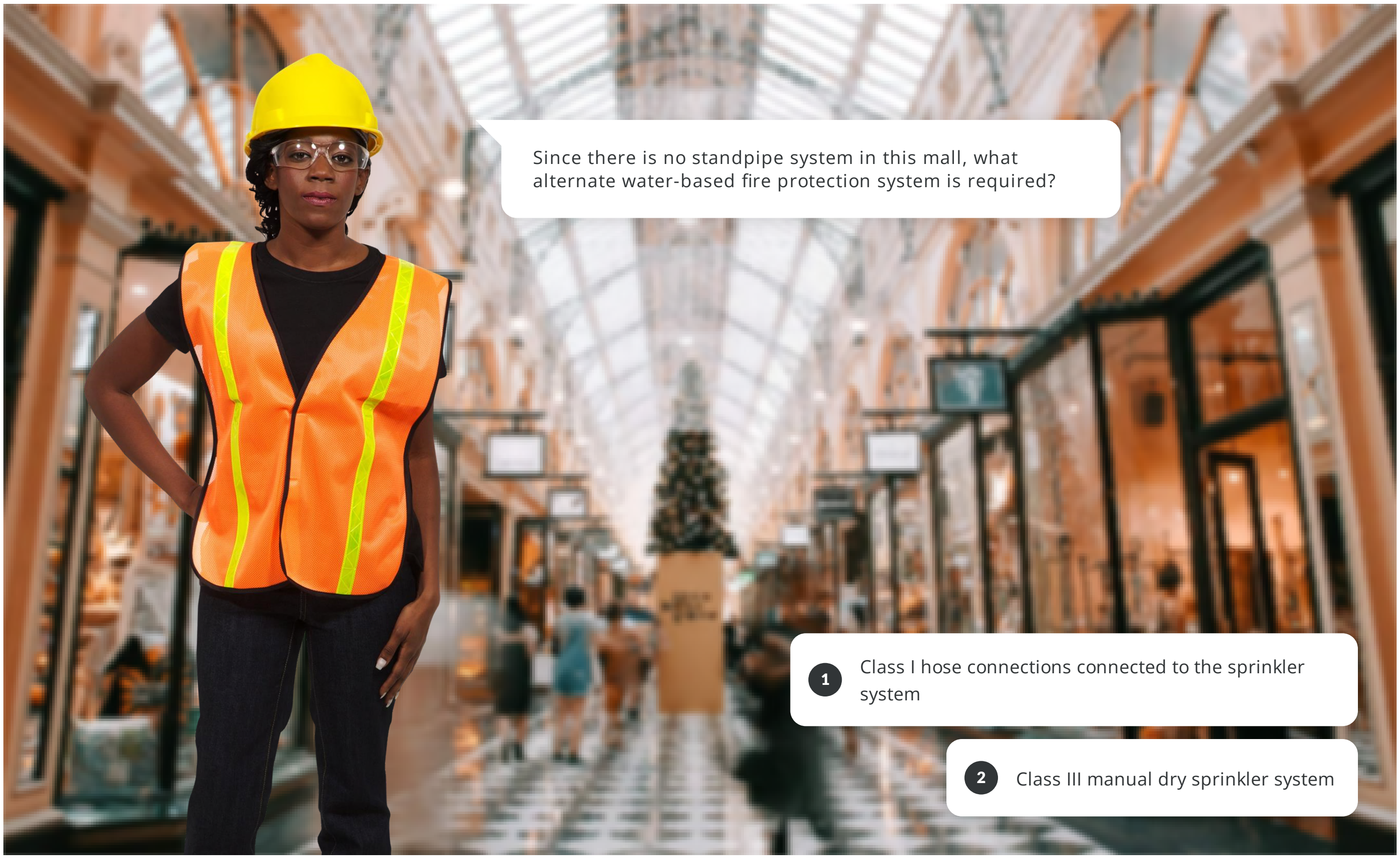


Mall Inspection

Prior to answering these questions, it is important to note that this mall is not required to have standpipe systems.

Scene 1 Slide 1

Continue → Next Slide



Since there is no standpipe system in this mall, what alternate water-based fire protection system is required?

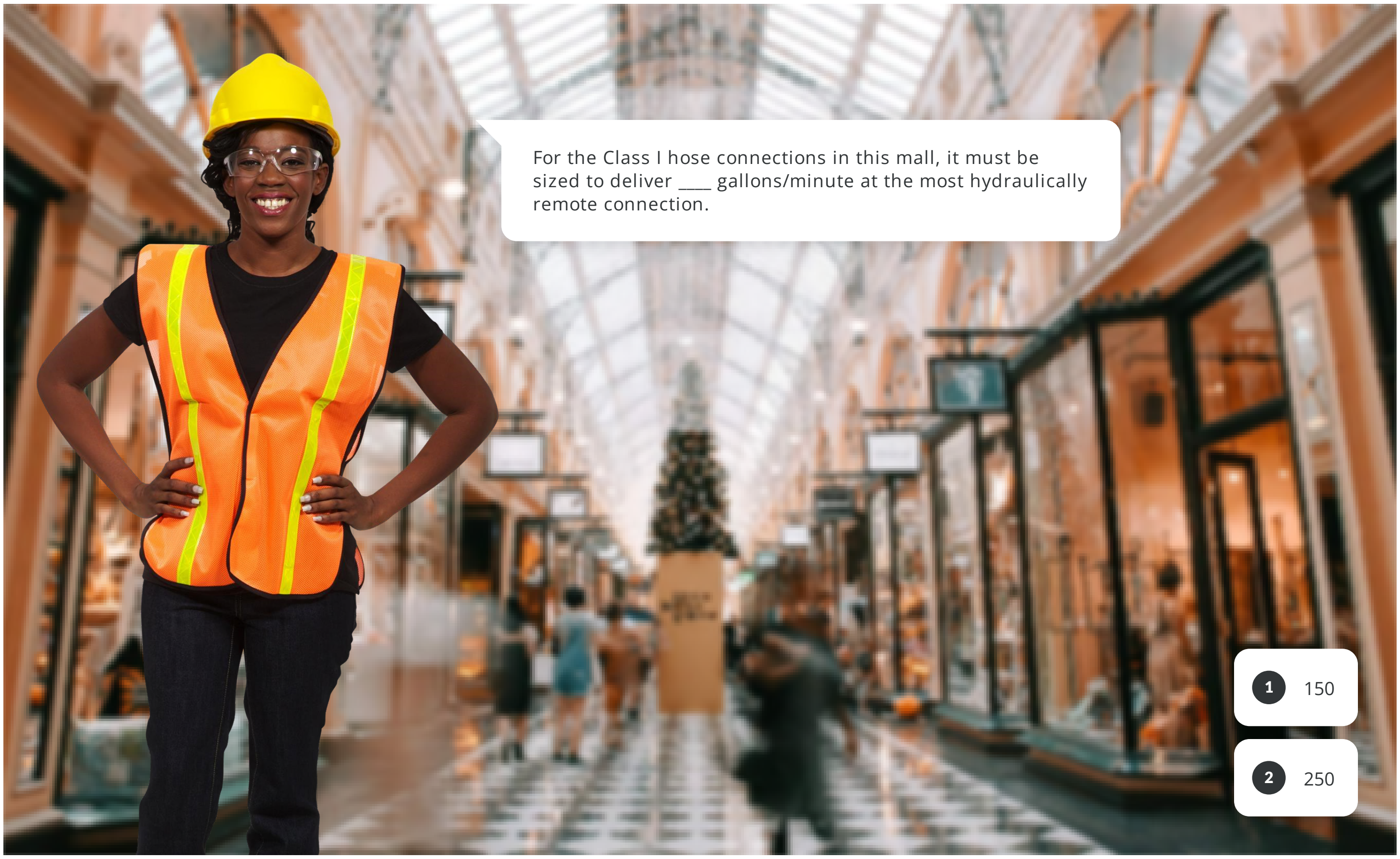
1 Class I hose connections connected to the sprinkler system

2 Class III manual dry sprinkler system

Scene 1 Slide 2

0 → Next Slide

1 → Next Slide



For the Class I hose connections in this mall, it must be sized to deliver ____ gallons/minute at the most hydraulically remote connection.

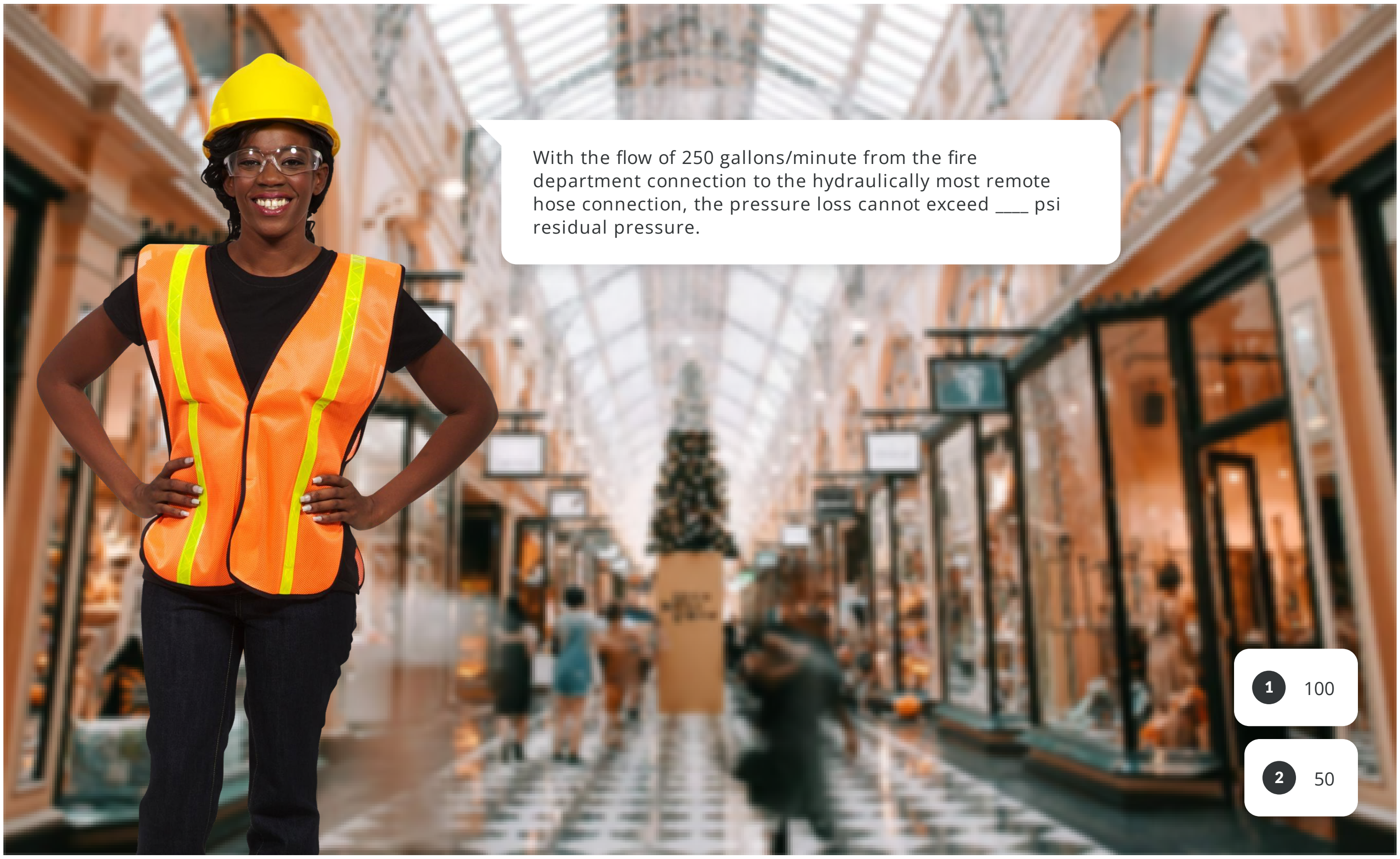
1 150

2 250

Scene 1 Slide 3

0 → Scene 1 Slide 1

1 → Next Slide



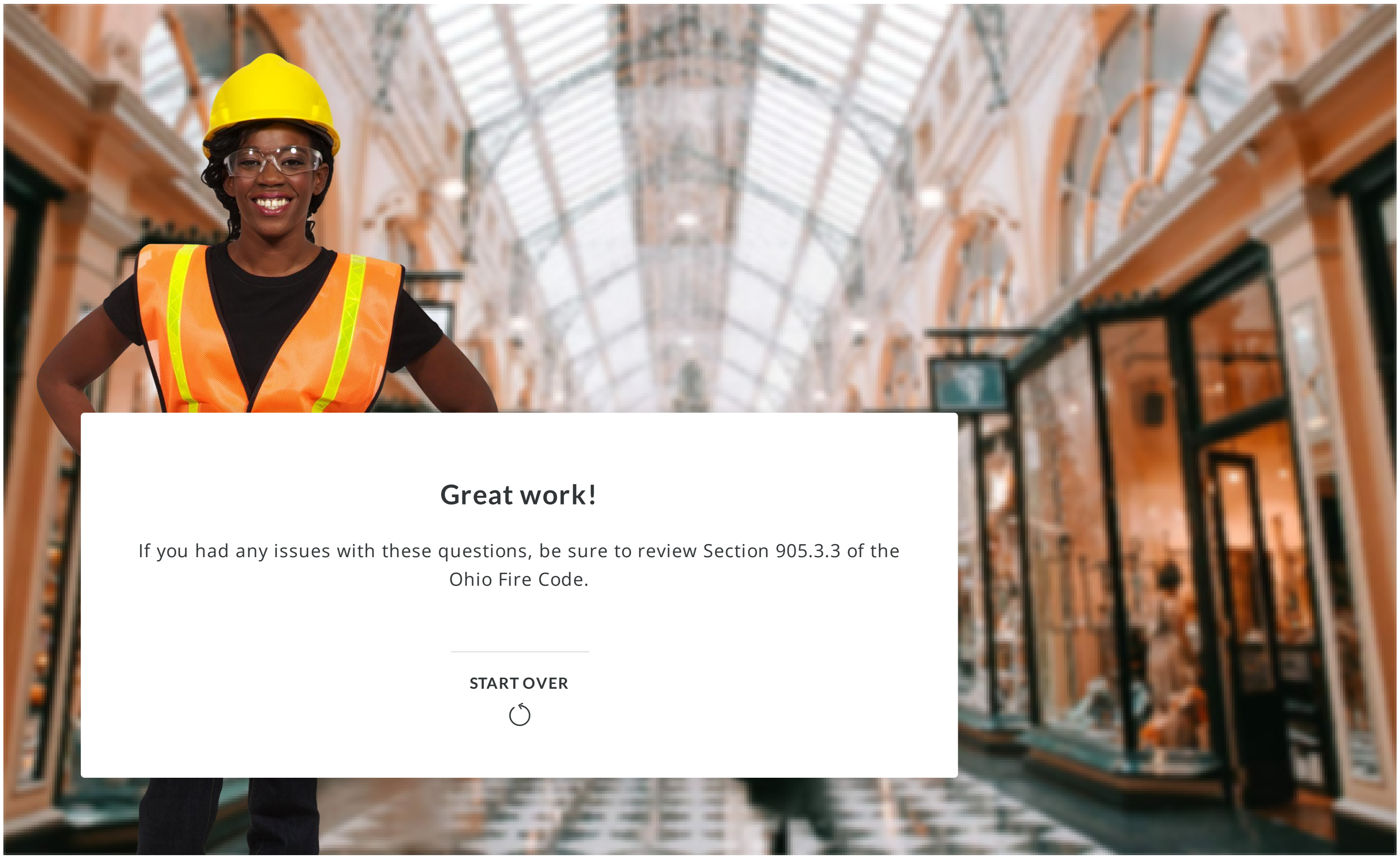
With the flow of 250 gallons/minute from the fire department connection to the hydraulically most remote hose connection, the pressure loss cannot exceed ____ psi residual pressure.

1. 100
2. 50

Scene 1 Slide 4

0 → Scene 1 Slide 1

1 → Next Slide



Great work!

If you had any issues with these questions, be sure to review Section 905.3.3 of the Ohio Fire Code.

Scene 1 Slide 5

Continue → End of Scenario

Complete the scenario above before moving on.

Location of Standpipe Hose Connections

Location of Class I Standpipe Hose Connections, Section 905.4

Class I **hose connections** are required in the following locations:

☐ For every required interior exit stairway – A hose connection is required for each story above or below grade plane.

☐ One on each side of the wall adjacent to the exit opening of a horizontal exit

☐ In every exit passageway, at the entrance from the exit passageway to other areas of a building

- In mall buildings

- For covered mall buildings, adjacent to each exterior public entrance to the mall and adjacent to each entrance from an exit passageway or exit corridor to the mall.
- For open mall buildings, adjacent to each public entrance to the mall at the perimeter line and adjacent to each entrance from an exit passageway or exit corridor to the mall.

☐ For roofs with a slope less than 33.3%, a hose connection is required to serve the roof or at the highest landing of an interior exit stairway with access to the roof.

☐ If the most remote portion of a non-sprinklered floor or story is more than 150 ft. from a hose connection or the most remote portion of a sprinklered floor or story is more than 200 ft. from a hose connection, additional hose connections may be required by the fire code official.

Buildings with **more than one standpipe system** are required to **interconnect the systems** following *NFPA* 14 2016 requirements.

CONTINUE

Location of Class II Standpipe Hose Connections, Section 905.5

Class II standpipe connections are required to be located so that all portions of the building are within 30 ft. of a **nozzle** attached to 100 ft. of hose.

Group A-1 and A-2 occupancies with occupant loads exceeding 1000 are required to have hose connections as follows:

- On each side of any stage

- On each side of the rear of the auditorium
- On each side of the balcony
- On each tier of dressing rooms

1-inch hose is permitted for **Light Hazard occupancies**, if approved by the fire code official.

CONTINUE

Location of Class III Standpipe Hose Connections, Section 905.6

Class III standpipe systems are required to have hose connections located following Class I standpipe requirements and have Class II hose connections.

Similar to Class I standpipe systems, buildings with **more than one Class III standpipe system are required to interconnect the systems** per *NFPA* 14 2016 requirements.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

Group A-1 and A-2 occupancies with occupant loads exceeding 1000 are required to have hose connections in the following locations: (Check all that apply)

☐ On each side of any stage

☐ On each side of the wall adjacent to the exit opening

☐ On each side of the rear of the auditorium

☐ Adjacent to each entrance from an exit passageway or exit corridor

☐ On each side of the balcony

SUBMIT

Buildings with more than one Class III standpipe system are required to ____ the systems following *NFPA* 14 2016 requirements.

Type your answer here

SUBMIT

Complete the knowledge checks above before moving on.

Cabinets, Section 905.7

Cabinets containing fire-fighting equipment are **required to be unobstructed and in clear sight**. These cabinets are to be identified with a **permanently attached sign** that shows the contained equipment. The lettering on the sign is required to be a least 2 in. high, with colors contrasting from the background.

Note the exceptions for small and glass doors.

The cabinets are to remain **unlocked**. Exceptions include:

- Visual identification glass panels that can be easily broken to allow access
- Approved locking arrangements
- Group I-3 occupancies

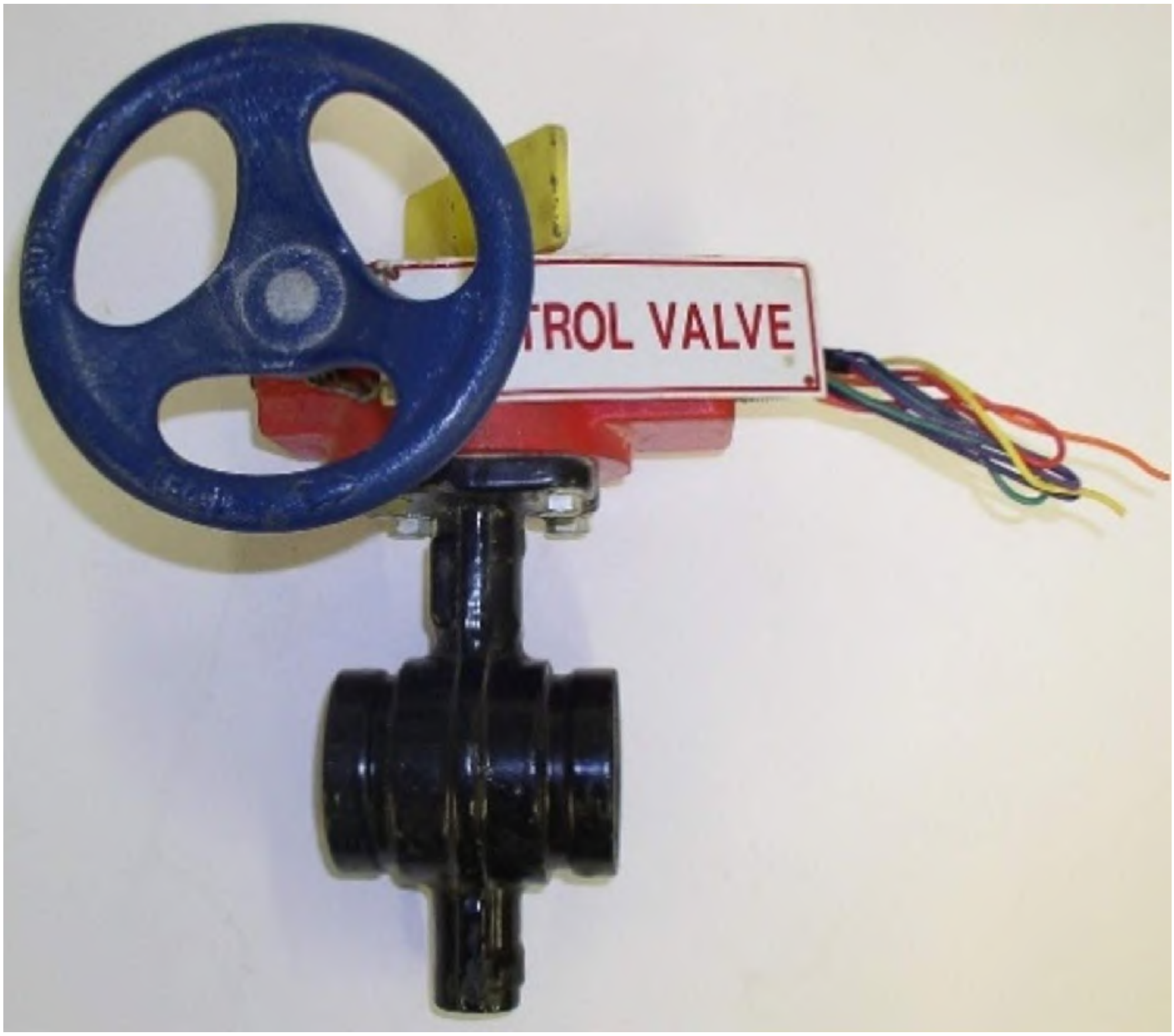
SECTION 905.8: DRY STANDPIPES

Dry Standpipes, Section 905.8

Dry standpipes are not permitted, except in areas where **freezing** is a concern.

SECTION 905.9: VALVE SUPERVISION

Valve Supervision, Section 905.9



Control valves for water supplies are required to be supervised in the open position. A change from normal is required to generate a **supervisory signal at the supervising station**. If a fire alarm system is provided, the signal is also required to be transmitted to the control unit.

Exceptions include valves to underground key or hub valves in roadway boxes and valves locked in the normal position in buildings without a fire alarm system.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

Even if a cabinet containing fire-fighting equipment has breakable glass panels, should the cabinet remain locked or unlocked?

○ Locked

○ Unlocked

SUBMIT

Complete the knowledge check above before moving on.

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

File Attachments for Item:

ER-6 Ohio Fire Alarm and Detection Equipment (new version, Fire Tech Productions)

All commercial certifications except PPE, PI, and MI (5 hours)

Staff Notes: Recommend expanded references to 2017 OBC Chapter 9, inclusion of PPE, PI and MI.

Committee Recommendation:

Ohio Course Submission

Included in this document: Course Outline, Instructor resume(s)

Course: Ohio Fire Alarm and Detection Equipment - FAOH 102

Course Outline:

1. Welcome
2. Intro
3. Basics and Wiring
4. Detection Devices
5. Location and Spacing
6. Notification Appliances
7. Household Fire Alarms
8. ITM
9. Emergency Control
10. Ohio Codes
11. Glossary

Instructor: Bill Ford

Charles William Ford

OBJECTIVE

To utilize my strong administrative and people skills in combination with my technical background, to eliminate or reduce the incidence of unfriendly fire and the resulting losses through motivation, education, behavior modification and engineering principles where applicable.

EDUCATION

EASTERN KENTUCKY UNIVERSITY, Richmond, Kentucky,
B. S. Degree in Fire Prevention and Control, 1982.
Minor Studies Law Enforcement

EXPERIENCE

KETTERING HEALTH NETWORK (2021-Present)

Operation Coordinator

- Manage seven technicians who hold sprinkler technician, fire alarm technician and portable extinguisher certifications
- Responsible for the inspection/testing of fire protection systems owned and operated by Kettering Health

KETTERING FIRE DEPARTMENT (2008-2021)

Fire Marshal

- Manage the fire investigation program
- Conduct plan reviews and field fire protection system acceptance tests for the Kettering Building Department

- Conduct fire safety code enforcement inspections

HUBER HEIGHTS FIRE DIVISON (2002- 2008)

Fire Chief

- Managed 51 person paid fire department with paramedic service with two stations
- Administered a 7.4 million dollar budget
- Developed City Emergency Operations Plan
- NIMS Compliance Coordinator
- Served as acting City Manager in the absence of the manager
- Authored FEMA Fire Act Grant for City Traffic Signal Pre-emption System

DAYTON AIRPORT FIRE DEPARTMENT (2000-2002)

Airport Fire Chief

- Managed 30 person paid fire department with paramedic service
- Responsible for budgeting, planning and policy development
- Administered 3 million dollar budget, including capital equipment
- Responsible for airport disaster planning and functional exercises
- Responded to aircraft emergencies, EMS calls, and structural alarms serving as incident command

CITY OF DAYTON FIRE DEPARTMENT (1982-2000)

Fire Protection Engineer/Fire Marshal

- Bureau head of Fire Prevention Bureau – responsible for planning, organizing and evaluation of fire prevention and hazard abatement programs and activities
- Responsible for budgeting and supervisory activities for 13 employees
- Served as acting Assistant Chief of Administration
- Sector commander at scene of major incidents
- Fire Investigator Regional Fire Investigation Unit
- Instructor - Dayton Fire Training Center and Dayton Police Academy
- Qualified fire investigation expert, Montgomery County Common Pleas Court

CITY OF DAYTON FIRE DEPARMENT (1979-1982)

Firefighter/EMT-A

- Graduate of Dayton Fire Academy, assigned to Operations Division and Fire Prevention Bureau
- Engaged in fire suppression activities and staffed ambulances serving as an EMT-A
- Conducted fire safety inspections and served as plans examiner

SINCLAIR COMMUNITY COLLEGE, (1989-2014)

Instructor – Lecturer II

- Instruct courses in Fire Science Technology Program, Department of Engineering Technologies

MONTGOMERY COUNTY SHERRIFF'S OFFICE, (1990-2015)

Commissioned Law Enforcement Officer (Deputy)

- Assigned commission as Fire Marshal for City of Dayton

SPECIAL INFORMATION

- Graduate Dayton Fire Academy, certified by the Ohio Division of Public Safety, 1979
- Graduate Dayton Police Academy, certified by the Ohio Peace Officers' Training Council, 1990
- State of Ohio Level II certified firefighter
- State of Ohio Fire Safety Inspector
- State of Ohio Fire Safety Inspector Instructor, Fire Fighter Instructor
- Hazardous Materials Operations certified
- Basic and Advanced Aircraft Rescue Firefighter certification, - American Association of Airport Executives
- Certified Fire Service and Fire Safety Inspector Instructor, State of Ohio
- Ohio Board of Building Standards, Fire Protection Inspector, Interim Fire Protection Plans Examiner certifications.
- National Fire Academy attendee
  - ✓ Strategic Analysis of Community Risk Reduction
  - ✓ Codes and Ordinances
  - ✓ Fire Prevention Specialist II
  - ✓ Microcomputers for Arson Squad Managers

PROFESSIONAL AFFILIATIONS

- Southwest Fire Safety Council
- International Code Council

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.

[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: Julie Miller
(Contact Name)
Organization: Fire Tech Productions
(Organization/Company)
Address: 7976 Clyo Rd.
(Include Room Number, Suite, etc.)
City: Centerville State: OH Zip: 45459
E-Mail: julie@firetech.com
Telephone: 937.434.3473 Fax: NA
Course Sponsor:

COURSE INFORMATION:

Course Title: Ohio Fire Alarm and Detection Equipment - FAOH 102

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

Purpose and Objective: This course provides training for the state of OH's Fire Alarm and Detection Equipment certification so you can pass your state certification on the first attempt! The course covers requirements found in NFPA 72 2016, NFPA 70 2017, and The Ohio Fire Code 2017.

Number of Instructional Contact Hours that can be obtained upon completion: 5.0

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	
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.

Welcome to Fire Tech Productions

Fire protection training to help you become an expert.

Please click on the "Begin" button above to get started.

Welcome to Fire Tech Productions

QUESTION BANKS

Lesson 1 of 1

Welcome to Fire Tech Productions

GET STARTED

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For information about this product, please contact Fire Tech Productions at:

937-434-FIRE (3473)

FIRE TECH
PRODUCTIONS
Training that makes a difference

Liability Disclaimer

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NFPA Disclaimer –

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I have read the copyright notification for using Fire Tech Productions' online training material and agree that I will not copy the lessons, quizzes, and/or simulated exams in part or in whole.

🔒 Please read all of the copyright and disclaimer information.

🔒 You must click "I agree" above to continue.

Before we get started, here are some tips for navigating the course.

Navigation Tip # 1

There are three ways to advance a slide.

1. Click the > arrow (if present).

2. Click the dark red button (if present).

3. Scroll down.

Navigation Tip # 2

You can go back if you want.

Just scroll up or click the < arrow.

Navigation Tip # 3

You can zoom in on most images.

If an image is difficult to see, you can click on it to make it larger. (Go ahead, try it.)

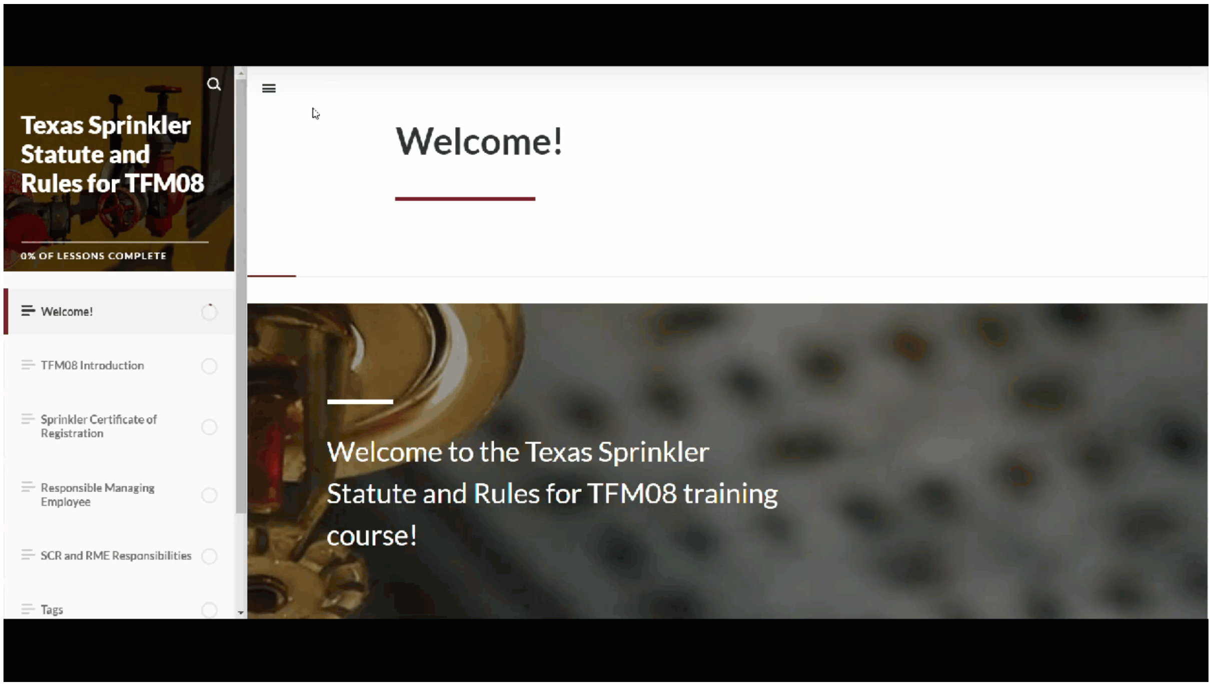
Navigation Tip # 4

Links open in external windows.

If you click on a link, don't worry — it won't navigate you away from the course. It'll open in its own separate browser window so you can use it for reference.

Navigation Tip # 5

You can open and close the sidebar using the hamburger menu.



Welcome!

Welcome to the Texas Sprinkler Statute and Rules for TFM08 training course!

Navigation Tip # 6

You can leave the course and come back later.

You'll be taken back to the beginning of the module from which you left. **Here's what to do when you return:**

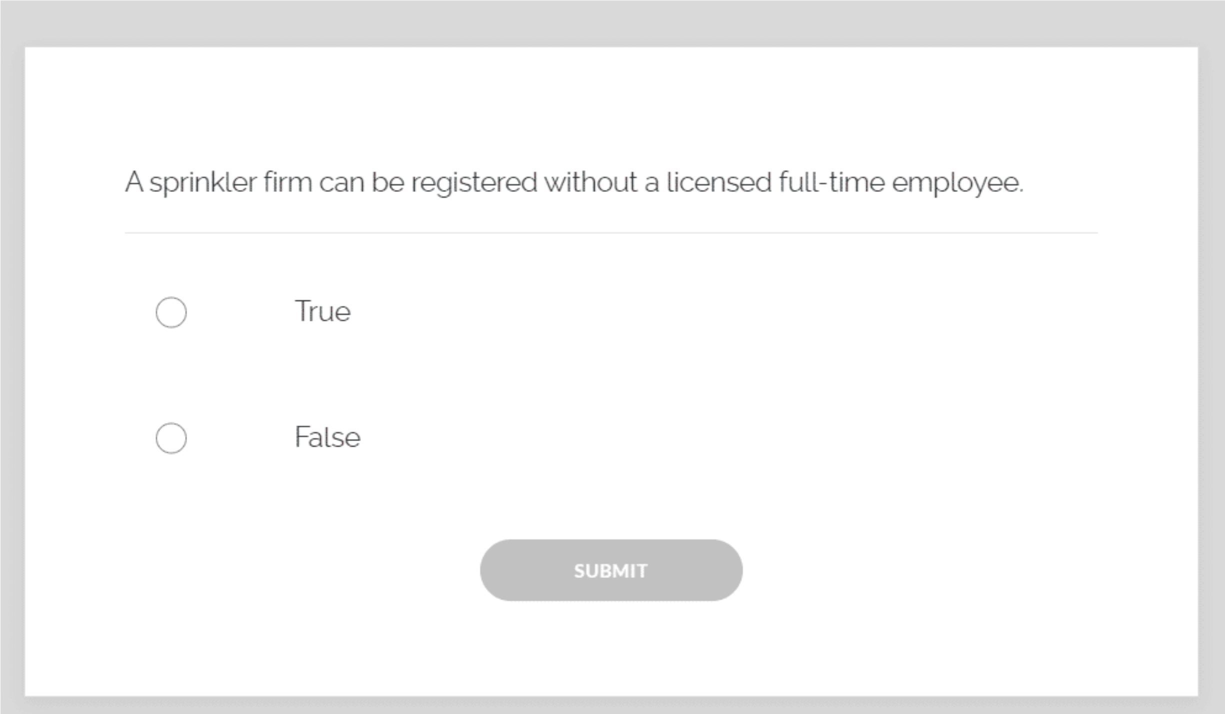
1. Log in with your username and password.
2. Launch the course from the home page.
3. Select the module you were last working in.
4. Scroll down to the point from which you left.

That's it!

Let's get started.

CONTINUE

Let's do a quick check to see how you're doing so far.



A sprinkler firm can be registered without a licensed full-time employee.

○ True

○ False

sample knowledge check

Knowledge checks

Throughout the course, you'll have the opportunity to check your understanding with quick quiz questions or interactions. These will give you the opportunity to practice, see what you recall, and get feedback. You can do these as many times as you like.

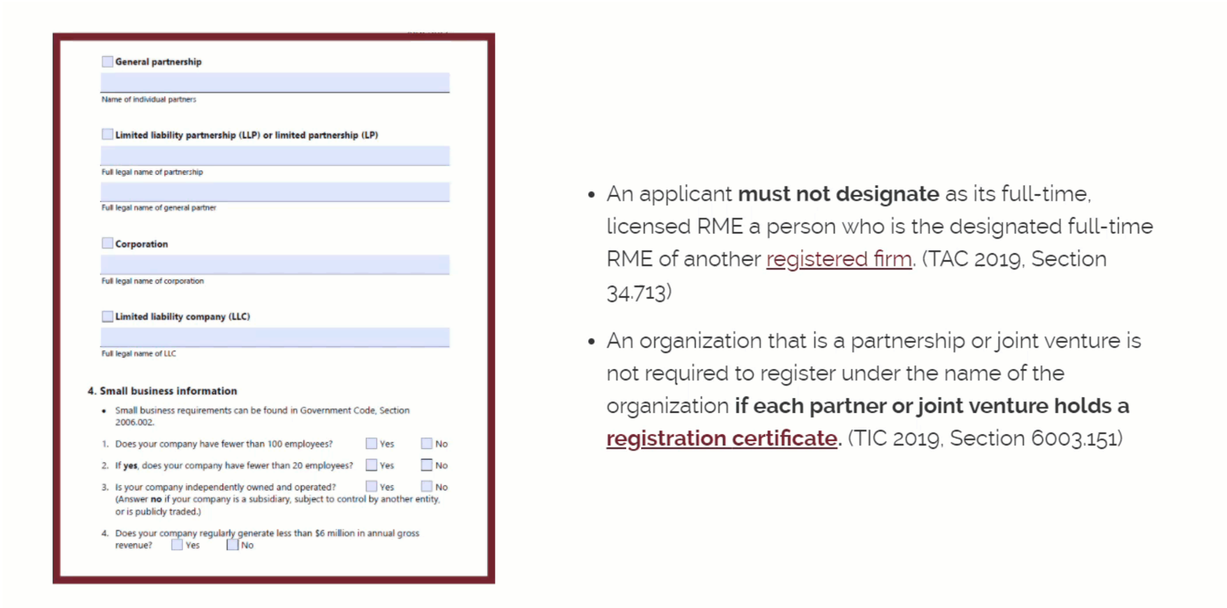
While completing knowledge checks, try at first to not look up the answer. This will help you gauge your understanding of the topic.

CONTINUE

Glossary

Some terms in this course have a definition that is provided in a glossary (the terms are underlined).

If you click on the term, a link will take you to the glossary, starting with the first letter of the term. Then, just scroll down to find the definition you need!



☐ **General partnership**

Name of individual partners

☐ **Limited liability partnership (LLP) or limited partnership (LP)**

Full legal name of partnership

Full legal name of general partner

☐ **Corporation**

Full legal name of corporation

☐ **Limited liability company (LLC)**

Full legal name of LLC

4. Small business information

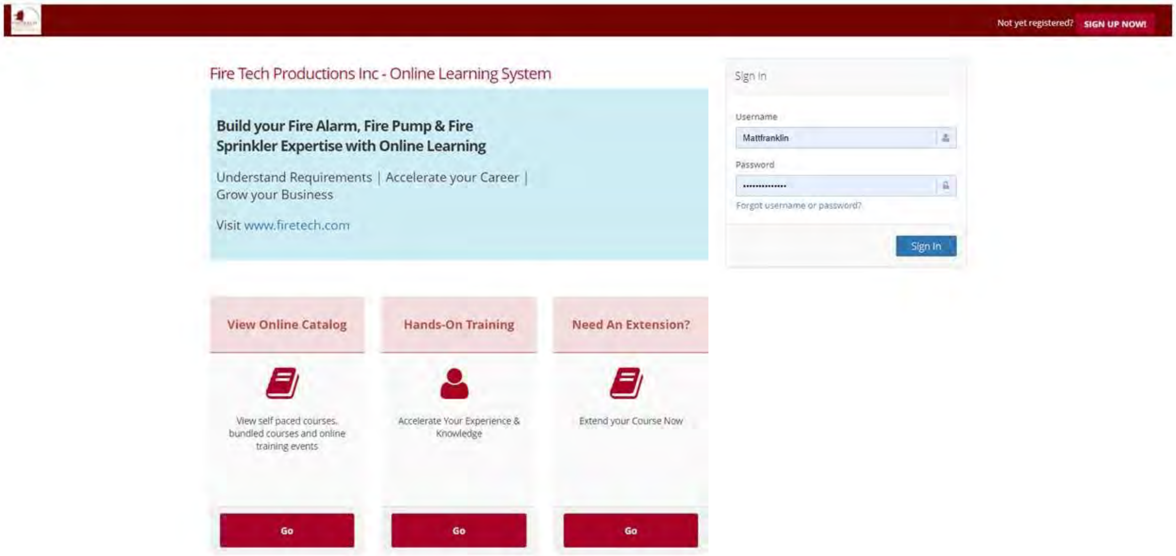
- Small business requirements can be found in Government Code, Section 2006.002.

1. Does your company have fewer than 100 employees? ☐ Yes ☐ No
2. If **yes**, does your company have fewer than 20 employees? ☐ Yes ☐ No
3. Is your company independently owned and operated? ☐ Yes ☐ No
(Answer **no** if your company is a subsidiary, subject to control by another entity, or is publicly traded.)
4. Does your company regularly generate less than $6 million in annual gross revenue? ☐ Yes ☐ No

- An applicant **must not designate** as its full-time, licensed RME a person who is the designated full-time RME of another registered firm. (TAC 2019, Section 34.713)
- An organization that is a partnership or joint venture is not required to register under the name of the organization **if each partner or joint venture holds a registration certificate.** (TIC 2019, Section 6003.151)

CONTINUE

Here are some tips for navigating in the online course platform.



Fire Tech Productions Inc - Online Learning System

Build your Fire Alarm, Fire Pump & Fire Sprinkler Expertise with Online Learning

Understand Requirements | Accelerate your Career | Grow your Business

Visit www.firetech.com

Sign In

Username: Mattfranklin

Password: ••••••••••••••

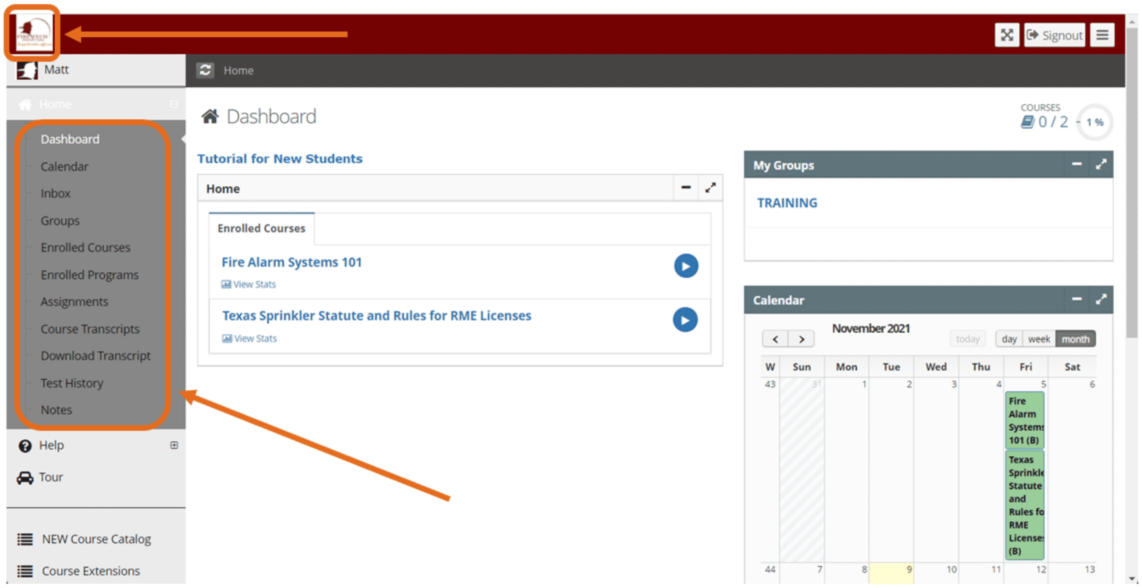
View self paced courses, bundled courses and online training events

Accelerate Your Experience & Knowledge

Extend your Course Now

Step 1

Home Page

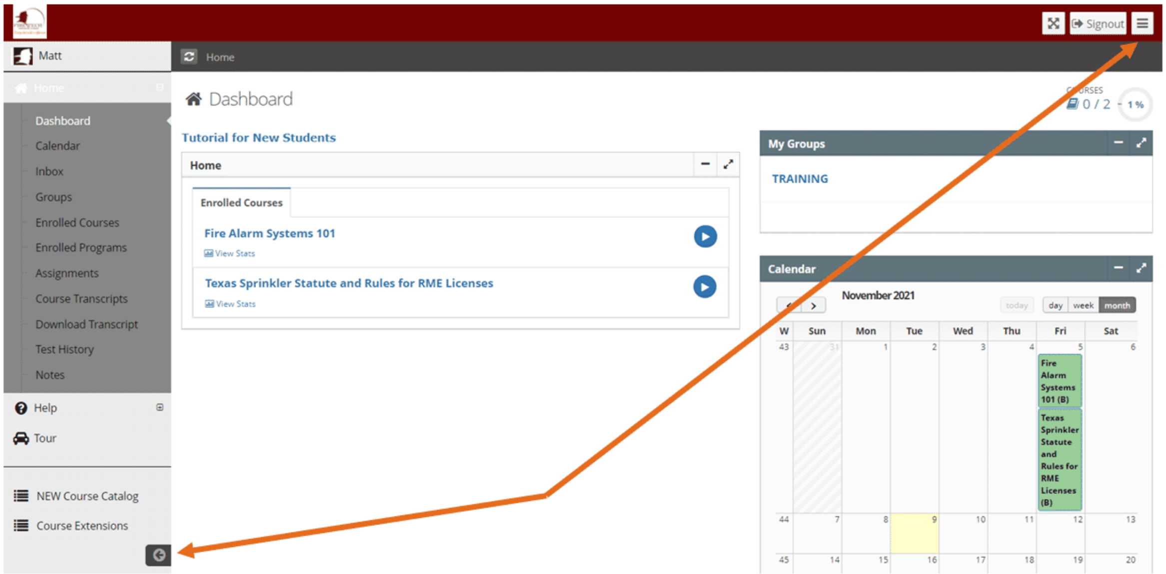


This is a quick overview on how to navigate the courses in the online course platform. Once you are signed in, the Home Page will appear.

You will find your **Dashboard** on left side of the Home Page. If you would like to return to the **Welcome Page** at anytime, just click on the **Fire Tech** icon in the upper left corner.

Step 2

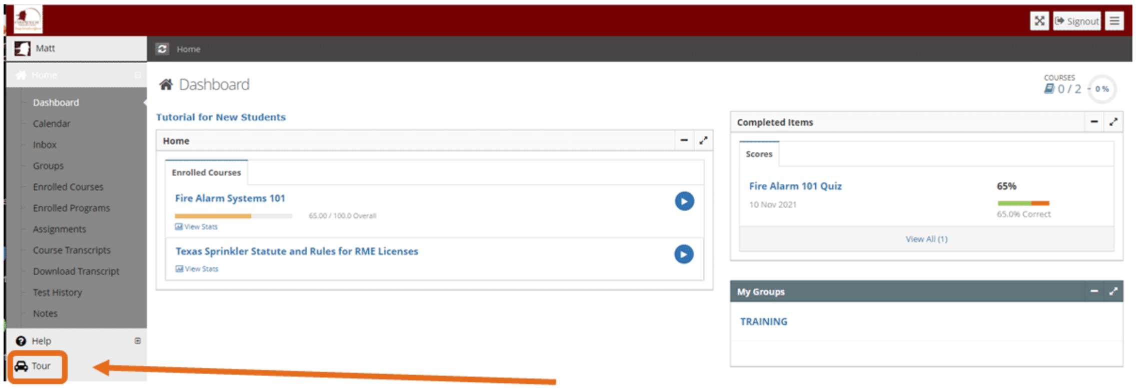
Enlarging Your Screen



These buttons collapse the menu on the left to provide a larger screen to work in.

Step 3

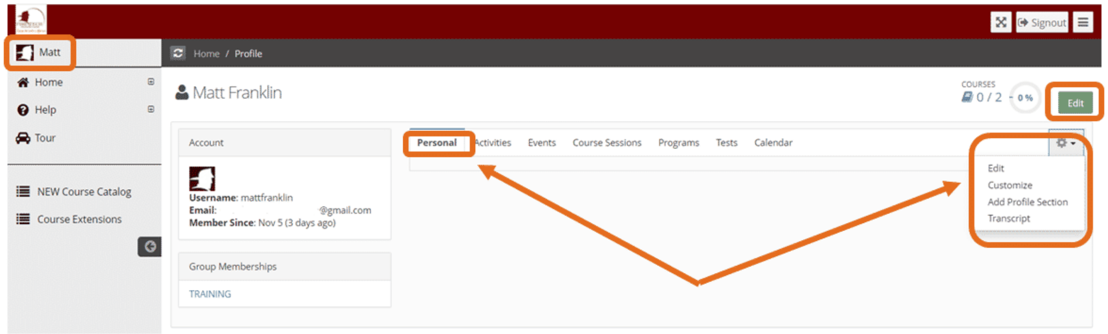
Tutorial



On the Dashboard you will notice a car icon that says **Tour.** This will help to familiarize you with the online learning platform.

Step 4

Profile Page

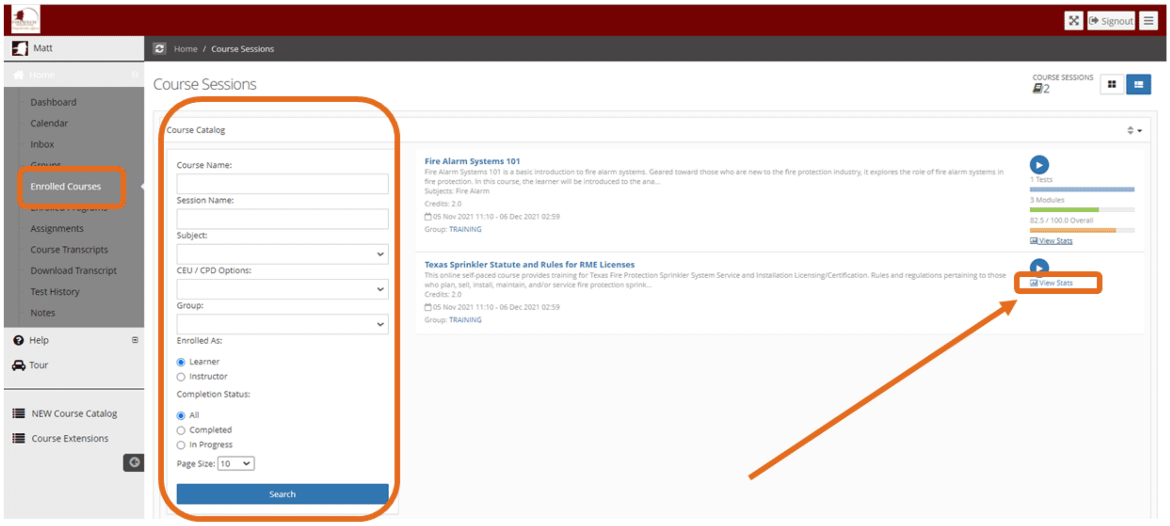


Username: mattfranklin
Email: @gmail.com
Member Since: Nov 5 (3 days ago)

When you click the firefighter icon on the left, next to your name, you will be taken to your **Profile Page**. This page allows you to edit your information and personalize your page.

Step 5

Course Sessions



Fire Alarm Systems 101

Fire Alarm Systems 101 is a basic introduction to fire alarm systems. Geared toward those who are new to the fire protection industry, it explores the role of fire alarm systems in fire protection. In this course, the learner will be introduced to the ana...

Subjects: Fire Alarm

Credits: 2.0

05 Nov 2021 11:10 - 06 Dec 2021 02:59

Group: TRAINING

Texas Sprinkler Statute and Rules for RME Licenses

This online self-paced course provides training for Texas Fire Protection Sprinkler System Service and Installation Licensing/Certification. Rules and regulations pertaining to those who plan, sell, install, maintain, and/or service fire protection sprink...

Credits: 2.0

05 Nov 2021 11:10 - 06 Dec 2021 02:59

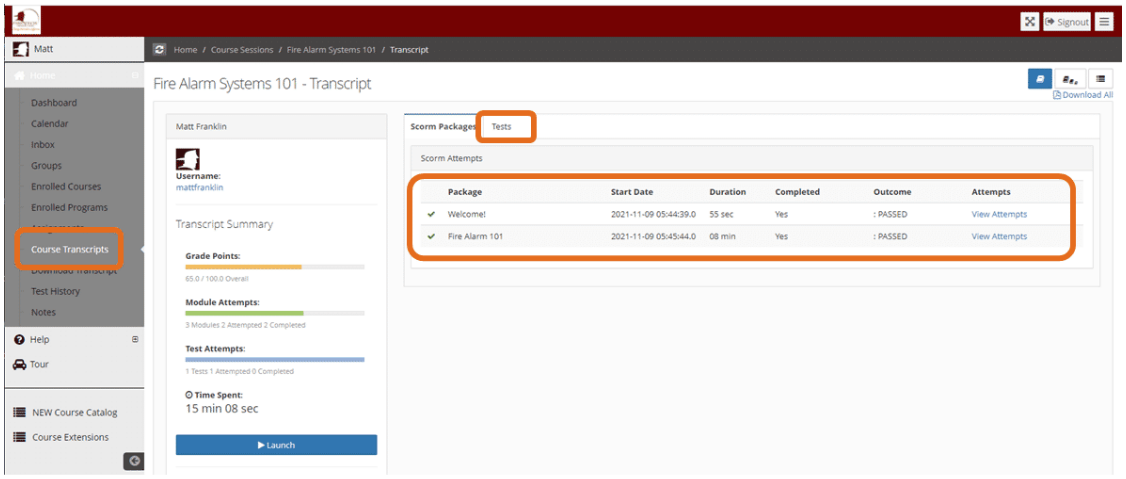
Group: TRAINING

Click on the **Enrolled Courses** link on the Dashboard to find your Course Sessions page. You may be taking multiple courses at once and the course search option may help you find it faster.

Under the play button to begin/resume your course, you will see a **View Stats** link. Click on this link to view your module and test completion for each course.

Step 6

Course Transcripts



Fire Alarm Systems 101 - Transcript

Matt Franklin

Username: mattfranklin

Transcript Summary

Grade Points: 65.0 / 100.0 Overall

Module Attempts: 3 Modules 2 Attempted 2 Completed

Test Attempts: 1 Tests 1 Attempted 0 Completed

Time Spent: 15 min 08 sec

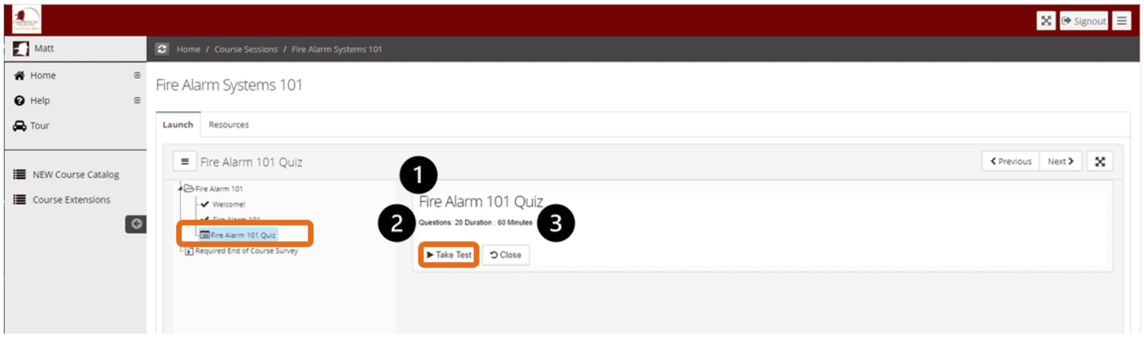
Scorm Attempts

	Package	Start Date	Duration	Completed	Outcome	Attempts
✓	Welcome!	2021-11-09 05:44:39.0	55 sec	Yes	: PASSED	View Attempts
✓	Fire Alarm 101	2021-11-09 05:45:44.0	08 min	Yes	: PASSED	View Attempts

Click on **Course Transcripts** to view the "packages" you have completed so far. You can click on the **Tests** tab to see your scores on the tests you have taken-including multiple attempts.

Step 7

Quizzes and Tests



Questions: 20 Duration : 60 Minutes

Once you have completed reading a lesson, you will be prompted to take a quiz.

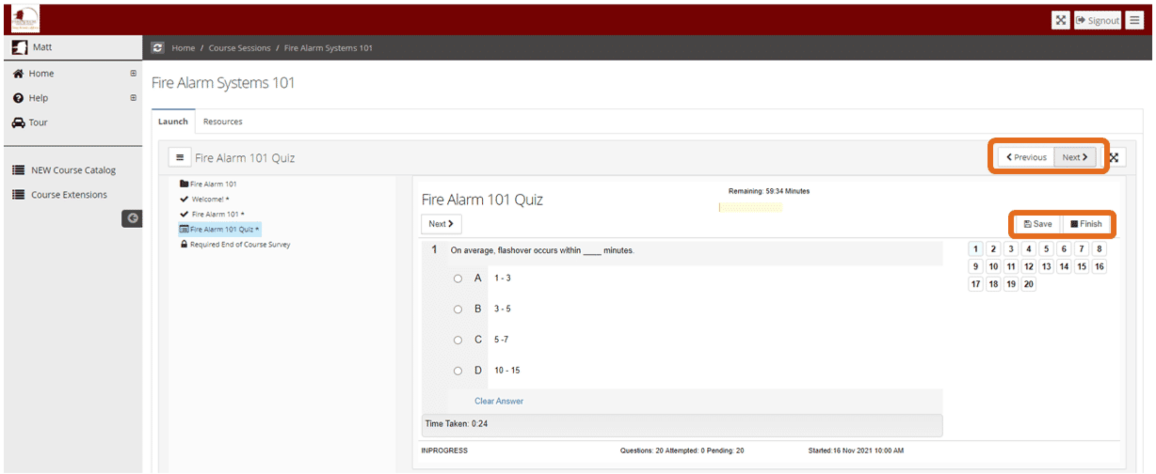
This shows:

1. The quiz you are taking.
2. The number of questions.
3. The length of time permitted to take the quiz.

Select the **Take Test** button when you are ready to take your quiz.

Step 8

Quizzes and Tests



Fire Alarm 101 Quiz

1 On average, flashover occurs within ____ minutes.

○ A 1 - 3

○ B 3 - 5

○ C 5 -7

○ D 10 - 15

Time Taken: 0:24

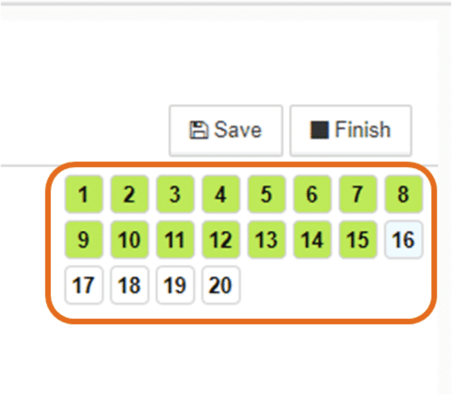
INPROGRESS Questions: 20 Attempted: 0 Pending: 20 Started:16 Nov 2021 10:00 AM

Once in the quiz, use the **Previous** and **Next** buttons to navigate through the questions. You can go back to a previous question at any time, however you are required to answer each question in order to complete the quiz.

You have the option to **Save** your answers if you need to take a break. Once you have answered all the questions, click **Finish** to end the quiz and review your results.

Step 9

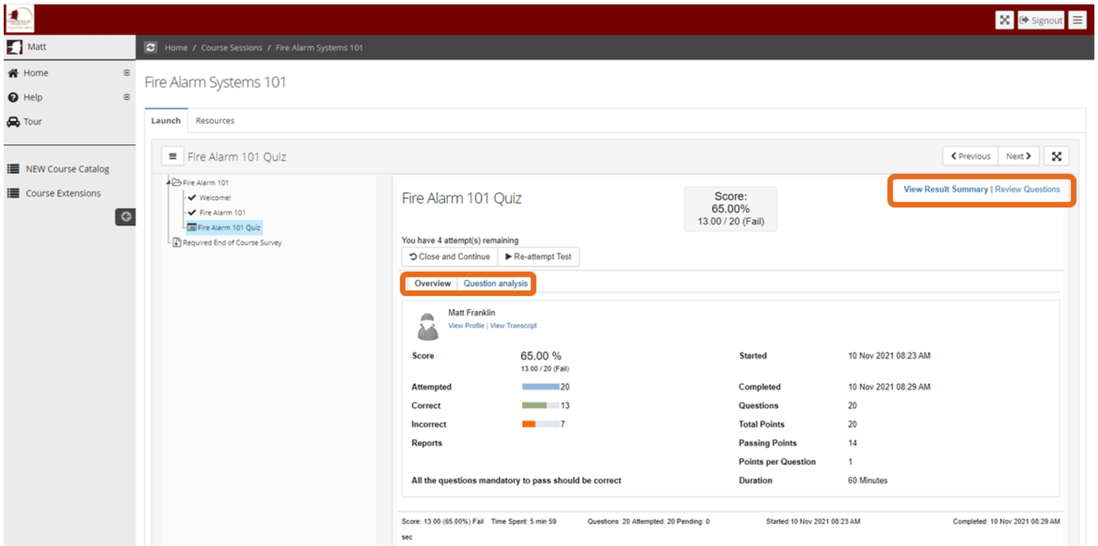
Quizzes and Tests



Just below the **Save** and **Finish** buttons, you will see the boxes at the **right side** of the screen **fill in** to show each question that you have **completed.**

Step 10

Quizzes and Tests Results



Fire Alarm 101 Quiz

Score:
65.00%
13.00 / 20 (Fail)

You have 4 attempt(s) remaining

Matt Franklin

Score	65.00 % 13.00 / 20 (Fail)	Started	10 Nov 2021 08:23 AM
Attempted	20	Completed	10 Nov 2021 08:29 AM
Correct	13	Questions	20
Incorrect	7	Total Points	20
Reports		Passing Points	14
		Points per Question	1
All the questions mandatory to pass should be correct		Duration	60 Minutes

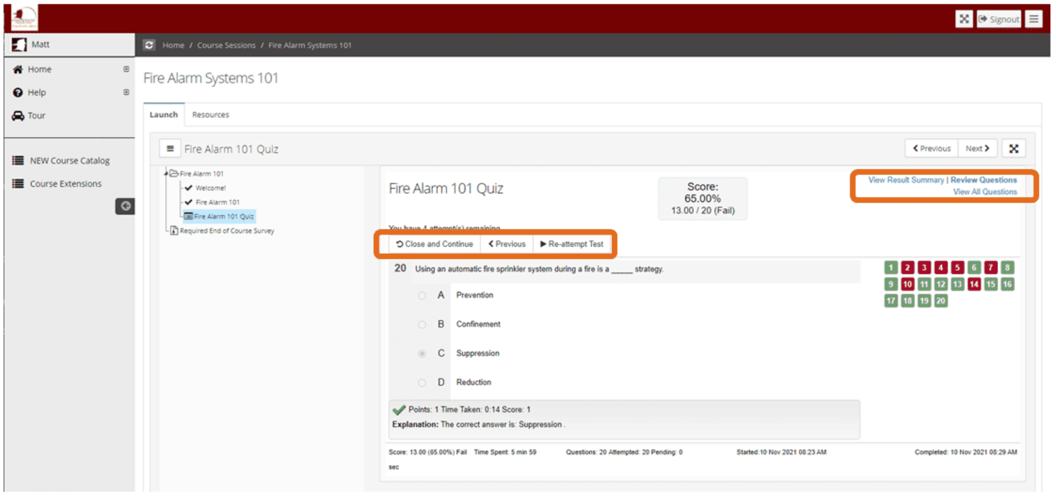
Score: 13.00 (65.00%) Fail Time Spent: 5 min 59 sec Questions: 20 Attempted: 20 Pending: 0 Started 10 Nov 2021 08:23 AM Completed: 10 Nov 2021 08:29 AM

Once you have finished the quiz, the following page will appear showing your **Result Summary**.

The **Overview** tab shows your results. The **Question Analysis** tab provides an analysis of all questions, as well as explanations and references for the answer solutions.

Step 11

Quiz and Test Review Questions



Fire Alarm Systems 101

Fire Alarm 101 Quiz

Score:
65.00%
13.00 / 20 (Fail)

You have 4 attempt(s) remaining

20 Using an automatic fire sprinkler system during a fire is a _____ strategy.

○ A Prevention
○ B Confinement
● C Suppression
○ D Reduction

✓ Points: 1 Time Taken: 0:14 Score: 1
Explanation: The correct answer is: Suppression .

Score: 13.00 (65.00%) Fail Time Spent: 5 min 59 sec Questions: 20 Attempted: 20 Pending: 0 Started:10 Nov 2021 08:23 AM Completed: 10 Nov 2021 08:29 AM

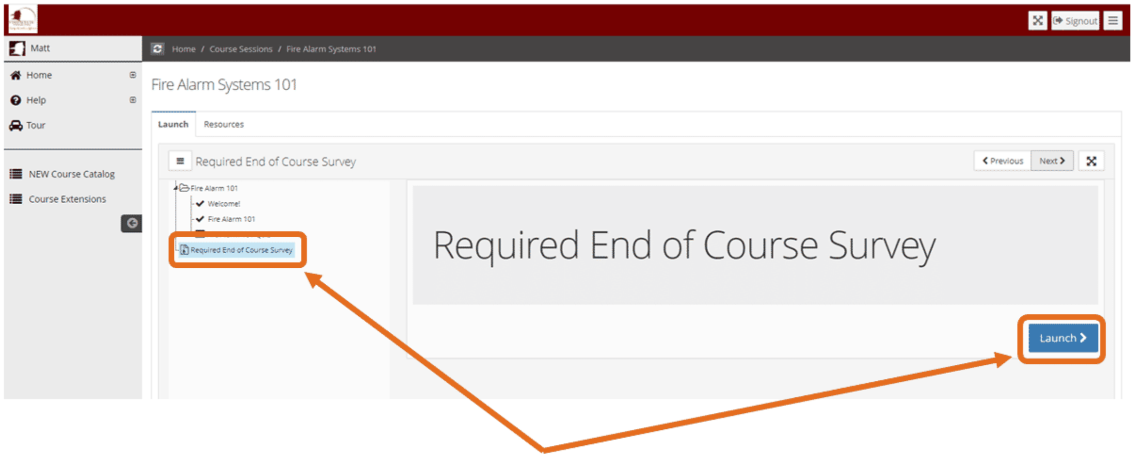
You also have the option to select **Review Questions**. This feature allows you to review each question and answer solution, one by one. Or choose **View All Questions** and scroll through them.

As you review your quiz, you can navigate between questions by selecting the question buttons on the right-hand side of the page, or by using the **Previous** or **Next** buttons.

Once you have reviewed your questions, you have the option to **Close and Continue** (proceed to the next module in the course) or **Re-attempt Test** to take the quiz again if you did not pass.

Step 12

Survey



When you have completed your course and the quiz, you will be directed to a **Required End of Course Survey**. This helps us to get your input on our courses. At Fire Tech, we are here to help you succeed. Let us know what is working and what we could do to improve our courses. Click the blue **Launch** button to begin the survey.

Summary

FIRE TECH
PRODUCTIONS
Training that makes a difference

Each self-paced course consists of a series of lessons and quizzes. The lessons and associated quizzes assess and provide immediate feedback on your understanding of the course material.

NICET and State prep courses will also offer three simulated exams at the end of the course. These simulated exams consist of quiz questions from each of the lesson modules, providing an additional opportunity to review the quiz questions in a more randomized format. The simulated exams in the NICET courses consist of the same number of questions as each corresponding official exam and are timed to duplicate the Computer-Based Testing experience.

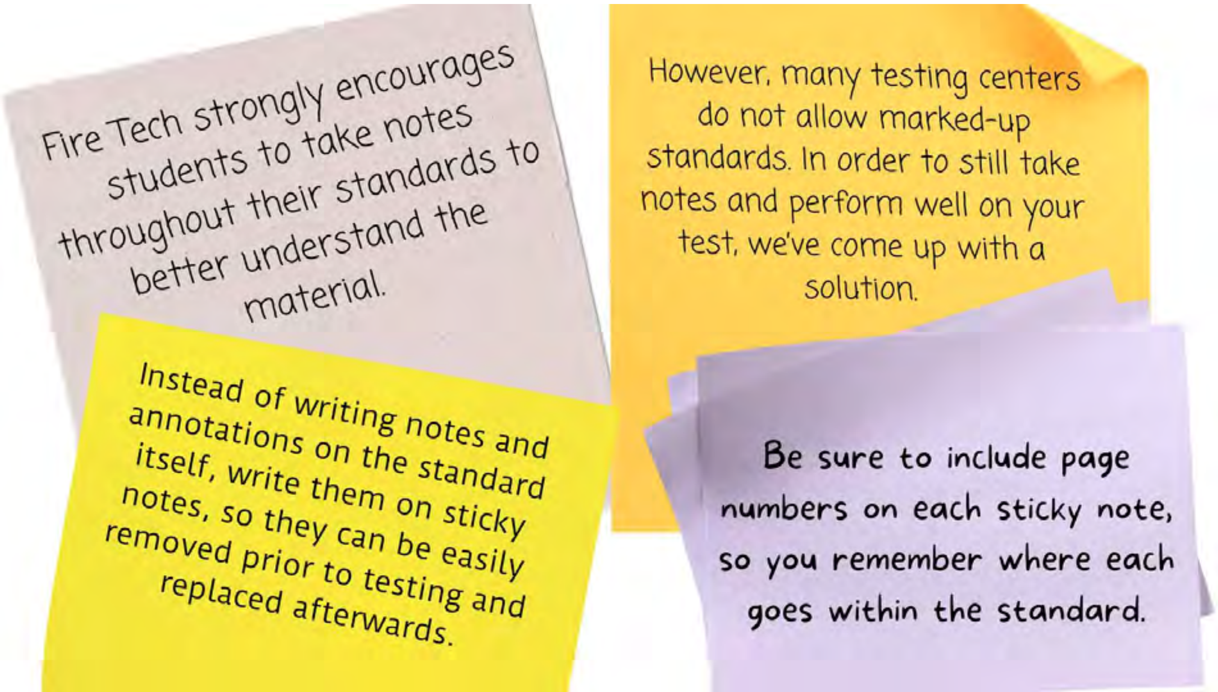
A completion certificate is available to download and print upon passing each course with a score of 70% or higher.

Best of Luck and Happy Studying

Please contact our office with questions:

info@firetech.com

CONTINUE



Fire Tech strongly encourages students to take notes throughout their standards to better understand the material.

Instead of writing notes and annotations on the standard itself, write them on sticky notes, so they can be easily removed prior to testing and replaced afterwards.

However, many testing centers do not allow marked-up standards. In order to still take notes and perform well on your test, we've come up with a solution.

Be sure to include page numbers on each sticky note, so you remember where each goes within the standard.

CONTINUE

Please click on the "Next" button above to get started on your course.

Glossary: Fire Alarm and Detection Equipment

This is the glossary for the Fire Alarm and Detection Equipment course. Click on a letter below to see each term and its definition.

A

B

C

D

E

F

H

I

L

M

- ☰ **N**
- ☰ **P**
- ☰ **R**
- ☰ **S**
- ☰ **T**
- ☰ **U**

Lesson 1 of 16

A

Addressable Fire Alarm System

A system in which the fire alarm control unit and its associated devices are connected and communicate digitally. Each device is separately addressed.

Alarm Signal

A signal that results from the manual or automatic detection of an alarm condition. (*NFPA* 72 2016, Section 3.3.253.1)

Automatic Fire Detector

A device designed to detect the presence of a fire signature and to initiate action. For the purpose of this Code, automatic fire detectors are classified as follows:
Automatic Fire Extinguishing or Suppression System Operation Detector, Fire-Gas Detector, Heat Detector, Other Fire Detectors, Radiant Energy-Sensing Detector, and Smoke Detector. (*NFPA* 72 2016, Section 3.3.66.2)

Authority Having Jurisdiction (AHJ)

An organization, office, or individual responsible for enforcing requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure. (*NFPA* 72 2016, Section 3.2.2)

Lesson 2 of 16

B

Beam Construction

Ceilings that have solid structural or solid nonstructural members projecting down from the ceiling surface more than 4 in. (100 mm) and spaced more than 36 in. (910 mm), center to center. (*NFPA* 72 2016, Section 3.3.38.1)

Lesson 3 of 16

C

Carbon Monoxide Alarm Signal

A signal indicating a concentration of carbon monoxide at or above the alarm threshold that could pose a risk to the life safety of the occupants and that requires immediate action. (*NFPA* 72 2016, Section 3.3.253.2)

Coded

An audible or visible signal that conveys several discrete bits or units of information. (*NFPA* 72 2016, Section 3.3.48)

Combination System

A fire alarm system in which components are used, in whole or in part, in common with a non-fire signaling system. Examples of non-fire systems are security, card access control, closed circuit television, sound reinforcement, background music, paging, sound masking, building automation, time, and attendance. (*NFPA* 72, 2016, Section 3.3.103.1)

Control Unit (Fire Alarm Control Unit-FACU)

A component of the fire alarm system, provided with primary and secondary power sources, which receives signals from initiating devices or other fire alarm control units, and processes these signals to determine part or all of the required fire alarm system output function(s). (*NFPA* 72 2016, Section 3.3.100)

Also known as the **Fire Alarm Control Panel** (FACP), **control panel**, or **control unit**.

Conventional Fire Alarm System

A fire alarm system that consists of a control panel employing one or more initiating circuits, wired in parallel. The system is not capable of identifying the device that is in alarm, supervisory, or trouble status.

D

Detector

A device suitable for connection to a circuit that has a sensor that responds to a physical stimulus such as heat or smoke. (*NFPA* 72 2016, Section 3.3.66)

Dwelling Unit

A single unit, providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation. (*NFPA* 72 2016, Section 3.3.79)

Lesson 5 of 16

E

Emergency Communications System (ECS)

A system for the protection of life by indicating the existence of an emergency situation and communicating information necessary to facilitate an appropriate response and action. (*NFPA* 72 2016, Section 3.3.85)

Evacuation Signal

A distinctive alarm signal intended to be recognized by the occupants as requiring evacuation of the building. (*NFPA* 72 2016, Section 3.3.253.4)

Lesson 6 of 16

F

Fire Alarm Control Unit

A component of the fire alarm system, provided with primary and secondary power sources, which receives signals from initiating devices or other fire alarm control units, and processes these signals to determine part or all of the required fire alarm system output function(s). (*NFPA* 72 2016, Section 3.3.100)

Also known as the **Fire Alarm Control Panel** (FACP), **control panel**, or **control unit**.

Fire Alarm System

A system or portion of a combination system that consists of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals. (*NFPA* 72 2016, Section 3.3.103)

H

Household Fire Alarm System

A system of devices that uses a fire alarm control unit (panel) to produce an alarm signal in the household for the purpose of notifying the occupants of the presence of a fire so that they will evacuate the premises. (*NFPA* 72 2016, Section 3.3.103.2)

Lesson 8 of 16

I

Initiating Device

A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box, or supervisory switch. (*NFPA* 72 2016, Section 3.3.131)

Initiating Device Circuit (IDC)

A circuit to which automatic or manual initiating devices are connected where the signal received does not identify the individual device operated. (*NFPA* 72 2016, Section 3.3.132)

Inspection Personnel

Individuals who conduct a visual examination of a system or portion thereof to verify that it appears to be in operating condition, in proper location, and is free of physical damage or conditions that impair operation. (*NFPA* 72 2016, Section 3.3.190.1)

L

Labeled

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner. (*NFPA* 72 2016, Section 3.2.4)

Level Ceiling

Ceilings that have a slope of less than or equal to 1 in 8 (*NFPA* 72 2016, Section 3.3.36.1)

Listed

Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose. (*NFPA* 72 2016, Section 3.2.5)

M

Malicious Alarm

An unwanted activation of an alarm initiating device caused by a person acting with malice. (*NFPA* 72 2016, Section 3.3.304.1)

Manual Fire Alarm Box

A manually operated device used to initiate a fire alarm signal. (*NFPA* 72 2016, Section 3.3.12.3)

Multiple-Station Alarm Device

Two or more single station alarm devices that can be interconnected so that actuation of one causes all integral or separate audible alarms to operate; or one single station alarm device having connections to other detectors or to a manual fire alarm box. (*NFPA* 72 2016, Section 3.3.161)

Multiplexing

A signaling method characterized by simultaneous or sequential transmission, or both, and reception of multiple signals on a signaling line circuit, a transmission channel, or a communications channel, including means for positively identifying each signal. (*NFPA* 72 2016, Section 3.3.162)

Lesson 11 of 16

N

Notification Appliance

A fire alarm system component such as a bell, horn, loudspeaker, visual notification appliance, or text display that provides audible, tactile, or visual outputs, or any combination thereof. (*NFPA* 72 2016, Section 3.3.172)

Notification Appliance Circuit (NAC)

A circuit or path directly connected to a notification appliance(s). (*NFPA* 72 2016, Section 3.3.173)

Nuisance Alarm

> An unwanted activation of a signaling system or an alarm initiating device in response to a stimulus or condition that is not the result of a potentially hazardous condition. (*NFPA* 72 2016, Section 3.3.304.2)

P

Private Operating Mode

Audible or visible signaling only to those persons directly concerned with the implementation and direction of emergency action initiation and procedure in the area protected by the fire alarm system. (*NFPA* 72 2016, Section 3.3.183.1)

Public Operating Mode

Audible or visible signaling to occupants or inhabitants of the area protected by the fire alarm system. (*NFPA* 72 2016, Section 3.3.183.2)

Lesson 13 of 16

R

Record of Completion

A document that acknowledges the features of installation, operation (performance), service, and equipment with representation by the property owner, system installer, system supplier, service organization, and the Authority Having Jurisdiction. (*NFPA* 72 2016, Section 3.3.229)

Lesson 14 of 16

S

Service Personnel

Individuals who perform those procedures, adjustments, replacement of components, system programming, and maintenance as described in the manufacturer’s service instructions that can affect any aspect of the performance of the system. (*NFPA* 72 2016, Section 3.3.190.2)

Shall

Indicates a mandatory requirement. (*NFPA* 72 2016, Section 3.2.6)

Should

Indicates a recommendation or that which is advised but not required. (*NFPA* 72 2016, Section 3.2.7)

Signal

An indication of a condition communicated by electrical, visible, audible, wireless, or other means. (*NFPA* 72 2016, Section 3.3.253)

Signaling Line Circuit (SLC)

A circuit path between any combination of addressable appliances or devices, circuit interfaces, control units, or transmitters over which multiple system input signals or output signals or both are carried. (*NFPA* 72 2016, Section 3.3.255)

Single-Station Alarm Device

An assembly that incorporates the detector, the control equipment, and the alarm-sounding device in one unit operated from a power supply either in the unit or obtained at the point of installation. (*NFPA* 72 2016, Section 3.3.260)

Sloping Ceiling

A ceiling that has a slope of more than 1 in 8. (*NFPA* 72 2016, Section 3.3.36.2)

Sloping Peaked-Type Ceiling

A ceiling in which the ceiling slopes in two directions from the highest point. Curved or domed ceilings can be considered peaked with the slope figured as the slope of the chord from highest to lowest point. (*NFPA* 72 2016, Section 3.3.36.3)

Sloping Shed-Type Ceiling

A ceiling in which the high point is at one side with the slope extending toward the opposite side. (*NFPA* 72 2016, Section 3.3.36.4)

Smoke Alarm

A single or multiple-station alarm responsive to smoke. (*NFPA* 72 2016, Section 3.3.265)

Smoke Detector

A device that detects visible or invisible particles of combustion. (*NFPA* 72 2016, Section 3.3.66.20)

Smooth Ceiling

A ceiling surface uninterrupted by continuous projections, such as solid joists, beams, or ducts, extending more than 4 in. (100 mm) below the ceiling surface. (*NFPA* 72 2016, Section 3.3.38.3)

Solid Joist Construction

Ceilings that have solid structural or solid nonstructural members projecting down from the ceiling surface for a distance of more than 4 in. (100 mm) and spaced at intervals of 36 in. (910 mm) or less, center to center. (*NFPA* 72 2016, Section 3.3.38.4)

Supervising Station

A facility that receives signals from protected premises fire alarm systems and at which personnel are in attendance at all times to respond to these signals. (*NFPA* 72 2016, Section 3.3.280)

Supervisory Signal

A signal that results from the detection of a supervisory condition. (*NFPA* 72 2016, Section 3.3.253.9)

System Designer

Individual responsible for the development of fire alarm and signaling system plans and specifications in accordance with this Code. (*NFPA* 72 2016, Section 3.3.190.3)

System Installer

Individual responsible for the proper installation of fire alarm and signaling systems in accordance with plans, specifications, and manufacturer’s requirements. (*NFPA* 72 2016, Section 3.3.190.4)

Lesson 15 of 16

T

Testing Personnel

Individuals who perform procedures used to determine the status of a system as intended by conducting acceptance, reacceptance, or periodic checks on systems. (*NFPA* 72 2016, Section 3.3.190.5)

Trouble Signal

A signal that results from the detection of a trouble condition. (*NFPA* 72 2016, Section 3.3.253.10)

Lesson 16 of 16

U

Unintentional Alarm

An unwanted activation of an alarm initiating device caused by a person acting without malice. (*NFPA* 72 2016, Section 3.3.304.3)

Unknown Alarm

An unwanted activation of an alarm initiating device or system output function where the cause has not been identified. (*NFPA* 72 2016, Section 3.3.304.4)

Unwanted Alarm

> Any alarm that occurs that is not the result of a potentially hazardous condition. (*NFPA* 72 2016, Section 3.3.304)

Ohio Fire Alarm and Detection Equipment-Introduction

FIRE TECH PRODUCTIONS

Welcome to the Introduction for the Ohio Fire Alarm and Detection Equipment course.

This introduction provides a brief overview of what will be covered in the course.

You can come back to this module and reference this information anytime in your menu.

Topics that are covered in this introduction are as follows:

- State of Ohio Important References
- Preparing for the Exam
- Study Tips
- Ohio Codes
- NFPA Codes
- *NFPA* 72 2016 Definitions

When you are ready to begin, click on the button above to start the course.

Overview

Glossary

Lesson 1 of 2

Overview

Welcome

Please review this introduction before getting started on the course.

We will look at key references and study tips. In addition, we will highlight key vocabulary terms in the glossary.

REFERENCES

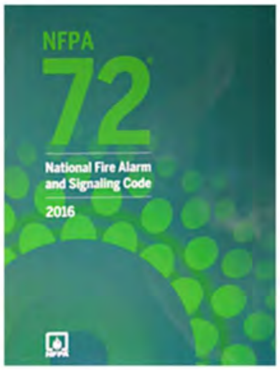
Key References

You will want to really focus on the following:

☐ *NFPA* 72 – National Fire Alarm and Signaling Code, 2016

☐ Ohio Building Code, 2017

☐ Ohio Fire Code, 2017



References

The exam is prepared from the following:

- Ohio Administrative Code Section 1301:7-7-09 (Ohio Fire Code), 2017 edition: https://codes.iccsafe.org/content/OHFCJAN2019E/ohio-administrative-code-1301-7-7-09-fire-protection-systems

- *NFPA* 72, 2016 edition

- Ohio Building Code Chapter 9, 2017 edition

CONTINUE

Additional Resources

Below is additional information and resources for the Ohio exam.

Ohio Department of Commerce – Division of State Fire Marshal:

Ohio Department of Commerce

To access the Ohio Department of Commerce – Division of State Fire Marshal, click on this "Click Here" button.

CLICK HERE

Ohio Department of Commerce phone: **(614) 752-7126**

The following downloadable PDF is for the Fire Protection Exam Application through the Ohio Department of Commerce:

PDF **FireProtectionExamApplication.pdf**
548.9 KB

PSI Candidate Information Bulletin

A very important source of information is the PSI Candidate Information Bulletin from PSI Services LLC. Take time to read it below in its **ENTIRETY**.

PDF

OhioCertificationExaminationBulletin.pdf

230.9 KB

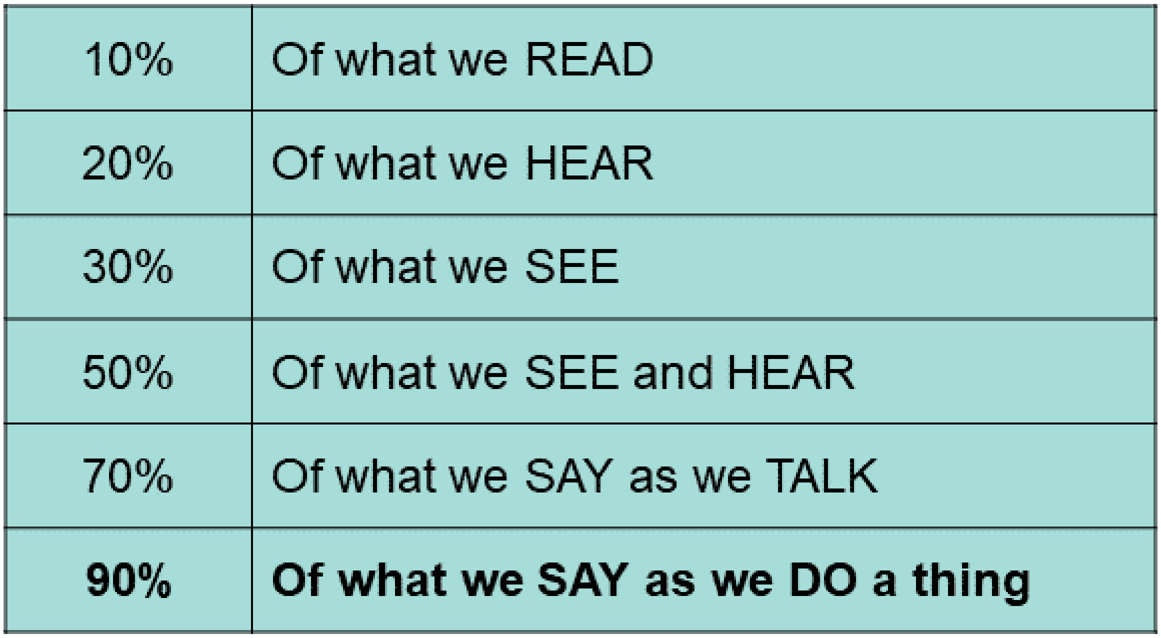
PSI Online Exams

To check for the most updated information on PSI Services, visit their website by clicking on this "Click Here" button.

CLICK HERE

HOW WE LEARN

Thinking About How We Learn



10%	Of what we READ
20%	Of what we HEAR
30%	Of what we SEE
50%	Of what we SEE and HEAR
70%	Of what we SAY as we TALK
90%	**Of what we SAY as we DO a thing**

Source: ***Skill With People*** by Les Giblin

Different people learn in different ways.

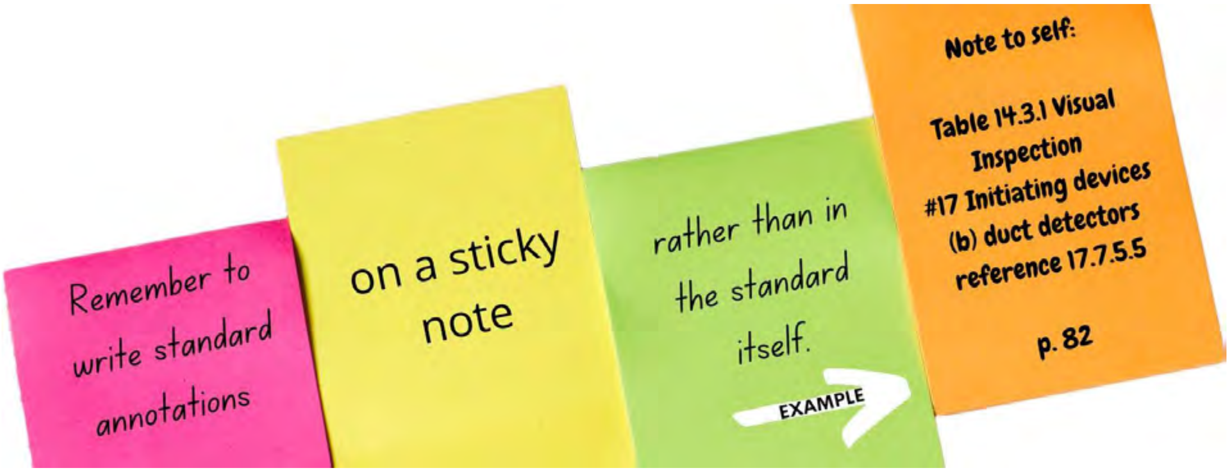
It is important to discover what works **best for you** and use your strengths to ensure you retain the material.

Training Modules

Be prepared to **refer to your copy of the referenced NFPA standards constantly** throughout these modules. Be comfortable with the technical material.

Each **training module** is carefully planned and designed to **highlight areas of the standards that you need to know in order to increase your chances of success on the exam**. The goal of these training modules is to help you become knowledgeable of important areas of the standards and to gain a working understanding of how to apply these requirements.

Take notes as you are studying, and **highlight** areas of the standards that are important to know.



The more familiar you are with the requirements, tables, and figures, the better your chances of success on the exam.

Ohio Codes

The Ohio Building Code has a lot of information in it. However, only a relatively small portion of the code pertains to fire alarm systems. It ***does*** give the State Fire Marshal the responsibility for administration and enforcement of any matter related to the installation, repair, modification or removal of fire protection equipment.

The Ohio Fire Code states that fire protection systems shall be installed, inspected, tested, and maintained per *NFPA* 72 2016 and *NFPA* 70 2017 (NEC). The code also defines specific rules for Ohio as well as reinforce some of the *NFPA* 72 2016 requirements.

- One of these requirements is to be certified and licensed by the state of Ohio.
- The only exception is for a provisional person in an approved formal apprenticeship program. They are permitted to work under the constant supervision of a certified person. The certified person is only allowed to supervise one provisional person.

NFPA Codes

NFPA 70 2017 (NEC) covers the wiring requirements for fire alarm systems

- General wiring practices and codes apply
- Article 760 covers fire alarm systems specifically

NFPA 72 2016 is the National Fire Alarm Code

- **Chapter 1** (Administration) – Defines the scope, purpose, and administration of *NFPA* 72 2016.
- **Chapter 2** (Referenced Publications) – Lists all referenced NFPA and ANSI specifications and codes.
- **Chapter 3** (Definitions) – Has a brief explanation of almost every fire alarm term.
- **Chapter 10** (Fundamentals of Fire Alarm Systems) – This large chapter includes power supplies, installation, equipment, and documentation.
- **Chapter 12** (Circuits and Pathways) – This relatively small chapter includes information on capabilities of types of circuits or system pathways.

- **Chapter 14** (Inspection, Testing and Maintenance) – Covers the requirements for the inspection, testing, and maintenance for all devices and systems.
- **Chapter 17** (Initiating Devices) – Contains all of the requirements for signaling devices, such as smoke and heat detectors.
- **Chapter 18** (Notification Appliances) – Covers the requirements for alarm bells, sirens, lights, and any device that indicates an alarm.
- **Chapter 21** (Emergency Control Functions and Interfaces) – Covers the requirements for emergency control function interfaces.
- **Chapter 23** (Protected Premises Fire Alarm Systems) – Covers system performance and integrity requirements.
- **Chapter 24** (Emergency Communications Systems (ECS)) – Covers the requirements of communications and mass notification systems.
- **Chapter 26** (Supervising Station Fire Alarm Systems) – Covers the requirements between a continuously attended supervising station and the protected premises.
- **Chapter 27** (Public Reporting Fire Alarm Systems) – Covers the requirements for municipal fire alarm systems.

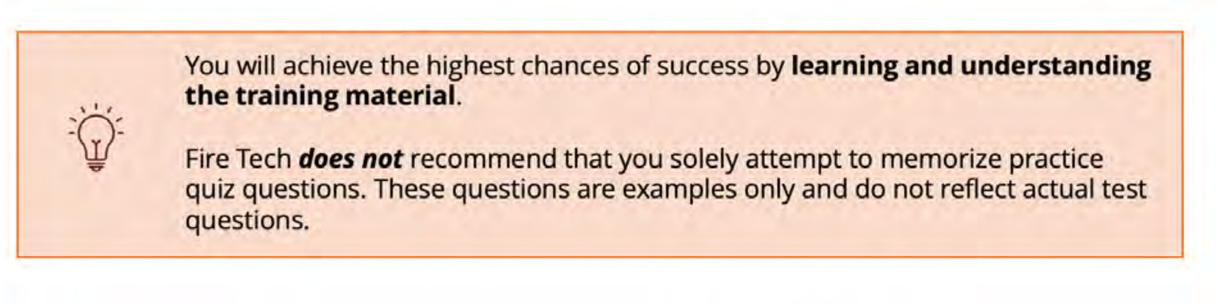
- **Chapter 29** (Single- and Multiple-Station Alarms and Household Fire Alarm Systems) – Covers requirements for dwellings, hotels, day care, and nursing facilities.

NFPA 72 2016 also **contains several Annexes and supplements** that have very **valuable examples and information**. It is **recommended you study this material** as well.

QUIZZES

The Quizzes

Fire Tech provides a practice quiz associated with each training module, which should be taken following completion of the module. As you take each practice quiz, use your copy of the referenced *NFPA* standards to **look up every answer to each quiz question**. This will assist you in **becoming more familiar with the requirements and where they are located** in each of the codes and standards.



You will achieve the highest chances of success by **learning and understanding the training material**.

Fire Tech ***does not*** recommend that you solely attempt to memorize practice quiz questions. These questions are examples only and do not reflect actual test questions.

Additionally, **read each question carefully**. Sift through what is pertinent to the question and what is irrelevant information that may be included as a distractor.

You will achieve the highest chances of success by learning and understanding the training material. Fire Tech does **not** recommend that you solely attempt to memorize practice quiz questions.

KNOWLEDGE CHECKS

Knowledge Checks

To help you apply course material and prepare for the quizzes, **knowledge checks** are sprinkled throughout each course.

Completing these knowledge checks is **required** to proceed further in the lesson. If you're stuck on a question, refer to previous lesson material and use your NFPA standard to find the answer.

Knowledge checks will help you apply course material and prepare for course quizzes.

○ True

○ False

SUBMIT

Complete the knowledge check above before moving on.

Practice Exams

Once you have read all of the lessons in this course and passed all of the quizzes, you will be ready to take the **Practice Exam**.

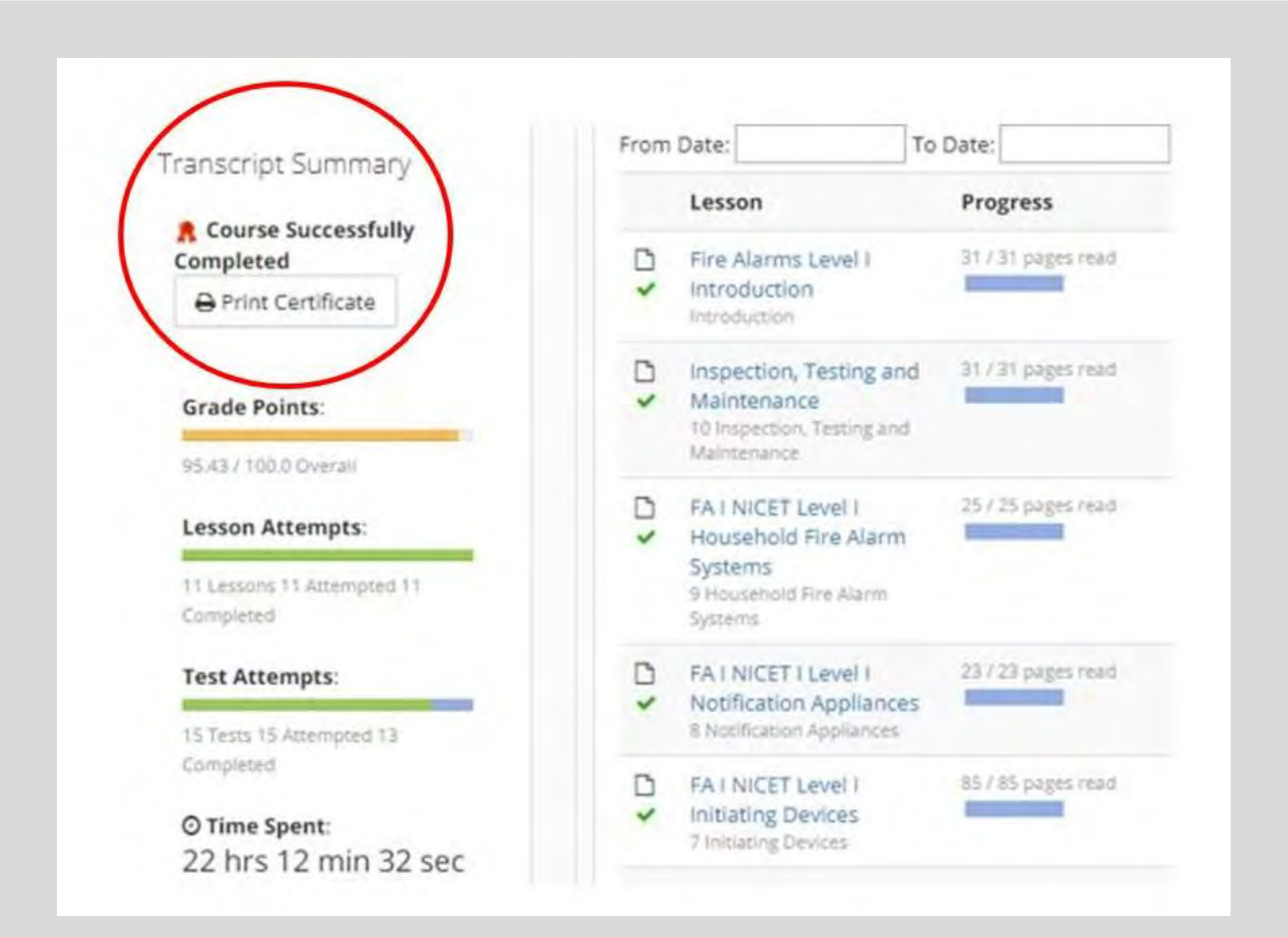
The Practice Exam consists of questions from the quizzes and are presented in a randomized manner. Fire Tech highly recommends that you take each of these practice exams.

Three practice exams are offered:

- Exam #1 is **required** to pass the course
- Exams #2 and #3 are **optional** and are not required to pass the course.

CONTINUE

Course Completion



Transcript Summary

Course Successfully Completed

Print Certificate

Grade Points:

95.43 / 100.0 Overall

Lesson Attempts:

11 Lessons 11 Attempted 11 Completed

Test Attempts:

15 Tests 15 Attempted 13 Completed

Time Spent:

22 hrs 12 min 32 sec

From Date: To Date:

	Lesson	Progress
✓	Fire Alarms Level I Introduction Introduction	31 / 31 pages read
✓	Inspection, Testing and Maintenance 10 Inspection, Testing and Maintenance	31 / 31 pages read
✓	FA I NICET Level I Household Fire Alarm Systems 9 Household Fire Alarm Systems	25 / 25 pages read
✓	FA I NICET I Level I Notification Appliances 8 Notification Appliances	23 / 23 pages read
✓	FA I NICET Level I Initiating Devices 7 Initiating Devices	85 / 85 pages read

Upon successful completion of the Practice Exam #1, you can download your course completion certificate, as shown in the transcript summary.

GLOSSARY

Lesson 2 of 2

Glossary

CONTINUE

Common Acronyms

Every industry has its own unique terms and acronyms. Here are some common acronyms related to fire alarm systems that you will see throughout this course. Click on each "**+**" sign below to learn more about common acronyms you will see in this module and in the field. For now, take a moment to become familiar with them, and see what the letters stand for.

AHJ —

Authority Having Jurisdiction

CFPS —

Certified Fire Protection Specialist

FACU —

Fire Alarm Control Unit (also called a Fire Alarm Control Panel (FACP)

FAS —

Fire Alarm System

IBC —

International Building Code

IDC —

Initiating Device Circuit

IFC —

International Fire Code

NAC —

Notification Appliance Circuit

NEC —

National Electrical Code

NFPA —

National Fire Protection Association

NICET —

National Institute for Certification in Engineering Technologies

SLC —

Signaling Line Circuit

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Glossary

Click on each "**+**" symbol to see the definition for each word below. These words are also linked throughout the course. Remember **all** of the definitions that may be on the exam are in *NFPA* 72 2016, Chapter 3.

Addressable Fire Alarm System —

A system in which the fire alarm control unit and its associated devices are connected and communicate digitally. Each device is separately addressed.

Alarm Signal —

A signal that results from the manual or automatic detection of an alarm condition. (*NFPA* 72 2016, Section 3.3.253.1)

Authority Having Jurisdiction (AHJ)

An organization, office, or individual responsible for enforcing requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure. (*NFPA* 72 2016, Section 3.2.2)

Automatic Fire Detector

A device designed to detect the presence of a fire signature and to initiate action. For the purpose of this Code, automatic fire detectors are classified as follows:

- automatic fire extinguishing or suppression system operation detector
- heat detector
- radiant energy-sensing fire detector
- fire-gas detector
- other fire detector
- smoke detector

(*NFPA* 72 2016, Section 3.3.66.2)

Beam Construction

Ceilings that have solid structural or solid nonstructural members projecting down from the ceiling surface more than 4 in. (100 mm) and spaced more than 36 in. (910 mm), center to center. (*NFPA* 72 2016, Section 3.3.38.1)

Carbon Monoxide Alarm Signal

A signal indicating a concentration of carbon monoxide at or above the alarm threshold that could pose a risk to the life safety of the occupants and that requires immediate action. (*NFPA* 72 2016, Section 3.3.253.2)

Coded

An audible or visible signal that conveys several discrete bits or units of information. (*NFPA* 72 2016, Section 3.3.48)

Combination System

A fire alarm system in which components are used, in whole or in part, in common with a non-fire signaling system. Examples of non-fire systems are security, card access control, closed circuit television, sound reinforcement, background music, paging, sound masking, building automation, time, and attendance. (*NFPA* 72 2016, Section 3.3.103.1)

Control Unit (Fire Alarm Control Unit-FACU)

A component of the fire alarm system, provided with primary and secondary power sources, which receives signals from initiating devices or other fire alarm control units, and processes these signals to determine part or all of the required fire alarm system output function(s). (*NFPA* 72 2016, Section 3.3.100)

Also known as the **Fire Alarm Control Panel** (FACP), **control panel**, or **control unit**.

Conventional Fire Alarm System

A fire alarm system that consists of a control panel employing one or more initiating circuits, wired in parallel. The system is not capable of identifying the device that is in alarm, supervisory, or trouble status.

Detector

A device suitable for connection to a circuit that has a sensor that responds to a physical stimulus such as heat or smoke. (*NFPA* 72 2016, Section 3.3.66)

Dwelling Unit

A single unit, providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation. (*NFPA* 72 2016, Section 3.3.79)

Emergency Communication Systems

A system for the protection of life by indicating the existence of an emergency situation and communicating information necessary to facilitate an appropriate response and action. (*NFPA* 72 2016, Section 3.3.85)

Evacuation Signal

A distinctive alarm signal intended to be recognized by the occupants as requiring evacuation of the building. (*NFPA* 72 2016, Section 3.3.253.4)

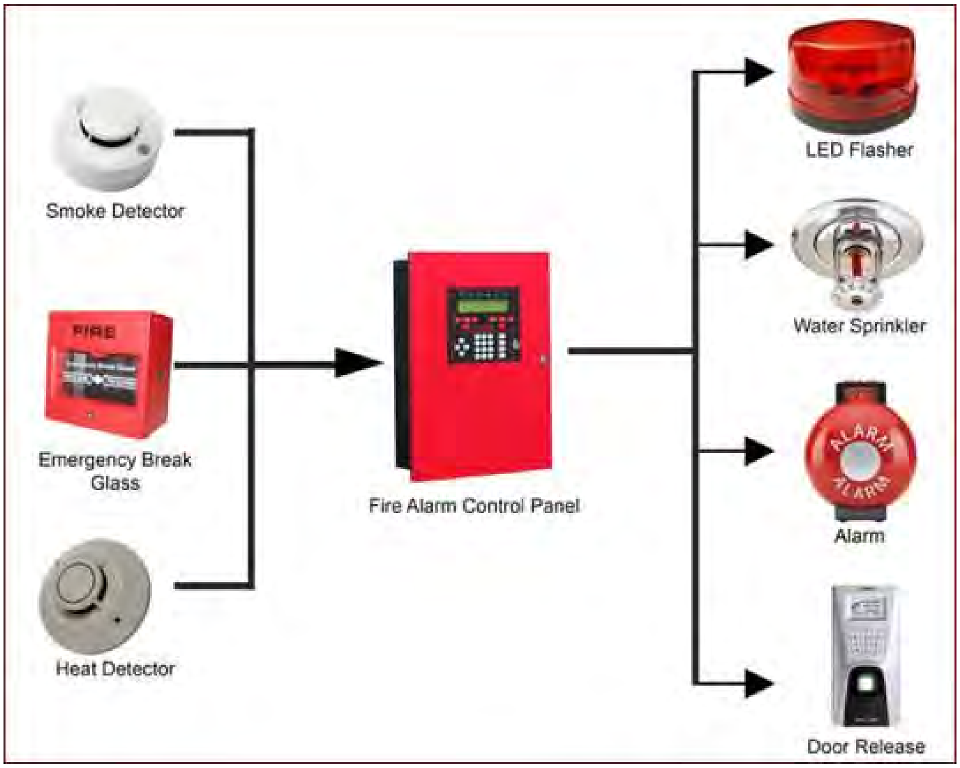
Fire Alarm Control Unit (FACU)

A component of the fire alarm system, provided with primary and secondary power sources, which receives signals from initiating devices or other fire alarm control units, and processes these signals to determine part or all of the required fire alarm system output function(s). (*NFPA* 72 2016, Section 3.3.100)

Also known as the **Fire Alarm Control Panel** (FACP), **control panel**, or **control unit**.

Fire Alarm System

A system or portion of a combination system that consists of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals.) (Section 3.3.103)



Household Fire Alarm System

A system of devices that uses a fire alarm control unit (panel) to produce an alarm signal in the household for the purpose of notifying the occupants of the presence of a fire so that they will evacuate the premises. (*NFPA* 72 2016, Section 3.3.103.2)

Initiating Device

A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box, or supervisory switch. (*NFPA* 72 2016, Section 3.3.131)

Initiating Device Circuit

A circuit to which automatic or manual initiating devices are connected where the signal received does not identify the individual device operated. (*NFPA* 72 2016, Section 3.3.132)

Inspection Personnel

Individuals who conduct a visual examination of a system or portion thereof to verify that it appears to be in operating condition, in proper location, and is free of physical damage or conditions that impair operation. (*NFPA* 72 2016, Section 3.3.190.1)

Lableled

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner. (*NFPA* 72 2016, Section 3.2.4)

Level Ceiling

Ceilings that have a slope of less than or equal to 1 in 8 (*NFPA* 72 2016, Section 3.3.36.1)

Listed

Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose. (*NFPA* 72 2016, Section 3.2.5)

Malicious Alarm

An unwanted activation of an alarm initiating device caused by a person acting with malice. (*NFPA* 72 2016, Section 3.3.304.1)

Manual Fire Alarm Box

A manually-operated device used to initiate a fire alarm signal. (*NFPA* 72 2016, Section 3.3.12.3)

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Two or more single station alarm devices that can be interconnected so that actuation of one causes all integral or separate audible alarms to operate; or one single station alarm device having connections to other detectors or to a manual fire alarm box. (*NFPA* 72 2016, Section 3.3.161)

Multiplexing

A signaling method characterized by simultaneous or sequential transmission, or both, and reception of multiple signals on a signaling line circuit, a transmission channel, or a communications channel, including means for positively identifying each signal. (*NFPA* 72 2016, Section 3.3.162)

Notification Appliance

A fire alarm system component such as a bell, horn, speaker, light, or text display that provides audible, tactile, or visible outputs, or any combination thereof. (*NFPA* 72 2016, Section 3.3.172)

Notification Appliance Circuit (NAC)

A circuit or path directly connected to a notification appliance(s). (*NFPA* 72 2016, Section 3.3.173)

Nuisance Alarm

An unwanted activation of a signaling system or an alarm initiating device in response to a stimulus or condition that is not the result of a potentially hazardous condition. (*NFPA* 72 2016, Section 3.3.304.2)

Private Operating Mode

Audible or visible signaling only to those persons directly concerned with the implementation and direction of emergency action initiation and procedure in the area protected by the fire alarm system. (*NFPA* 72 2016, Section 3.3.183.1)

Public Operating Mode

Audible or visible signaling to occupants or inhabitants of the area protected by the fire alarm system. (*NFPA* 72 2016, Section 3.3.183.2)

Record of Completion

A document that acknowledges the features of installation, operation (performance), service, and equipment with representation by the property owner, system installer, system supplier, service organization, and the Authority Having Jurisdiction. (*NFPA* 72 2016, Section 3.3.229)

Service Personnel

Individuals who perform those procedures, adjustments, replacement of components, system programming, and maintenance as described in the manufacturer's service instructions that can affect any aspect of the performance of the system. (*NFPA* 72 2016, Section 3.3.190.2)

Shall

Indicates a mandatory requirement. (*NFPA* 72 2016, Section 3.2.6)

Should

Indicates a recommendation or that which is advised but not required. (*NFPA* 72 2016, Section 3.2.7)

Signal

An indication of a condition communicated by electrical, visible, audible, wireless, or other means. (*NFPA* 72 2016, Section 3.3.253)

Signaling Line Circuit

A circuit or path between any combination of circuit interfaces, control units, or transmitters over which multiple system input signals or output signals, or both, are carried. (*NFPA* 72 2016, Section 3.3.255)

Single-Station Alarm Device

An assembly that incorporates the detector, the control equipment, and the alarm-sounding device in one unit operated from a power supply either in the unit or obtained at the point of installation. (*NFPA* 72 2016, Section 3.3.260)

Sloping Ceiling

A ceiling that has a slope of more than 1 in 8. (*NFPA* 72 2016, Section 3.3.36.2)

Sloping Peaked-Type Ceiling

A ceiling in which the ceiling slopes in two directions from the highest point. Curved or domed ceilings can be considered peaked with the slope figured as the slope of the chord from highest to lowest point. (*NFPA* 72 2016, Section 3.3.36.3)

Sloping Shed-Type Ceiling

A ceiling in which the high point is at one side with the slope extending toward the opposite side. (*NFPA* 72 2016, Section 3.3.36.4)

Smoke Detector

A device that detects visible or invisible particles of combustion. (*NFPA* 72 2016, Section 3.3.66.20)

Smooth Ceiling

A ceiling surface uninterrupted by continuous projections, such as solid joists, beams, or ducts, extending more than 4 in. (100 mm) below the ceiling surface. (*NFPA* 72 2016, Section 3.3.38.3)

Solid Joist Construction

Ceilings that have solid structural or solid nonstructural members projecting down from the ceiling surface for a distance of more than 4 in. (100 mm) and spaced at intervals of 36 in. (910 mm) or less, center to center. (*NFPA* 72 2016, Section 3.3.38.4)

Supervising Station

A facility that receives signals and at which personnel are in attendance at all times to respond to these signals. (*NFPA* 72 2016, Section 3.3.280)

Supervisory Signal

A signal indicating the need for action in connection with the supervision of guard tours, the fire suppression systems or equipment, or the maintenance features of related systems. (*NFPA* 72 2016, Section 3.3.253.9)

System Designer

Individual responsible for the development of fire alarm and signaling system plans and specifications in accordance with this Code. (*NFPA* 72 2016, Section 3.3.190.3)

System Installer

Individual responsible for the proper installation of fire alarm and signaling systems in accordance with plans, specifications, and manufacturer's requirements. (*NFPA* 72 2016, Section 3.3.190.4)

Testing Personnel

Individuals who perform procedures used to determine the status of a system as intended by conducting acceptance, reacceptance, or periodic checks on systems. (*NFPA* 72 2016, Section 3.3.190.5)

Trouble Signal

A signal that results from the detection of a trouble condition. (*NFPA* 72 2016, Section 3.3.253.10)

Unintentional Alarm

An unwanted activation of an alarm initiating device caused by a person acting without malice. (*NFPA* 72 2016, Section 3.3.304.3)

Unknown Alarm

An unwanted activation of an alarm initiating device or system output function where the cause has not been identified. (*NFPA* 72 2016, Section 3.3.304.4)

Unwanted Alarm

> Any alarm that occurs that is not the result of a potentially hazardous condition. (*NFPA* 72 2016, Section 3.3.304)

CONTINUE

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

Ohio Fire Alarm and Detection Equipment-Fire Alarm Basics and Wiring

Welcome to the Fire Alarm Basics and Wiring module of the Ohio Fire Alarm and Detection Systems Course.

By the end of this module, you will be able to do the following:

- Distinguish between conventional and addressable fire alarm systems and related subsystems
- Identify a fire alarm system
- Identify wiring requirements from Article 760 of *NFPA 70 (National Electrical Code) 2017*
- Define various pathway class designations
- Recognize capacity requirements for back-up and secondary power supply operations and alarm conditions
- Include a 20% safety margin for battery amp-hour calculations
- Identify three different types of fire alarm circuits
- Clarify the difference between Class A redundant circuits and Class B non-redundant circuits

- Describe the differences between two-wire and four-wire detectors

Key References for this module are:

- *NFPA* 70 – National Electric Code, Article 760, 2017
- *NFPA* 72 – National Fire Alarm and Signaling Code, Chapter 10 and Chapter 12, 2016

When you are ready to begin, click on the button above to start the course.

Conventional vs Addressable Fire Alarm Systems

Articles and Circuits

Power Supplies and Generators

Circuits and Pathways

Two-Wire vs. Four-Wire Detectors

Lesson 1 of 5

Conventional vs Addressable Fire Alarm Systems

This section will clarify the differences between **conventional** and **addressable** fire alarm systems.

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Distinguish between conventional and addressable fire alarm systems and related subsystems

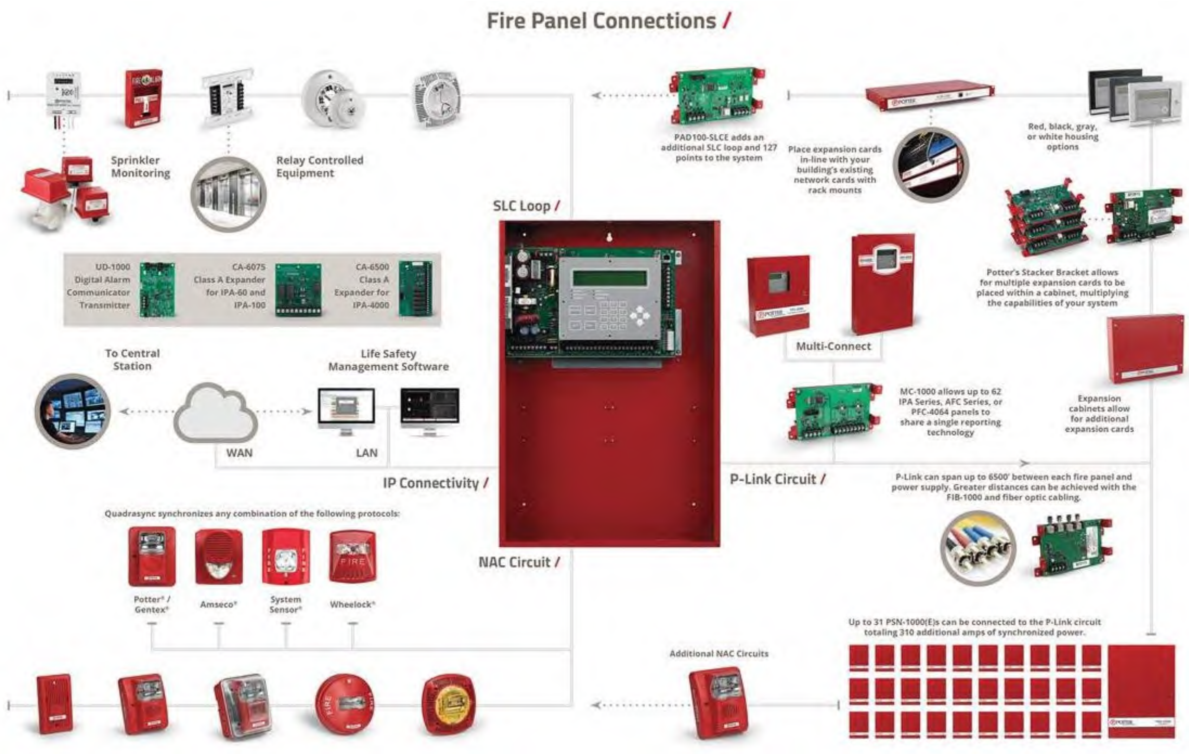
2 Identify a fire alarm system

CONTINUE

ⓘ **Key Reference: *NFPA 72* 2016, Section 3.3.103**

What is a fire alarm system?

Per *NFPA* 72 2016, Section 3.3.103, a **fire alarm system** is *"a system or portion of a combination system that consists of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals."*



(Click to enlarge)

To state it simply: a fire alarm system is a network of **wiring, appliances, devices, power, and control**, including **supervision**, intended to **warn** people of a fire condition, encourage **evacuation**, and **notify** emergency personnel and/or organizations.

CONTINUE

Watch the video below to learn more about a fire alarm and detection system.

Video run time 1:36

ⓘ Systems that have positive alarm features shall be permitted if approved by the AHJ. ***NFPA 72*** **2016, Section 23.8.1.2.1**

CONTINUE

Conventional vs. addressable fire alarm systems

There are two common types of fire alarm systems: **conventional fire alarm systems** and **addressable fire alarm systems**.

Both systems monitor circuits for **opens**, **shorts**, and **grounds**. They both also monitor primary and secondary **power supplies** for abnormal conditions. But they do have some important differences.

Watch the video below for an explanation about the differences between conventional and addressable fire alarm systems.

Video run time 1:44

CONVENTIONAL FIRE ALARM SYSTEMS

Conventional fire alarm systems

Conventional fire alarm systems consist of three subsystems:

CONTROL UNIT

INITIATING DEVICE CIRCUIT (ID...

NOTIFICATION APPLIANCE CIRCUI...

Comprised of primary and secondary power supplies; monitors circuits for open, shorts, or grounds; activates notification appliances and control outputs as necessary.

CONTROL UNIT	INITIATING DEVICE CIRCUIT (ID...	NOTIFICATION APPLIANCE CIRCUI...

Provides inputs to the control unit.
Initiating Device Circuits (IDCs) are the input circuits to the fire alarm control unit, which initiate action. The IDCs are comprised of initiating devices such as:

- Heat detectors
- Smoke detectors
- Manual pull stations
- Waterflow switches

- Sprinkler valve tamper switches

CONTROL UNIT	INITIATING DEVICE CIRCUIT (ID…	NOTIFICATION APPLIANCE CIRCUI…

Warns occupants of the condition detected and/or solicits assistance to rectify that condition.
Notification Appliance Circuits (NACs) are the audio, visual, or other means by which the fire alarm system **informs** occupants and/or supervising stations about fire emergencies or other abnormal conditions. The NACs are connected to devices such as horns, strobe lights, speakers, bells, or combinations thereof.

CONTINUE

Conventional fire alarm systems use **Initiating Device Circuits (IDCs)**. These circuits make up "zones" consisting of multiple initiating devices (e.g., heat detectors, smoke detectors, or manual pull stations), which are connected to the control unit.

Conventional fire alarm systems identify the zone that has a trouble signal, alarm signal, or supervisory signal. If needed, notification appliances on a **Notification Appliance Circuit (NAC)** are then activated to warn occupants or emergency personnel to take appropriate action.

LET'S TAKE A CLOSER LOOK

1


COMM. FAIL
AC POWER
BATT. FAULT
ALARM
SYSTEM TRBL.
SUPERVISORY
FIRE WATCH
411UDAC
FIRE ALARM COMMUNICATOR

Control Unit

The **control unit** (also known as a control panel, fire alarm control panel [FACP] or fire alarm contol unit [FACU]) is the **"brain" of the fire alarm system.**

When an initiating device detects a fire condition (heat, smoke, flame, etc.) or manual activation, the device **produces a short circuit** on the circuit.

CONTINUE

Watch the video below for an overview of the Fire Alarm Control Panel.

Video run time 0:44

The **control unit** makes decisions based on programming to:

- activate notification appliances
- activate relays
- provide auxiliary output

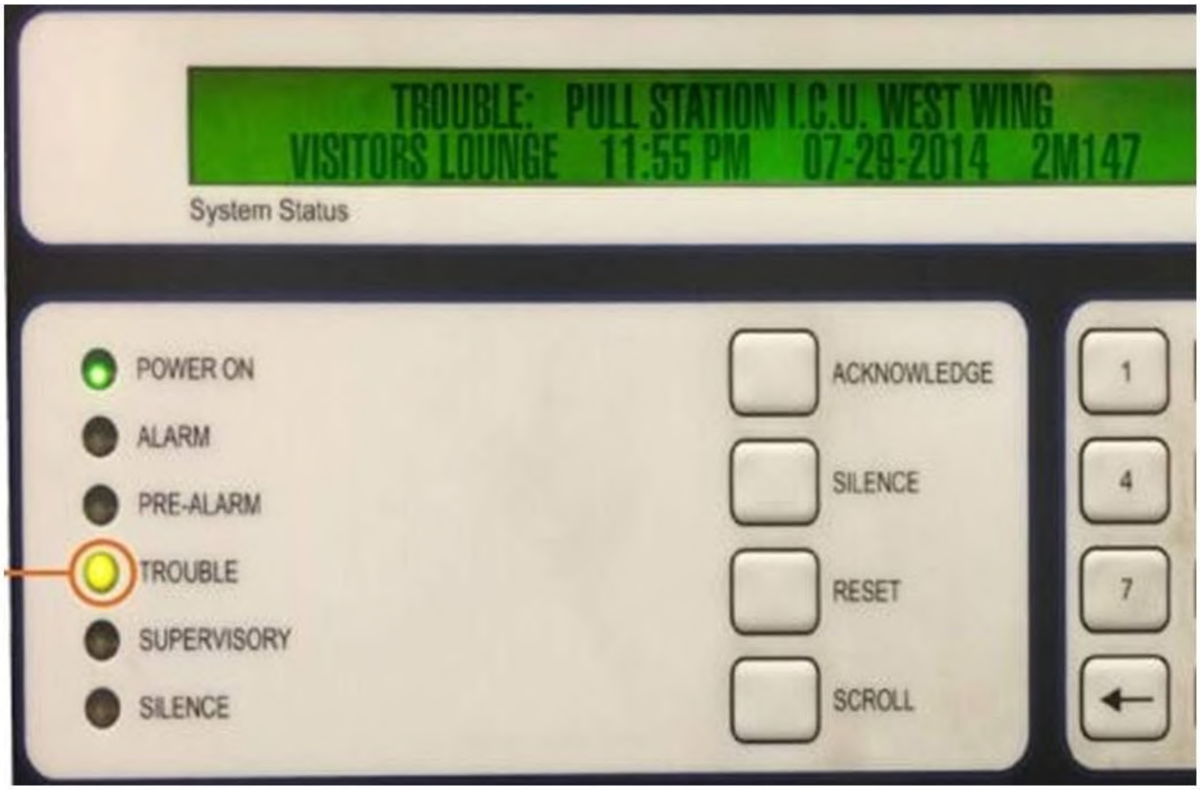
CONTINUE

Trouble signals

The control unit also generates **trouble signals** to tell us when the integrity of any portion of the fire alarm system has been compromised and requires **immediate action**.

Problems may pertain to:

- The **initiating device circuits**
- The **notification appliance circuits**
- Any portion of the control unit
- Anything associated with power supplies



Trouble signal image

The **trouble circuits** monitor:

- All wiring for opens or shorts to ground
- The control unit and power supplies for system integrity

The trouble circuits trigger a **trouble signal** at the **control unit**. They then activate any required signals and report the condition to the appropriate persons when required.

2

Initiating Device Circuits (IDCs)

IDC Diagram

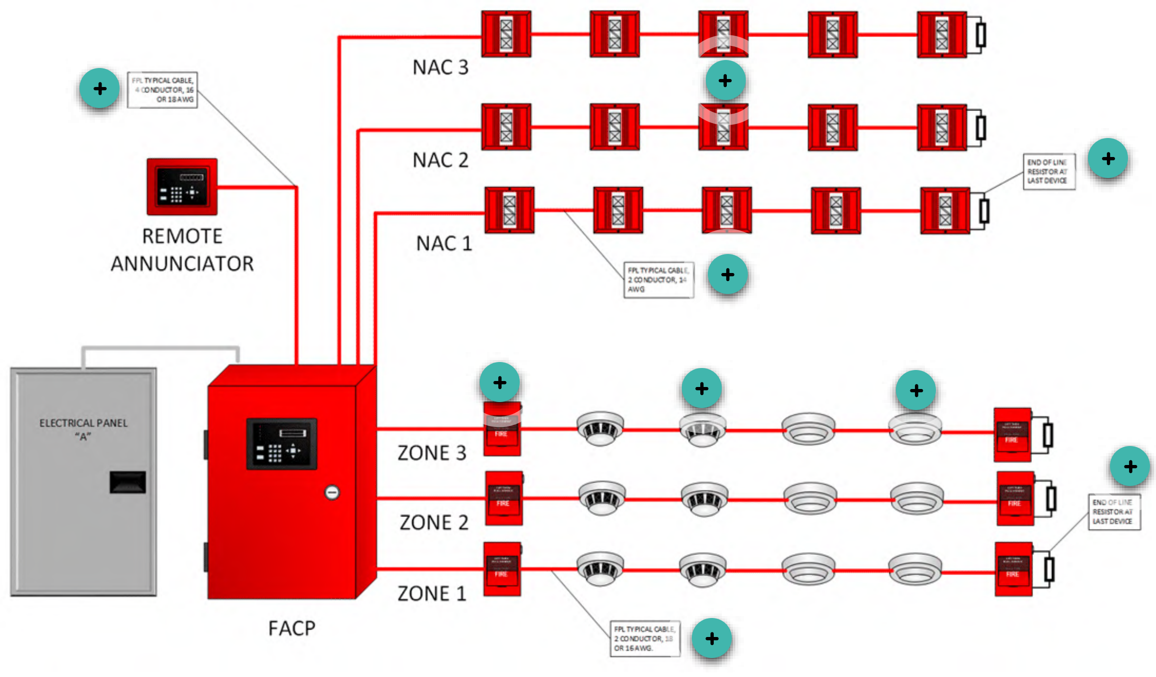
IDCs **monitor device status** and **report it to the control unit** for the appropriate action. These actions include:

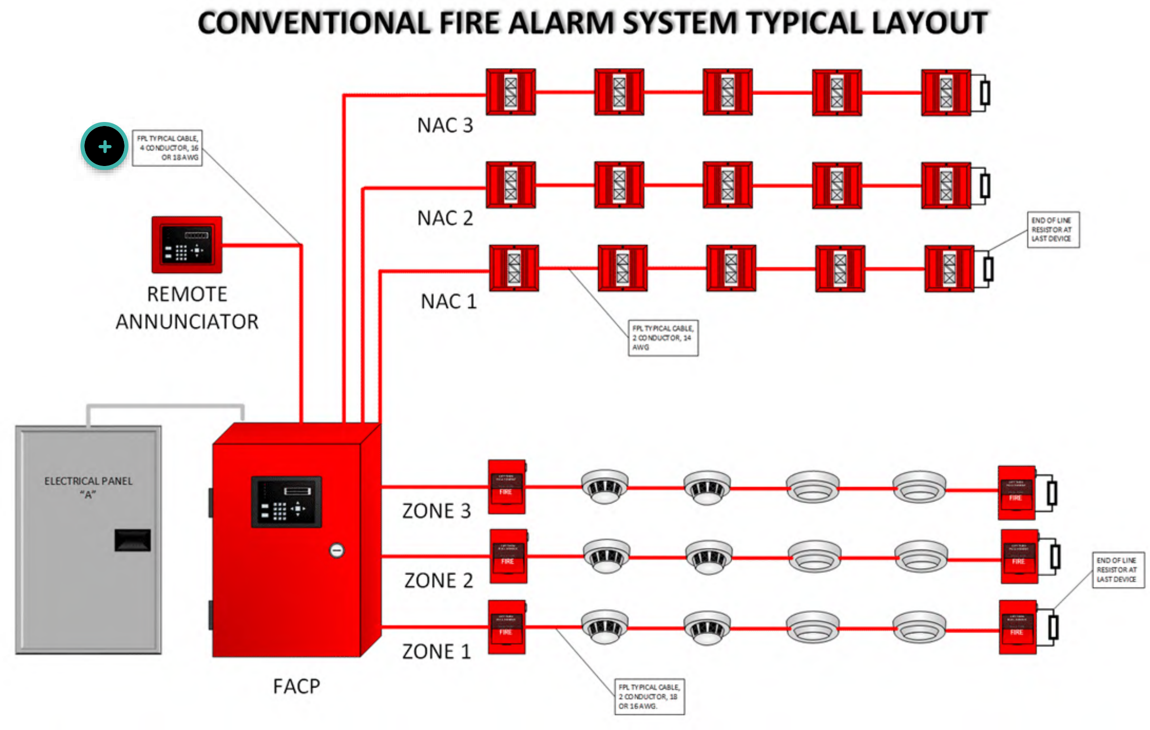
- Sounding an evacuation alarm
- Displaying a **supervisory condition**
- Reporting the alarm or supervisory conditions to the appropriate persons when required

Detectors report alarms in an **ON or OFF state** on an IDC.

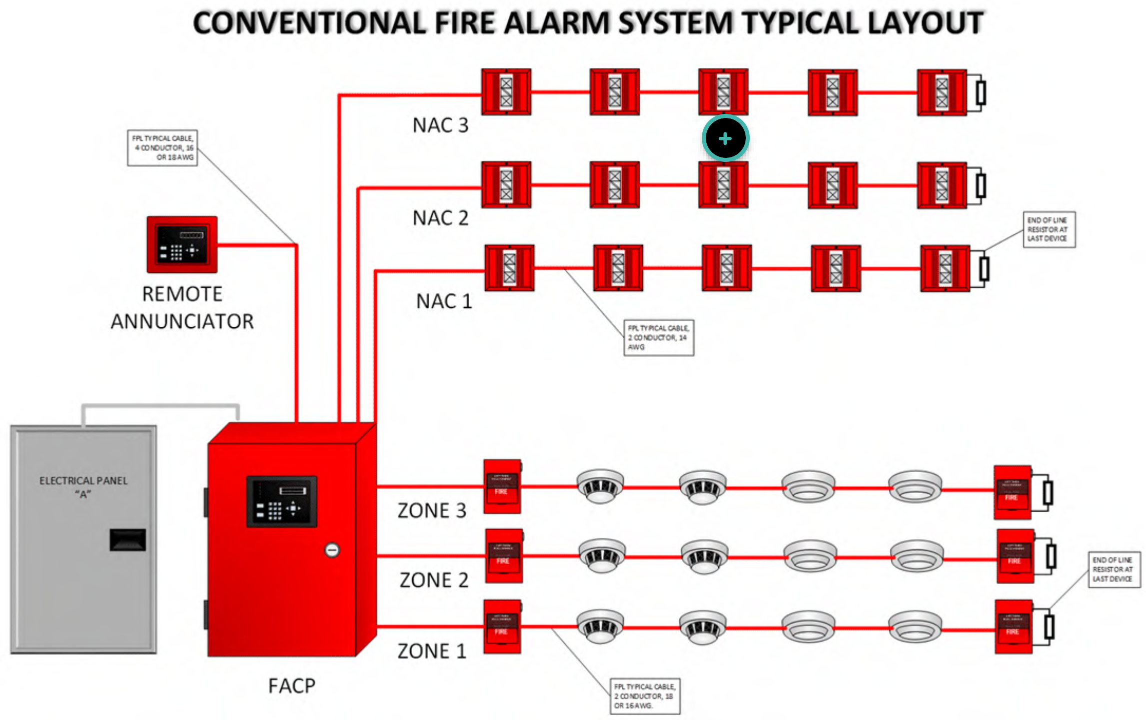
CONTINUE

CONVENTIONAL FIRE ALARM SYSTEM TYPICAL LAYOUT

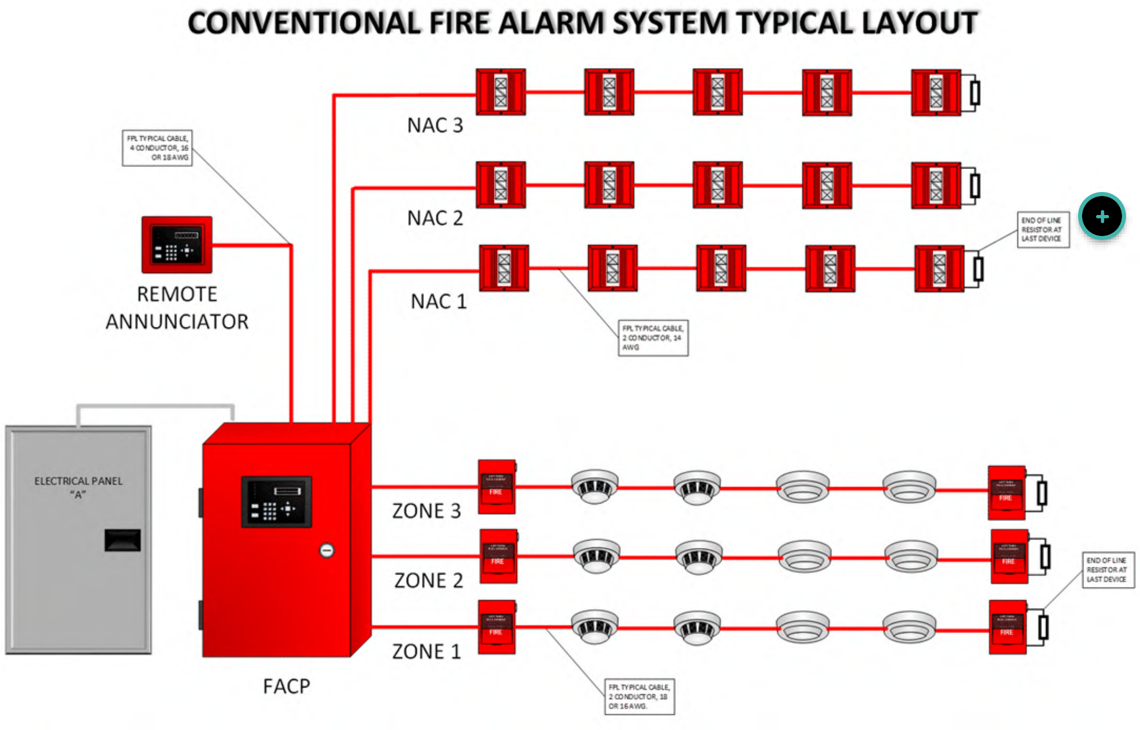




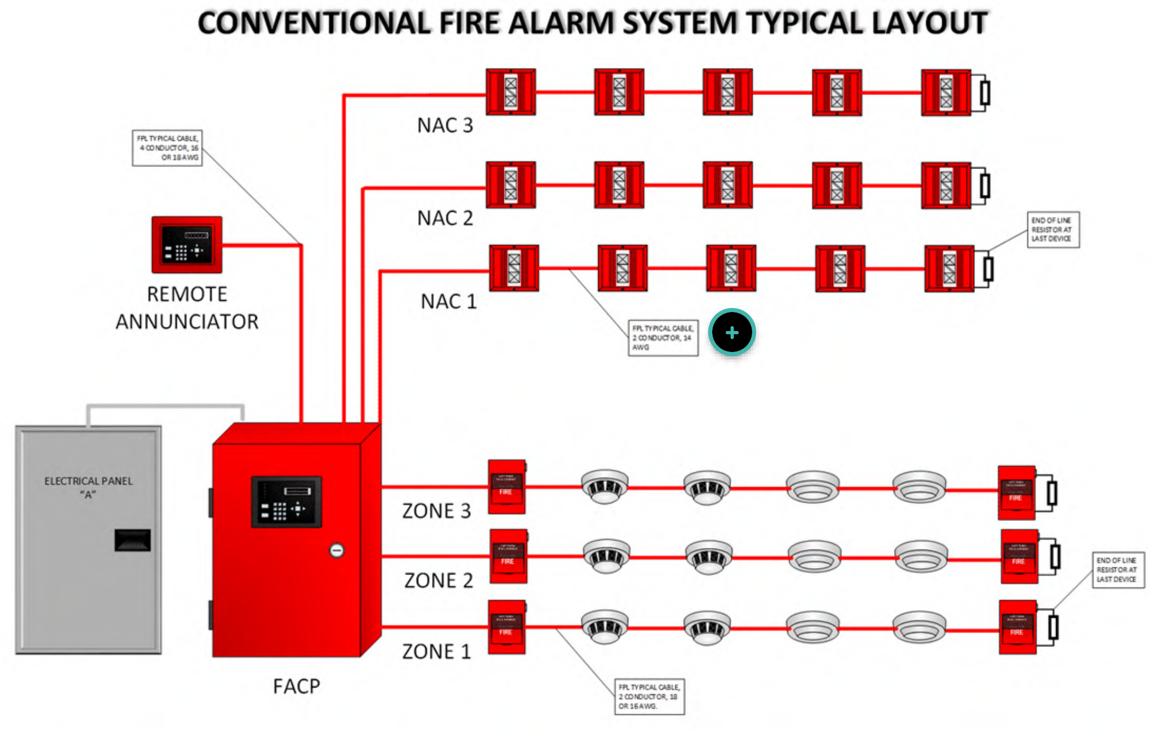
FPL Typical Cable, 4 conductor, 16 or 18 AWG



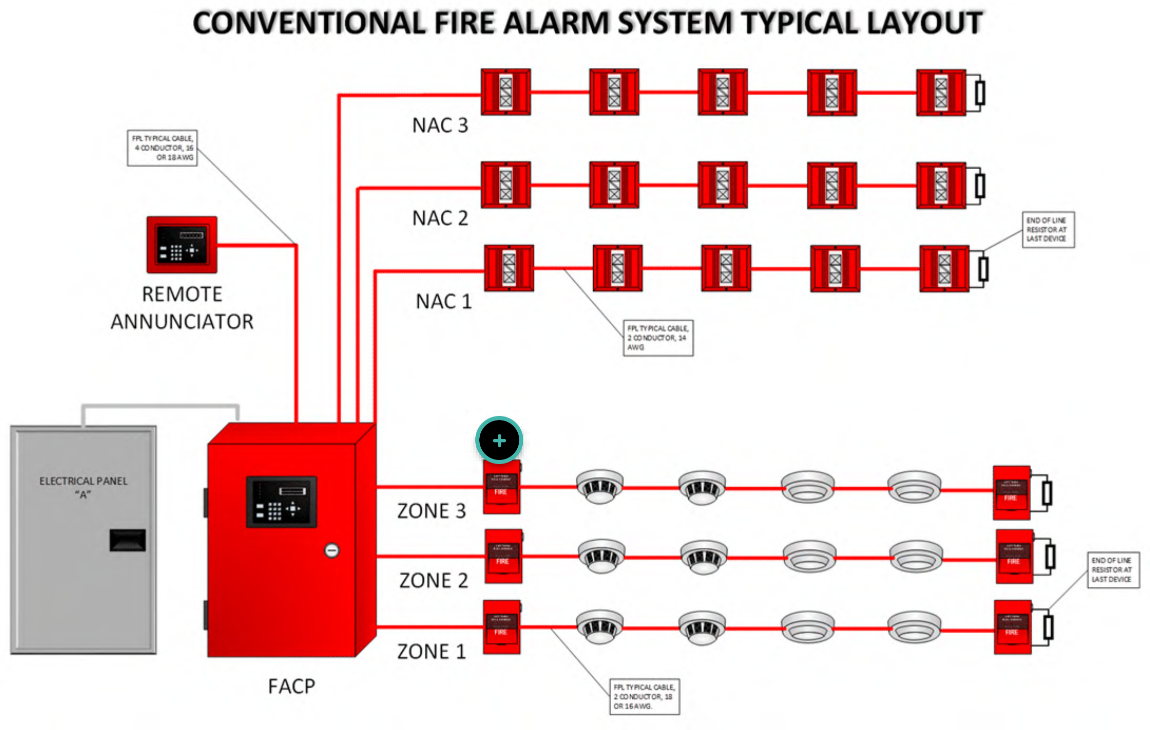
Notification Device



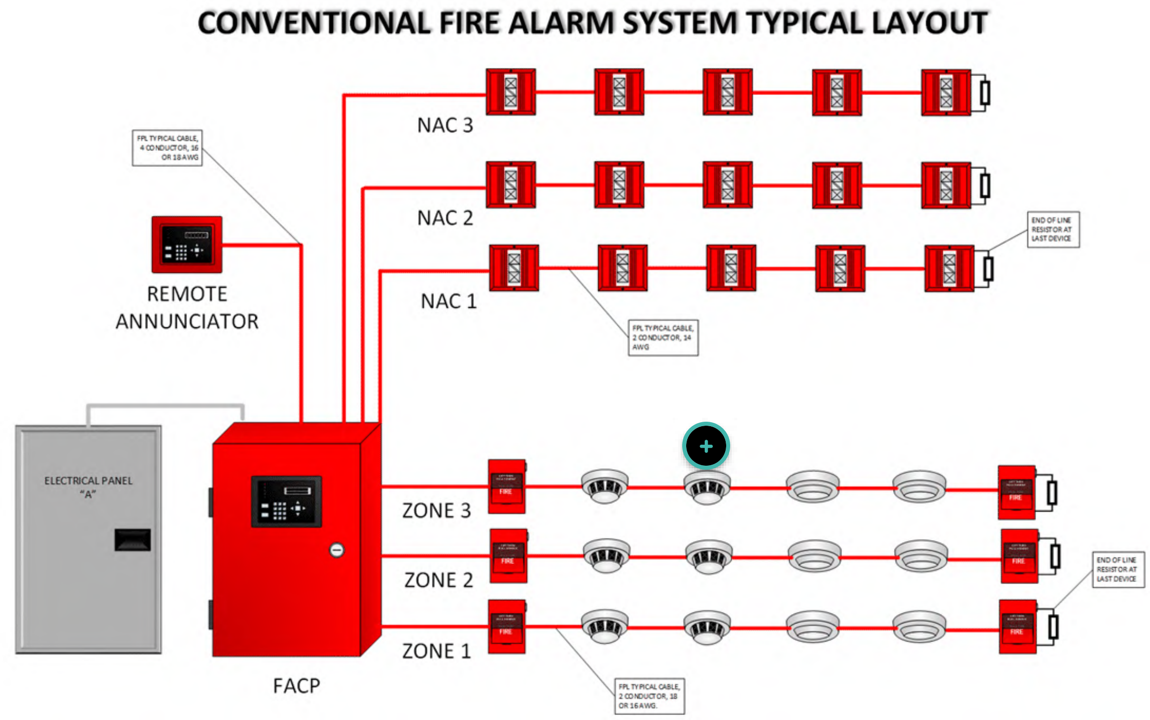
End of Line Resistor at last device



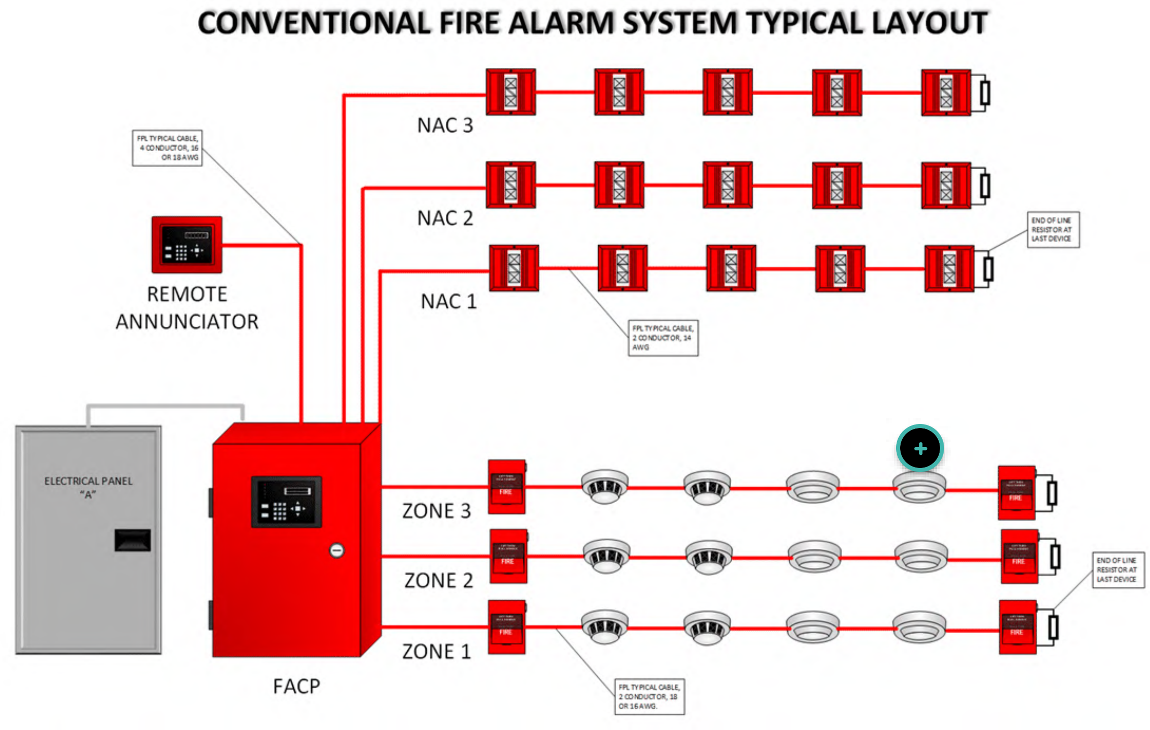
FPL Typical Cable, 2 conductor, 14 AWG



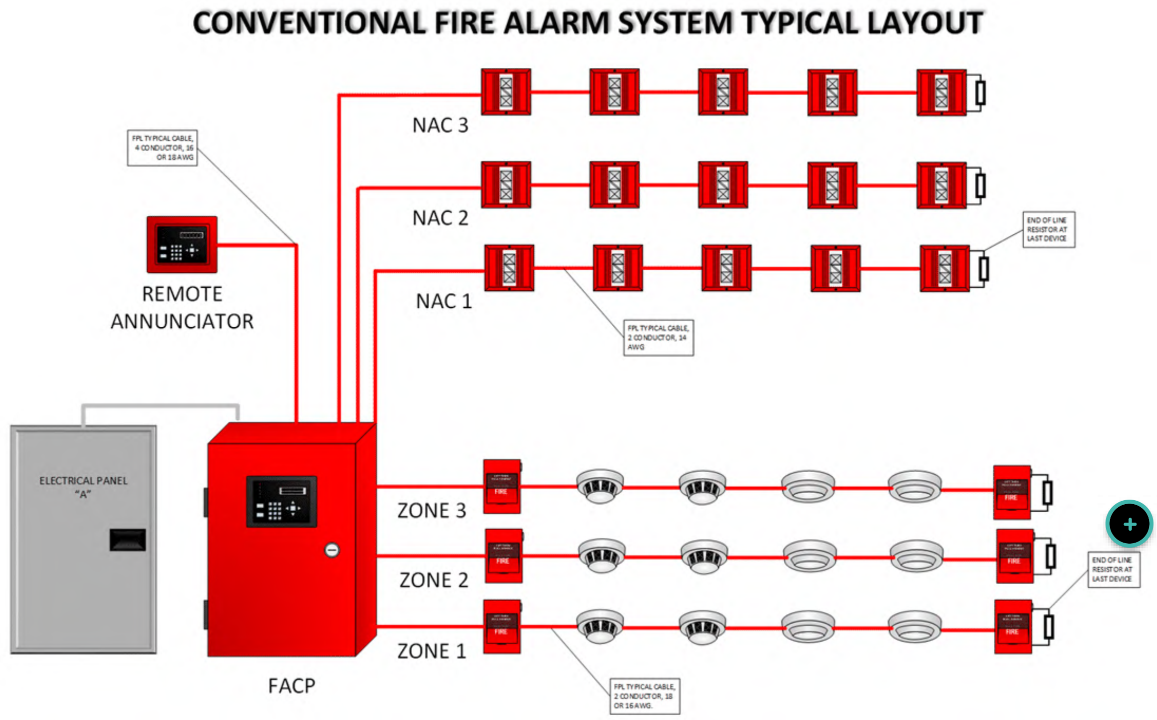
Manual fire alarm box



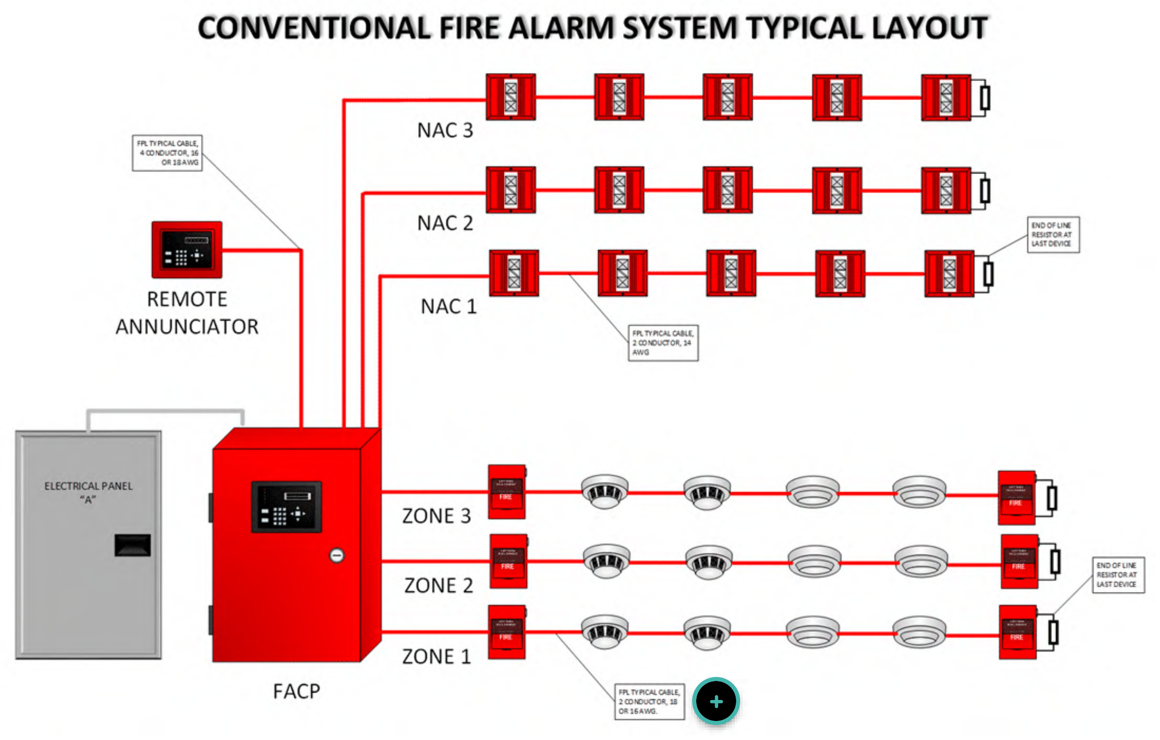
Heat detector



Smoke detector



End of Line Resistor at Last Device



FPL Typical Cable, 2 Conductor 18 or 16 AWG

3

Notification Appliance Circuits

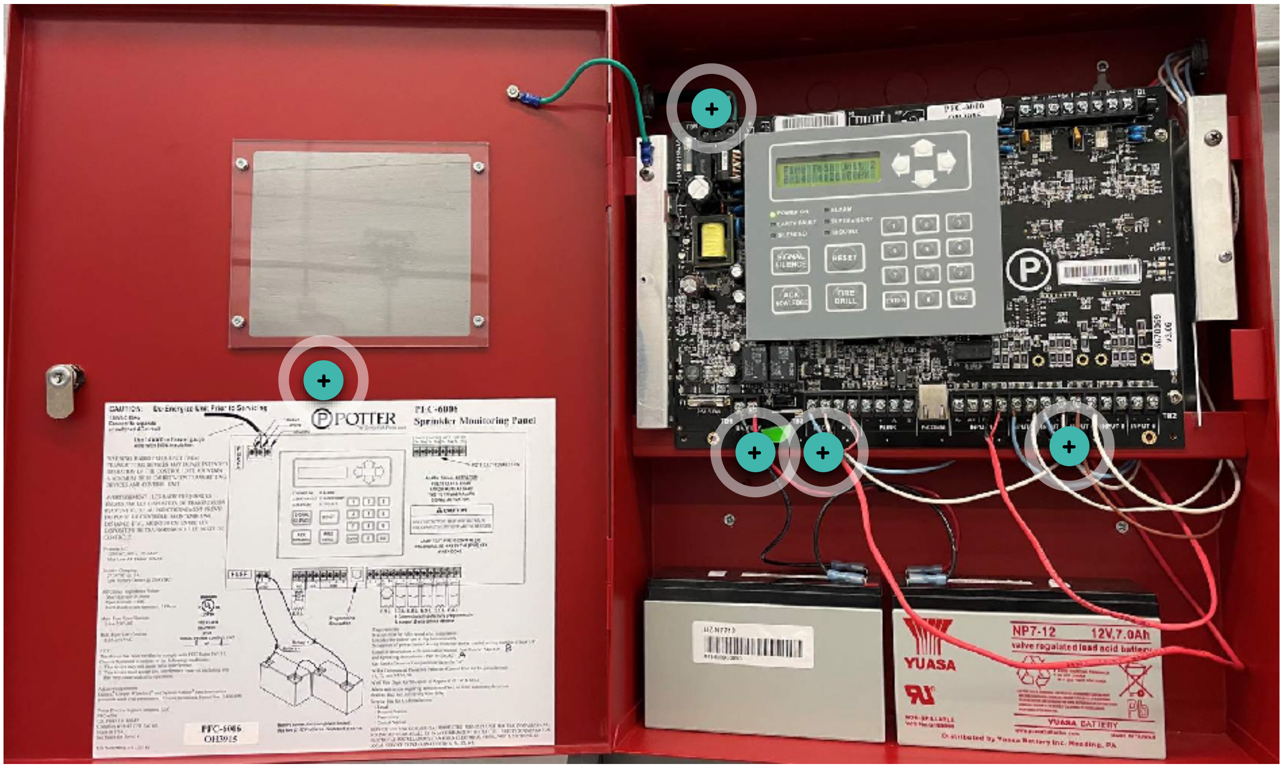
Notification Appliance Circuits (NACs) are the audio, visual, or other means by which the fire alarm system **informs** occupants and/or supervising stations about fire emergencies or other abnormal conditions. The NACs are connected to devices such as horns, strobe lights, speakers, bells, or combinations thereof.

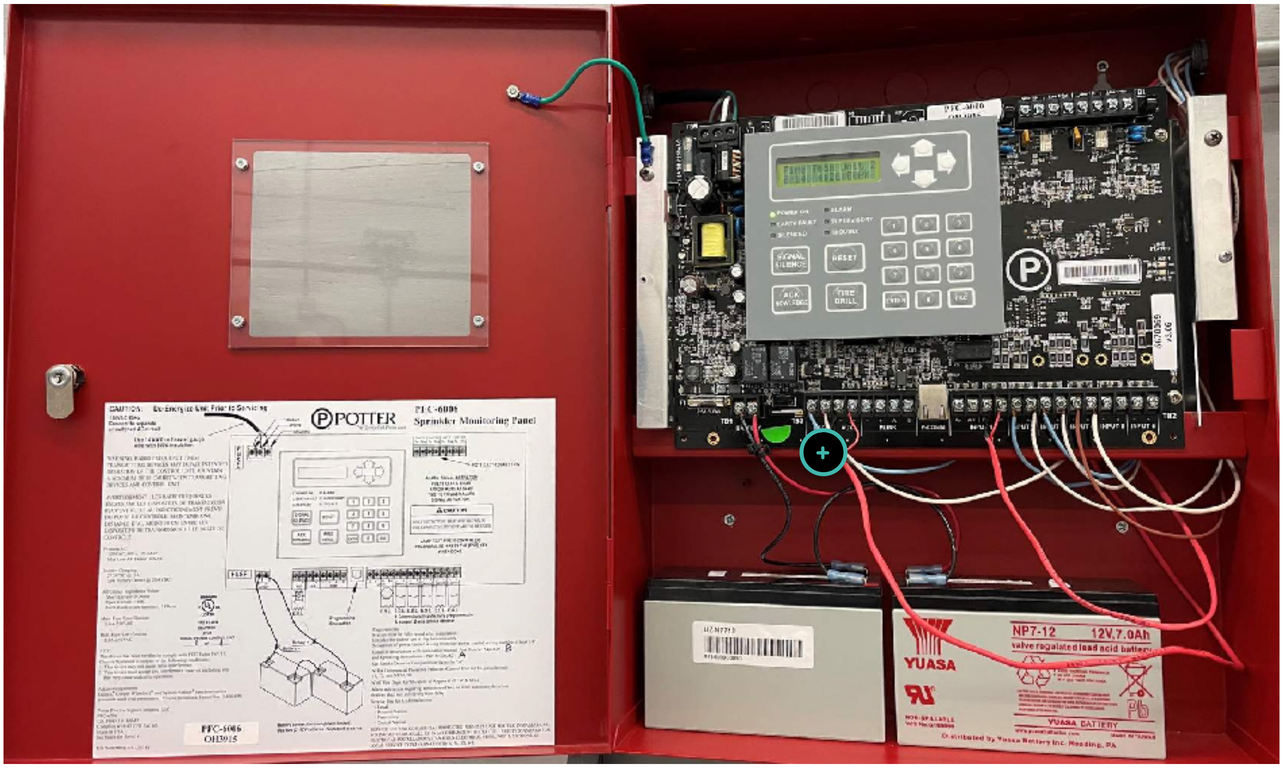
NACs are connected to the **output side** of the control unit.

CONTINUE

Conventional FACU

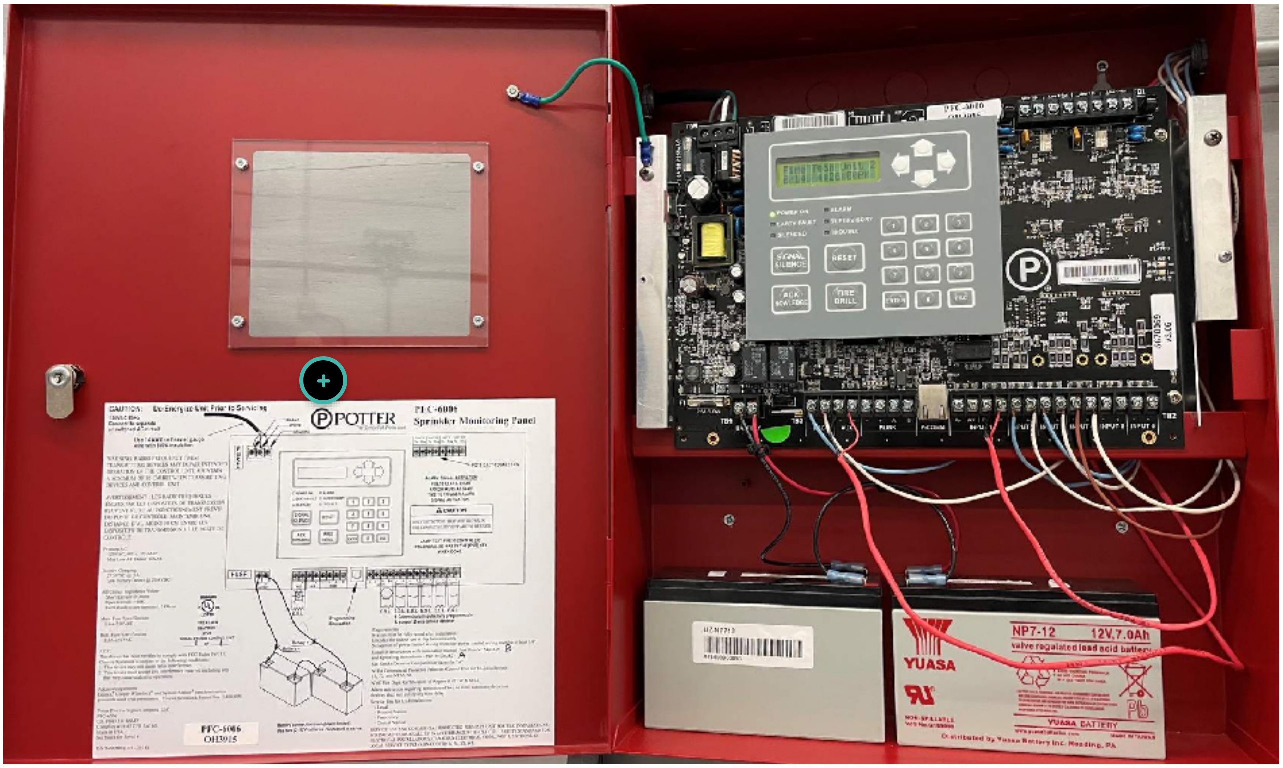
Click on each "+" symbol below to learn about each component or subsystem.


POTTER
PFC-6006
Sprinkler Monitoring Panel
SIGNAL SILENCE
RESET
ACK
FIRE DRILL
YUASA
NP7-12
12V,7.0Ah



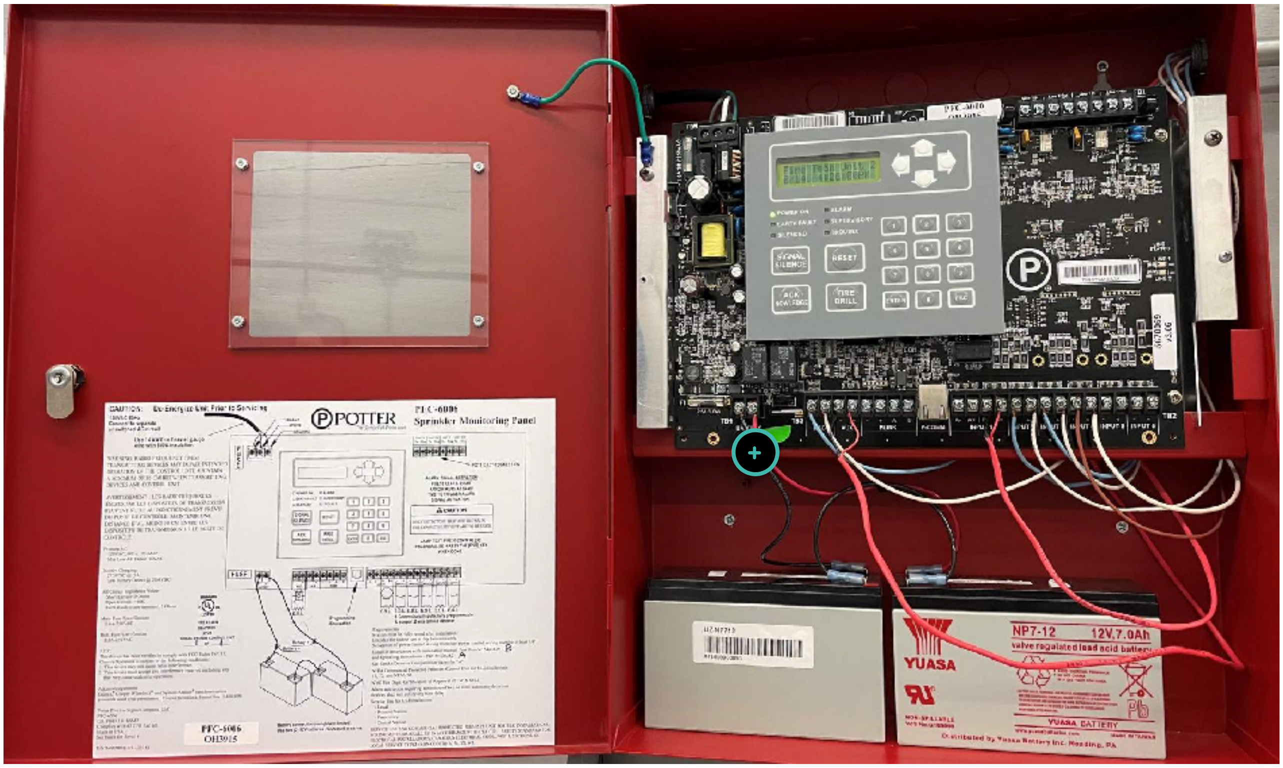
NAC

Notification Appliance Circuit connections are located here where it is labeled "NAC."



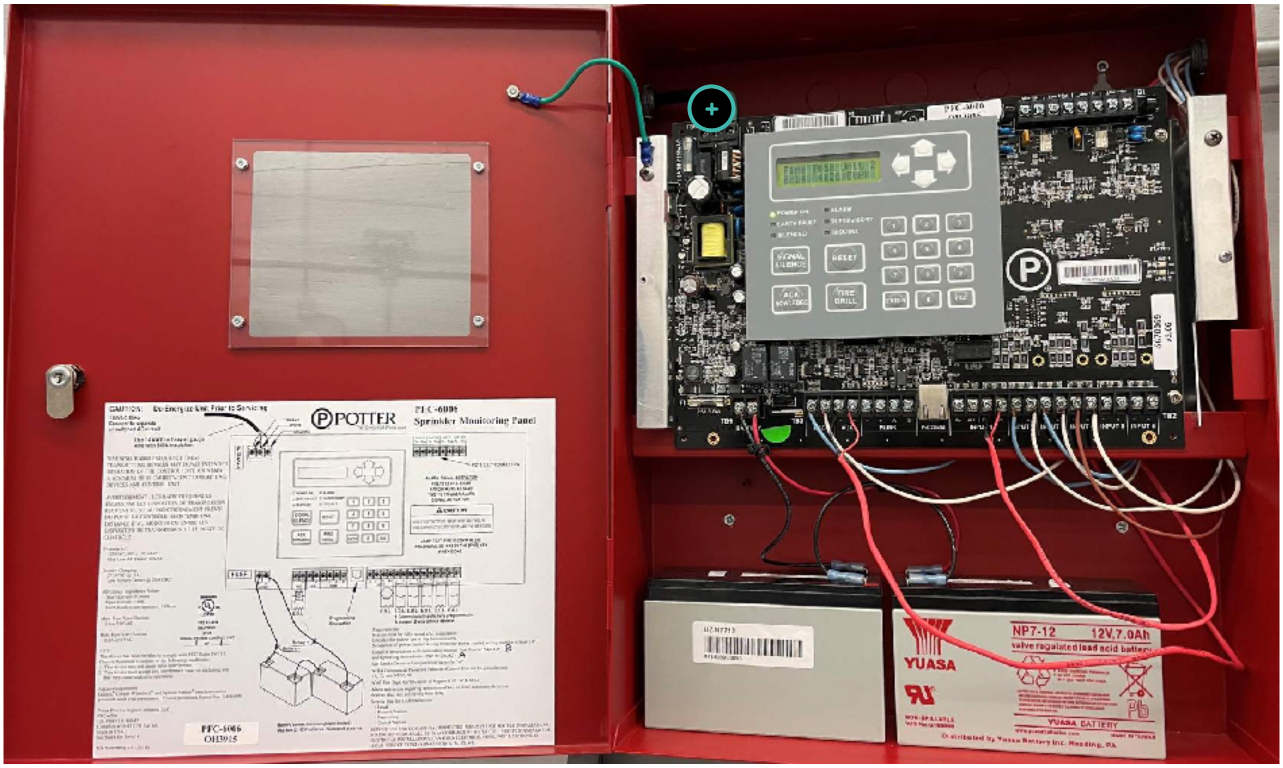
FACU Diagram

The diagram is like a quick reference guide. Not all FACUs have one inside the door, and even if they do, it is still best to reference the manual to the FACU.



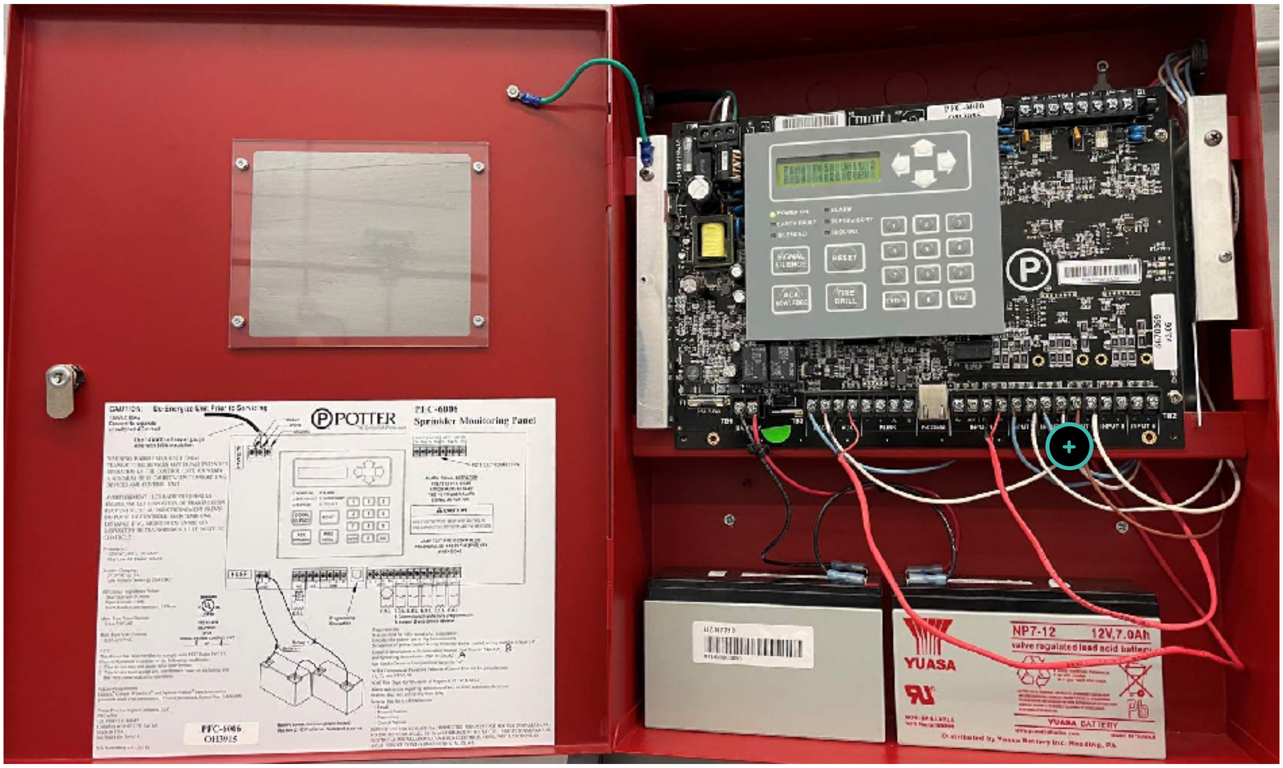
Secondary Power Source

This is where the secondary power source (battery back-up) is connected to the panel.



Primary Power Source

The primary power source for the FACU is connected here.



IDC

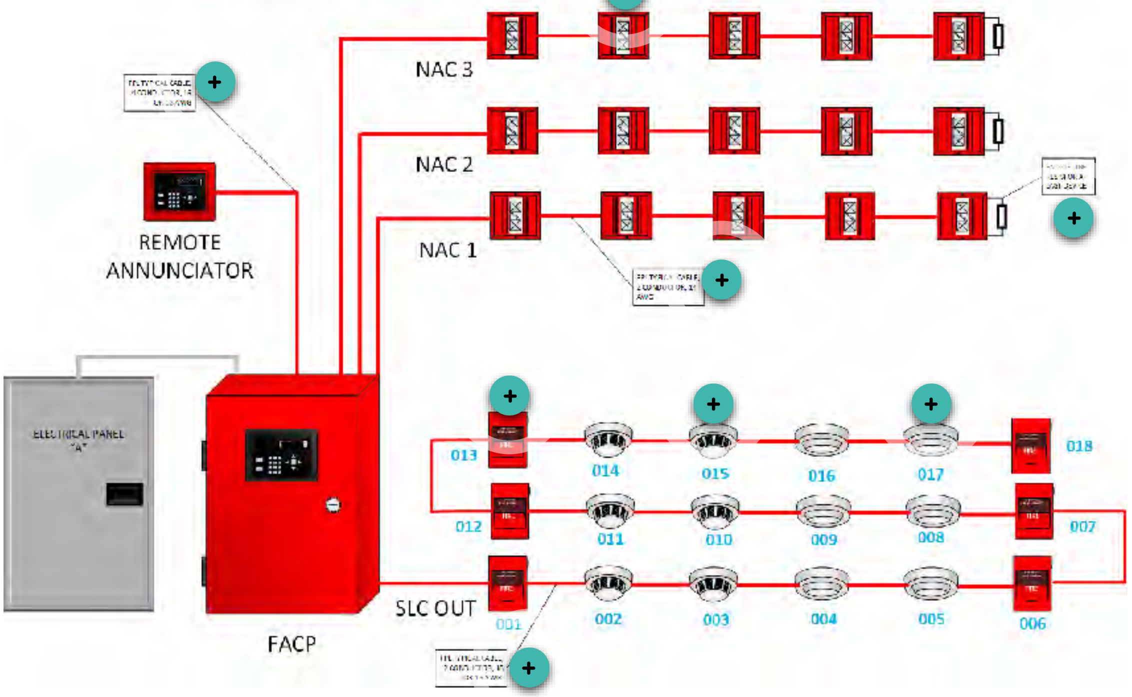
Initiating Device Circuits connections are here where it is labeled "Input."

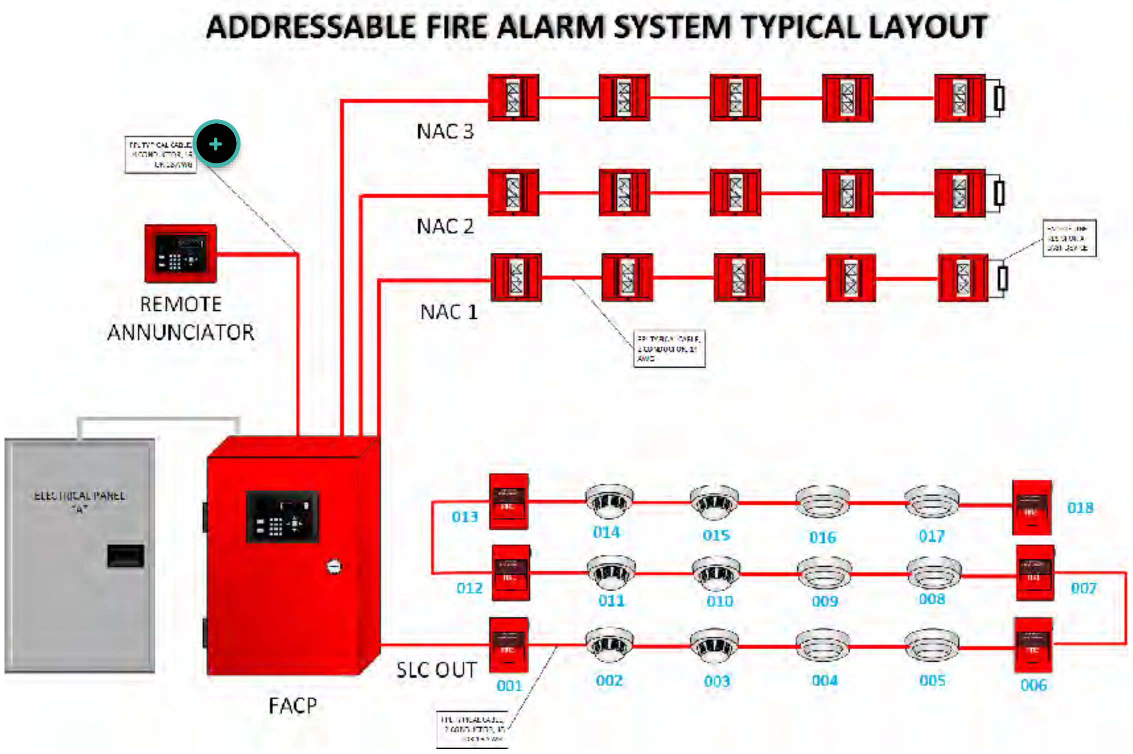
ADDRESSABLE FIRE ALARM SYSTEMS

Addressable fire alarm systems

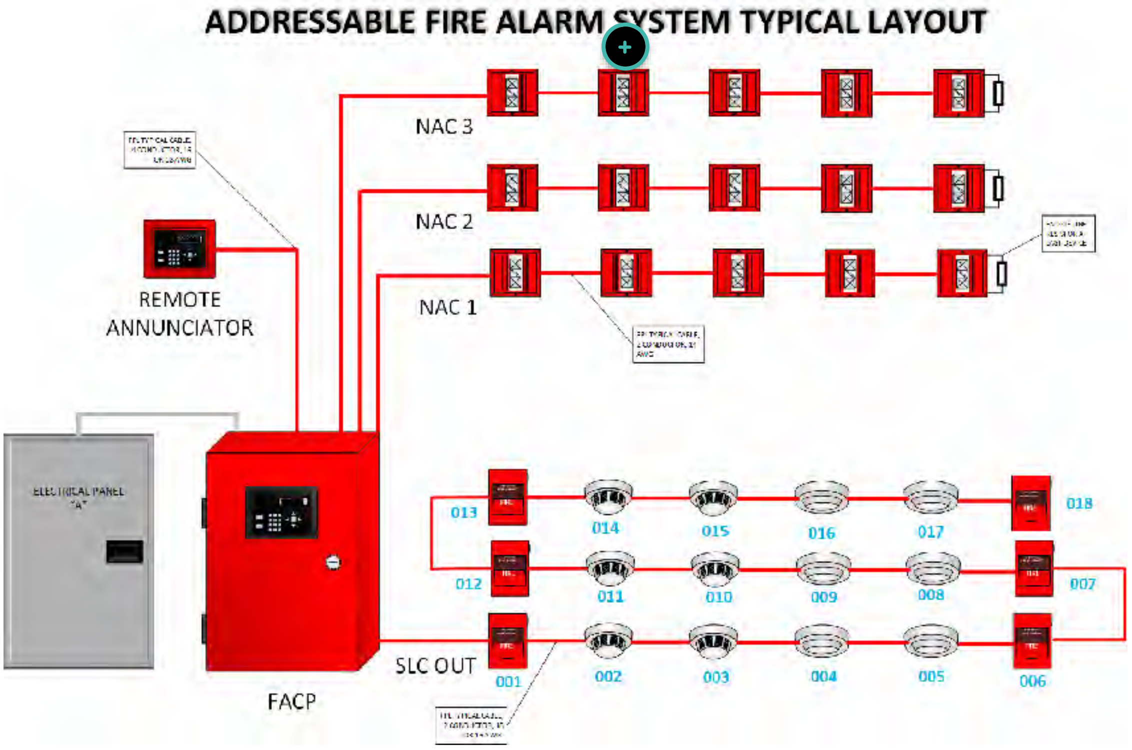
In an addressable fire alarm system, detectors report alarms using **digital communications protocols** in a **Signaling Line Circuit (SLC)** instead of reporting to an IDC. In most cases, the notification appliances are wired to **Notification Appliance Circuits (NACs)**, just as they are on conventional systems.

ADDRESSABLE FIRE ALARM SYSTEM TYPICAL LAYOUT

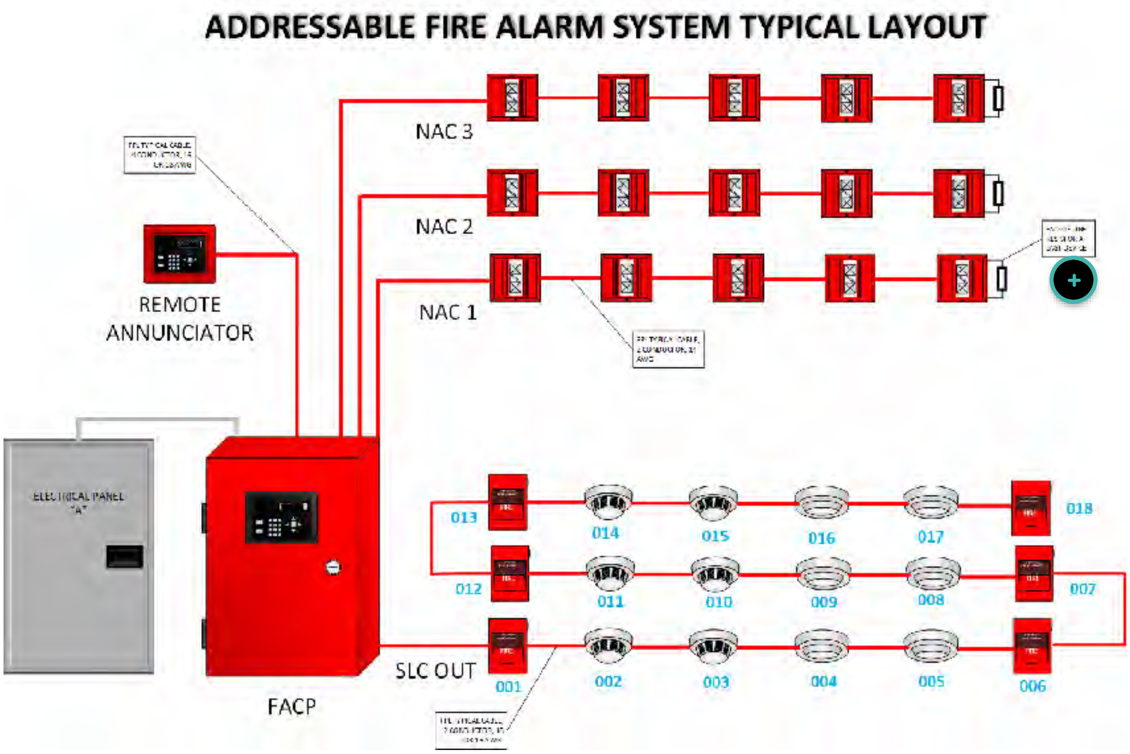




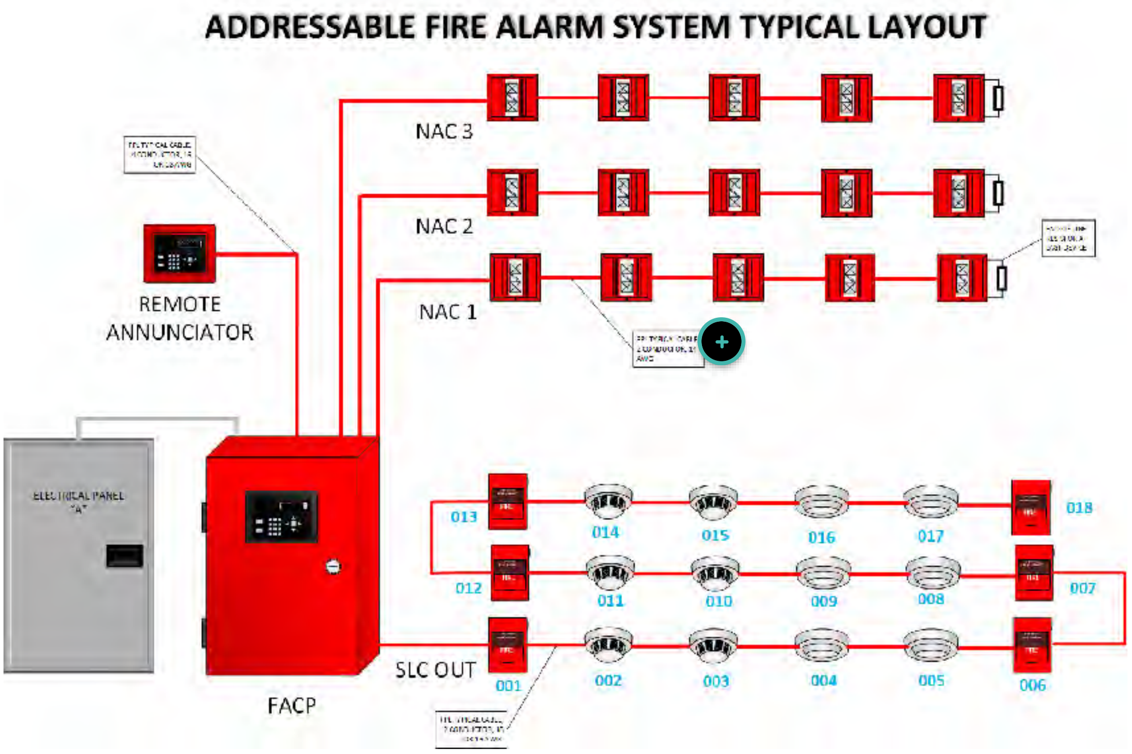
FPL typical cable, 4 conductor, 16 or 18 AWG



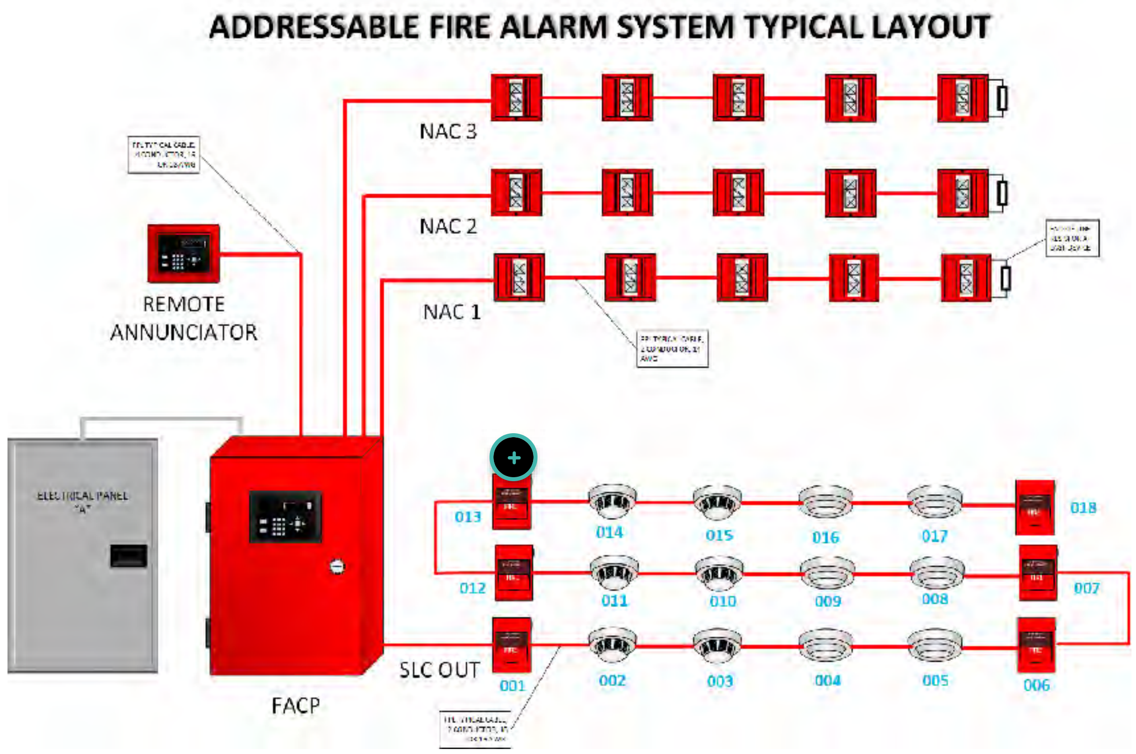
Notification Appliance



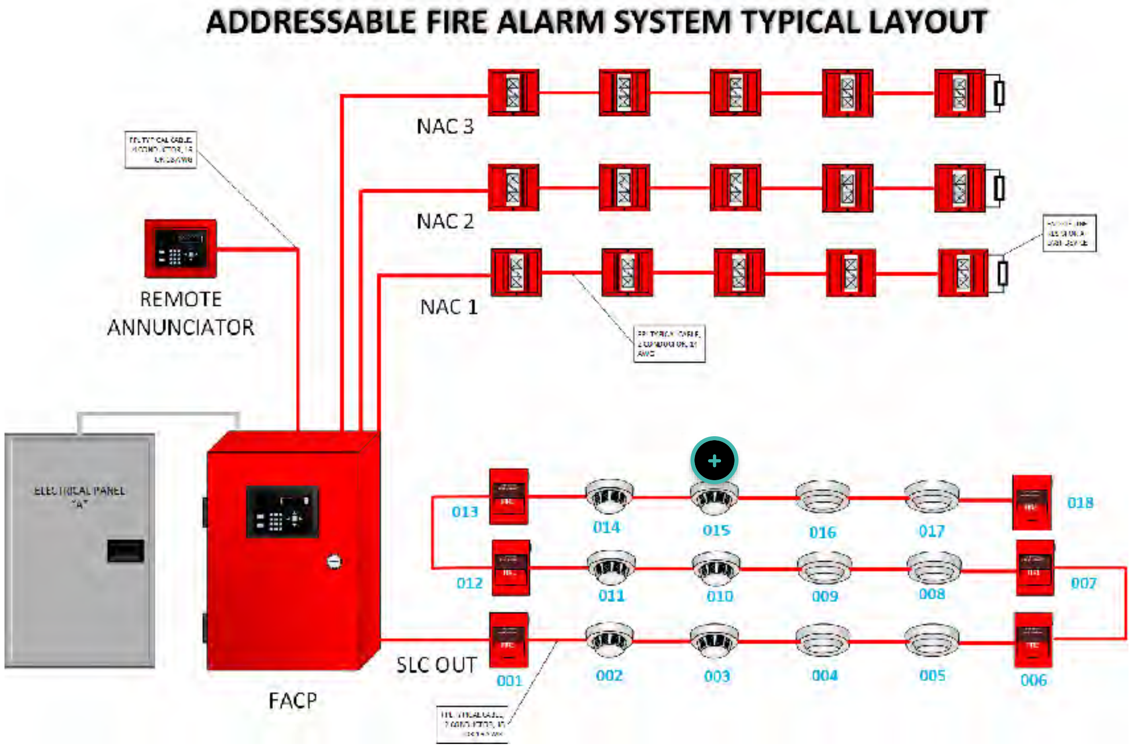
End of Line, resistor at last device



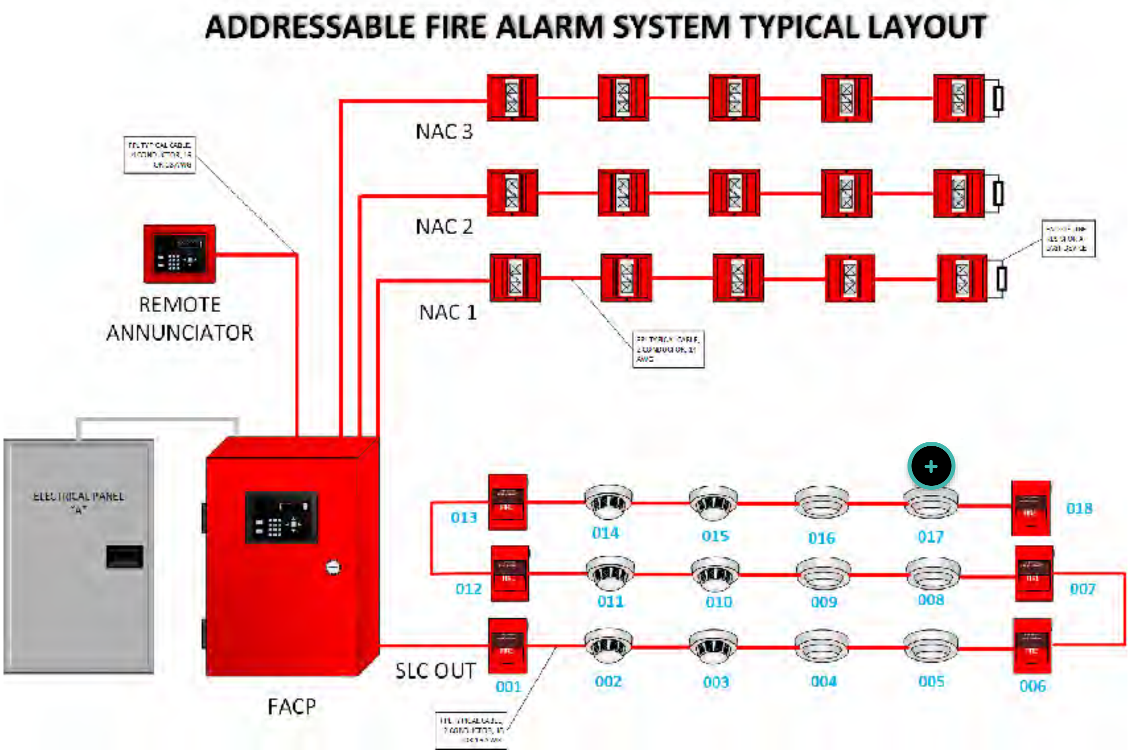
FPL typical cable, 2 conductor, 14 AWG



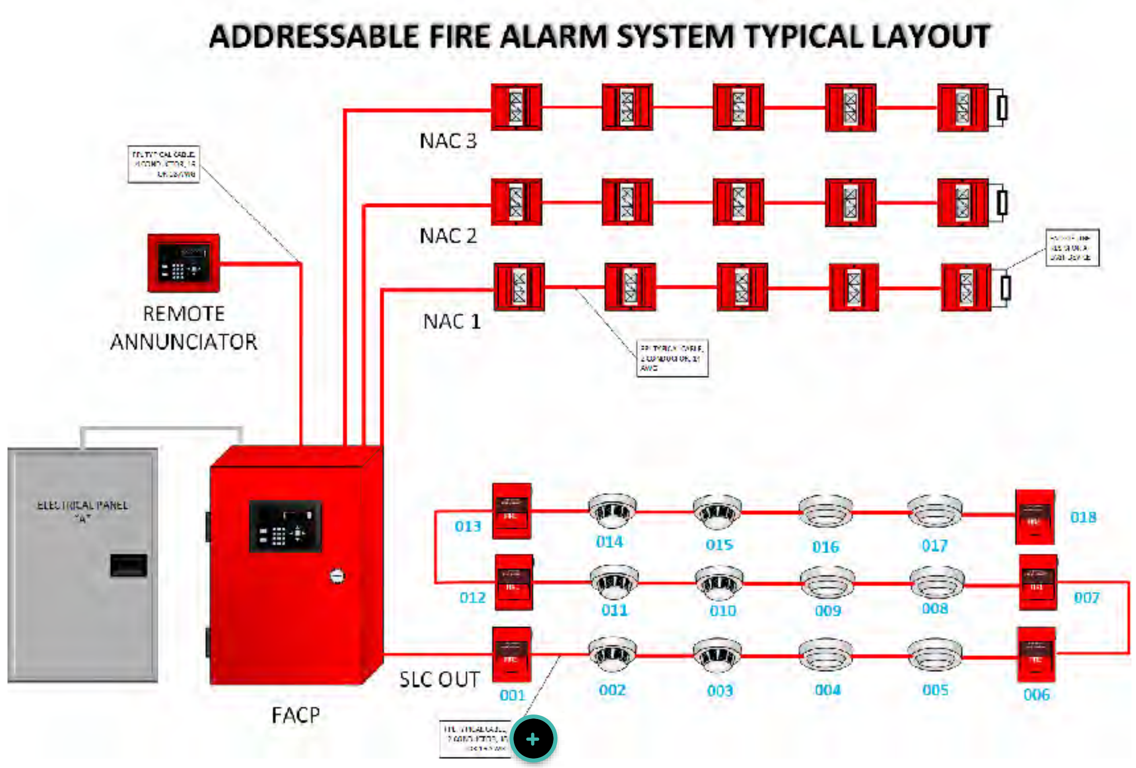
Manual Fire Alarm Box



Heat Detector



Smoke Detector



FPL typical cable, 2 conductor, 18 or 16 AWG

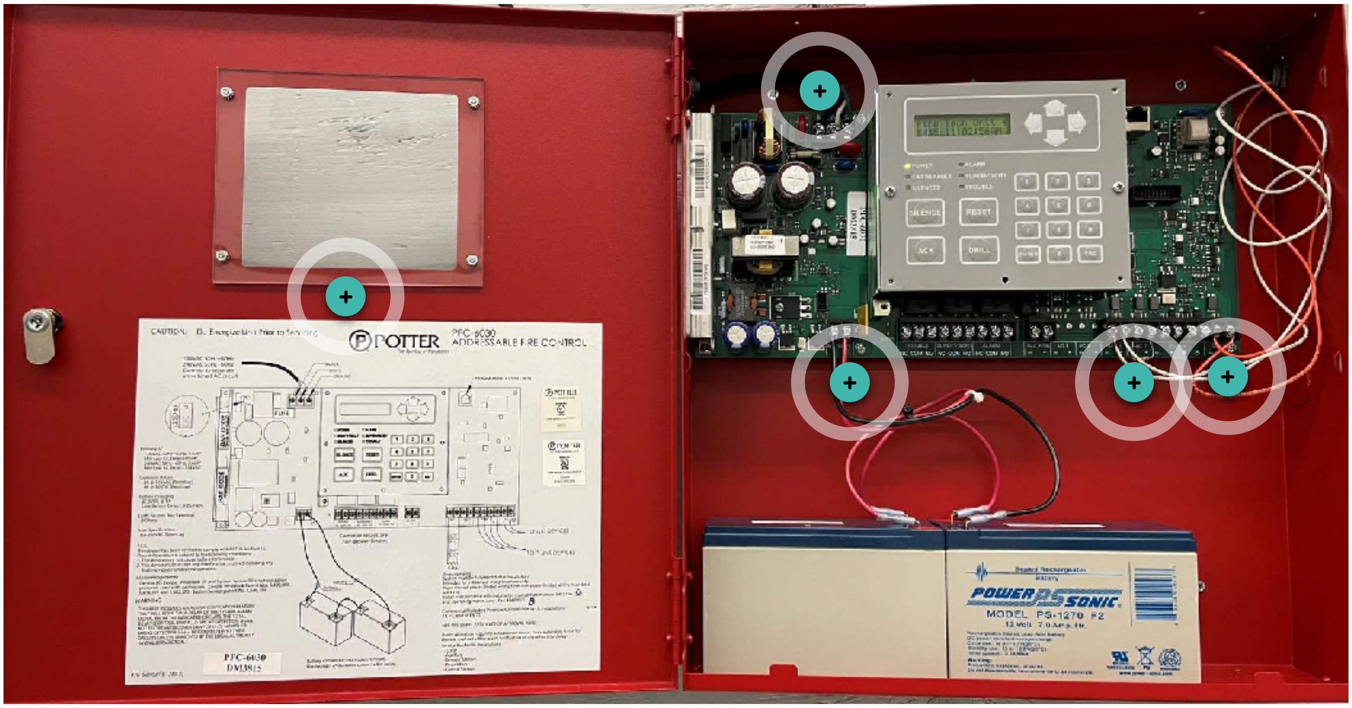
Unlike in conventional fire alarm systems, each addressable initiating device has an **individual address**. That means that addressable systems can identify the **specific device** that has an alarm signal, supervisory signal, or trouble signal.

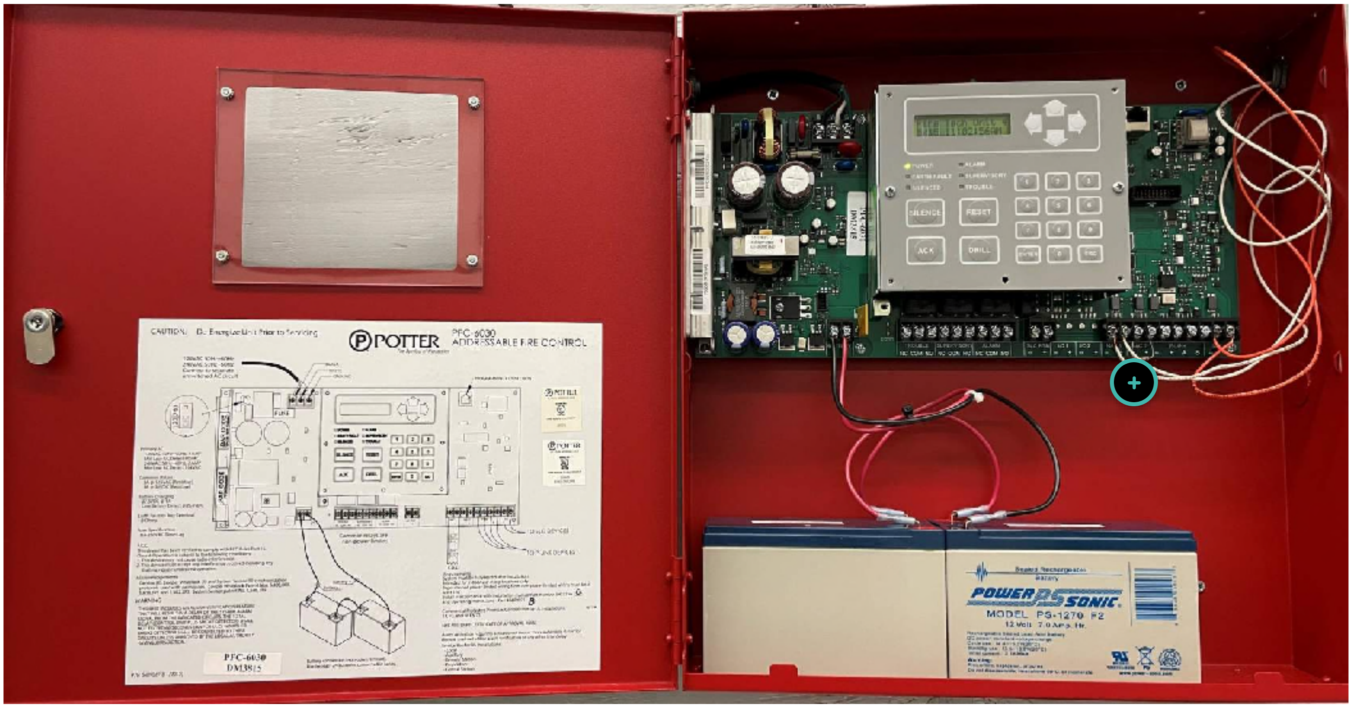
Newer devices and systems are also able to provide additional data, such as **ambient temperature** or **smoke concentration** in an area.

CONTINUE

Addressable FACU

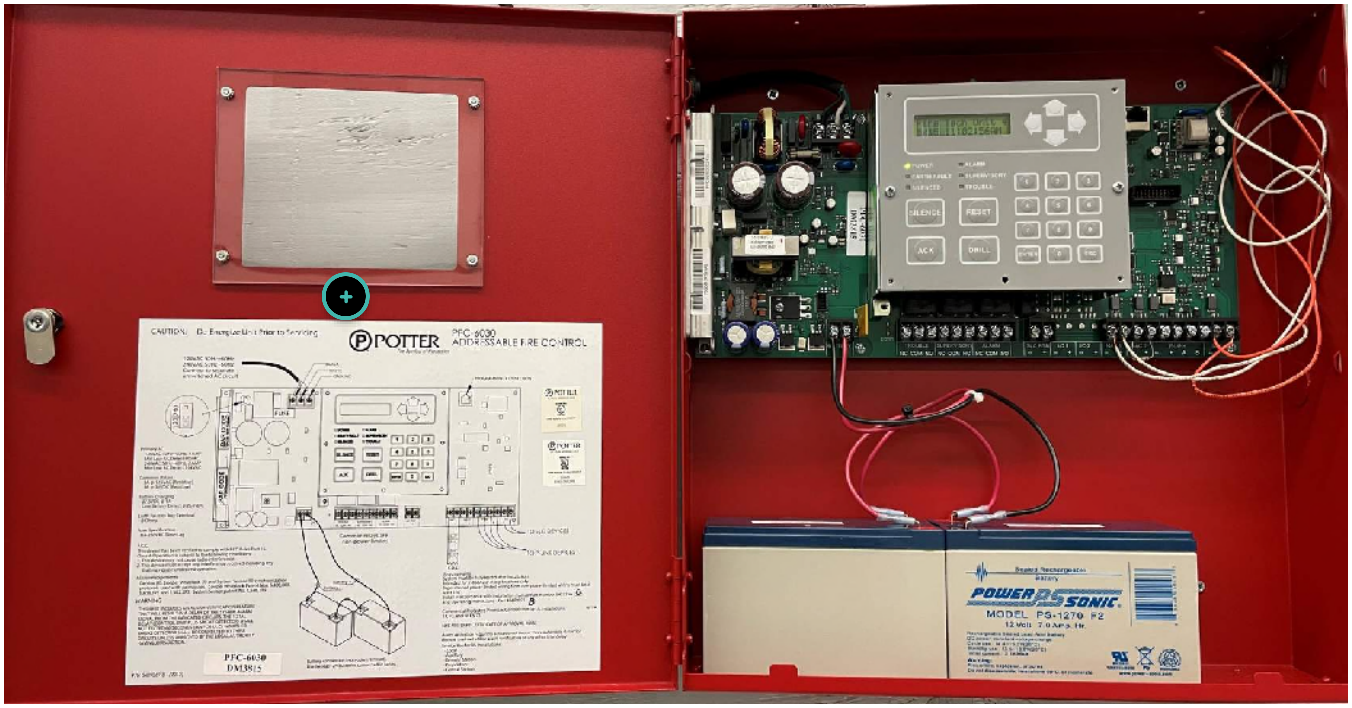
Click on each "+" symbol below to learn about each component or subsystem.





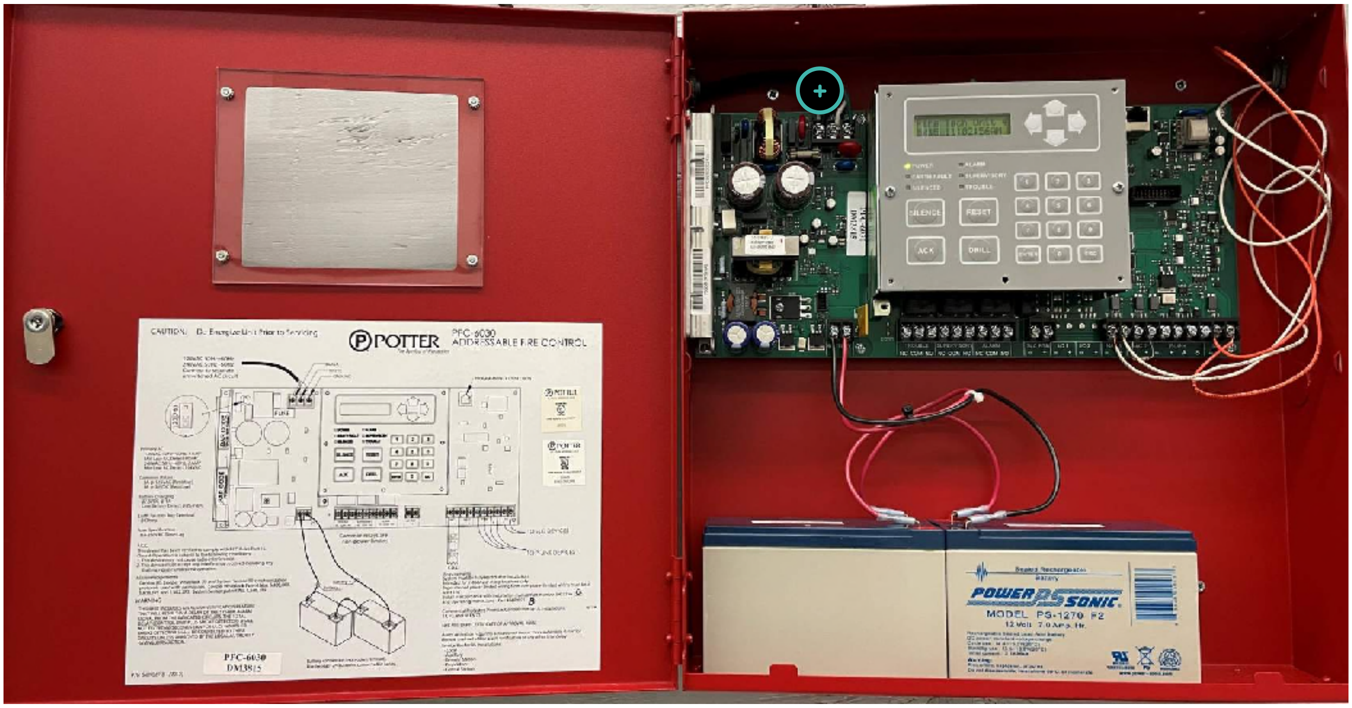
NAC

Notification Appliance Circuit connections are located here where it is labeled "NAC 1" and "NAC 2."



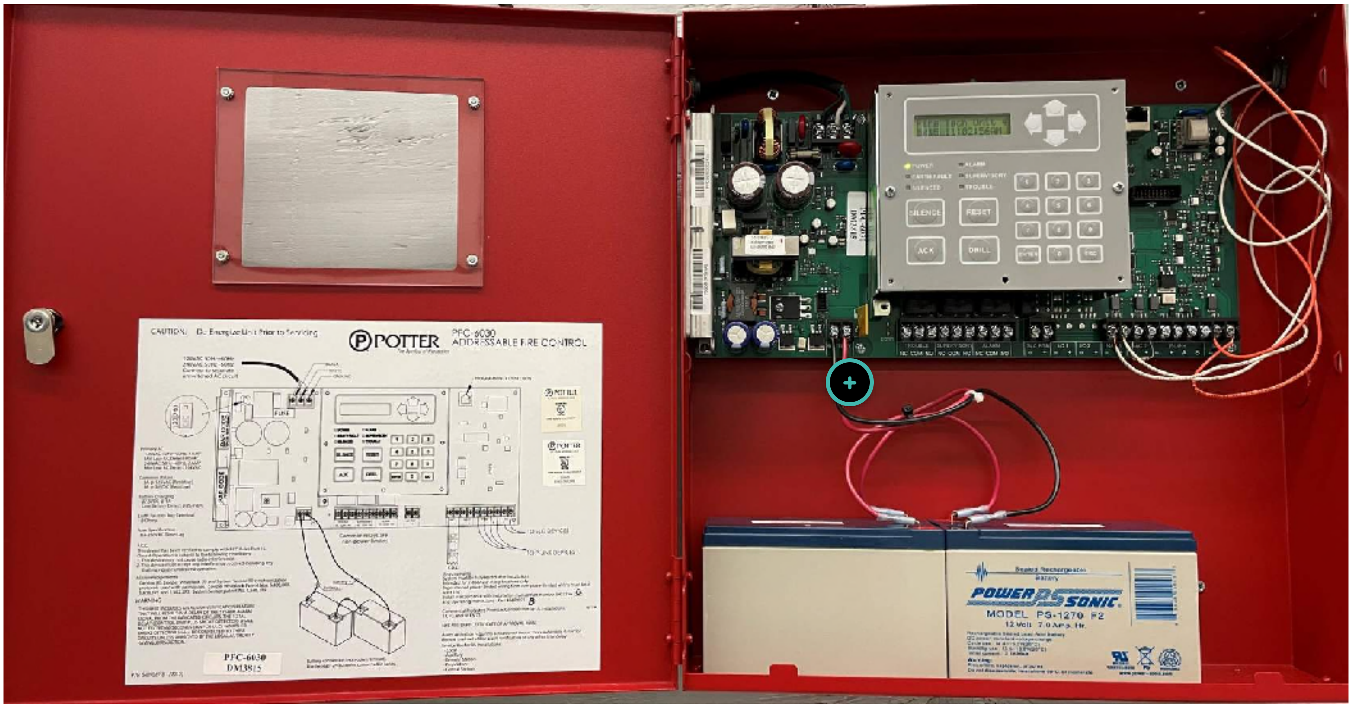
FACU Diagram

The diagram is like a quick reference guide. Not all FACUs have one inside the door, and even if they do, it is still best to reference the manual to the FACU.



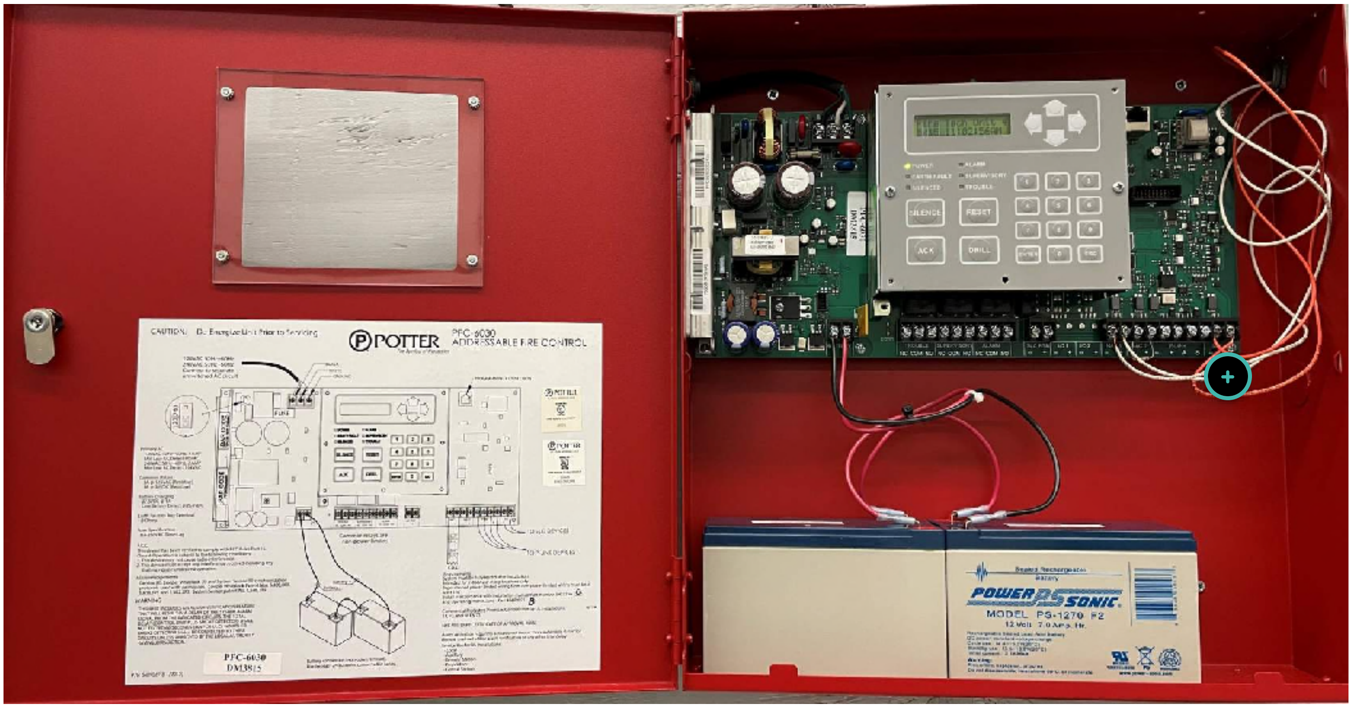
Primary Power Source

The primary power source for the FACU is connected here.



Secondary Power Source

This is where the secondary power source (battery back-up) is connected to the panel.



SLC

Initiating devices are connected to the circuit labeled SLC (Signaling Line Circuit) because on an addressable device the initiating devices can be identified specifically as to which devices are detecting fire or trouble.

LET'S REVIEW

Drag and drop the stack of cards below into the correct categories.

Conventional Fire Alarm Systems

Consists of 3 subsystems

Detectors report alarms in ON or OFF state on an IDC

Alarm, trouble, or supervisory condition indicated by circuit or zone

Addressable Fire Alarm Systems

Each initiating device has an individual address

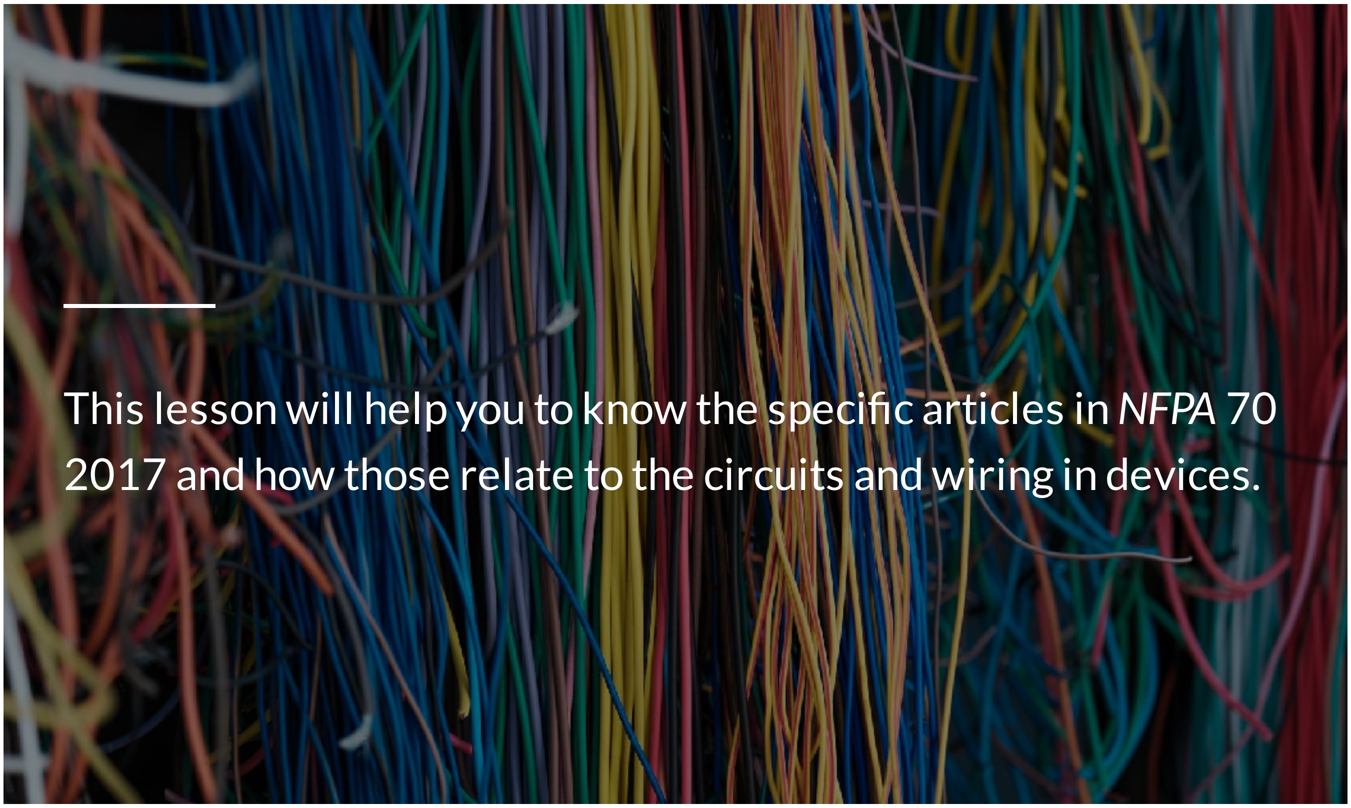
Initiating device and modules are wired to an SLC

Identify the specific device that has an alarm, supervisory, or trouble signals

🔒 Complete the card sort above before moving on.

Lesson 2 of 5

Articles and Circuits



This lesson will help you to know the specific articles in *NFPA* 70 2017 and how those relate to the circuits and wiring in devices.

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Identify wiring requirements from Article 760 of *NFPA* 70 2017 *(National Electrical Code)*

2 Define various pathway class designations

CONTINUE

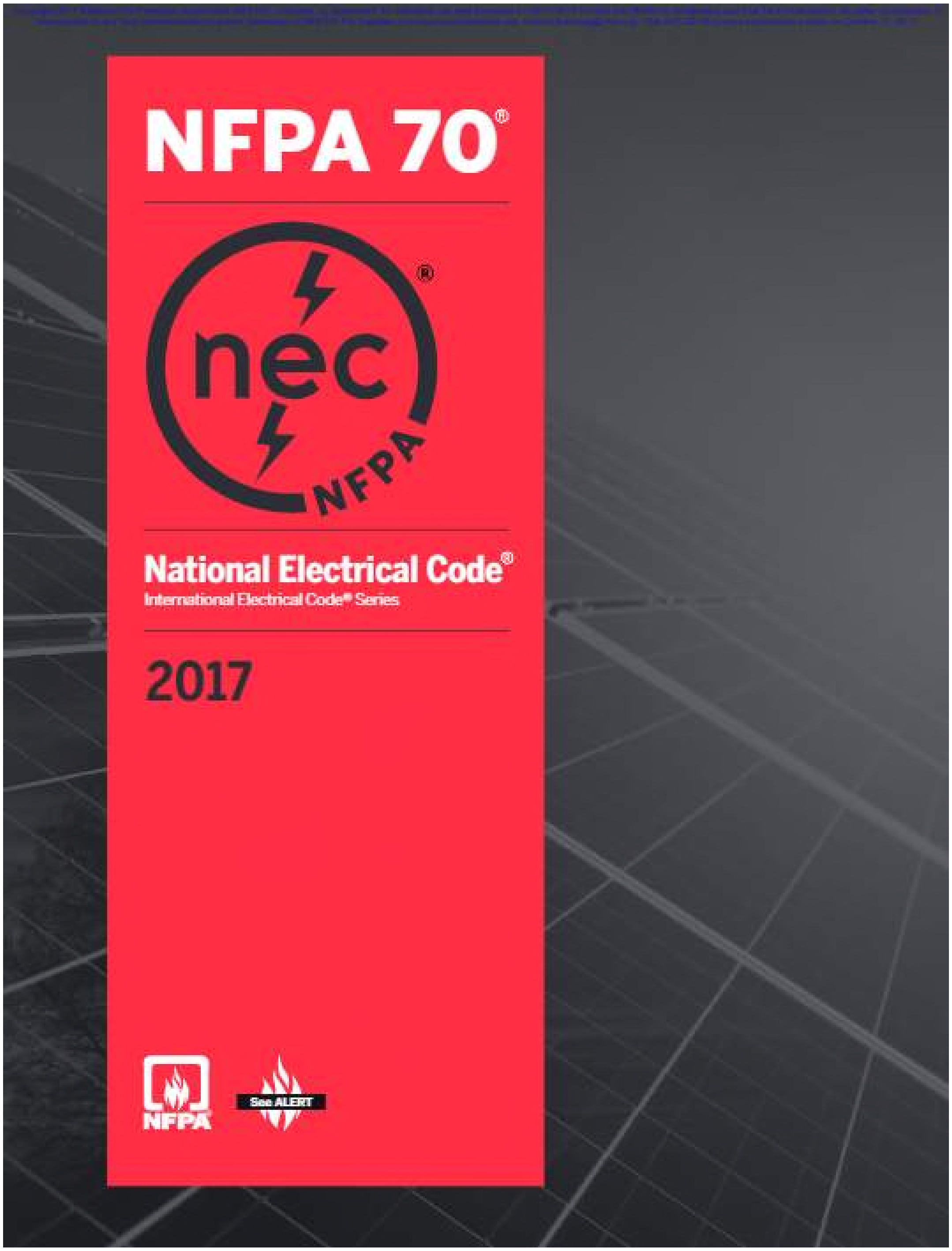
ⓘ Key Reference: ***NFPA 70 (National Electrical Code)*, 2017, Article 760**

NFPA 70 2017— National Electrical Code (NEC)

NFPA* 70 2017 — *National Electrical Code (NEC) is a **model code**, which means it is developed and managed by a standards organization independent of the jurisdiction enforcing the code.

***NFPA* 70 2017** is one of the few standards not configured in the typical NFPA fashion.

Its intent is **purely advisory** by the NFPA.



FIRE ALARM CIRCUITS

Fire alarm circuits

Per ***NFPA* 70 2017**, a **fire alarm circuit** is the portion of the wiring system between the **load side** of the overcurrent device or the power-limited supply and the **connected equipment** of all circuits powered and controlled by the fire alarm system.

Basically, the code says all wiring ***from*** the **power source** and ***to*** the **fire alarm control unit** and **all of the devices** are considered a **fire alarm circuit**.

CONTINUE

Watch the video below about a fire alarm panel.

Video run time 0:54

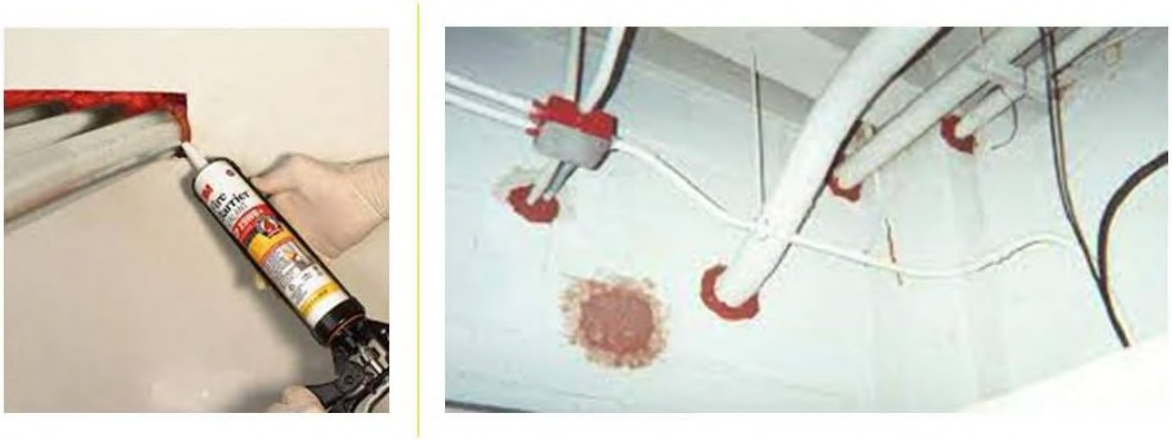
NFPA 70 2017 ARTICLES

Introduction

Be aware that *NFPA* 70 2017 has many other articles, covering the following (among other topics):

Additional Topic 1

Article 300.21



Spread of Fire or Products of Combustion (Fire Stopping)

Additional Topic 2

Article 300.22

Ducts, Plenums, and Other Air-Handling Spaces

Additional Topic 3

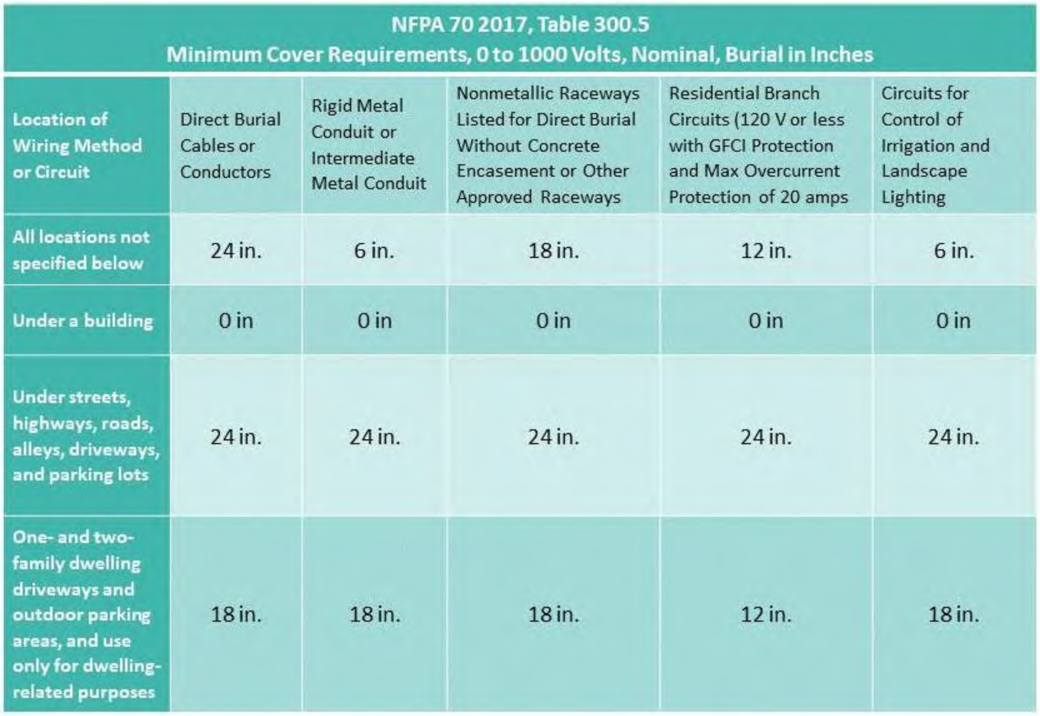
Article 500

Hazardous/Corrosive Environments is covered in Article 500, however this also applies to Articles 511-555

NFPA 70 2017 defines **dusttight** as "Constructed so that dust will not enter the enclosing case under specified test conditions."

Additional Topic 4

Article 300.5



NFPA 70 2017, Table 300.5
Minimum Cover Requirements, 0 to 1000 Volts, Nominal, Burial in Inches

Location of Wiring Method or Circuit	Direct Burial Cables or Conductors	Rigid Metal Conduit or Intermediate Metal Conduit	Nonmetallic Raceways Listed for Direct Burial Without Concrete Encasement or Other Approved Raceways	Residential Branch Circuits (120 V or less with GFCI Protection and Max Overcurrent Protection of 20 amps	Circuits for Control of Irrigation and Landscape Lighting
All locations not specified below	24 in.	6 in.	18 in.	12 in.	6 in.
Under a building	0 in	0 in	0 in	0 in	0 in
Under streets, highways, roads, alleys, driveways, and parking lots	24 in.	24 in.	24 in.	24 in.	24 in.
One- and two-family dwelling driveways and outdoor parking areas, and use only for dwelling-related purposes	18 in.	18 in.	18 in.	12 in.	18 in.

Damp or Wet Locations (any cable, raceway, enclosure installed underground is considered to be damp or wet location)

Table 300.5 applies to underground installations. The columns define requirements for specific conductor/raceway types. The rows define the characteristic of the underground installation, showing the depth that the corresponding cable/raceway needs to be installed.

Additional Topic 5

Articles 600-770

Building Control Circuits-Articles 600-770 (there are a broad number of building control circuits-examples are electric charging systems, elevators, fire pumps etc.)

Additional Topic 6

Article 770

Install optical fiber cables in a neat and workmanlike manner. Support exposed cables on the surface of ceilings and sidewalls so the cable will not be damaged by normal use. Cables are permitted to be secured by straps, staples, cable ties, hangers, or similar fittings. - NFPA 70 2017, Article 770.24

Additional Topic 7

Article 300.3 (C)

Installation of Conductors with Other Systems

***NFPA* 70 2017** defines the **requirements to wire a fire alarm system**. Contained in this code is **Article 760,** entitled "Fire Protective Signaling Systems."

Article 760 is short; however, it references **other chapters or articles** in ***NFPA* 70 2017**. For example, in one instance, it refers to Chapter 3 of the *NEC*, which is quite long.

Article 760 is divided into 3 parts:

Part I

General:
Part I covers the **installation and wiring** of all equipment used for fire protective signaling systems (fire alarm systems).

Part II

Non-Power-Limited Fire Alarm (NPLFA) Circuits-
A non-power-limited circuit is a **common circuit**, similar to a

home receptacle or lighting circuit, that is **protected by a fuse or circuit breaker**.

Part III

Power-Limited Fire Alarm (PLFA) Circuits-

Power-limited circuits are circuits which have a power source that is a **Class 3 transformer** or a **Class 3 DC power supply** that limits the amount of

Click on each of the cards above for a summary of each of the three parts.

We'll go through each of these three parts individually in more detail.

If a bold and italic ***N*** appears next to an Article, that indicates the material is **new to the 2017** edition of the ***NEC***.

NFPA 70 2017, ARTICLE 760 PART I

1

NFPA 70 2017, Article 760 Part I: General

Part I covers the **installation and wiring** of all equipment used for fire protective signaling systems (fire alarm systems).

It references other articles in *NFPA* 70 2017 which may apply. For example:

- Section 300.22 is designated for applications such as duct work.
- Articles 500 – 516 are referenced within Part 1. These involve hazardous locations and the definition of those hazardous locations, such as corrosive, damp, or wet locations.

CONTINUE

Some other areas covered in Part I are:

- Definitions
- Other related sections of the code
- Fire alarm circuit identification
- Abandoned cables

ⓘ New to the **2017 edition** is the inclusion of **cable routing assemblies** and **communications raceways** covered in **760.3(L)** and **760.3(M)**, respectively.

NFPA 70 2017, ARTICLE 760 PART II

2

NFPA 70 2017, Article 760 Part II: Non-Power-Limited Fire Alarm Circuits

A non-power-limited circuit is a **common circuit**, similar to a home receptacle or lighting circuit, that is **protected by a fuse or circuit breaker**.

If this circuit is shorted, the short circuit current surge in the wiring can be **much larger** than the rating of the over-current protection device.

A 20-amp circuit could have hundreds or thousands of amps of short circuit current for a period of microseconds. **That is long enough to damage the fire alarm system and/or its components.**

Part II

CONTINUE

ground fault circuit interrupter (GFCI)

Fire alarm system branch circuits **can never be protected at the source** by a ground fault circuit interrupter or arc fault circuit interrupter.

- This may cause the breaker to trip during an actual fire.
- The idea is to keep the notification appliances operating **as long as possible** during a fire.
- If the circuit breaker trips during a fire condition and the batteries are not in good condition, **the appliances would cease to operate** during this critical period.

CONTINUE

Part II of Article 760 states non-power-limited circuits must comply with **Chapters 1 through 4 of *NFPA* 70 2017.** This means that fire alarm wiring is treated as most other common wiring with regards to insulation and wiring methods.

Part II covers:

- branch circuit supply wiring and overcurrent protection
- conductors of different circuits in same enclosure or raceway
- NPLFA circuit conductors and cables
- wiring methods

Listed NPLFA Cables

The cable shall have insulation suitable for **600 volts.** All conductors must be 18 AWG or larger solid or stranded copper.

There are three types of cables installed as wiring within buildings:

- **NPLFP** — Non-Power-Limited Fire Alarm Plenum cable
- **NPLFR** — Non-Power-Limited Fire Alarm Riser cable
- **NPLF** — Non-Power-Limited Fire Alarm cable

These cables possess a hierarchy of fire resistance and low-smoke-producing material. Hence, **NPLFP can be used in all applications,** although the cable is higher priced. Similarly, **NPLF** can only be used for **general purpose** fire alarm use, but **NOT** for **risers, plenums,** and **environmental air spaces**.

Exceptions apply, but the standard usage is shown on the following table:

Wire Marking Description	Characteristics	Name	Description
NPLFP	Adequate fire resistance and low smoke producing	Non-Power-Limited Fire Alarm circuit cable for other spaces used for environmental air	Cables used for other spaces used for environmental air
NPLFR	Fire resistant characteristics to prevent carrying of fire between floors	Non-Power-Limited Fire Alarm Circuit Riser Cable	Cables for use in a vertical run in a shaft or from floor to floor
NPLF	Resistant to the spread of fire	Non-Power-Limited Fire Alarm circuit cable	Cables installed for general purpose fire alarm use with exceptions for riser, ducts, plenums and environmental air spaces
xxxx-CI* *additional suffix to above descriptions	Survivability	Fire Alarm Circuit Integrity (CI)	Cables used for survivability of critical circuits

Cables shall be marked with the description shown in the above chart.

The **-CI marking** shall be added for **2-hour circuit integrity cables**.

3

Part III: Power-Limited Fire Alarm Circuits

Part III

- Wiring methods on the supply side of the PLFA power source
- Wiring methods on the load side of the PLFA power source
- Separation from other circuit conductors
- PLFA conductors and cables

Power-Limited Circuits

Power-limited circuits are circuits which have a power source that is a **Class 3 transformer** or a **Class 3 DC power supply** that limits the amount of available current in a short circuit condition. If the power supply is rated at 0.002 amps, it will never deliver more than 0.002 amps.

These circuits must be **specially marked** and are afforded certain installation considerations.

Power-limiting is accomplished by circuit characteristics. A power-limited circuit is inherently limited by its design.

- A power-limiting component in a circuit is a transformer or power supply, which by design, is only capable of providing so much energy.
- The power supply for a PLFA system must be a Class 3 transformer or power supply.
- A simple fuse is **not** an acceptable power-limiting component.

Above is a sample of a Class 2 transformer which can be a Class 3 when installed in a wet location. A Class 2 or Class 3 Transformer is used in a fire alarm to convert the 120 VAC power from the dedicated circuit from the fire alarm. This transformer converts this power to the 24VDC power to power the circuits on the fire alarm panel for notification and initiation circuits.

LISTED PLFA CABLES

Listed PLFA cables

The cable shall have **insulation suitable for 300 volts**. All conductors must be solid or stranded copper.

Multiconductor cable must not be smaller than **26 AWG**. A single conductor shall not be smaller than **18 AWG**.

There are three types of cables installed as wiring within buildings:

1. FPLP-A 16 AWG 2 conductor FPLP cable assembly. Most manufacturers will print on the jacket the cable type, as well as footage left on the spool or box.
2. FPLR-A 16 AWG 2 conductor FPLR cable assembly. Most manufacturers will print on the jacket the cable type, as well as the footage left on the spool or box.
3. FPL

FPLP Cable

FPLR Cable

Standard usage is shown on the following table:

Wire Marking Description	Characteristics	Name	Description
FPLP	Adequate fire resistance and low smoke producing	Power-Limited Fire Alarm circuit cable for other spaces used for environmental air	Cables used for duct, plenums and other spaces used for environmental air
FPLR	Fire resistant characteristics to prevent carrying of fire between floors	Power-Limited Fire Alarm Circuit Riser Cable	Cables for use in a vertical run in a shaft or from floor to floor
FPL	Resistant to the spread of fire	Power-Limited Fire Alarm circuit cable	Cables installed for general purpose fire alarm use with exceptions for riser, ducts, plenums, and environmental air spaces
xxxx-CI* *additional suffix to above descriptions	Survivability	Fire Alarm Circuit Integrity (CI)	Cables used for survivability of critical circuits

ⓘ **Key References: *NFPA 70* (2017), Articles 760.41 and 760.121**

LET'S REVIEW

Let's do a quick check over what we just covered.

In addition to covering the installation and wiring of all equipment used for fire protective signaling systems (fire alarm systems), what other topics are covered in *NFPA* 70 2017, Article 760 Part I? Select all that apply.

☐ Definitions

☐ Fire alarm circuit identification

☐ Power limited circuits

☐ Abandoned cables

SUBMIT

Based on the table in Part II of *NFPA* 70 2017, Article 760, which cables (insulation suitable for **600 volts)** should be used for environmental air?

○ NPLF

○ NPLFA

○ NPLFP

○ NPLFR

SUBMIT

Based on the table in Part III of NFPA 70 2017, Article 760, which cables (insulation suitable for **300 volts)** should be installed for general purpose fire alarm use with exceptions for riser, ducts, plenums, and environmental air spaces

○ FPL

○ FPLG

○ FPLP

○ FPLR

SUBMIT

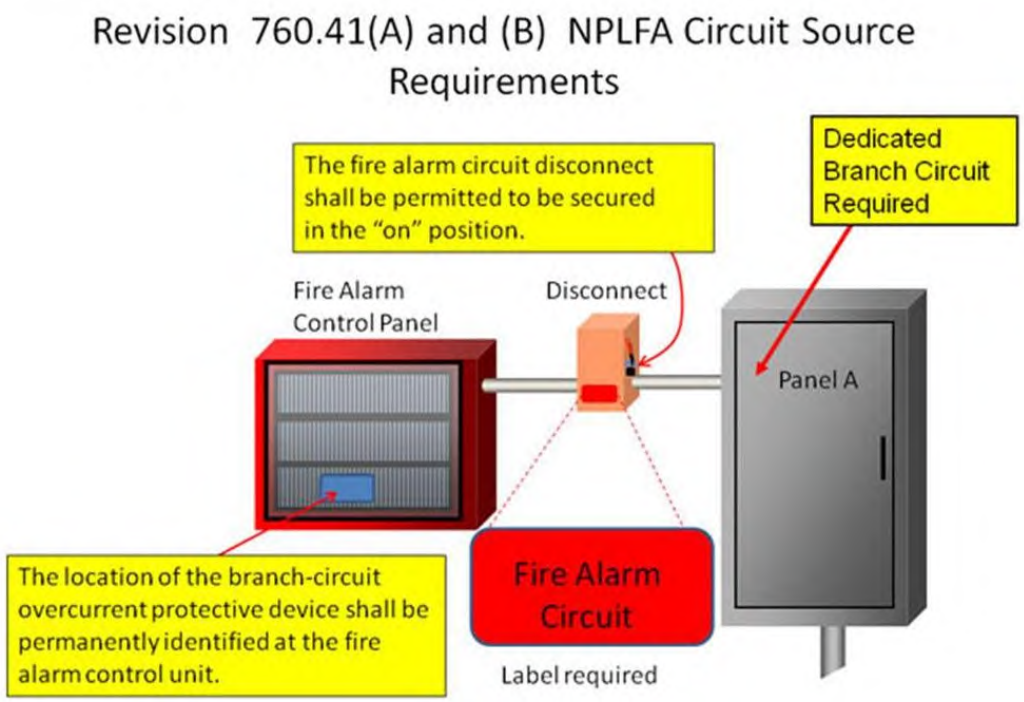
Complete the knowledge check above before moving on.

Power and branch circuit requirements

The NEC defines the power and branch circuit requirements for fire alarm systems in Articles 760.41 and 760.121.

Requirement 1

Dedicated circuit



What is shown is the operation of an NPLFA circuit as defined in Article 760.41 of the NEC. Panel A is the electrical panel that contains the dedicated circuit (or branch circuit) that will provide the FACP with its primary power. The dedicated circuit can be in the locked position at a disconnection point that is not in the electrical panel location as shown. Generally, this disconnection point is in the panel that provides the FACP with its primary power.

Requirement 2

Location identification

The branch circuit supplying the fire alarm equipment(s) shall supply no other loads (dedicated circuit). The location of the branch-circuit overcurrent protective device shall be **permanently identified** at the fire alarm control unit.

Requirement 3

Circuit disconnecting means identification

The circuit disconnecting means shall have **red** identification, shall be accessible **only to qualified personnel**, and shall be identified as “**FIRE ALARM CIRCUIT**.” The red identification **shall not damage the overcurrent protective devices** or obscure the manufacturer’s markings.

Requirement 4

Circuit interrupters

This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters.

Requirement 5

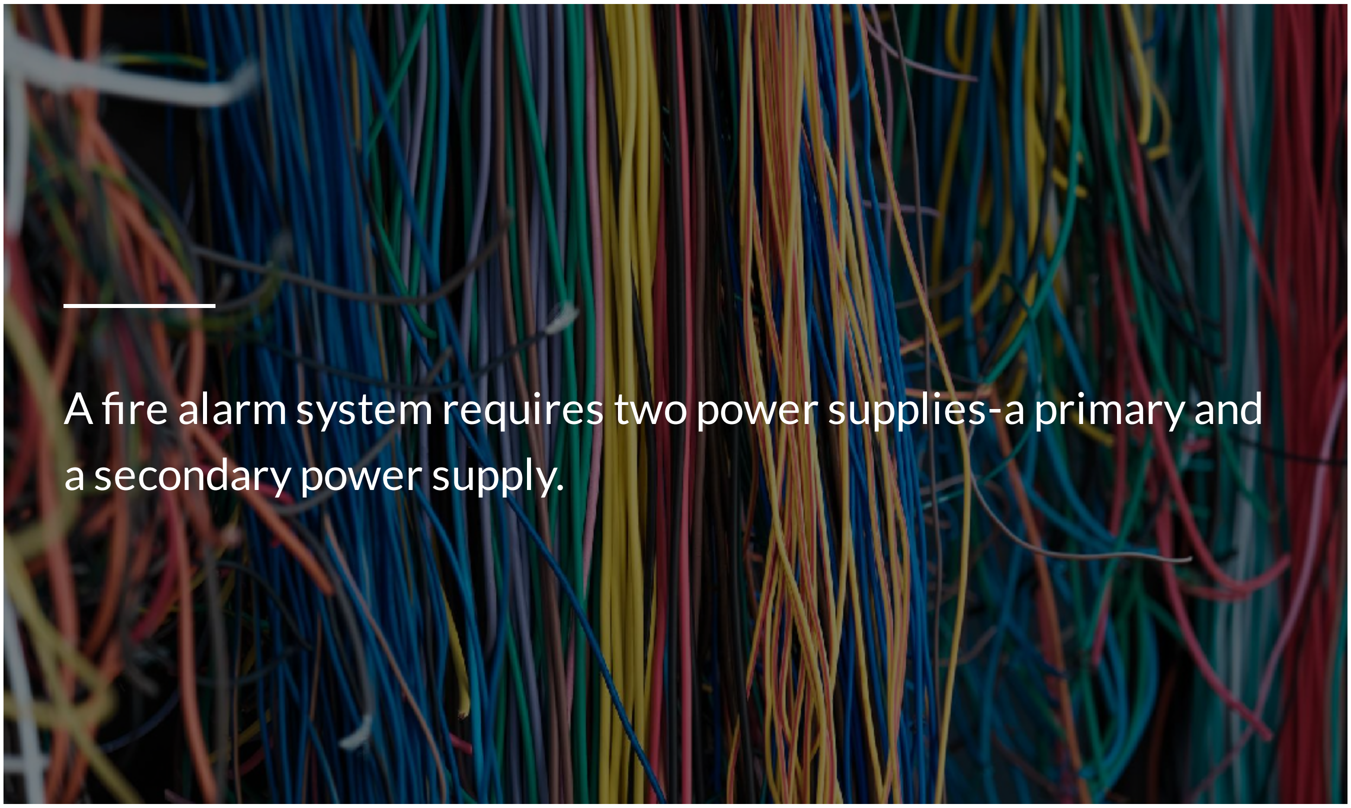
Fire alarm circuit disconnect

The location of the branch circuit must be identified in the FACP, the dedicated circuit disconnect locked in the "on" position, and marked red at the disconnecting means. The fire alarm circuit disconnect shall be permitted to be secured in the “on” position.

CONTINUE TO NEXT LESSON: POWER SUPPLIES AND GENERATORS

Lesson 3 of 5

Power Supplies and Generators



A fire alarm system requires two power supplies-a primary and a secondary power supply.

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Recognize capacity requirements for back-up and secondary power supply operations and alarm conditions

2. Include a 20% safety margin for battery amp-hour calculations

ⓘ **Key Reference: *NFPA* 72 2016, Section 10.6**

POWER SUPPLIES

Power Supplies

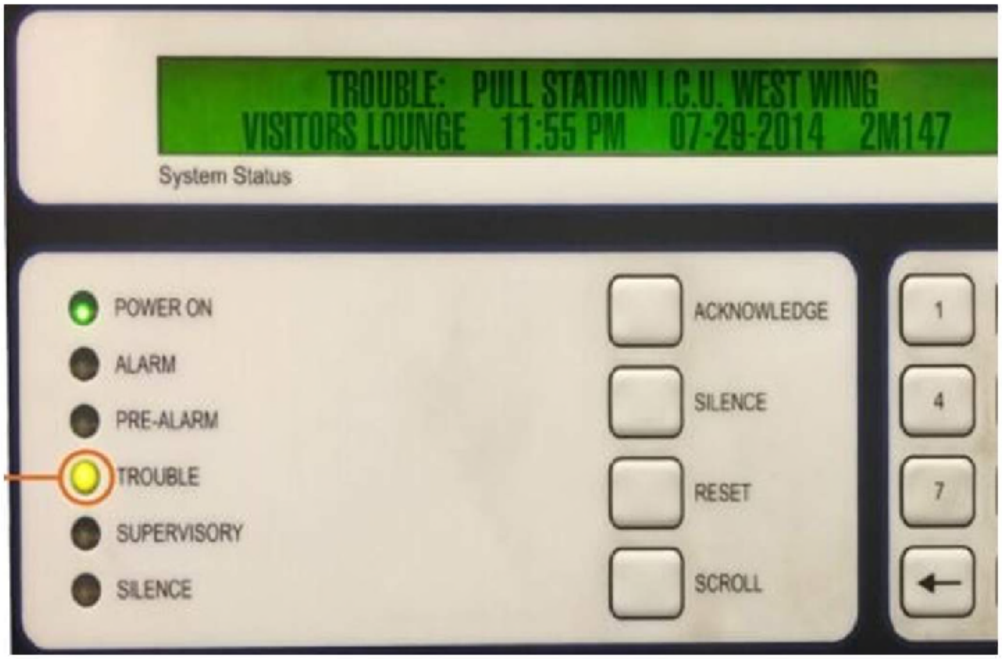
At least two power supplies are required for a fire alarm system. Both must have **adequate capacity for the intended application**. They are designated as **primary** and **secondary supplies.**

Power supplies must be monitored per ***NFPA* 72 2016, Section 10.6.9**. All power supplies shall be monitored for voltage at their connection to the system.

UNINTERRUPTABLE POWER SUPPLIES

Uninterruptable Power Supplies (UPS)

NFPA 72 2016, Section 10.6



UPSs must be configured in compliance with *NFPA 111: Standard on Stored Electrical Energy Emergency and Standby Power Systems.*

They must be set up for **Type O, Class 24, Level 1** system and must be supplied by a **dedicated branch circuit** per Section 10.6.5.

Failure of the UPS shall result in a **trouble signal**.

PRIMARY POWER SUPPLY

Primary Power Supply

NFPA 72 2016, Section 10.6.5

The primary power supply shall be a commercial power and light service or an engine driven generator. This is required to assure adequate reliability and capacity. It must be supplied by a dedicated branch circuit.

The **dedicated branch circuit** must be identified as "**Fire Alarm Circuit.**"

> ⓘ **If a circuit breaker is the disconnecting means, an approved breaker locking device is required to be installed. — *NFPA 72* 2016, Section 10.6.5.4**

CONTINUITY OF POWER SUPPLIES

Continuity of Power Supplies

NFPA 72 2016, Section 10.6.6

secondary power supply

For **fire alarm systems**, the **secondary power supply** shall automatically supply power **within 10 seconds** of when the primary power fails to provide the minimum system voltage required for proper operation.

For **supervising station** **facilities and equipment**, the secondary power supply shall automatically supply power **within 60 seconds** of when the primary power fails to provide the minimum system voltage required for proper operation.

Any required signals shall not be lost, interrupted, or delayed by more than **10 seconds** because of primary power failure.

CAPACITY

Capacity

NFPA 72 2016, Section 10.6.7

The **fire alarm backup supply** must operate the system for **24 hours** and then, at the end of that period, **support a full alarm condition of the system for 5 minutes**.

The **secondary power supply for an emergency voice/alarm communications system** must operate for **24 hours** and then operate for **15 minutes in a fire or other emergency condition.**

Battery amp-hour calculations for fire alarm or emergency voice/alarm communications systems must include an additional **20% safety margin**.

LET'S REVIEW

Let's see what you remember about power supplies.

The fire alarm system must have both a primary and secondary power supply. The secondary power supply must provide standby power for 24 hours followed by _____ minutes in full alarm.

- ○ 5 minutes
- ○ 10 minutes
- ○ 15 minutes
- ○ 30 minutes

SUBMIT

If the system is an emergency voice communication system, the secondary power supply must provide standby power for 24 hours followed by _____ minutes in full alarm.

○ 5 minutes

○ 10 minutes

○ 15 minutes

○ 30 minutes

SUBMIT

Complete the knowledge check above before moving on.

Engine-Driven Generators

Engine-driven generators can supply either **primary** or **secondary** power.

A Diesel-powered generator for electrical service is shown below. If this is a primary power source for a fire alarm, there are additional points requiring supervision to minimize power loss.

A **trained operator** must be on **duty at all times** for manually started generators.

Installation must be in compliance with **NFPA 110, Standard for Emergency and Standby Power Systems.**

A **separate** starter battery and automatic charger are also **required**.

18 amp hour batteries installed in a FACP for secondary power. These are 12 volt batteries, there are 2 batteries because the panel power supply is 24 volts. The battery size shall be calculated to provide 20% spare capacity in addition to running the fire alarm in a normal condition for 24 hours, or in alarm for 5 minutes in a non-voice evacuation system. Although it is prudent to provide the date of installation as shown, NFPA 72 2016 requires the date of MANUFACTURE to be provided on the batteries.

Excellent practice of noting battery replacement dates here - shown with white labels on top of these Powersonic sealed lead acid batteries.

LET'S REVIEW

Let's see what you remember about power supplies.

Engine-driven generators can supply what type(s) of power?

○ Primary

○ Secondary

○ Both primary or secondary power

SUBMIT

The battery size (for the secondary power of a FACP) shall be calculated to provide 20% spare capacity in addition to running the fire alarm in a normal condition for __ hours, or in alarm for 5 minutes in a non-voice evacuation system.

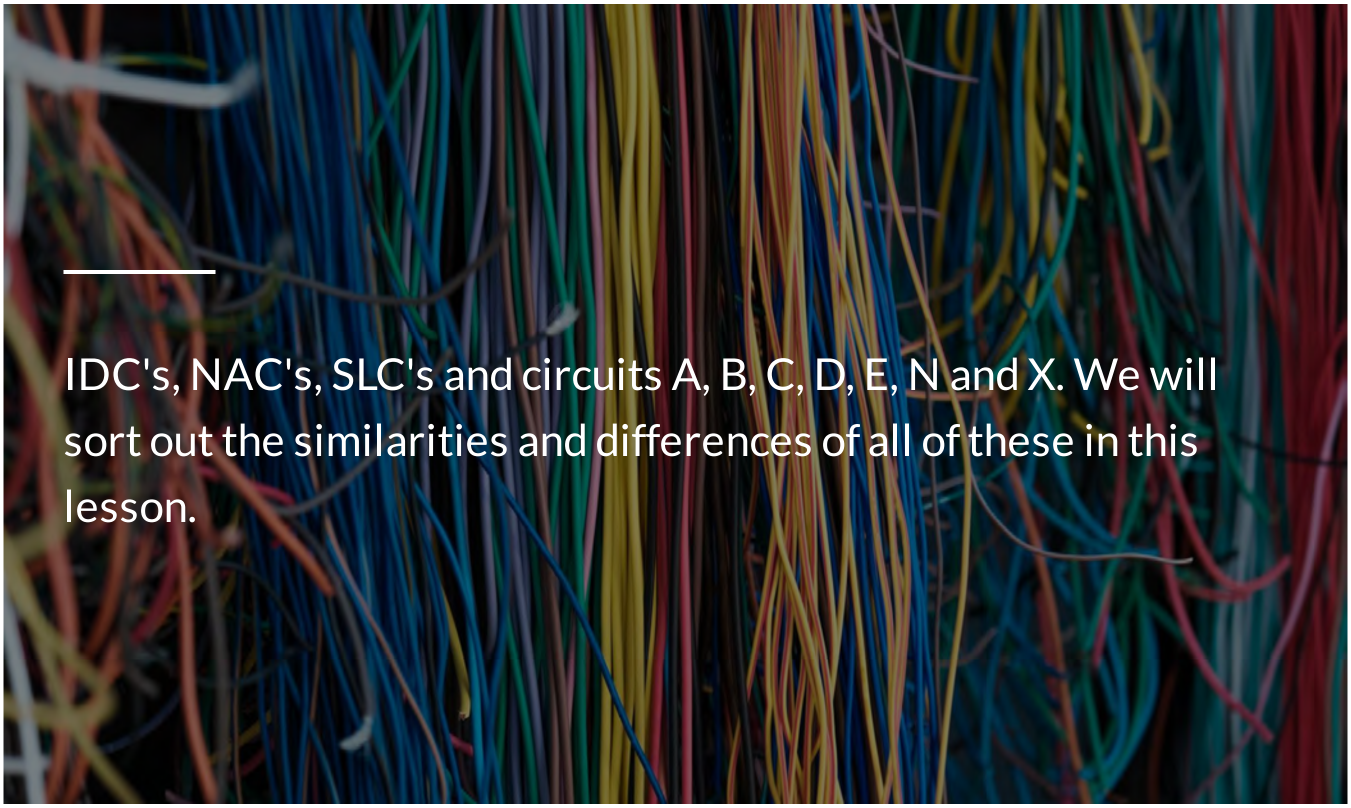
Type your answer here

SUBMIT

Complete the knowledge check above before moving on.

Lesson 4 of 5

Circuits and Pathways



IDC's, NAC's, SLC's and circuits A, B, C, D, E, N and X. We will sort out the similarities and differences of all of these in this lesson.

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Define various pathway designations
2. Identify three different types of fire alarm circuits

3 Clarify the difference between Class A redundant circuits and Class B non-redundant circuits

CONTINUE

Circuits and pathways

This chapter covers the performance capabilities of circuits (or pathways) that are used with fire alarm systems. **Circuits** typically refer to copper wiring interconnection methods. **Pathways** typically refer to non-copper interconnection such as fiber optic, internet, or wireless.

CONTINUE

The following are important definitions related to Chapter 12:

Path (Pathways)

Any circuit, conductor, optic fiber, radio carrier, or other

Pathway Survivability

The ability of any conductor, optic fiber, radio carrier, or other means for transmitting system information to means connecting two or more locations. (Section 3.3.187)

remain operational during fire conditions. (Section 3.3.188)

TYPES OF FIRE ALARM CIRCUITS

Types of fire alarm circuits

Earlier in this module, we looked at three different types of fire alarm circuits: initiating device circuits (IDCs), signaling line circuits (SLCs), and notification appliance circuits (NACs).

Take a moment to review their definitions. Click each card below to see the definitions and take a moment to compare the similarities and differences.

Initiating Device Circuit (IDC)

A fire alarm circuit that is connected directly to initiating devices such as automatic detectors and/or manual pull boxes.

The signal received by the control

Signaling Line Circuit (SLC)

A fire alarm circuit that provides a path between any combination of circuit interfaces, control units, or transmitters.

The term **interface** simply means **a connection to another circuit or device** such as initiating devices.

Notification Appliance Circuit (NAC)

A fire alarm circuit that is connected directly to notification appliances such as bells, horns, strobe lights, and speakers.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

Match the words below to their descriptions.

Circuits	Typically refer to copper wiring interconnection methods
Pathways	Typically refer to non-copper interconnection such as fiber optic, internet, or wireless

SUBMIT

Complete the knowledge check above before moving on.

Pathway class designations

Fire alarm circuits are designated by class depending on their ability to perform during specified fault conditions. Fault conditions include:

- Single open conductor
- Single grounded conductor
- Wire-to-wire shorts

Before we go into detail, here is a brief overview of each type of circuit.

Class A

Section 12.3.1

Redundant path; the physical conductors **are monitored for integrity.**

Class B

Section 12.3.2

Non-redundant path; the physical conductors **are monitored for integrity.**

Class C

Section 12.3.3

May be **redundant or non-redundant path**; the circuit **is monitored for integrity** via loss of end-to-end communications.

Class D

Section 12.3.4

Non-redundant path; supplementary circuit such as magnetic door holder; the circuit is **not monitored for integrity.**

Class E

Section 12.3.5

Non-redundant path; supplementary circuit for nonrequired circuits such as a lighted status board that does not affect the operation of the fire alarm system; the circuit is **not monitored for integrity.**

Class N

Section 12.3.6

Network system with **redundant path**; redundant path to each device is **verified by end-to-end communications** between network switch and endpoint device(s).

Class X

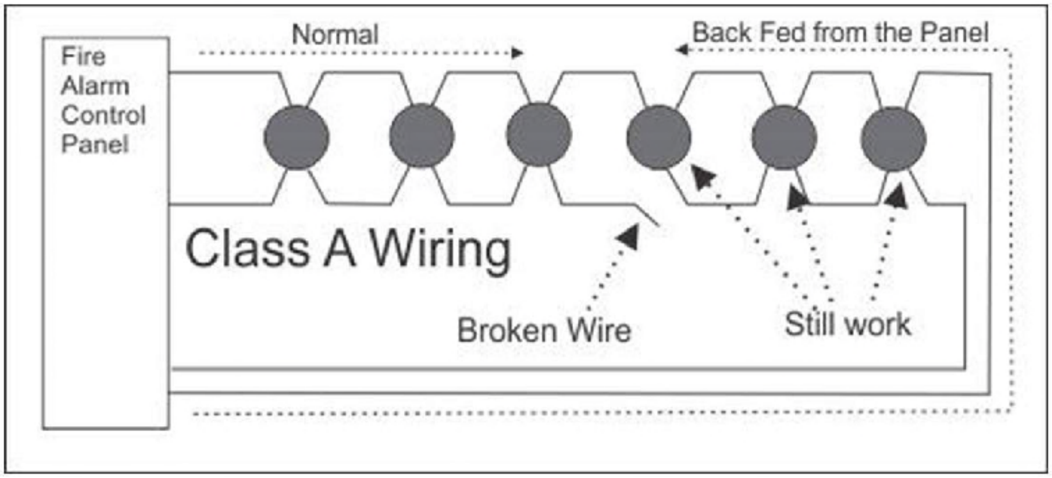
Section 12.3.7

Redundant path; conductive circuit **is monitored for integrity similar** to Class A or B circuits; nonconductive circuits such as fiber optics or wireless **also monitored for integrity.**

IDCs FOR CONVENTIONAL SYSTEMS

ⓘ **Key References: *NFPA 72* (2016), Sections 12.3.1 – 12.3.2**

IDCs for conventional systems



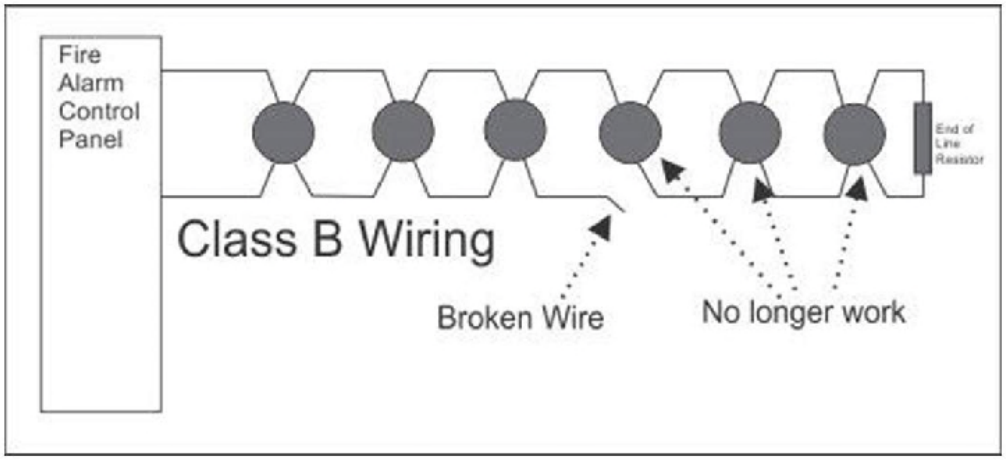
Class A Circuit

Class A IDCs **(Section 12.3.1)** for conventional systems are **redundant circuits.** Any devices past the single open will continue to receive power from the control unit and will be able to send an alarm signal to the control unit.

- With a ground fault on the circuit, the unit will still be able to receive an alarm signal from any device.
- In the case of an open or ground, the control unit will indicate a trouble condition.

Class B IDCs (Section 12.3.2) for conventional systems are **not redundant circuits.** Any devices past the single open will not receive power from the control unit and will be unable to send an alarm signal to the control unit.

- With a ground fault on the circuit, the unit will still be able to receive an alarm signal from any device **that is not past an open.**
- In the case of an open or ground, the control unit will indicate a trouble condition.



Class B Circuit

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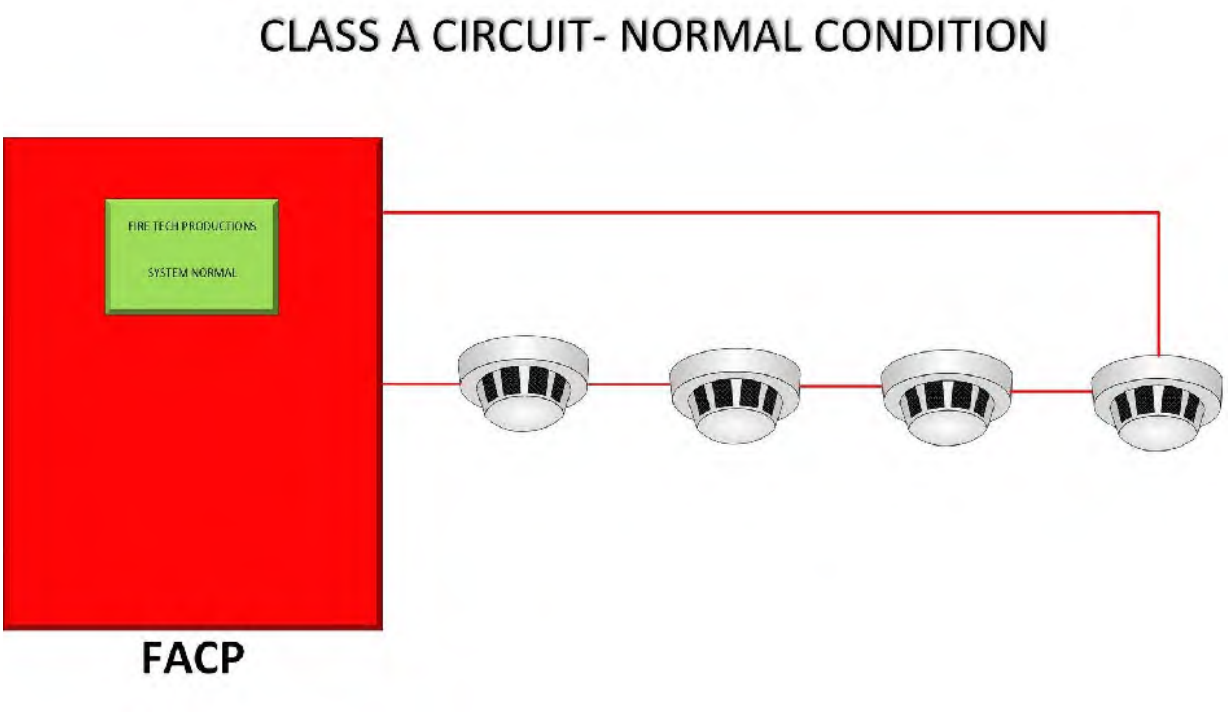
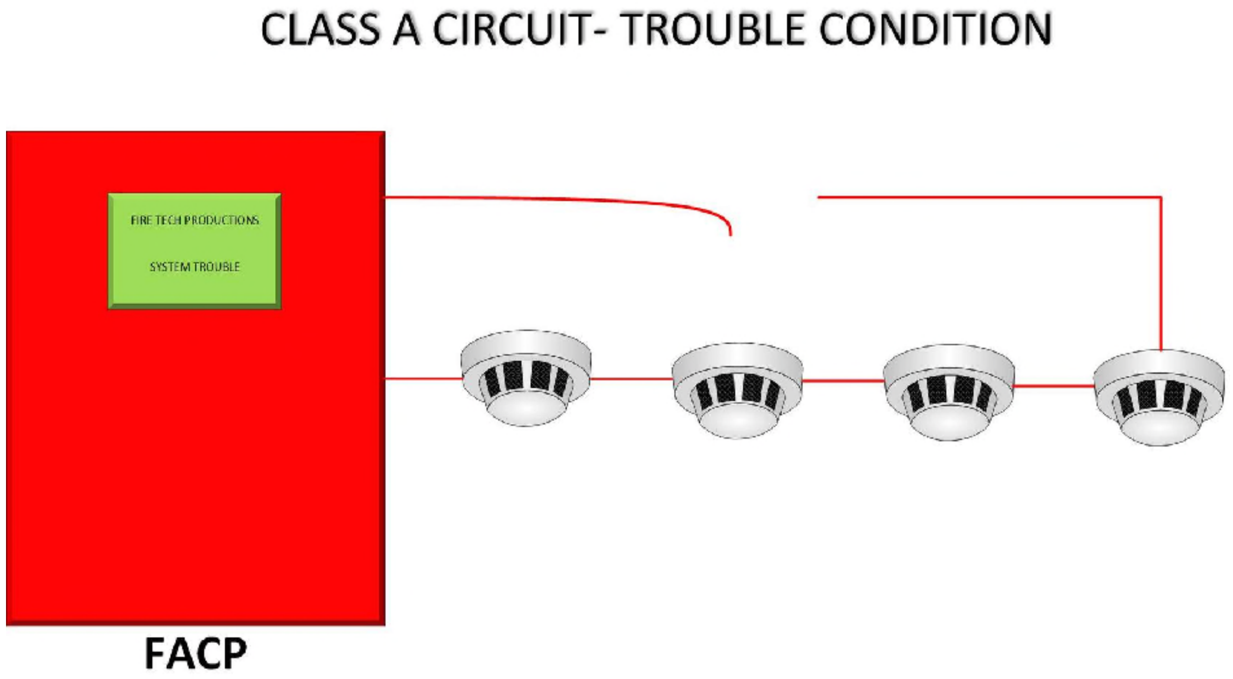
CLASS A



Class A Circuit

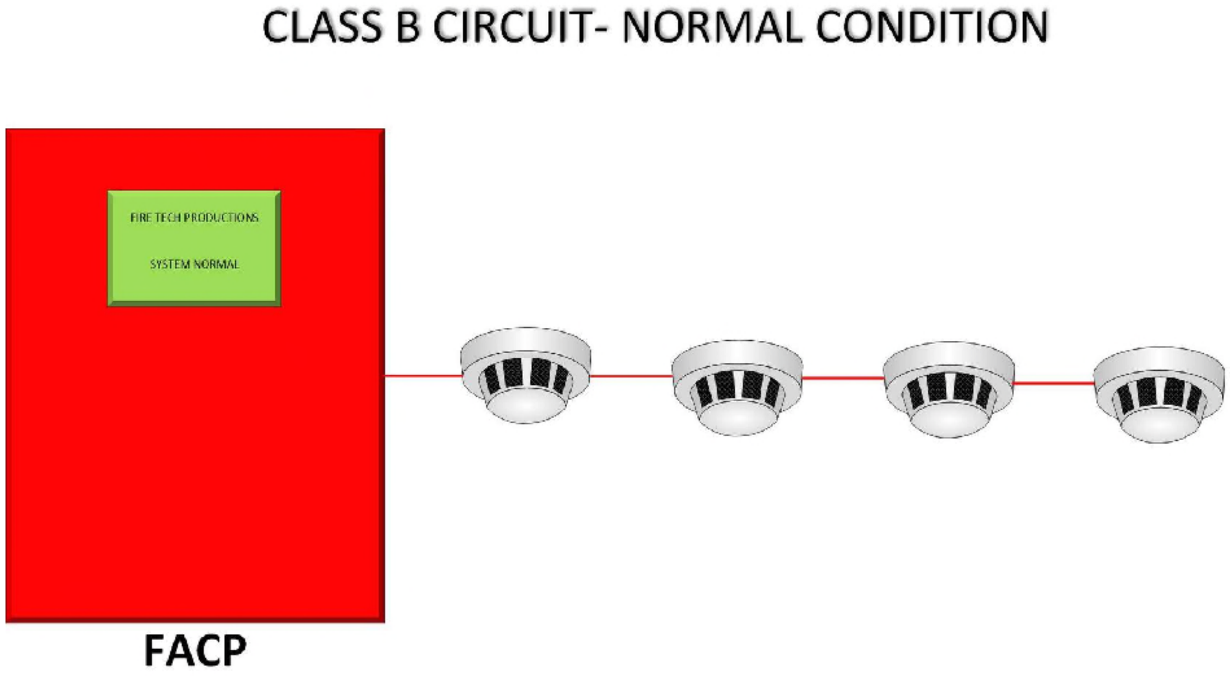
A Class A pathway can be installed for NACs, IDCs, or SLCs. A Class A circuit requires the use of a redundant path from the field devices back to the FACP. The redundant path of the Class A circuit (inbound from the last device on the circuit) cannot be in the same raceway system, as the path that leaves (outbound from the FACP) to ensure circuit integrity. If there is a single-open or break in the circuit, the devices on the circuit will still operate.

When there is a **break or open** in a **Class A circuit** as shown, the FACP shall **annunciate a trouble condition**.



Class A Circuit-Trouble Condition

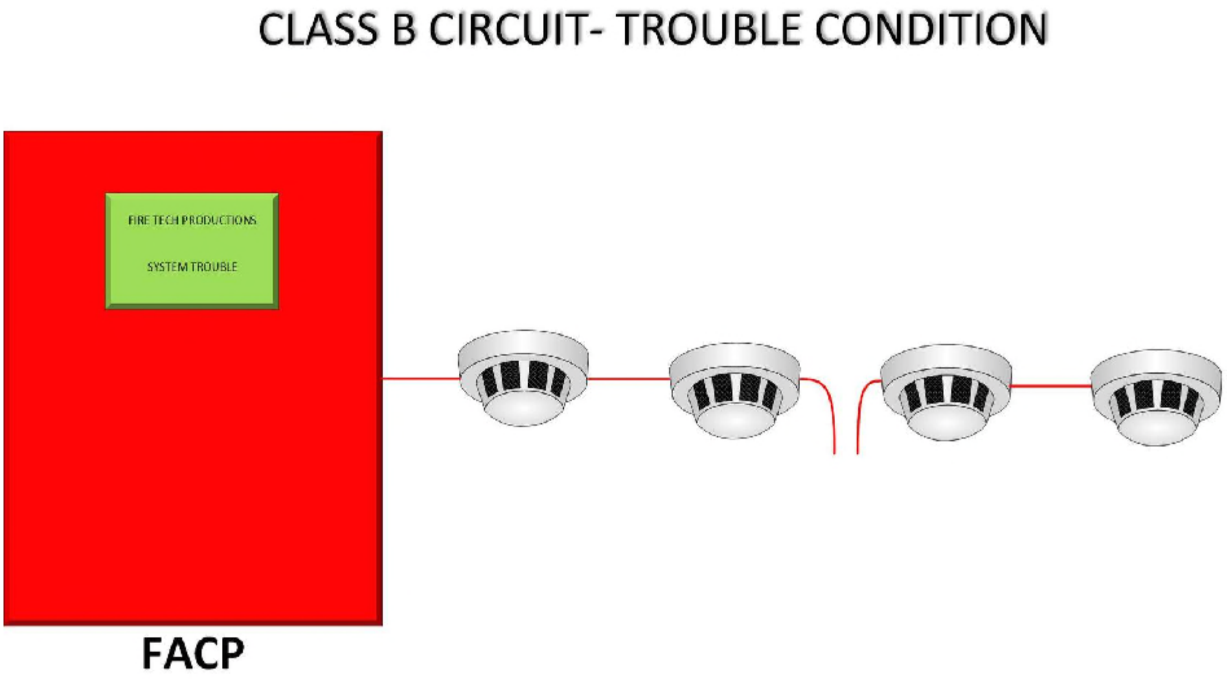
CLASS B



Class B Circuit

A **Class B pathway** can be installed for NACs, IDCs, or SLCs. A Class B circuit has no requirement for redundant paths from the FACP to the field devices. The downfall of this pathway is if there is an open or break in the circuit the devices past the break or open in the circuit will no longer operate.

When there is a break or open in a **Class B circuit** as shown, the FACP shall annunciate a trouble condition. Additionally, in this image devices 1 and 2 will operate, however devices 3, and 4 will not.



Class B Circuit-Trouble Condition

LET'S REVIEW

Let's do a quick check about what has been covered so far.

Sort the following pathway class designation cards below as to whether they are Redundant Paths or Non-Redundant Paths.

Redundant Paths

Class A Section 12.3.1

Class N Section 12.3.6

Class X Section 12.3.7

Non-Redundant Paths

Class B Section 12.3.2

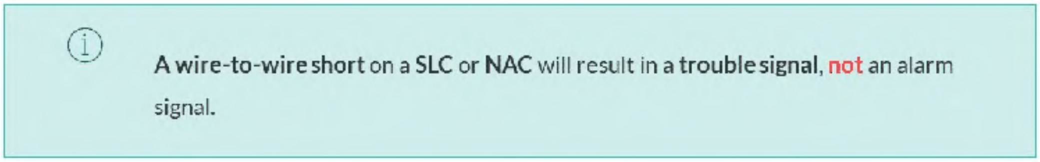
Class D Section 12.3.4

Class E Section 12.3.5

Complete the card sort above before moving on.

What about wire-to-wire shorts?

At this point you may have noticed that we have not discussed what happens to Class A or Class B initiating device circuits when we have a wire-to-wire short on the circuit. As discussed, an open or ground fault results in a trouble signal. However, **a wire-to-wire short is what causes an alarm condition on these two circuits.**



A wire-to-wire short on a SLC or NAC will result in a **trouble signal**, **not** an alarm signal.

Once an automatic fire detector (heat, smoke, flame, etc.) senses a fire, or when we activate a manually actuated device (pull station), a set of electrical contacts will close, which produces a wire-to-wire short. The control unit reads this wire-to-wire short on the IDC and will go into alarm mode.

SLCs for addressable systems

Class A SLCs for addressable systems are **redundant circuits**, just like Class A IDCs. The control unit can back feed the circuit in case of an open in the wiring. All devices will continue to receive power (with a single open).

With a single open or ground on the circuit, the control unit will still be able to receive an alarm signal from any device or pull station on the circuit. In the case of a wire-to-wire short, or a wire-to-wire short with an open, the control unit **may or may not** be able to receive an alarm signal.

Class B SLCs for addressable systems are **not redundant circuits**. Any devices past the single open will **not** receive power from the control unit.

With an open in the circuit, the control unit **will not be able to receive an alarm signal from any device past the open**. The control unit will still be able to receive an alarm signal from all devices with a **single ground** on the circuit.

In the case of an open, short, ground, or loss of a carrier signal, the control unit will indicate a **trouble condition**.

NACs

Class A NACs are **redundant circuits**. The control unit can back feed the circuit in case of an open in the wiring. All notification appliances **will continue to receive power and operate during an alarm condition** (with a single open).

With **a single open on the circuit or a ground** on the circuit, the control unit **will still be able** to send power to all notification appliances to let the occupants know to evacuate.

With a wire-to-wire short, the entire circuit **will not operate.**

In the case of an open, ground, or wire-to-wire short, the control unit will indicate a **trouble condition**.

Class B NACs are **not redundant circuits**. Any notification appliance past the single open will **not** receive power from the control unit and will be unable to operate during an alarm condition.

With a **single ground** on the circuit, the control unit **will still be able** to send power to all notification appliances to let the occupants know to evacuate.

With a wire-to-wire short, the entire circuit **will not operate** if the control unit goes into alarm mode. The existing wire-to-wire short will cause a fuse to blow, making the entire circuit inoperable.

In the case of an open, ground, or wire-to-wire short, the control unit will indicate a **trouble condition**.

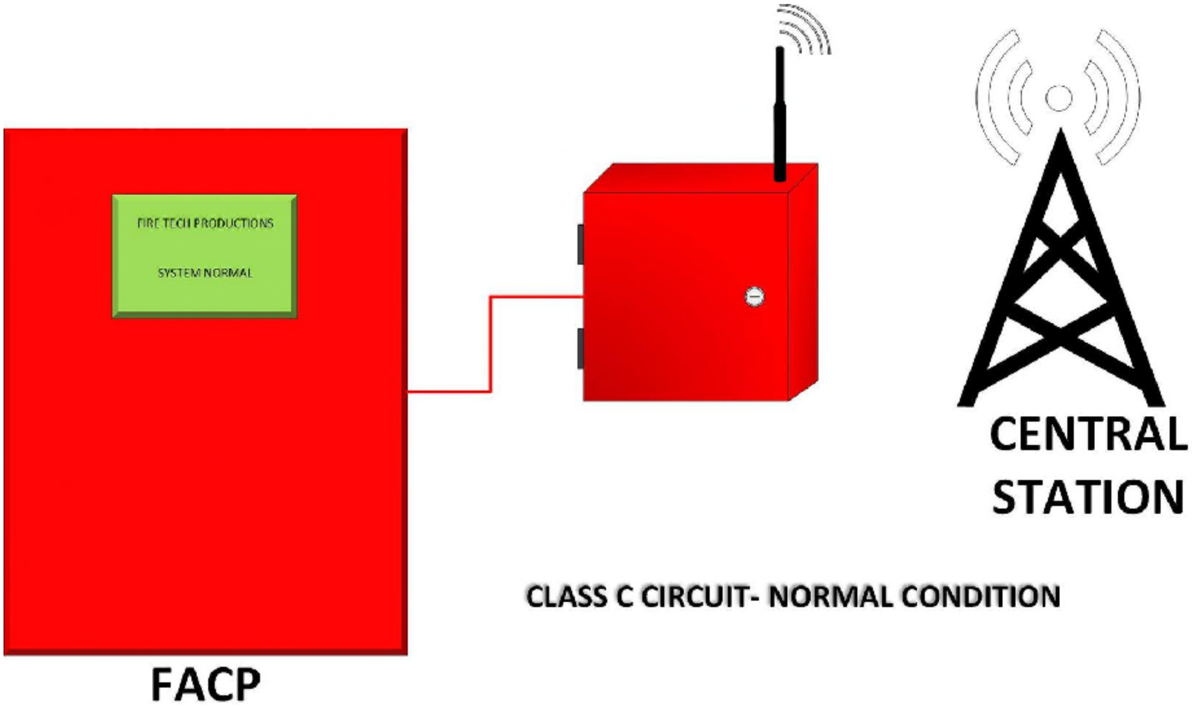
CLASS C CIRCUITS

ⓘ **Key References: NFPA 72 (2016), Sections 12.3.3 and A.12.3.3**

Class C Circuits

Class C circuits describe fire alarm system circuits that perform as follows:

1. They include one or more pathways where **operational capability is verified via end-to-end communication**, but the integrity of individual paths is **not** monitored.
2. A loss of end-to-end communication is **annunciated**.



Class C Circuits

Per **Section A.12.3.3**, Class C is intended to describe technologies that supervise the communication pathway by **polling or continuous communication “handshaking”** such as the following:

1. Fire alarm control unit or supervising station connections to a wired or wireless LAN, WAN, or Internet
2. Fire alarm control unit or supervising station connections to a wireless (proprietary communications)
3. Fire alarm control unit digital alarm communicator transmitter or supervising station digital alarm communicator receiver connections to the public switched telephone network

A Class C circuit is a circuit that for all intents and purposes is not supervised for circuit integrity. These circuits are generally used for communication purposes, from an FACP to a DACT (Digital Alarm Communication Transmitter) or Cellular dialer.

These devices are wired to FACPs; however, their system trouble occurs when the communication device does not operate properly in their communication protocols (SIA, Contact ID), or if the communicator or DACT is not programmed correctly within the FACP.

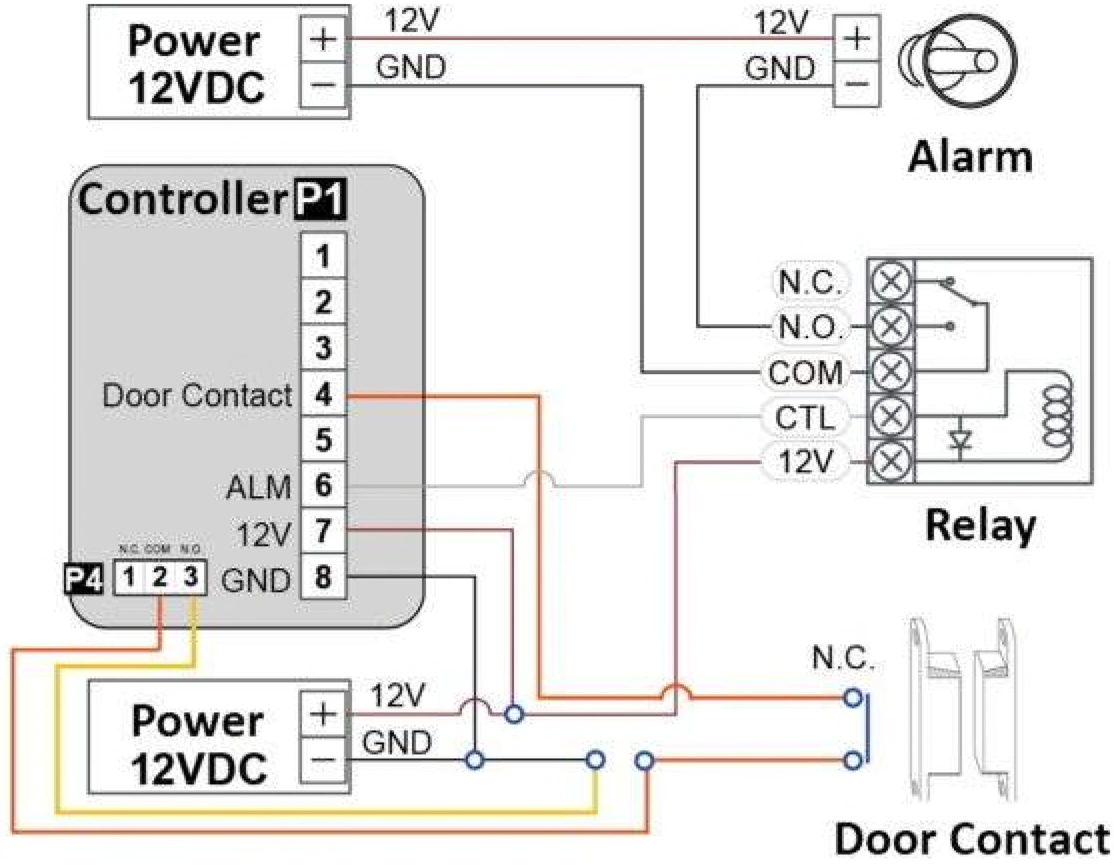
Fire Alarms, by code are required to perform a “Handshake” and “Kiss-off” every 24-hours to ensure the protected premise fire alarm system communicates to the supervising station. The “handshake” process begins with the receiver at the supervising station sending a signal to the system DACT or cellular dialer. If the DACT acknowledges this signal this is a handshake; when the DACT/cellular dialer sends the signal back, this process is known as a kiss-off.

If these signals are missed/ignored this is where the trouble results, generally as a “communication loss” trouble.

CLASS D CIRCUITS

ⓘ **Key References:** ***NFPA 72*** **2016, Sections 12.3.4 and A.12.3.4**

Class D Circuits



Class D Circuit

Class D circuits describe fire alarm system circuits that perform as follows:

- They have **fail-safe** operation, where **no fault is annunciated**, but the intended operation **is performed** in the event of a pathway failure.

Per **Section A.12.3.4**, Class D is intended to describe pathways that are **not supervised** but have a fail-safe operation that performs the intended function when the connection is lost.

Examples include the following:

1. Power to door holders where interruption of the power results in the door closing
2. Power to locking hardware that release upon an open circuit or fire alarm operation

Class D is a "fail-safe" pathway that is **not supervised** by the FACP.

This pathway is generally found in access control systems, fire doors, or fire smoke dampers. This is accomplished by using a relay that interfaces between the fire alarm and access control system, so when the system goes into fire alarm, doors that are normally locked will fail-safe open by the relay de-energizing the lock to the door.

The same principle applies to fire doors that are magnetically held open, or building dampers that are in an open position that need to close in alarm.

CLASS E CIRCUITS

ⓘ Key References: *NFPA 72* 2016, Sections 12.3.5 and A.12.3.5

Class E Circuits

Class E circuits describe fire alarm system circuits that are **not monitored for integrity**.

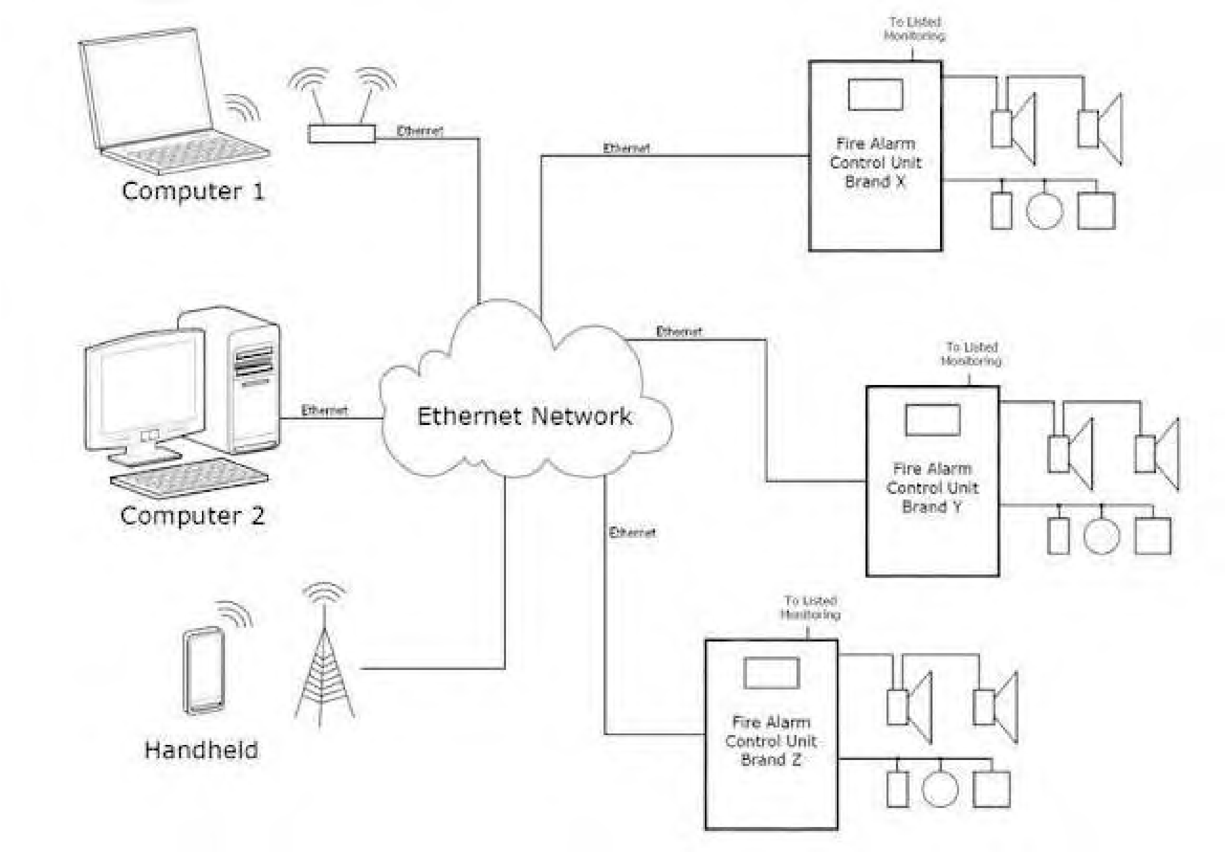
Per **Section A.12.3.5**, the Class E reference is intended to describe pathways that **do not require supervision** as described in Section 12.6.

CLASS N CIRCUITS

ⓘ Key Reference: *NFPA 72* 2016, Section 12.3.6

Class N Circuits

Class N is a network pathway requiring 2 or more redundant paths for networked campus/community fire alarms using an ethernet or fiber backbone network to network the systems together. There are limitations to this network based upon the backbone that is being used. Ethernet networks are generally limited to 325 ft. point-to-point, fiber can generally go further but is more costly.



Class N Circuit

Class N circuits describe fire alarm system (networked infrastructure) circuits that perform as follows:

1. It includes a **redundant path verified through end-to-end communications**.
2. A loss of intended communications between endpoints is annunciated as a **trouble signal**.

3. A single open, ground, or short, or combination of faults of one pathway **shall not affect any other pathway**.

4. Conditions that affect the intended operation of the path are annunciated as a **trouble signal**.

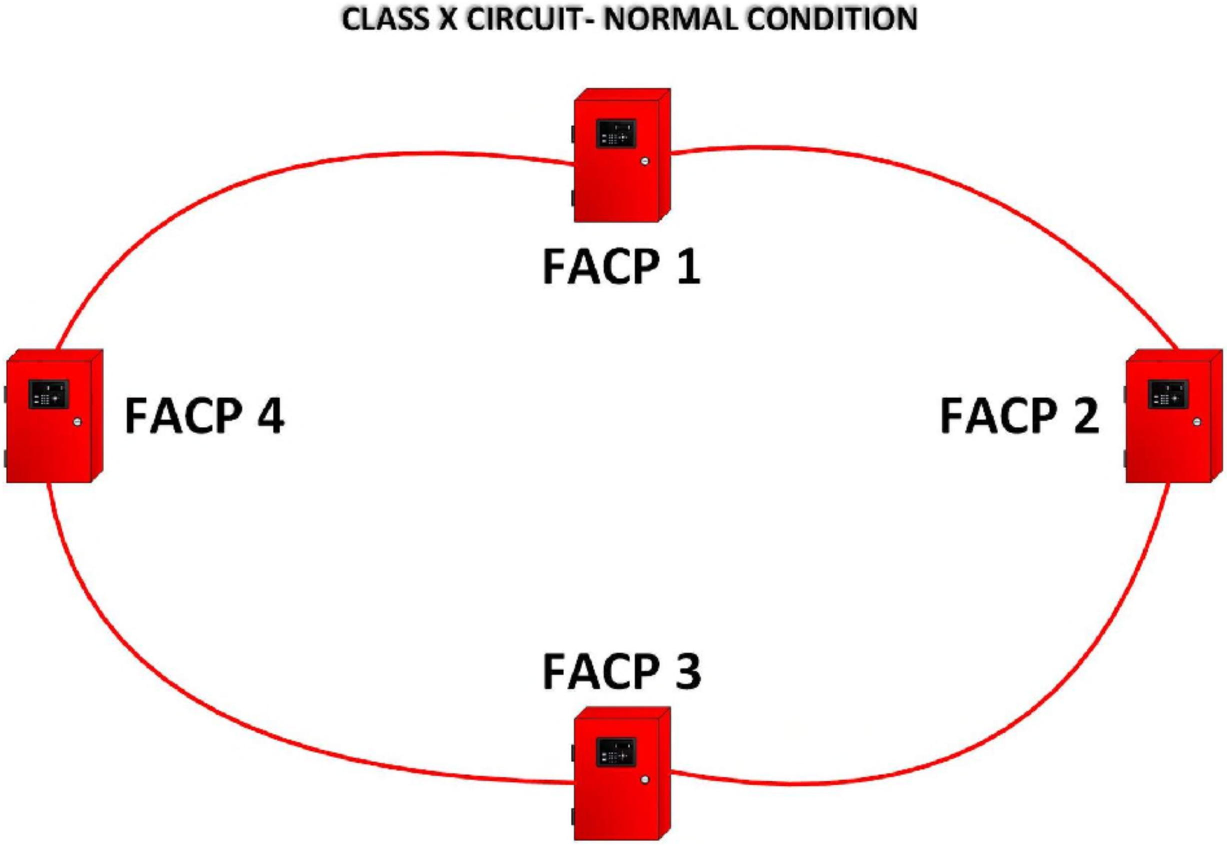
5. Primary and redundant pathways are **not permitted to share traffic** over the same physical segment.

CLASS X CIRCUITS

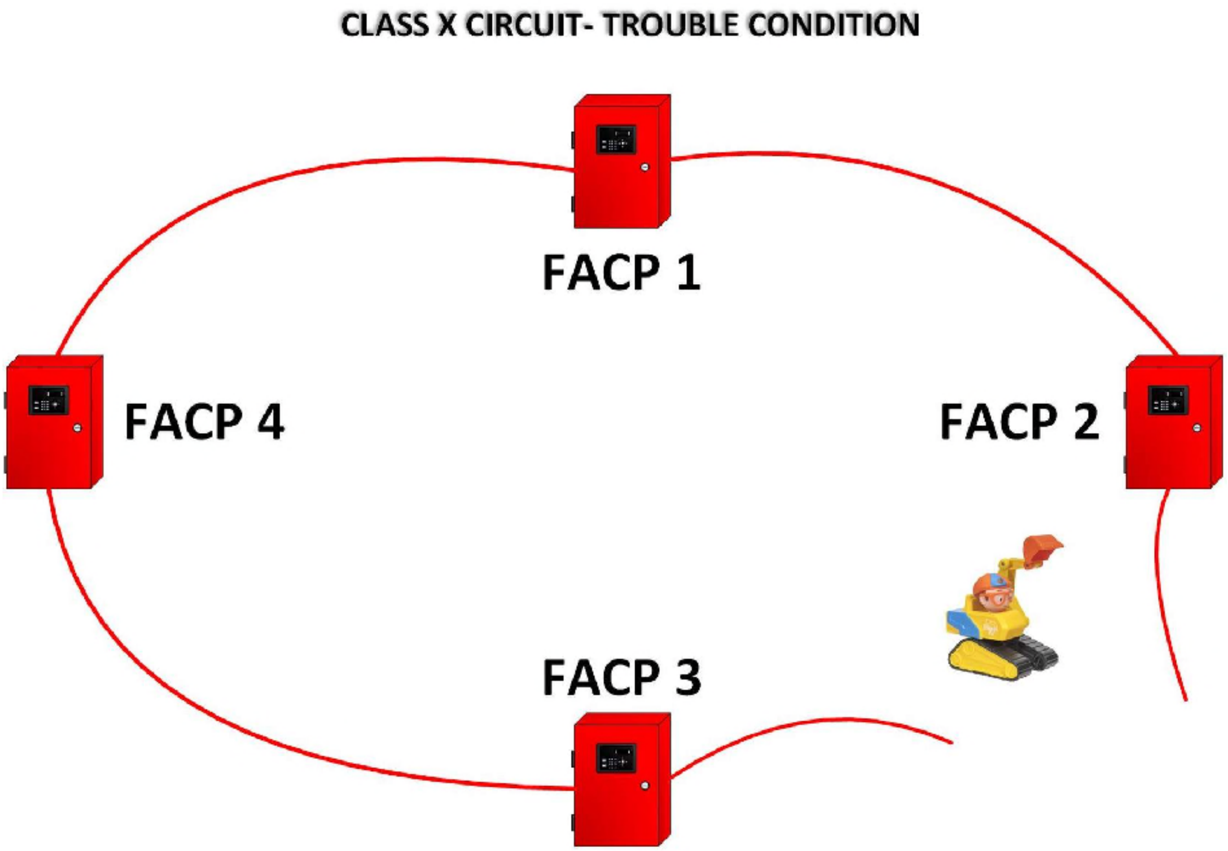
ⓘ Key Reference: *NFPA 72* 2016, Section 12.3.7

Class X Circuits

A **Class X circuit** is identical in principle to a **Class A network**, in the sense that there is a redundant path required, and that the redundant path is not in the same raceway as the outbound path. **Class X paths** are generally used to network systems similarly to **Class N in a campus/community layout**. This network pathway is generally more cost-inhibitive, because this uses circuit properties like FPLP, or FPLR (copper wiring). If the pathway between one FACP to the other is compromised the integrity of the network shall still operate because there is redundancy from the “Master” FACP to the remaining nodes in the network.



Class X circuit



Class X Circuit-Trouble Condition

When a Class X circuit is in trouble, the panel that is programmed as Master (likely communicates all conditions for all panels to supervising station) is the panel which annunciates this trouble.

In the example on the left, when Excavator Eric dug a trench between buildings 2 and 3 and severed the circuit between both buildings, all building systems still operate and communicate due to the redundancy in the circuit.

Class X circuits describe fire alarm system circuits that perform as follows:

1. They include a redundant path.
2. Operational capability continues past a single open or short circuit.
3. Conditions that affect the intended operation of the path are annunciated.

Class X pathways are meant for **SLCs for addressable systems only** and **do not apply to Class A IDCs** for conventional fire alarm systems.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

Sort the following cards below into the two categories-Class A (Redundant Circuits) or Class B (Not Redundant Circuits).

Class A (Redundant Circuits)

Control unit can back feed the circuit in case of an open in the wiring. (NACs)

Devices past the single open will continue to receive power from the CU (IDCs)

Control unit can back feed the circuit in case of an open in the wiring. (SLCs)

Class B (Not Redundant Circuits)

Any notification appliance past the single open will not receive power. (NACs)

Devices past the single open will not receive power from the control unit (IDCs)

Devices past the single open will not receive power from the control unit (SLCs)

In the case of an open, ground, or wire-to-wire short, (Class A and Class B IDCs and NACs) the control unit will _____

○ not operate.

○ still be able to send power.

○ indicate a trouble condition.

○ not receive power.

SUBMIT

In the case of a wire-to-wire short, or a wire-to-wire short with an open, the control unit of a Class A SLC _______________ be able to receive an alarm signal.

○ may

○ may not

○ may or may not

SUBMIT

🔒 Complete the knowledge check above before moving on.

Lesson 5 of 5

Two-Wire vs. Four-Wire Detectors

Two-wire vs. four-wire detectors. Is one better than the other? How do you know which one to choose?

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

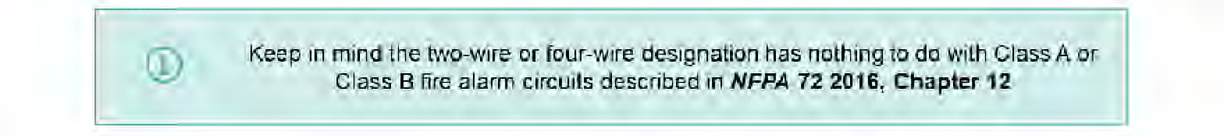
1. Describe the differences between two-wire and four-wire detectors.

CONTINUE

Two-Wire vs. Four-Wire Detectors

Now that we've described the types of circuits and pathways and their performance, we need to discuss **two-wire devices** and **four-wire devices**.

Occasionally technicians confuse the use of two- or four-wire devices with *NFPA* 72 2016's descriptions of Class A and Class B circuits. This can happen after a new technician sees a wiring diagram of Class A and Class B circuits.



ⓘ Keep in mind the two-wire or four-wire designation has nothing to do with Class A or Class B fire alarm circuits described in ***NFPA* 72 2016, Chapter 12**

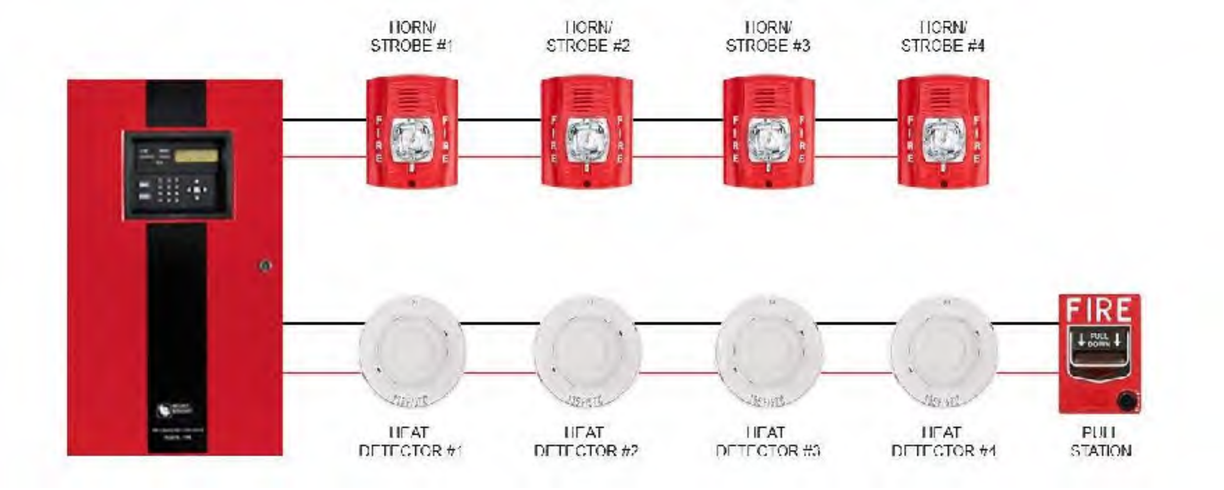
Two-wire or four-wire designation has to do with **how the device receives its power from the fire alarm control unit**. Two-wire devices and four-wire devices can be installed on the **same** Class A or Class B fire alarm circuit if the system design calls for it.

TWO-WIRE DETECTORS (CLASS B)

Two-wire detectors (Class B)

We will start with a **Class B** **IDC** since that is the easiest circuit to understand.

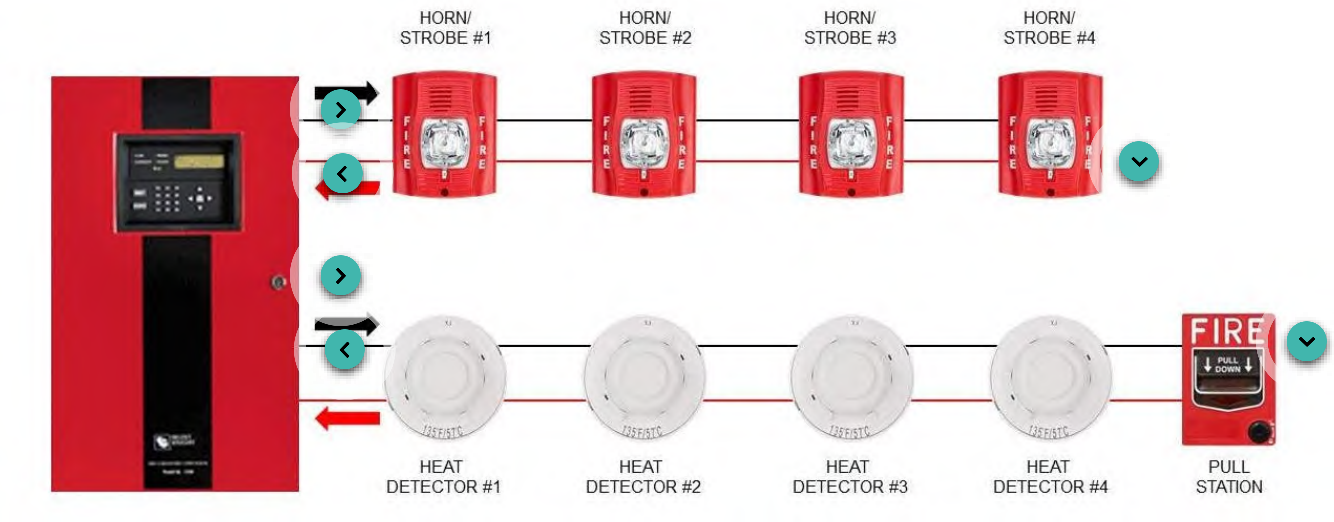
The image below shows what the circuit might look like pictorially. Each circuit has two wires going to each detector, pull station, or notification appliance. The detectors receive system power from the two wires that monitor the circuit.

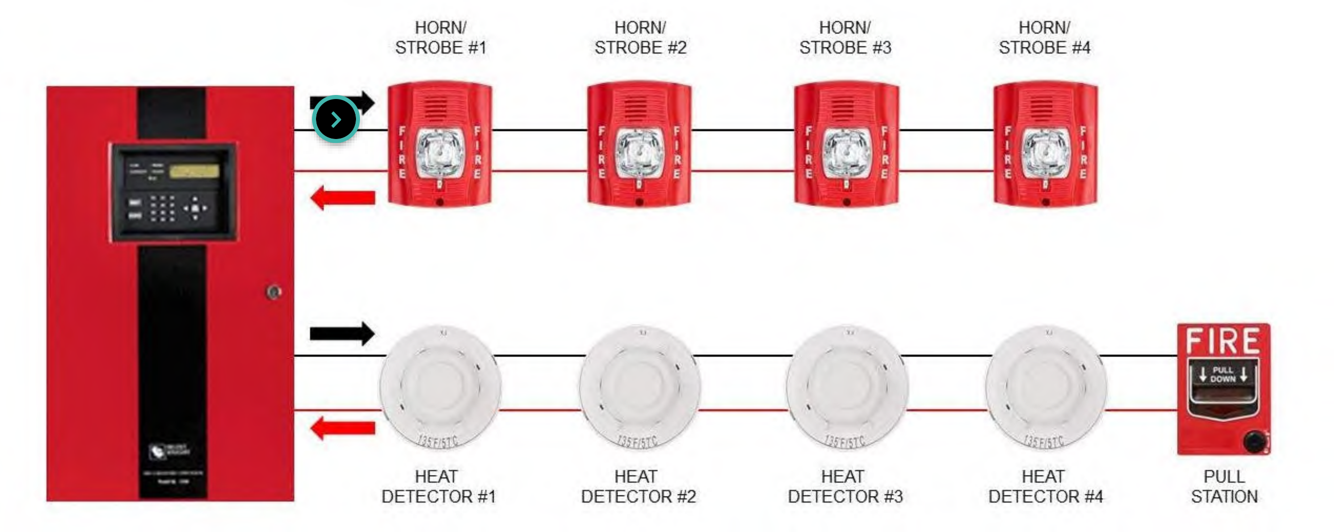


two-wire IDC

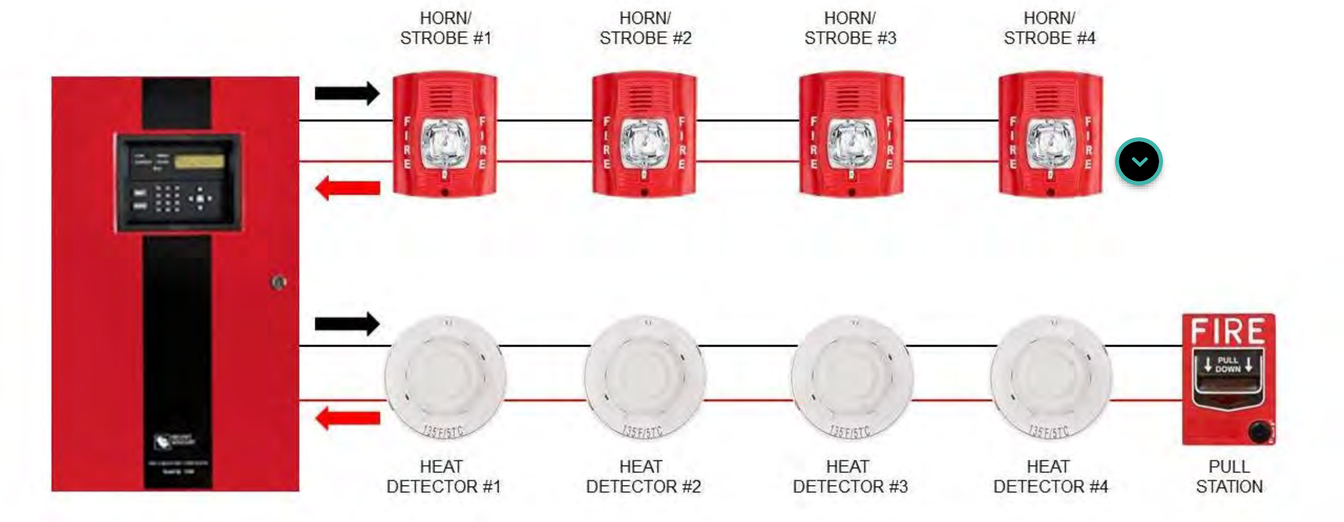
CONTINUE

Click the each of the markers in the diagram below to follow how the current flows through the circuit to the end-of-line resistor (EOLR), then returns to the control unit.

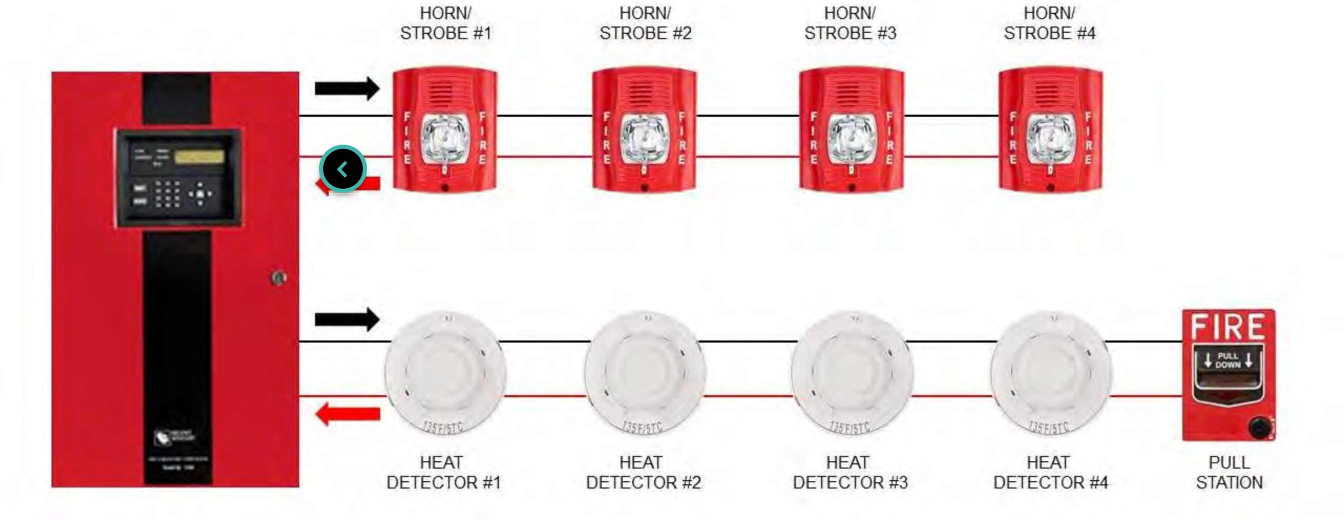

HORN/ STROBE #1
HORN/ STROBE #2
HORN/ STROBE #3
HORN/ STROBE #4
FIRE
PULL DOWN
HEAT DETECTOR #1
HEAT DETECTOR #2
HEAT DETECTOR #3
HEAT DETECTOR #4
PULL STATION



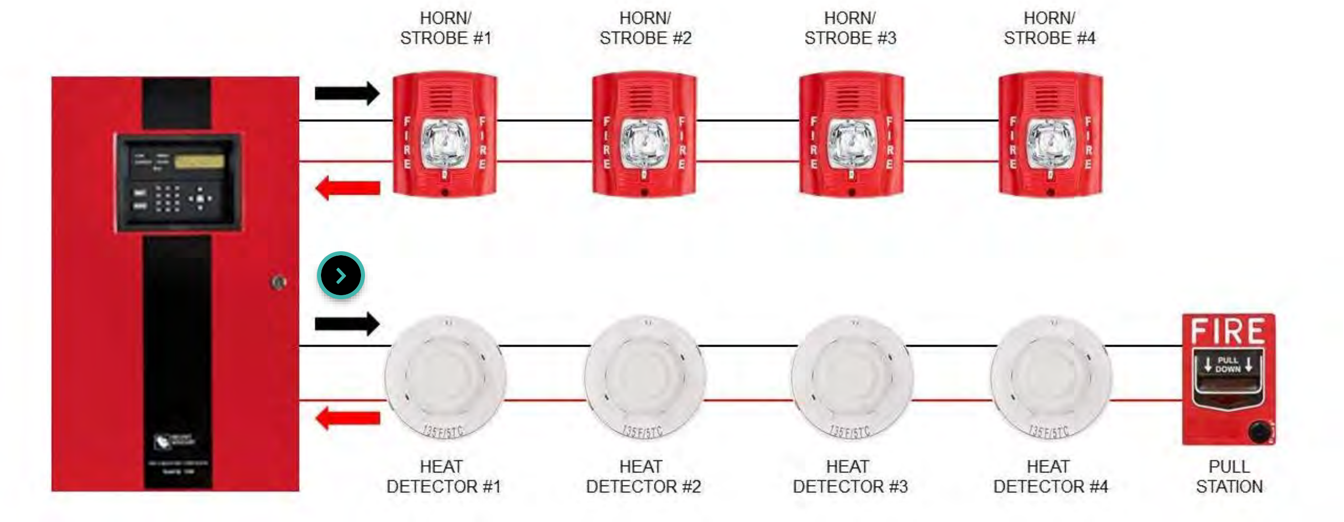
Current flows from the negative terminal (black wire) through the circuit to the end-of-line resistor (EOLR).



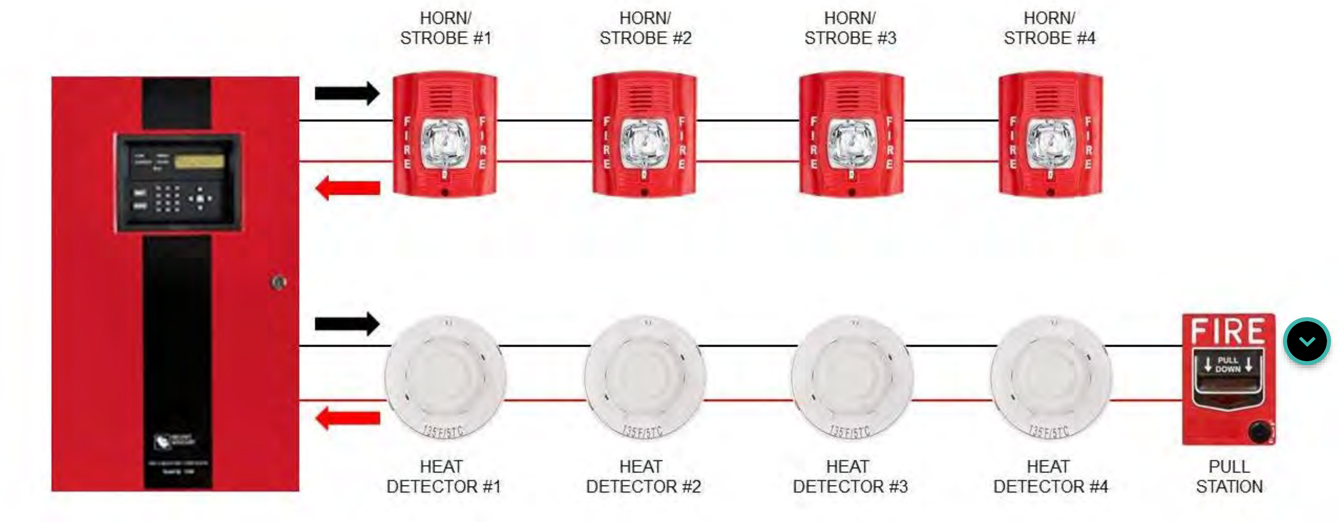
The EOLR limits the amount of current flow for supervision.



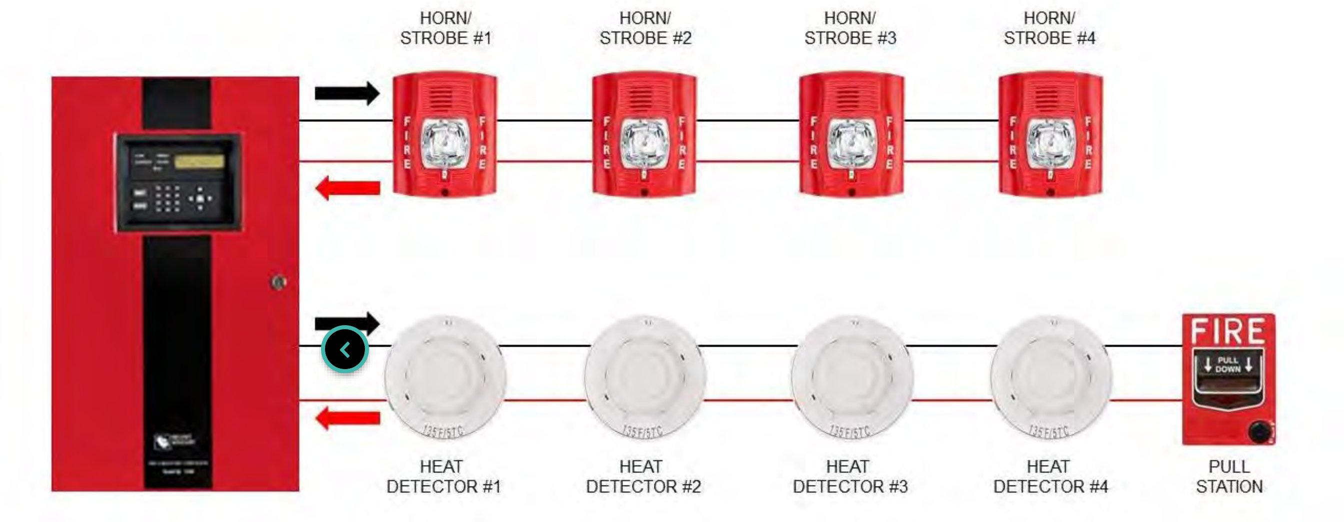
After going through the EOLR, the current returns to the control unit through the red wire to the positive terminal.



Current flows from the negative terminal (black wire) through the circuit to the end-of-line resistor (EOLR).

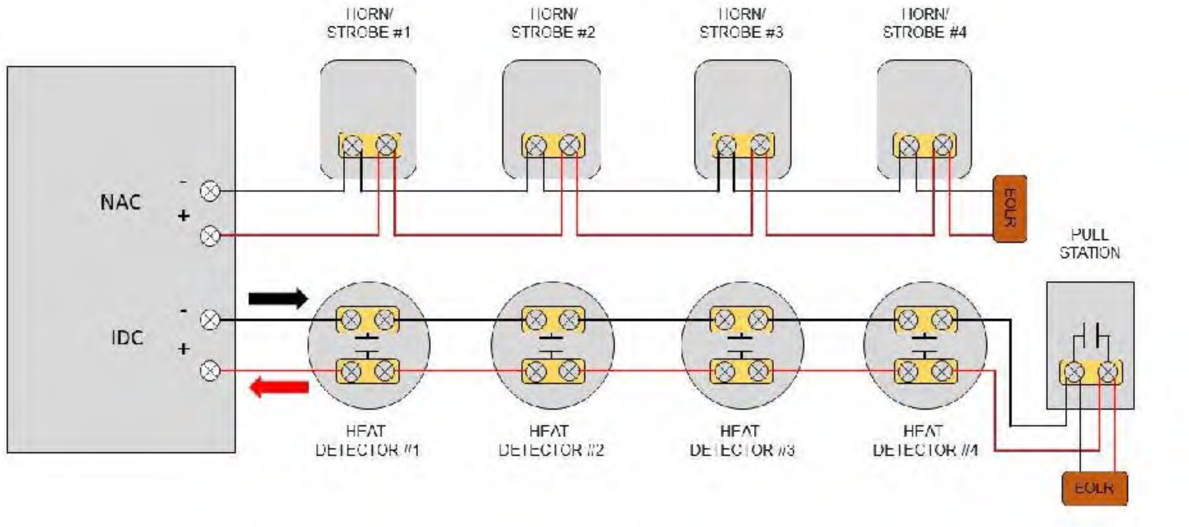


The EOLR limits the amount of current flow for supervision.



After going through the EOLR, the current returns to the control unit through the red wire to the positive terminal.

CONTINUE



2-wire detectors (Click on image to enlarge)

This is how the circuit might look electrically.

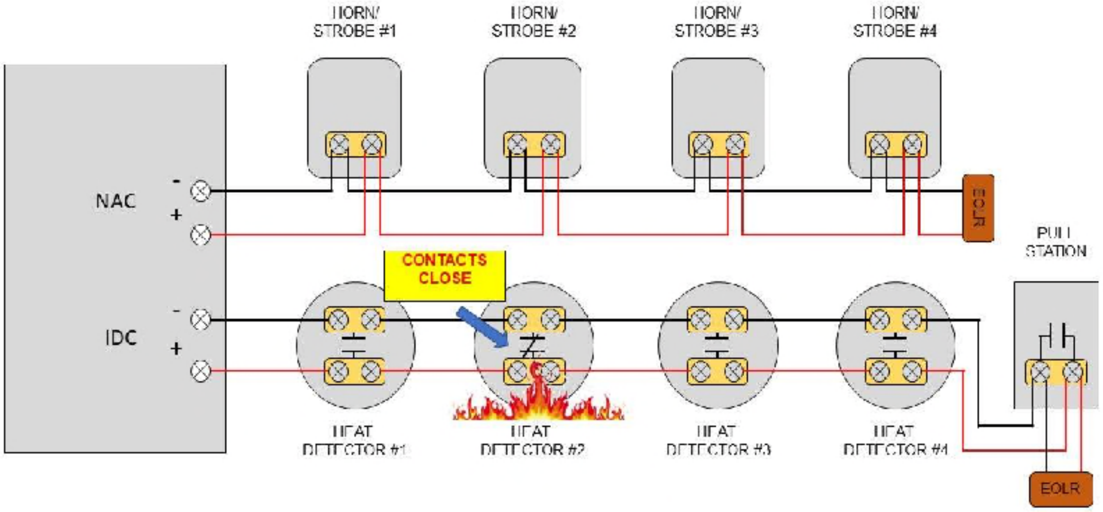
Each device has terminals for **power/circuit in** and **power/circuit out** to the next device or EOL device as applicable.

At the end of the circuit there will usually be an **EOL device, typically a resistor**. The value of the EOLR is determined by the unit manufacturer.

If one or more of the detectors on the IDC senses an alarm, or an occupant actuates the pull station, a set of electrical contacts will close and cause a **wire-to-wire short** between the black and red wires (negative and positive terminals).

The circuit current will bypass the EOLR, causing a rapid increase in current.

The control unit will read that short circuit and go into **alarm mode**, activating the appliances connected to the NAC.



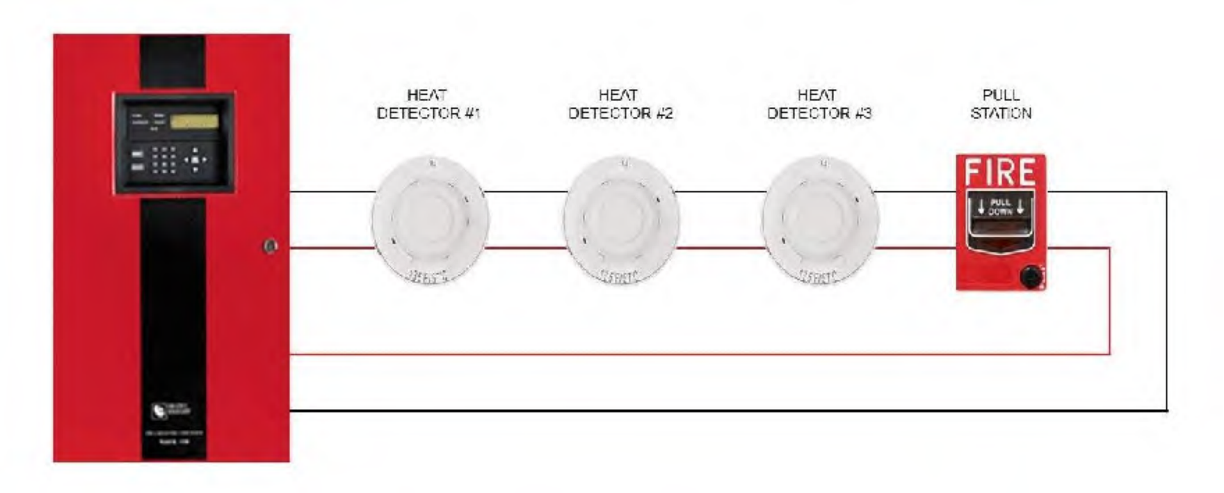
2-wire detector (Click on image to enlarge)

TWO-WIRE DETECTORS (CLASS A)

Two-wire detectors (Class A)

For simplicity, we will only use the IDC for our two-wire Class A circuit explanation.

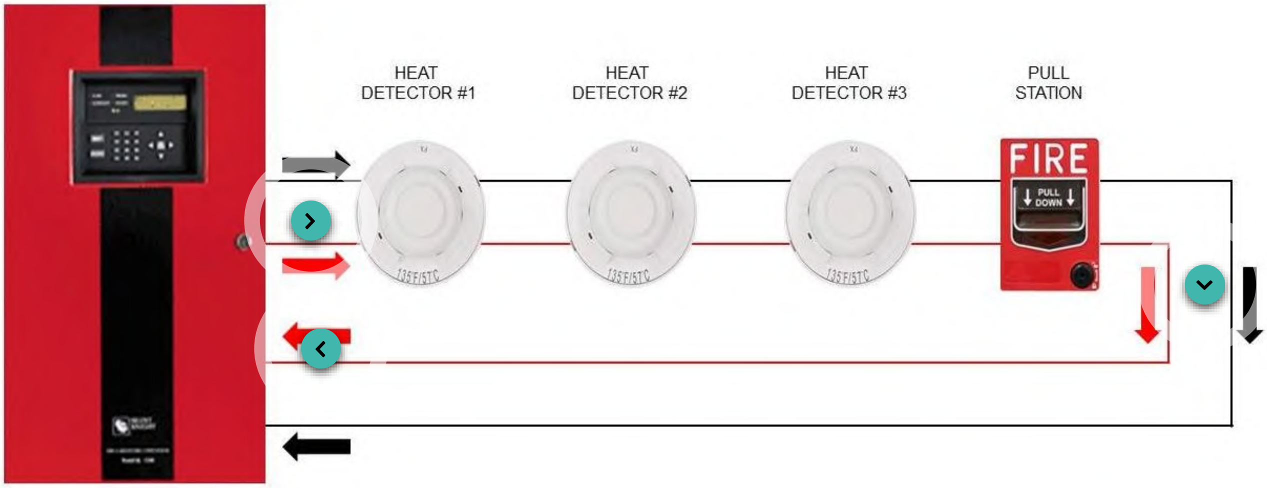
The picture below shows what the circuit might look like pictorially. Each circuit has two wires going to each detector or pull station. After the last device in the circuit, the wires return to the control unit.

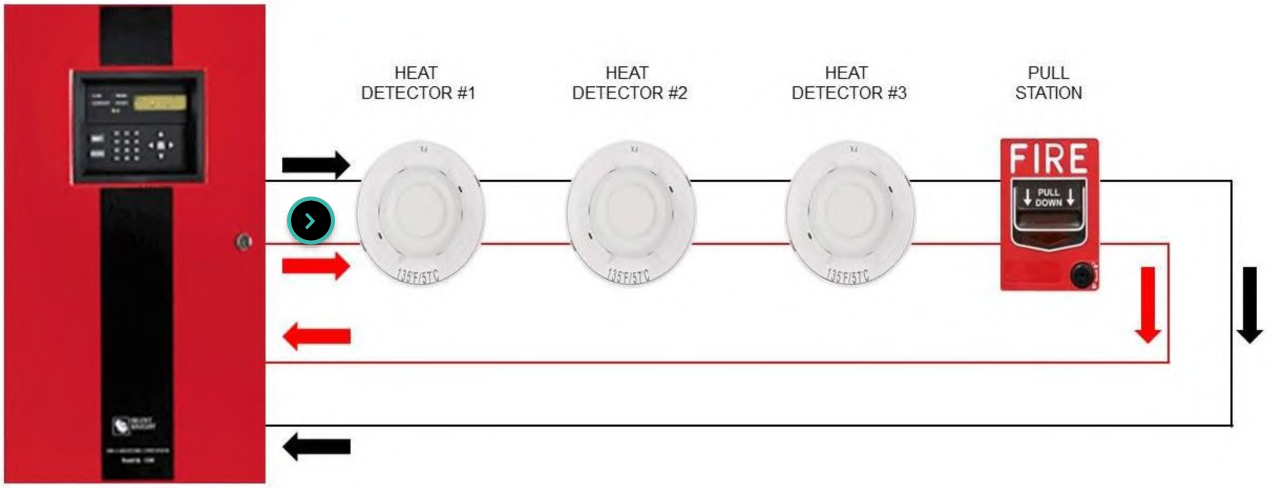


2-wire Class A detector (Click to enlarge image)

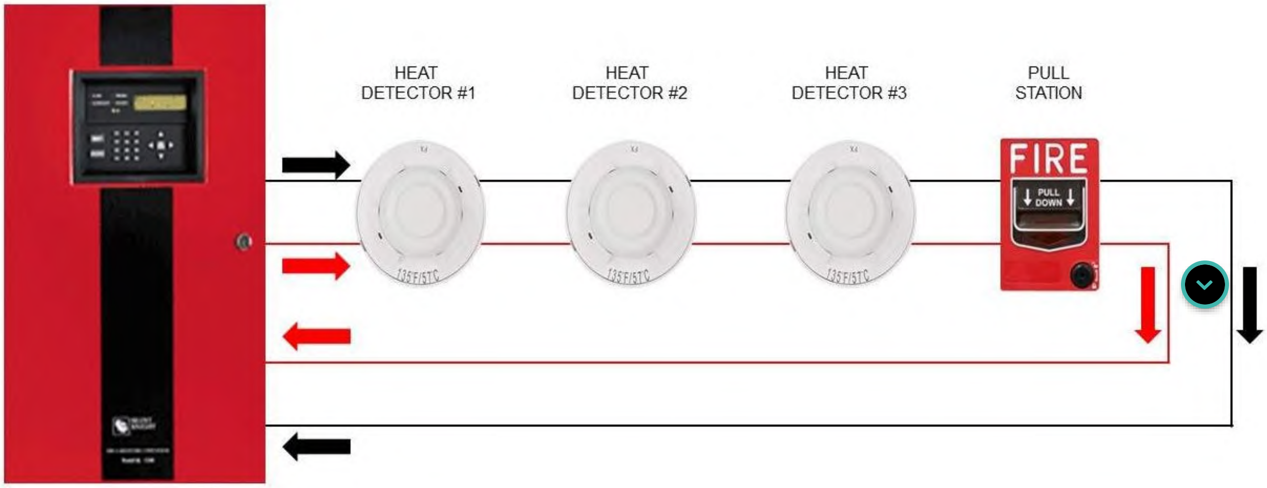
CONTINUE

Click the each of the markers in the diagram below to follow how the control unit monitors the circuit and “looks” for circuit voltage and current across the negative and positive terminals inside the control unit.

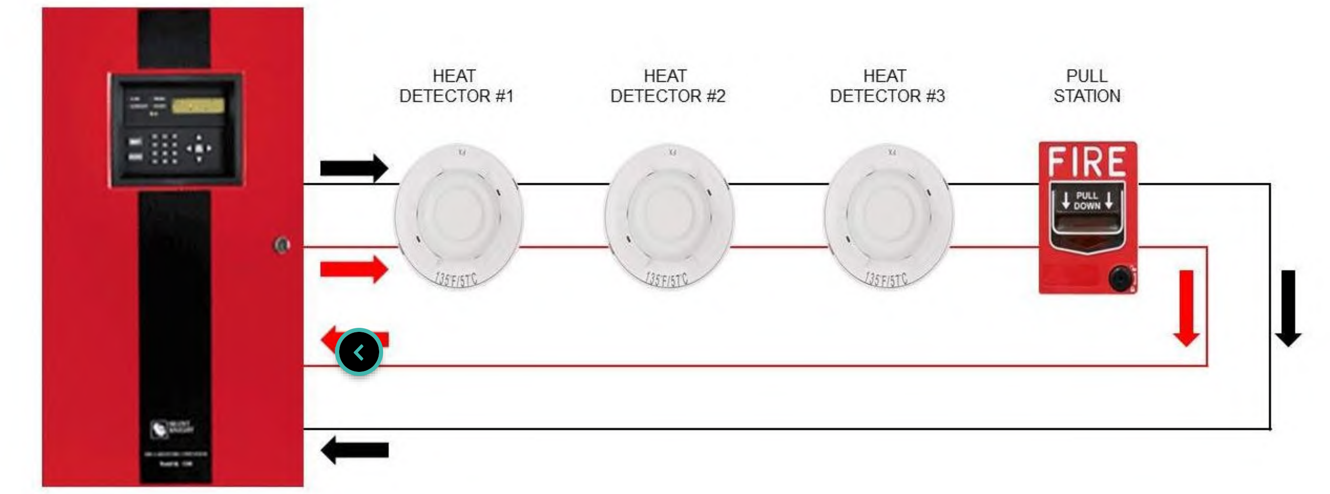

HEAT DETECTOR #1
HEAT DETECTOR #2
HEAT DETECTOR #3
PULL STATION
FIRE
PULL DOWN
135F/57C



In this case, **current flows through the entire circuit and back to the control unit** (there is **no** EOLR).

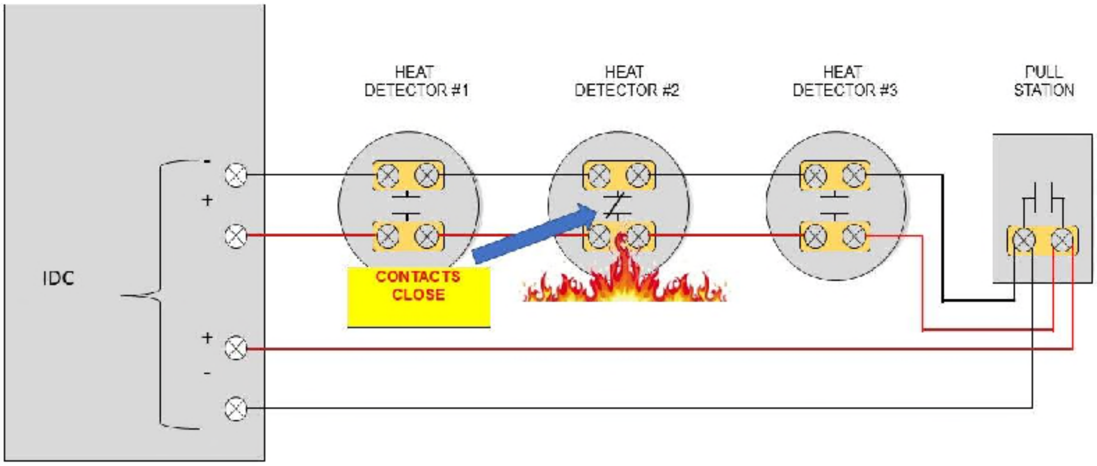


The control unit monitors the circuit and “looks” for circuit voltage and current across the negative and positive terminals inside the control unit.



If the control unit reads normal circuit voltage and current, it stays in **normal mode**.

CONTINUE



(Click to enlarge image)

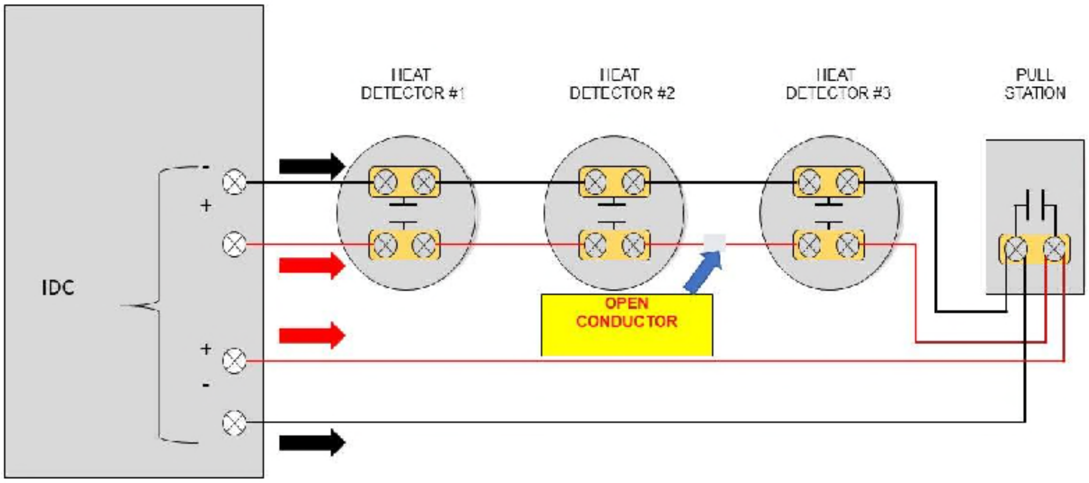
If one or more of the detectors on the IDC senses an alarm, or an occupant actuates the pull station, a set of electrical contacts will close and cause a **wire-to-wire short** between the red and black wires.

The control unit will read that short circuit across the terminals in the control unit and go into **alarm mode**, activating the appliances connected to the NAC.

If there is an open on the circuit, the control unit will sense a loss of power across the return terminals.

The control unit will indicate a **trouble signal**.

Then the control unit will back feed power through the return terminals so that all detectors are still able to receive power, and the control unit **can still sense a wire-to-wire short to go into alarm mode**.



(Click to enlarge image)

LET'S REVIEW

Let's do a quick check about what has been covered so far.

Two-wire devices and four-wire devices can be installed on the same Class A or Class B fire alarm circuit if the system design calls for it.

○ True

○ False

SUBMIT

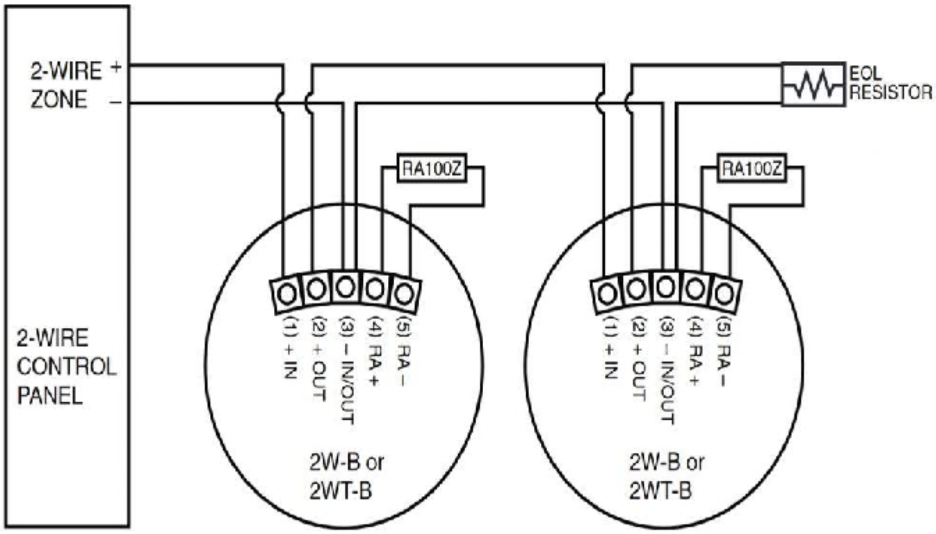
Complete the knowledge check above before moving on.

Two-wire detectors

The diagram to the right shows typical two-wire smoke detectors on a circuit.

Notice there are **more terminals for a remote annunciator** (terminals 4 and 5).

The remote annunciator will be powered from the detectors and the detectors receive power from the IDC.



2-wire detectors (Click to enlarge image)

TWO-WIRE DETECTORS: CLASS A AND CLASS B

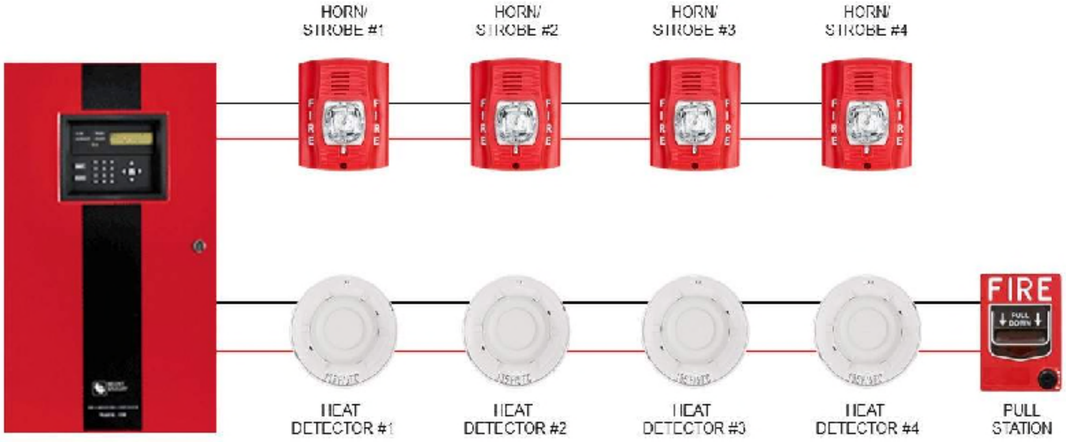
Two-wire detectors: Class A and Class B

Two-wire detectors: Class A and Class B

A summary…

Summary 1

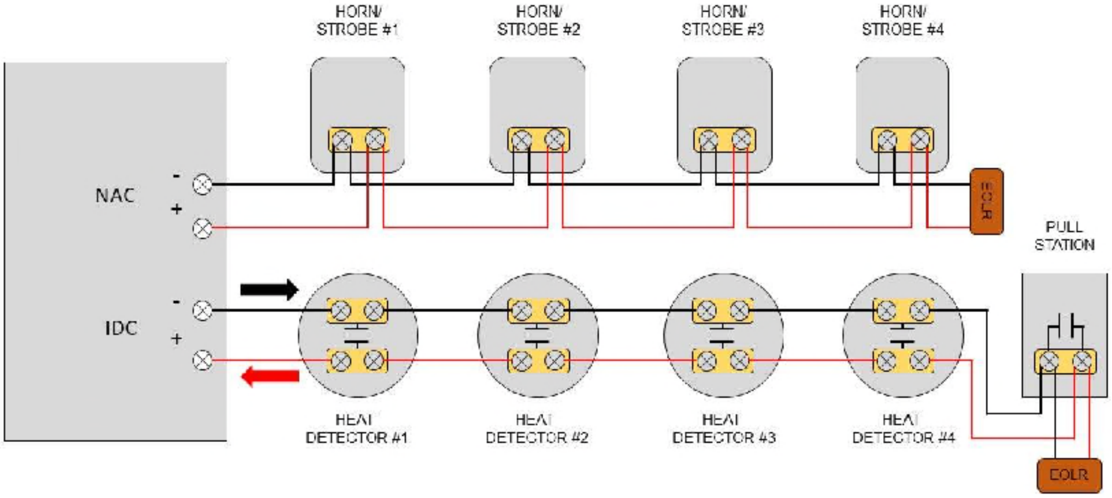
Two-Wire Detectors



Two-wire detectors receive their power from the **same two-wire** **fire alarm control unit** **alarm initiating device circuit** over which they report an alarm.

Summary 2

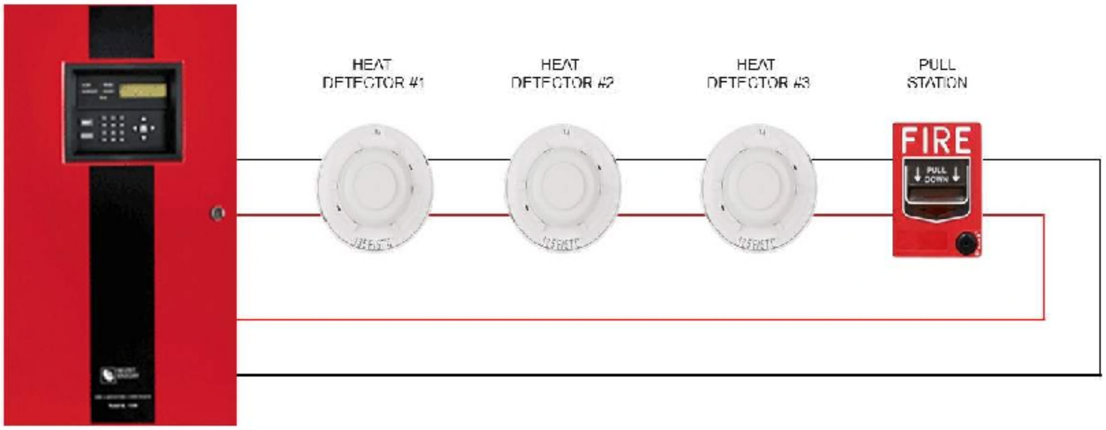
Two-Wire Detectors Class B



On two-wire Class B IDCs, the circuit **ends at the last device** and are typically monitored by an **EOLR**.

Summary 3

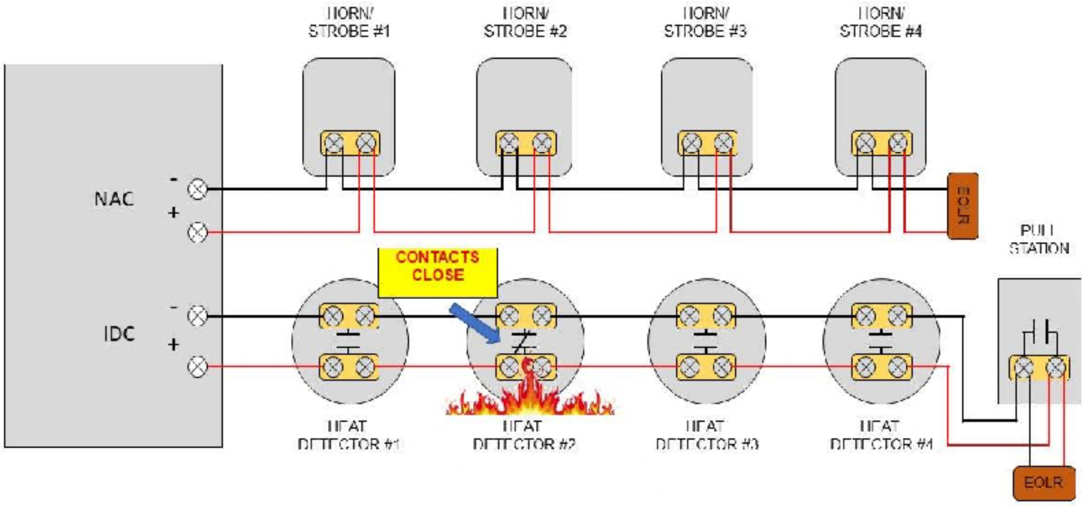
Two-Wire Detectors Class A



Two-wire Class A IDCs **have wires that return to the control unit** after the last device in the circuit.

Summary 4

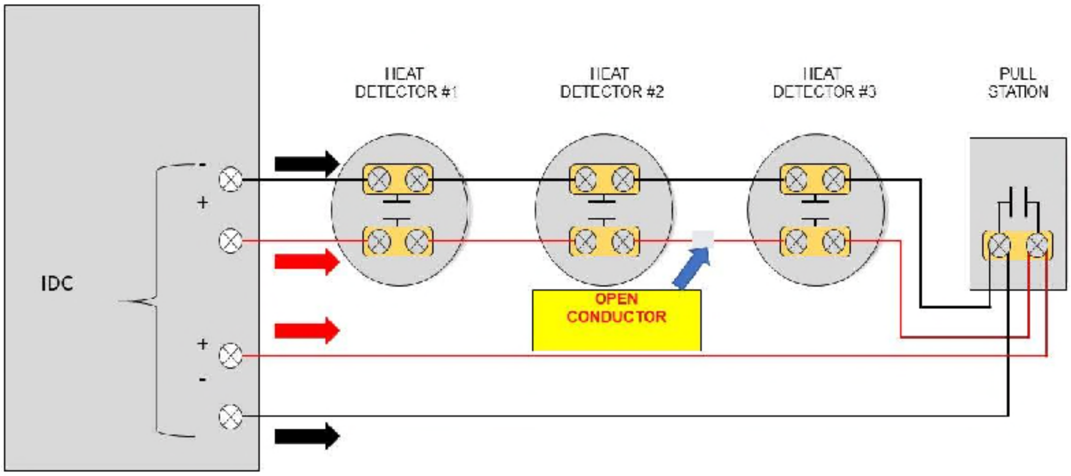
Class A and Class B IDCs



On both Class A and Class B IDCs, if the wires become shorted, **the current in the circuit will rapidly increase, causing the system to go into alarm.**

Summary 5

Class A and Class B Open Circuit



If an **open circuit** occurs, the current in the circuit will **decrease to zero**, causing the system to indicate a **trouble signal**.

Summary

Even though there are only two wires, care must be taken on wiring two-wire detectors to maintain the Class A or Class B functionality.

FOUR-WIRE DETECTORS

Four-wire detectors

Four-wire detectors on Class A or Class B circuits are **very similar to two-wire detectors** on Class A or Class B circuits.

The difference is that the four-wire detectors are **not powered from the Initiating Device Circuit (IDC)**.

An **additional two-wire power circuit** is run from an auxiliary circuit in the fire alarm control unit to supply operating power to the detectors.

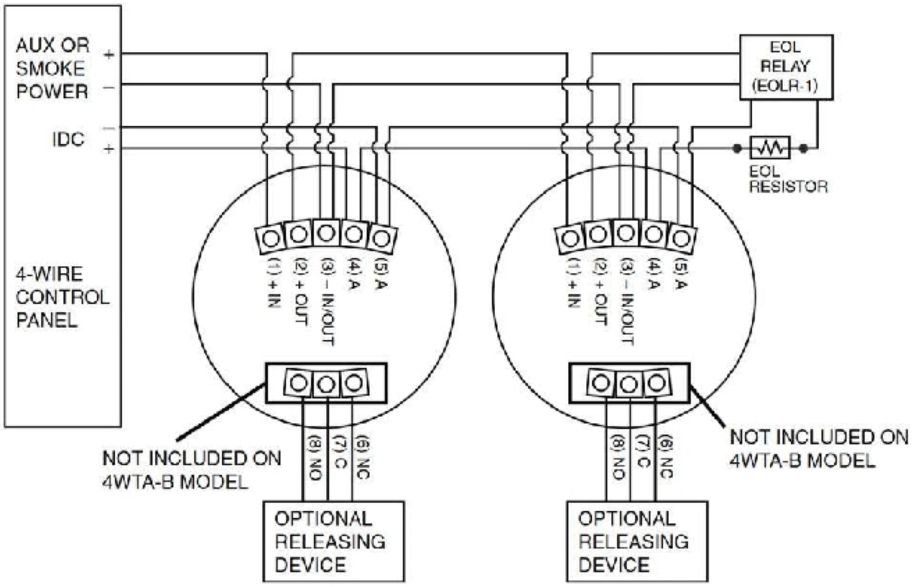
Four-wire detectors are used to provide **additional functions** such as relays to turn a safety function on or off, control smoke or fire doors, activate elevator recall, etc.

The auxiliary power circuit is needed because the IDC will not be able to support the added functions and still allow any two-wire detectors on that circuit to operate.

The diagram to the right shows typical four-wire smoke detectors on a circuit. Notice the additional terminals for relay contacts (terminals 6, 7, and 8).

The internal relay will be powered from the **auxiliary or smoke power**. The detector will report an **alarm** on the IDC terminals (terminals 1, 2, and 3).

To ensure the smoke detector and the IDC is monitored for integrity/supervised, **an EOL supervisory relay** is used to open the IDC if power is lost.



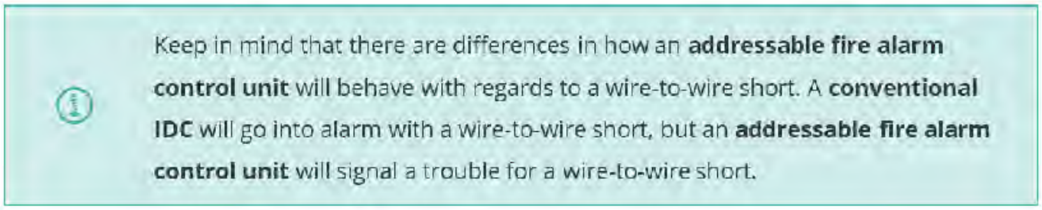
4-wire detector (click on image to enlarge)

ADDRESSABLE SYSTEM WIRING

Addressable System Wiring

The wiring and compatibility of addressable devices is **driven by the manufacturers of the devices and systems** due to signal levels and the proprietary software protocols used.

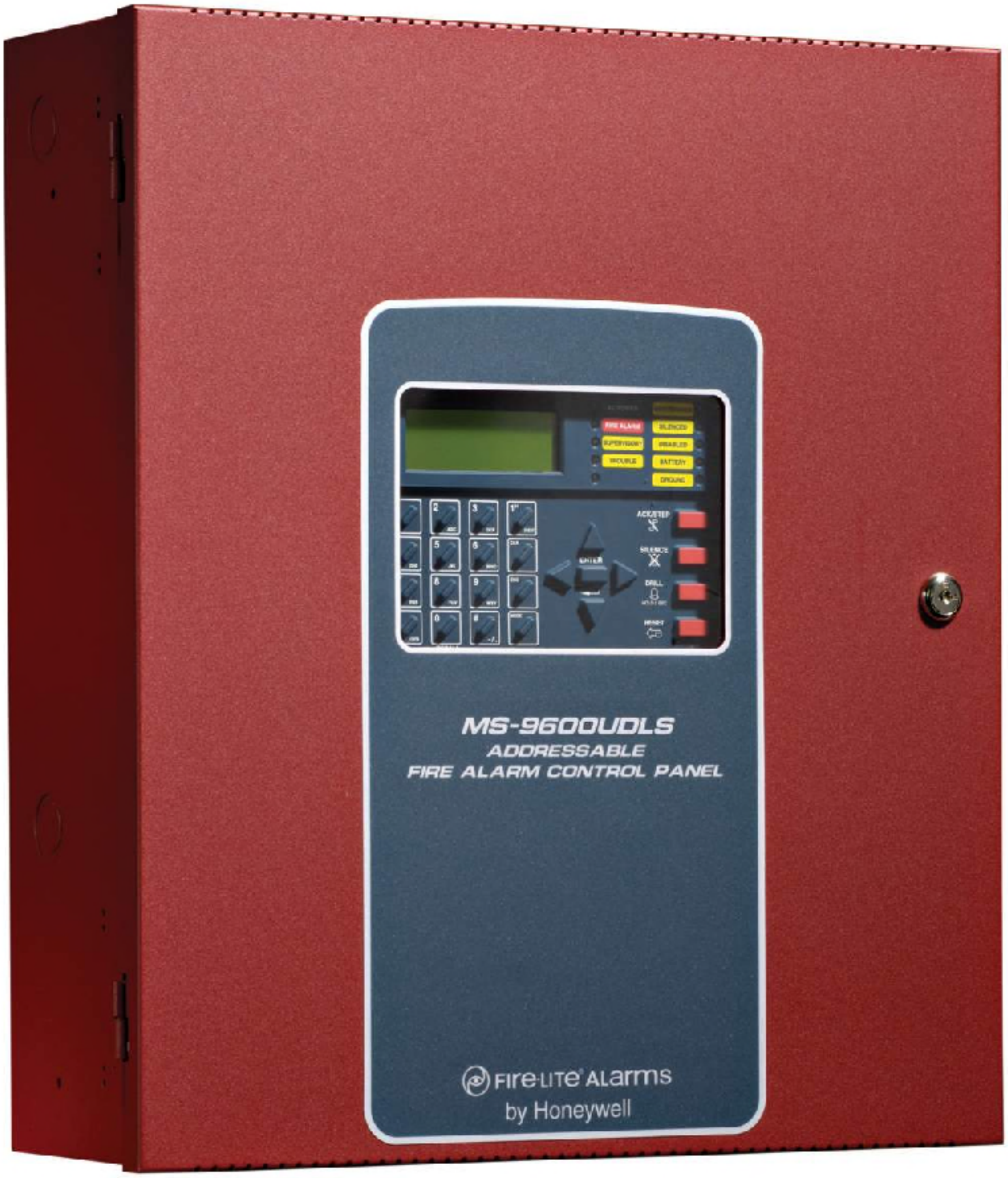
Most addressable devices are **two- or four-wire devices** that are **wired to SLCs** in **Class A, Class B, or Class X circuits.**



Keep in mind that there are differences in how an **addressable fire alarm control unit** will behave with regards to a wire-to-wire short. A **conventional IDC** will go into alarm with a wire-to-wire short, but an **addressable fire alarm control unit** will signal a trouble for a wire-to-wire short.

The notable difference, of course, is the fact that the devices in an addressable system have **unique identifiers** that may be programmed by computer, the control unit, or rotary switches on the devices themselves.

Although there are differences in the capabilities of conventional systems vs. addressable systems**, the wiring of the devices is very similar**.



Addressable Control Panel

Summary

1

A fire alarm system is made up of the fire alarm control unit, initiating devices and circuits, and notification appliances and circuits.

2

NFPA 70 2017 (*NEC*) defines the requirements for the wiring of fire alarm systems. **Article 760** of the *NEC* defines wiring for power limited and non-power limited circuits.

3

The fire alarm system must have both a **primary and secondary power supply**. The secondary power supply must provide standby power for **24 hours** followed by **5 minutes** in full alarm.

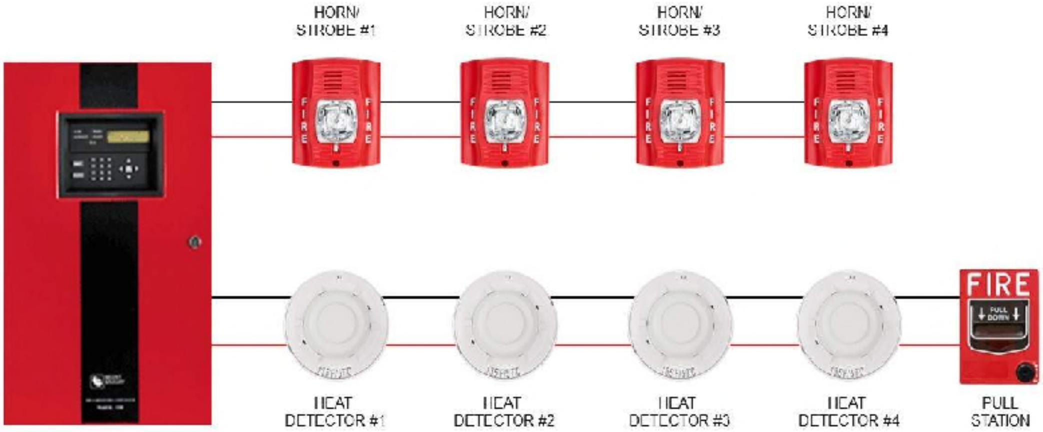
4

If the system is an emergency voice communication system, the secondary power supply must provide standby power for **24 hours** followed by **15 minutes** in full alarm.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

Is the image below an example of a two-wire or a four-wire circuit?

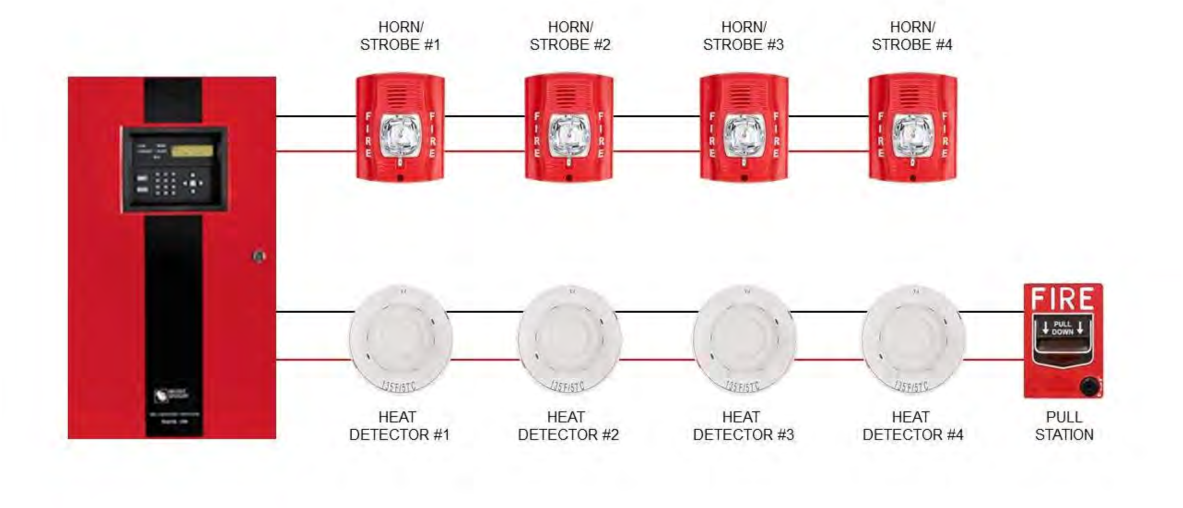


○ Two-wire

○ Four-wire

SUBMIT

Is the image below an example of a Class A or a Class B circuit?



○ Class A

○ Class B

SUBMIT

NFPA 70 (NEC) defines the requirements for the wiring of fire alarm systems.

Article _______ of the NEC defines wiring for power limited and non-power limited circuits.

Type your answer here

SUBMIT

Complete the knowledge check above before moving on.

After completing this module, you should now have a better understanding of the fire alarm basics and different types of wiring and circuits for fire alarm systems.

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

Ohio Fire Alarm and Detection Equipment-Detection Devices

FIRE TECH
PRODUCTIONS

Welcome to the Detection Devices module of the Ohio Fire Alarm and Detection Systems Course.

By the end of this module, you will be able to do the following:

- Identify design features for each type of heat detector.
- Compare advantages and disadvantages of restorable and non-restorable heat detectors.
- Recognize operational characteristics for different types of smoke detectors.
- Select the correct smoke detector for various installation environments.
- Properly locate smoke detectors in different construction configurations.
- Define methods required for duct detector installation.
- Explain the unique features of sprinkler waterflow alarms and their impact on a fire alarm system.
- Identify types and purpose of alarm-initiating supervisory devices.

- Describe the functionality of different types of manually-actuated alarm-initiating devices.

Key Reference for this module:
NFPA 72 - National Fire Alarm and Signaling Code, Chapter 17, 2016

When you are ready to begin, click on the button above to start the course.

- **Heat Detectors**
- **Smoke Detectors**
- **Location and Spacing**
- **Other Types of Detectors**

Lesson 1 of 4

Heat Detectors

What is the difference between a restorable and a non-restorable heat detector? Is one better to use than the other or does it depend on the situation?

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Identify design features for each type of heat detector.

2. Compare advantages and disadvantages of restorable and non-restorable heat detectors.

LET'S GET STARTED

Automatic Fire Detectors

The detector is designed to respond to different fire signatures. There are several different design types of automatic fire detectors, including:

1. Heat detector
2. Smoke detector
3. Radiant energy detector
4. Gas detector
5. Combination detector (heat & smoke, smoke and gas)

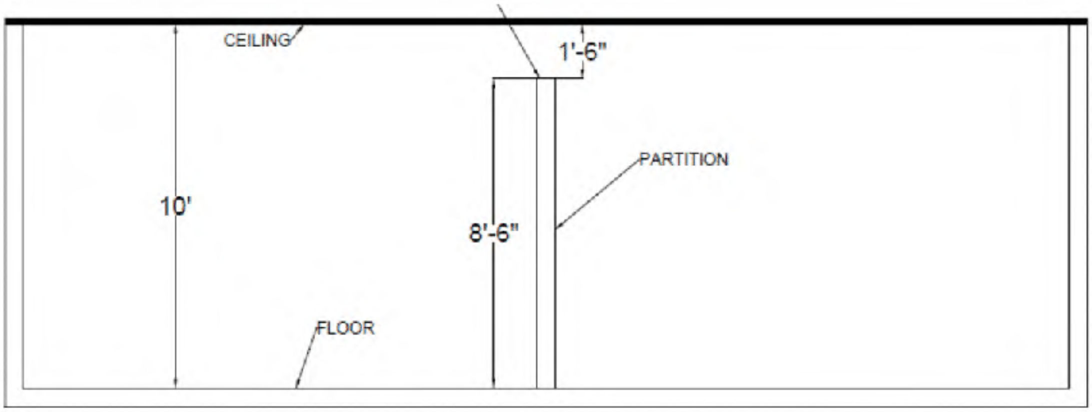
HEAT DETECTORS

Heat Detectors

Heat detectors are **triggered** by heat from the fire. Smoke causes more injuries and fatalities than the heat from the fire. This is one reason heat detectors are not used for life safety.

While smoke detectors are sensitive to contaminants in the air and the environment, heat detectors are rugged and fairly immune to these issues. Sometimes this makes them the best choice for an area or application.

Heat detectors have been made in many designs including **restorable, non-restorable, electronic, mechanical, fixed temperature,** and **temperature rate-of-rise.**



This dividing partition is within 15% of the total ceiling height of the room. Based upon the NFPA code reference provided, this space is considered 2 rooms, requiring 2 detectors. (Click image to enlarge)

ⓘ Unless tested and listed for recessed mounting, detectors shall not be recessed into the mounting surface. Where partitions extend to within 15% of the ceiling height, the spaces separated by the partitions shall be considered as separate rooms. **- *NFPA* 72 2016, Sections 17.5.1 and 17.5.2**

SPOT-TYPE HEAT DETECTOR

Spot-Type Heat Detector Operation

Spot-type heat detectors only detect heat at a single point or location. There are several versions of this type of detector.

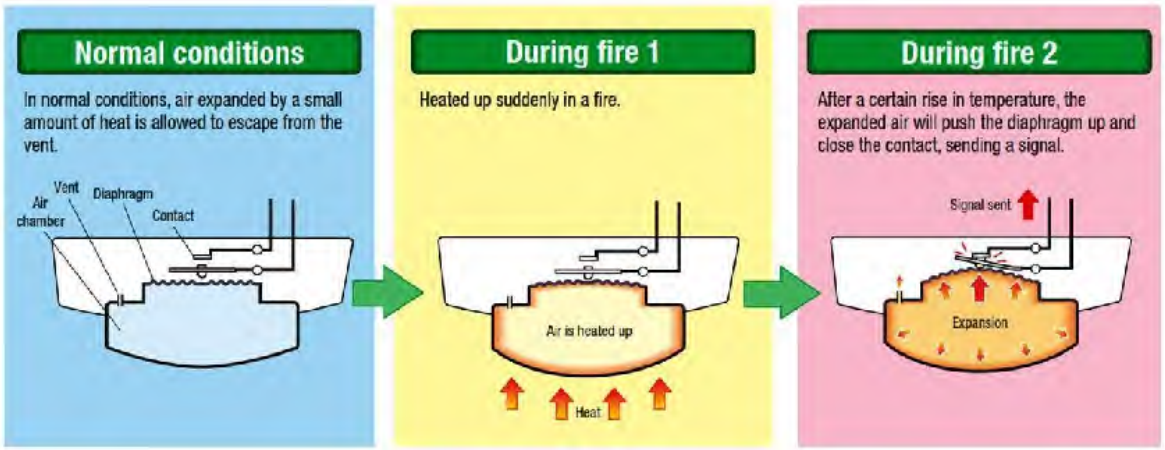
Spot-type heat detectors have been made in many designs including **restorable, non-restorable, electronic, mechanical, fixed temperature,** and **temperature rate-of-rise.**

RESTORABLE VS NON-RESTORABLE HEAT DETECTORS

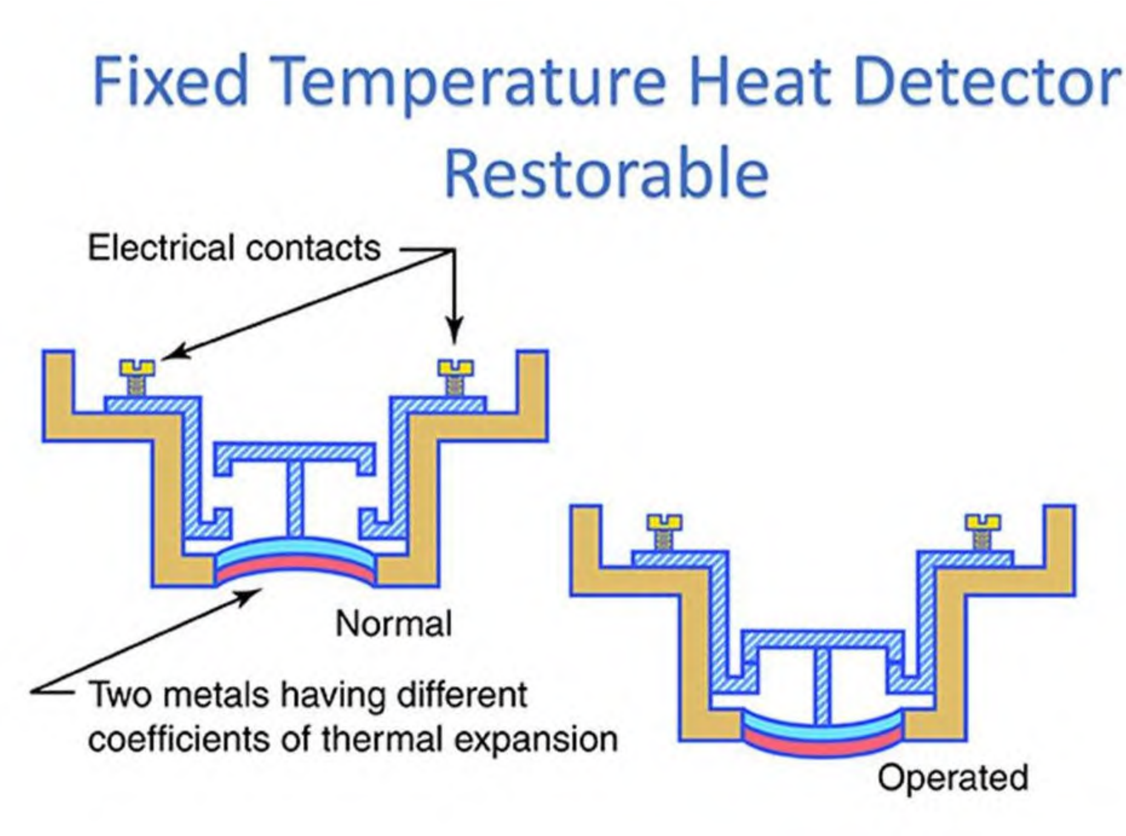
Restorable vs. Non-Restorable Heat Detectors

Restorable means that after the fire is over, or more accurately, after the heat has been reduced to an acceptable level, these detectors will normally **restore themselves to a condition where they are ready for action** again.

Rate-of-Rise Detector (Restorable)



This image visualizes how a rate-of-rise heat detector operates. A rate-of-rise detector is an example of a restorable detector, as this device will not typically be destroyed in a fire. (Click to enlarge image)



The restorable versions have 2 bi-metal plates that when heated cause the plates to expand causing the plunger to drop and go into alarm. (Click to enlarge image)

These devices **respond to rapid increases in temperature** (approximately 15° F per minute or faster) and generate a **pneumatic signal** from the increased air pressure. This pressure can be used directly to trigger an actuator, or indirectly to close an electrical contact.

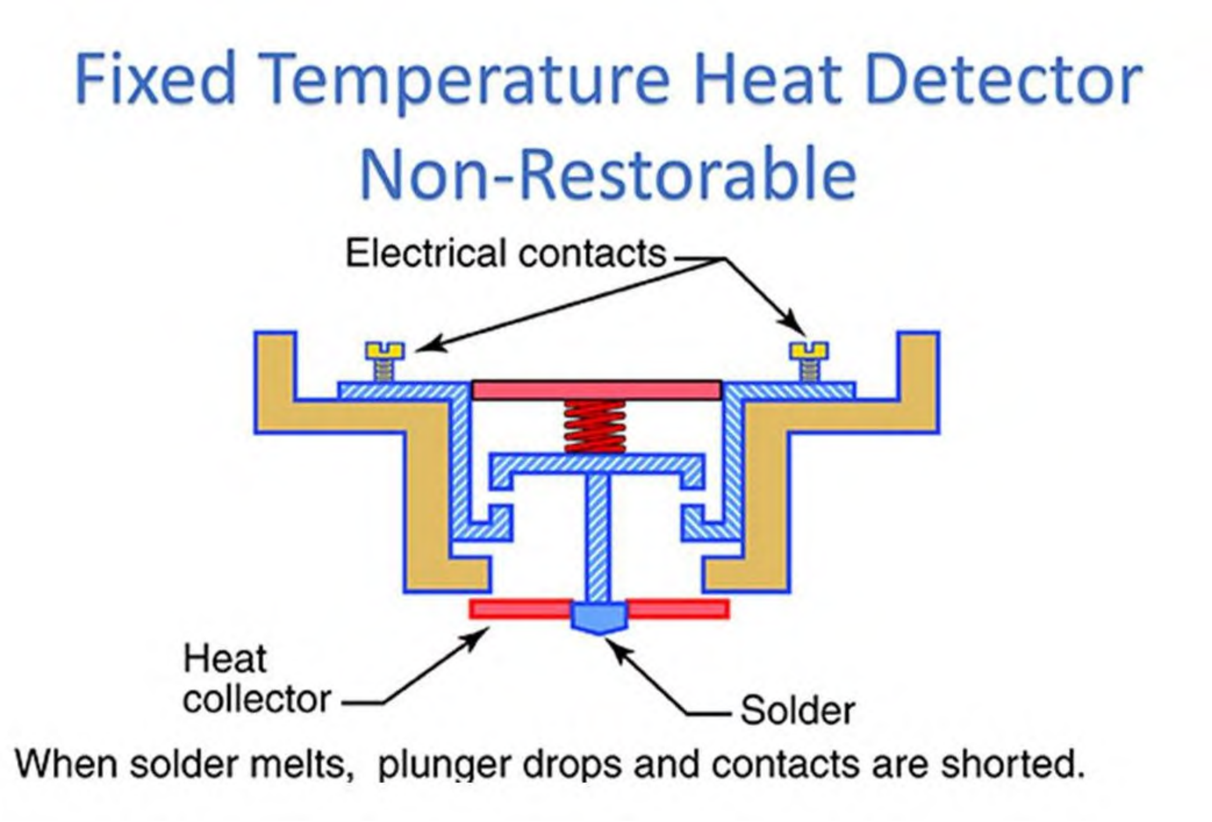
When the temperature is decreased, the air pressure decreases and the pneumatic signal vanishes. At this point, the rate-of-rise detector will generally restore itself to a ready condition.

If a **mechanical actuator** is part of the design, it is almost always necessary to **manually reset the actuator** prior to the system being put back into operation.

CONTINUE

Non-restorable designs **self-destruct** when exposed to their design temperature. These devices must be replaced in order to restore the detector to service. The most common example is the **fusible link**. The fusible link is two pieces of metal soldered together with an **eutectic solder**.

The **eutectic solder** is designed to **melt at a specified temperature**. The heat of the fire fuses, or melts, the eutectic solder. The metal parts held together by the solder will separate, causing the device to initiate an alarm.



When the detector reaches its listed temperature the solder melts causing the plunger to drop. When the plunger drops, this requires the detector to be replaced. This is the most common configuration with fixed temperature heat detectors. (Click to enlarge image)

Sample of quartzoid bulbs. Each color represents a certain temperature threshold that the bulb can withstand before it melts. (Click to enlarge image)

A **quartzoid bulb** is sometimes used in a non-restorable detector. It is comprised of a liquid inside of a glass or plastic vial that is similar to a sprinkler head. As the temperature increases to the design level of the detector:

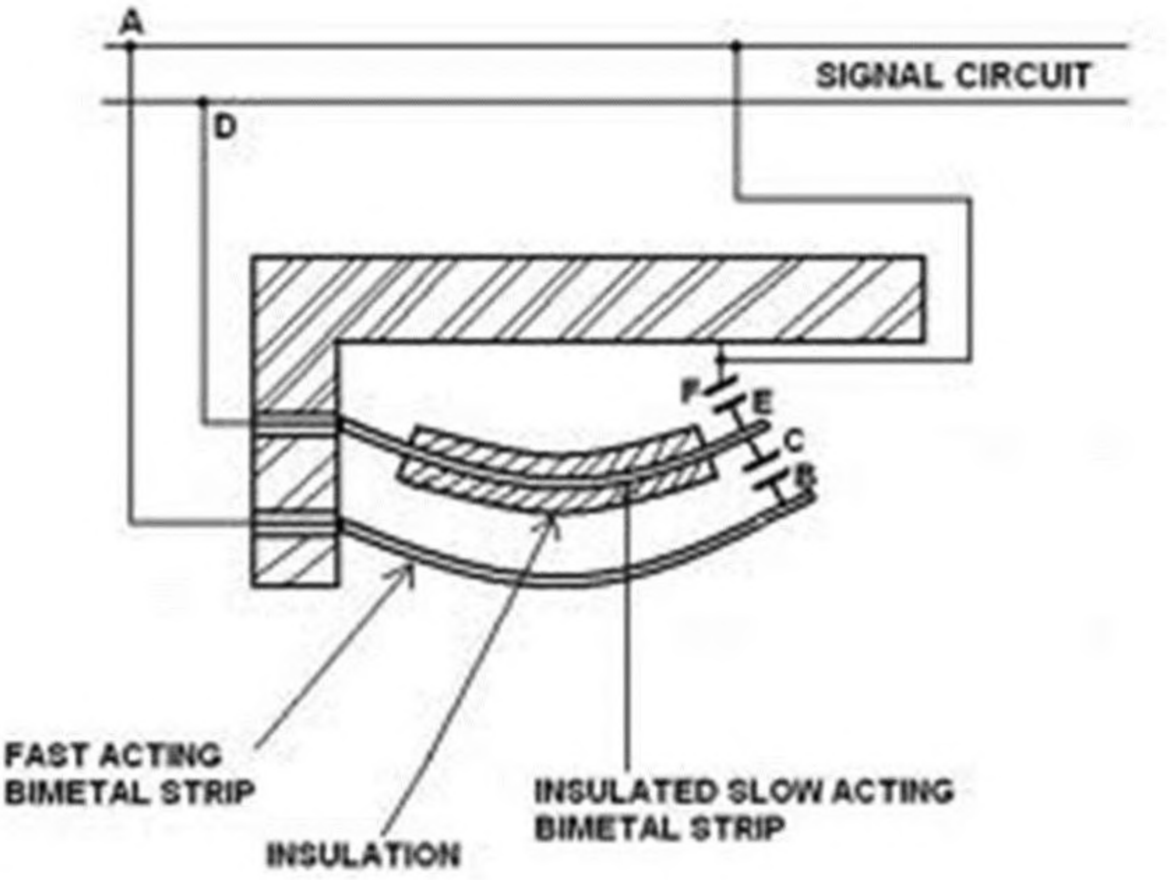
1. The liquid expands.
2. This expansion breaks the glass.
3. The mechanical portion of the detector actuates (releases).
4. This actuation provides slack in a tensioned cable, or some other form of mechanical signal according to its intended functions.

CONTINUE

Mechanical Heat Detectors (Non restorable)

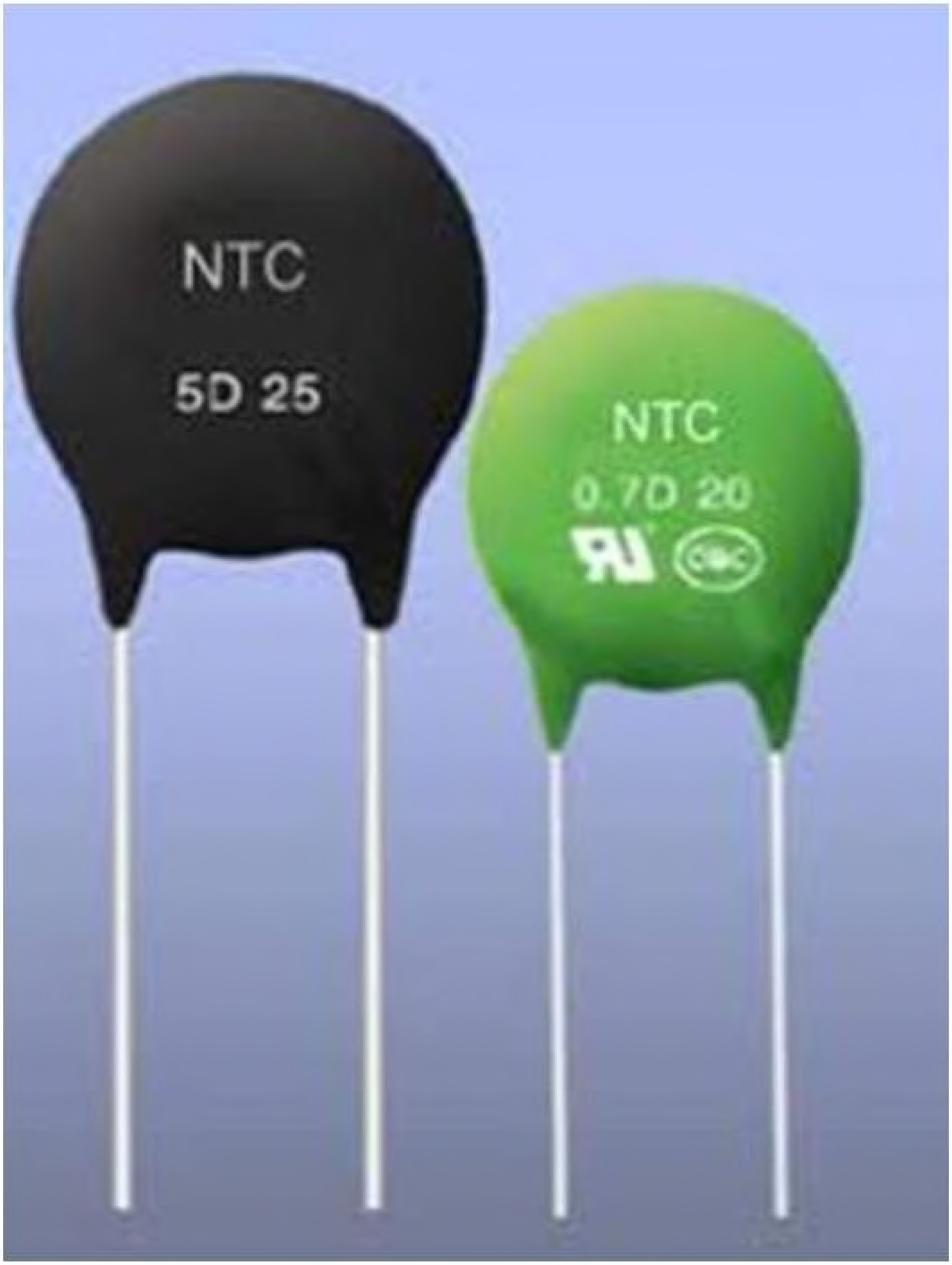
Mechanical heat detectors are typically **lower in cost**, but are most often **not restorable**. The mechanical elements are destroyed or damaged, so these detectors cannot be field tested.

One type of mechanical restorable detector is a simple bimetallic device or thermistor (bottom right). A bimetallic device is one which has two different kinds of metals fused together. When they are exposed to heat, the metals **expand at different rates** which cause the bimetallic component to bend or twist. This physical phenomenon can be used to open or close an electrical contact.



ELECTRONIC HEAT DETECTORS

Electronic Heat Detectors



thermistor

Some heat detectors combine the rate-of-rise feature with a fixed temperature unit. In a rapid change of temperature from a fire, **the rate-**

of-rise will activate before the fixed temperature is reached. A **bi-metallic strip** or **thermistor** are sometimes used in restorable heat detectors.

Electronic heat detectors utilize thermistors that are resistors that change resistance based on the ambient temperature. By using electronic circuitry, it is not difficult to make a thermistor-based detector operate at a **fixed temperature or a rapid change in temperature**, improving the response time.

CONTINUE

Let's do a quick check about what has been covered so far.

The detector is designed to respond to different fire signatures. There are several different design types of automatic fire detectors, including: (Select all that apply)

☐ Heat detector

☐ Radiant energy detector

☐ Gas detector

☐ Carbon monoxide detector

SUBMIT

Heat detectors have been made in many designs including: (Select all that apply)

☐ manual

☐ non-restorable

☐ restorable

☐ temperature rate-of-rise

SUBMIT

Complete the knowledge check above before moving on.

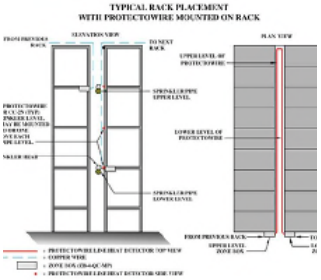
Line-Type Heat Detectors

All of the heat detectors we have discussed so far are referred to as "spot-type" detectors. There are also non-restorable, "line-type“ detectors. They can respond to the fire signature along its entire length.

These linear heat detection cables can be hundreds of feet in length, making them ideal for conveyor, rack storage, or cable tray applications.

They are **non-restorable** because **the insulation must melt away** in order to generate the electrical signal. At least the section of cable which has been exposed to the high temperature **must be replaced**.

(Click to enlarge image)



(Click to enlarge image)

CONTINUE

Sort the cards below to demonstrate what you have learned.

Restorable

rate-of-rise detector

pneumatic signal

mechanical actuator

electronic heat detector

Non-restorable

eutectic solder

quartzoid bulb

mechanical detector

line type

Complete the card sort above before moving on.

Lesson 2 of 4

Smoke Detectors

When we hear "smoke detector" probably an image of a round, white smoke detector in your house comes to mind, however there are many other types of smoke detectors which are designed for various surroundings.

Goals for This Lesson

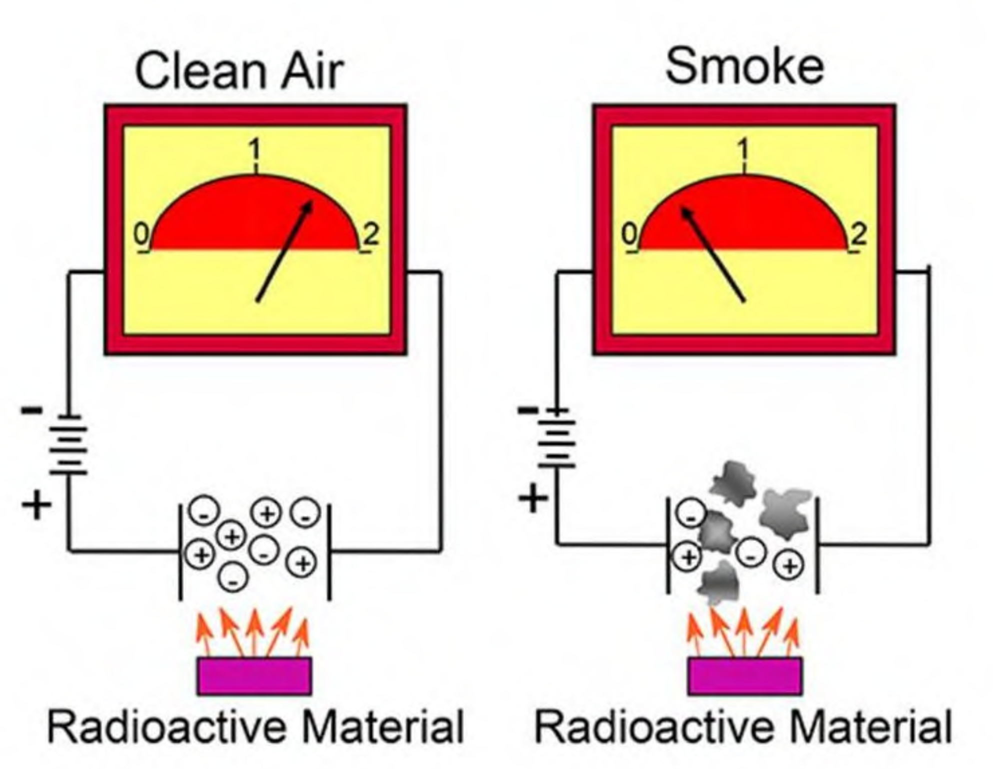
By the end of this lesson, you will be able to do the following:

1. Recognize operational characteristics for different types of smoke detectors.

2 Select the correct smoke detector for various installation environments.

SPOT-TYPE SMOKE DETECTORS

Ionization Smoke Detectors



Ionization detectors are the most common technology in the life safety industry. The detector has a chamber that contains ions (small radioactive particles), and as smoke enters the chamber these ions disappear causing the detector to go into alarm. These detectors are prone to nuisance alarms, as smoke as simple as toast burning in a toaster can cause these detectors to go in alarm. (Click to enlarge image)

Ionization smoke detectors operate on the principal of air in the detector being **ionized**, or given an electrical charge. **Ionized air easily conducts electricity**.

Smoke particles attach themselves to the ionized air. These combined particles create a larger mass which conducts current more slowly than does the clean ionized air.

This current reduction, or resistance, is sensed by the calibrated circuitry in the ionization detector. This results in an alarm signal to the control.

Ionization smoke detectors **will respond faster to flaming fires**. You may not want ionization detectors near a cooking area or bathroom area due to their **susceptibility of false alarms** from invisible smoke or high humidity.

Dirt or dust entering the chamber also reduce the amount of current in the ionized air and will make the unit more sensitive or create a false alarm.

Chambers must be **periodically cleaned** to maintain specified sensitivity rating.

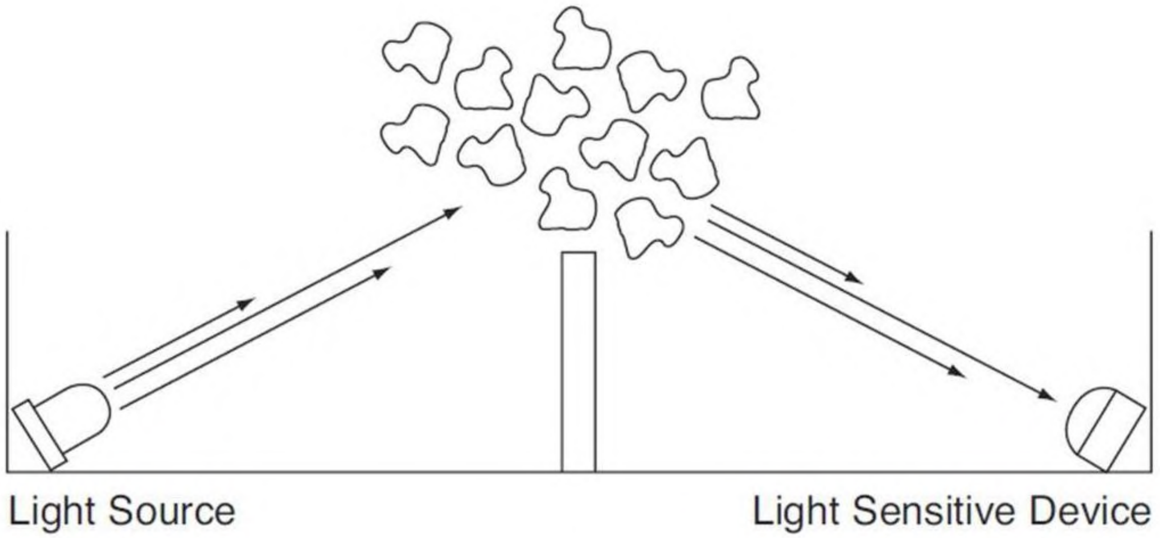
PHOTOELECTRIC SMOKE DETECTORS

Photoelectric Smoke Detectors

Photoelectric smoke detectors operate with the **light-scattering** concept.

There is a **light source** and a **light-sensitive** target. The target is NOT accustomed to receiving a significant amount of light from the light source because it is not directly in the path of the light beam.

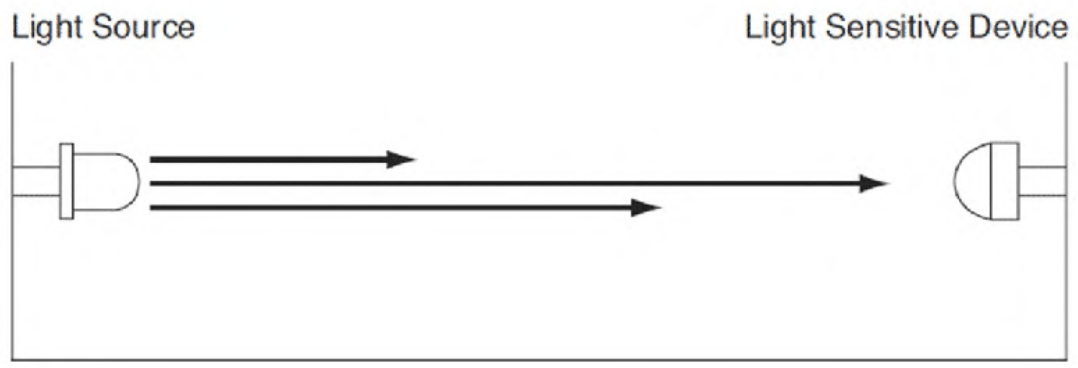
Smoke gets into the detector chamber and **scatters the light beam** (the light energy is deflected, or scattered), or **redirects it to hit the target**. When the target receives this reflected light, the detector circuitry generates an alarm.



(Click to enlarge image)

PHOTOELECTRIC BEAM-TYPE SMOKE DETECTORS

Photoelectric Beam-Type Smoke Detectors



(Click to enlarge image)

Photoelectric beam-type smoke detectors use the **light obscuration concept.**

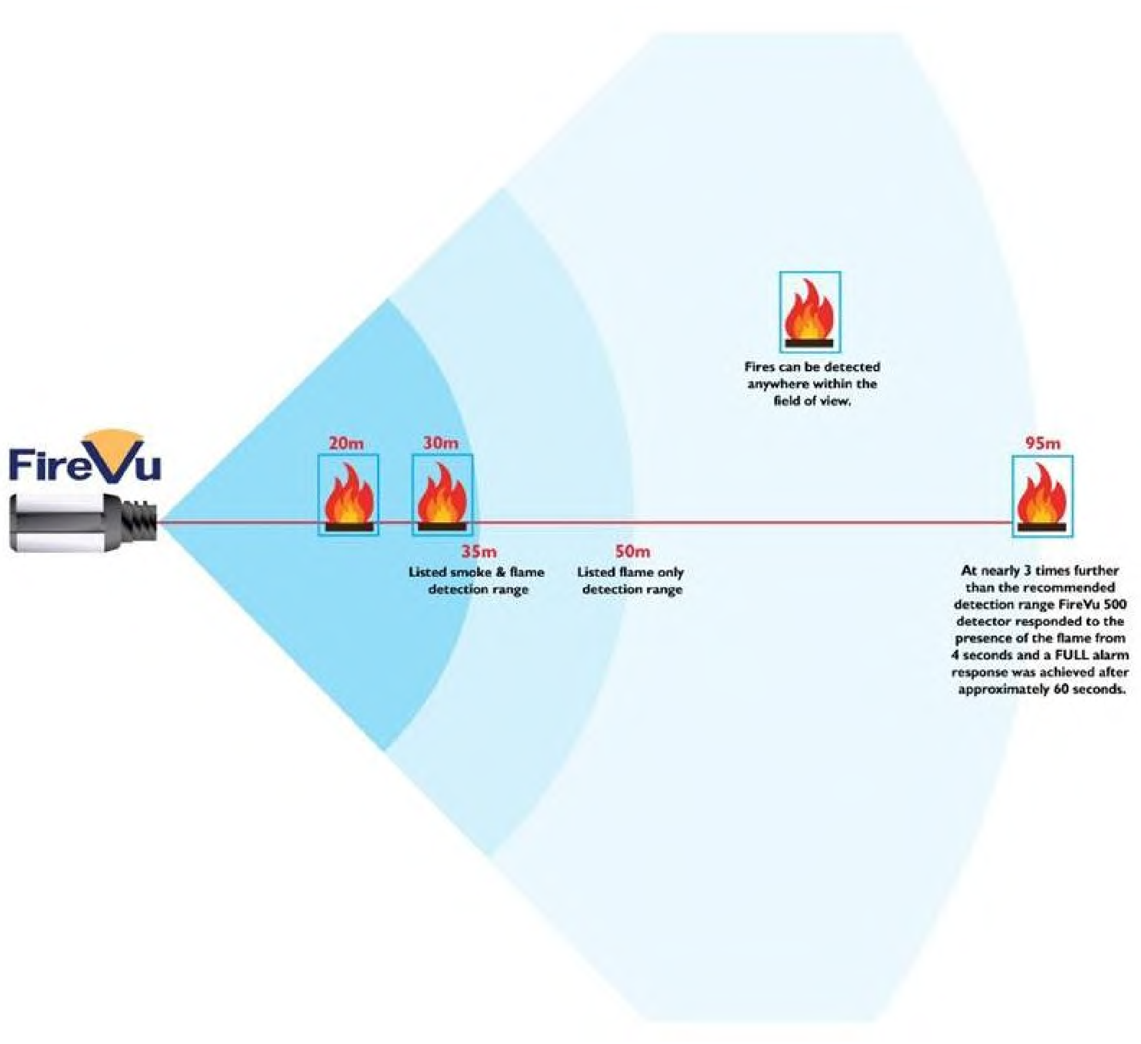
Particles of combustion obscure a beam of light which is directed from a source to a target. The target then **senses the reduction in light** from the light source.

This light reduction reaches the design level of the detector, generating a signal which the control panel interprets as smoke in the protected area.

Light obscuration detectors are primarily intended for **large open areas** such as atriums, large entrances, large hallways, or other building features where we need to cover a large distance, area, or volume.

A **beam detector uses 2 components for detection**. The transmitter is the electronic part of the detector, and sends a beam to a receiver or reflector across from the transmitter. When smoke obstructs the beam path to the listed obstruction percentage, the transmitter provides an alarm signal. What is being shown in this image is photoelectric technology.

(Click to enlarge image)



(Click to enlarge image)

There are video based smoke detection systems that are available and listed for these applications. This is accomplished by the installation of listed cameras that are focused on a view area, and when there is smoke present in this view area the system goes into alarm. The image (on the left) shows how video smoke/flame detection operates. These types of systems are recommended for large outdoor applications, like vehicle storage or airplane hangars.

Air Sampling-Type Smoke Detectors

An air sampling-type smoke detector has a **central detection unit** that draws air through a network of sampling pipes to detect smoke. They can detect smoke before it is visible to the human eye, and are normally used for challenging or special environmental applications such as data centers, cold storage areas, museums, or hospitals.

The use of laser and LED technology along with microcontrollers with advanced algorithms has advanced this technology, allowing for both early warning or elimination of nuisance alarms in places with rapidly changing environments.

(Click to enlarge image)

(Click to enlarge image)

CONTINUE

Let's do a quick check about what has been covered so far.

Match the following spot-type smoke detectors to their functions.

SUBMIT

🔒 Complete the knowledge check above before moving on.

Which Smoke Detector is Best?

Ionization —

Most common and the **most sensitive** because they sense both visible and invisible particles of combustion. Since ionization detectors are some of the most sensitive, you may want to choose another type detector to minimize **nuisance alarms** — for example, if a toaster always activates the fire alarm system.

Photoelectric light-scattering —

Does not work well with **dark smoke**.

Air sampling-type —

Very accurate, extremely sensitive, yet not prone to nuisance alarms as much as spot-type detectors . . . and **VERY expensive**.

Photoelectric beam-type –

Best for **high areas** such as atriums and shopping malls.

There is no single smoke detector that is best for all applications. It is important to select the best smoke detector for your specific application.

AMBIENT CONDITIONS

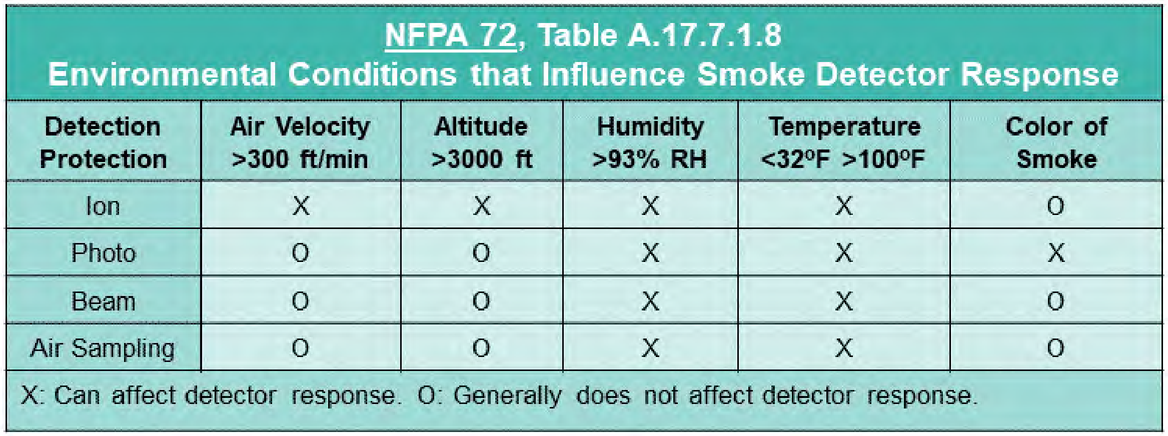
Ambient Conditions

NFPA 72 2016, Section 17.7.1.8

Smoke detectors **shall not be installed** if any of the following ambient conditions exist, unless specifically **designed** and **listed** for the expected conditions:

- Temperature below 32^{O}F
- Temperature above 100^{O}F
- Relative humidity above 93%
- Air velocity greater than 300 ft/min

***NFPA* 72 2016, Annex A** has a table that details how different detector technologies’ response times are affected by environmental conditions.



NFPA 72, Table A.17.7.1.8
Environmental Conditions that Influence Smoke Detector Response

Detection Protection	Air Velocity >300 ft/min	Altitude >3000 ft	Humidity >93% RH	Temperature <32°F >100°F	Color of Smoke
Ion	X	X	X	X	O
Photo	O	O	X	X	X
Beam	O	O	X	X	O
Air Sampling	O	O	X	X	O

X: Can affect detector response. O: Generally does not affect detector response.

The table shows that **ionization detectors are most affected** by the environment, but **photoelectric spot-type detectors** are affected by the **color of the smoke**. Dark smoke will tend to absorb the light rather than reflect the light, making it harder to detect.

CONTINUE

NFPA 72 2016, Section 17.7.1.11

This section of the code is concerned with smoke detector chambers collecting dust and dirt during building construction.

If the smoke detectors are required to be operational during construction, they **must be cleaned or replaced** after construction is complete.

Another option is to **install approved covers** over the detectors until construction is complete.

ⓘ If the detectors are not required to be operational during construction, the detectors shall not be installed until after all other trades have completed cleanup. If they are required for signal initiation during construction, they are required to be *cleaned and verified* to be operating per their listed sensitivity, or replaced prior to final acceptance test of the system. **- *NFPA* 72 2016, Section 17.7.1.11**

CONTINUE TO NEXT LESSON: LOCATION AND SPACING

Lesson 3 of 4

Location and Spacing

How do you get a smoke detector to detect smoke if there is a draft blowing the smoke away from the detector?

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Properly locate smoke detectors in different construction configurations.

2 Define methods required for duct detector installation.

LOCATION AND SPACING OF SMOKE DETECTORS

Heating, Ventilating, and Air Conditioning Systems

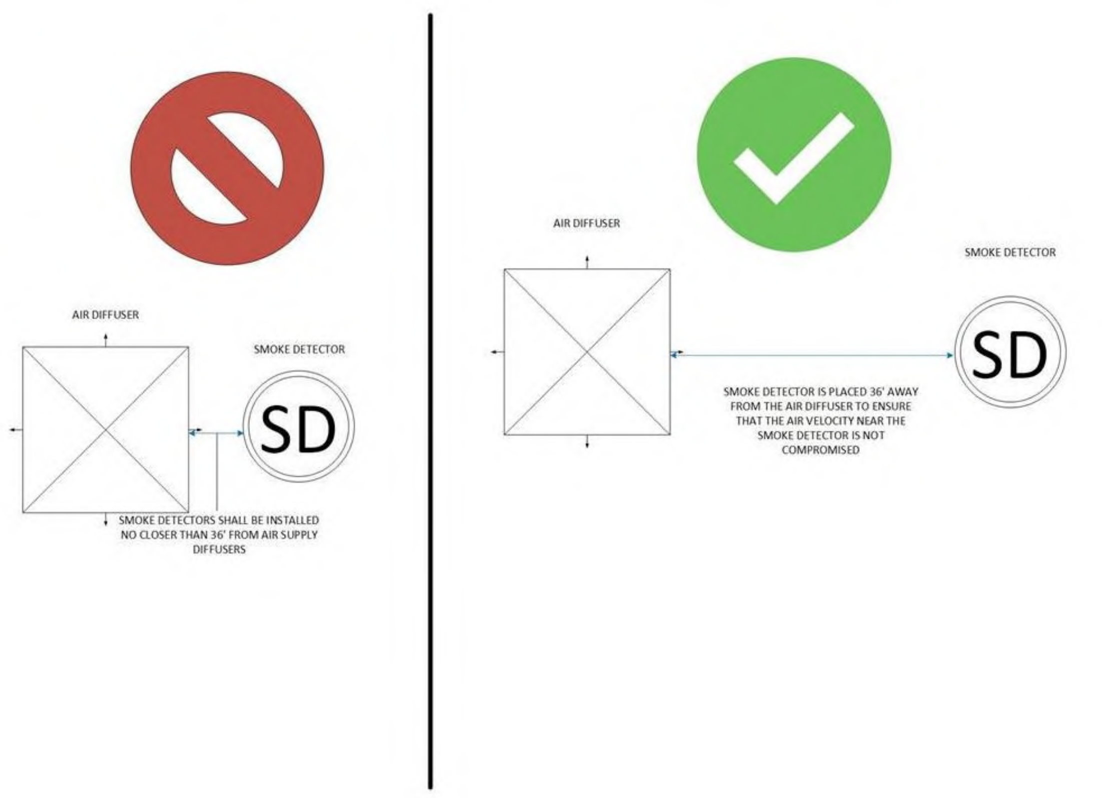
The use of smoke detectors can become quite interesting if our application happens to be spaces served by heating, ventilating, and air conditioning systems.

Smoke is going to travel in the direction of the air flow.

- We must be careful that the smoke which we are trying to detect will not be taken away or diluted to the point where it will not be effectively detected.
- Considerations must be given to potentially reducing the spacing of the detectors in these areas unless we can be assured that the flow and quantity of air is reasonable for our detector to handle.

- For example, a **smoke detector** **should not be located closer than three feet** to an air supply diffuser.

CONTINUE



(Click to enlarge image)

The image above illustrates incorrect placement of a smoke detector near an air diffuser. At this close distance to an air diffuser, the air velocity near this smoke detector could be greater than 300 ft/minute, thus affecting the operation of the detector negatively. When the detector is 3’ or more away from the diffuser as shown on the right, the air velocity is not adversely affected. What if the spacing works out to have a detector less than 3’ from a diffuser? The prudent thing is to provide additional detectors to ensure proper coverage and operation of detectors.

CONTINUE

When spaces under floors and above ceilings are used as plenums or ducts for heating, ventilating, and air conditioning systems, the detectors are required to be listed for the air velocities anticipated.

These special smoke detectors are not suitable for use in normal applications.

(Click to enlarge image)

SPOT TYPE DETECTOR

Spot-Type Heat Detector and Spot-Type Smoke Detector Spacing

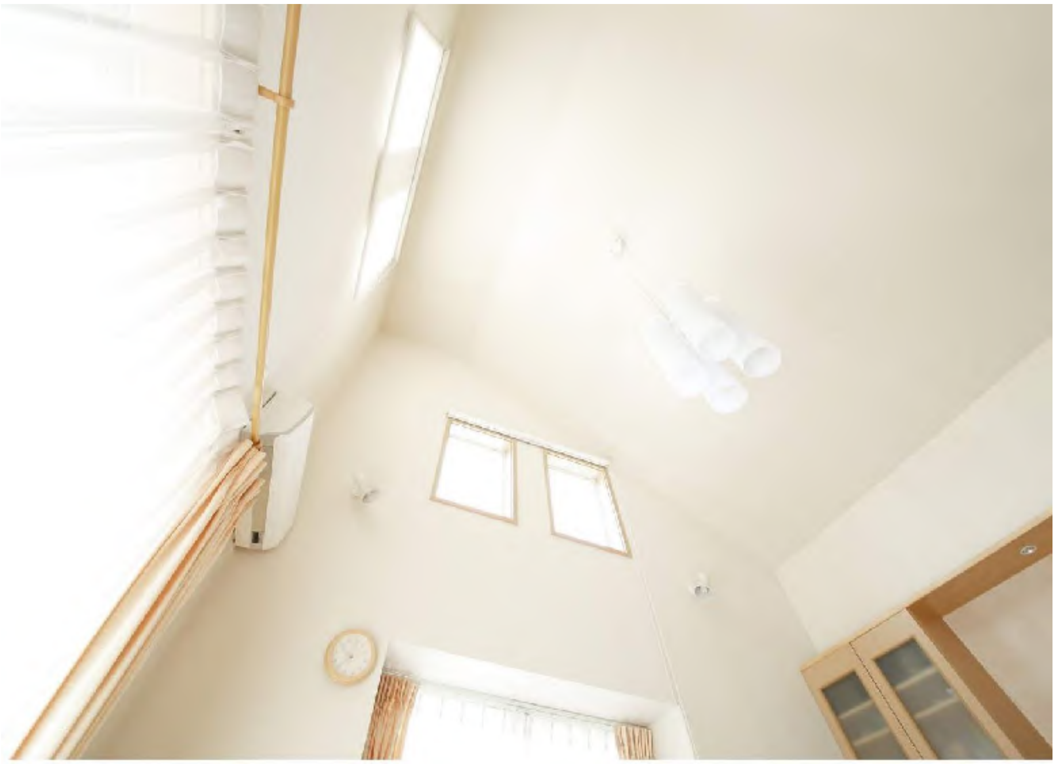
Section 17.7.3.2 is titled “Spot-Type Smoke Detectors.” The ionization and photoelectric light scattering detectors are examples of spot-type smoke detectors.

NFPA 72 2016, Section 17.7.3

Spot-Type Smoke Detectors

Location 1

High Ceiling



The Annex material of this section states that in high ceiling areas where spot-type detectors are not accessible for maintenance, projected beam or air sampling detectors shall be used.

Location 2

Ceiling

Spot-type detectors must be located on the ceiling or on the wall not more than 12 in. from the ceiling to the top of the detector.

Location 3

Raised Floor

Detectors must always be mounted in the orientation that they have been listed for, even if they are installed under a raised floor.

Location 4

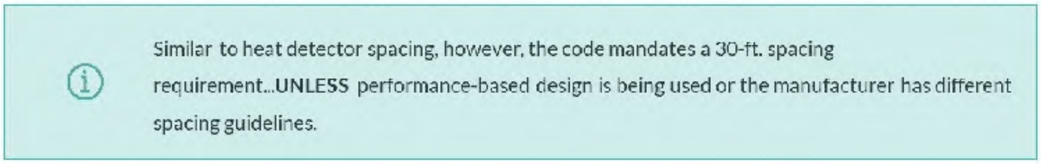
High Rack Storage

If smoke detectors are used in high rack storage, they should be mounted above each aisle and at intermediate levels in the racks per Section A.17.7.6.2.

CONTINUE

NFPA 72 2016, Section 17.7.3.2.3.1

When it comes to the spacing of spot-type smoke detectors, there's not much difference between spot-type heat detector and spot-type smoke detector spacing.

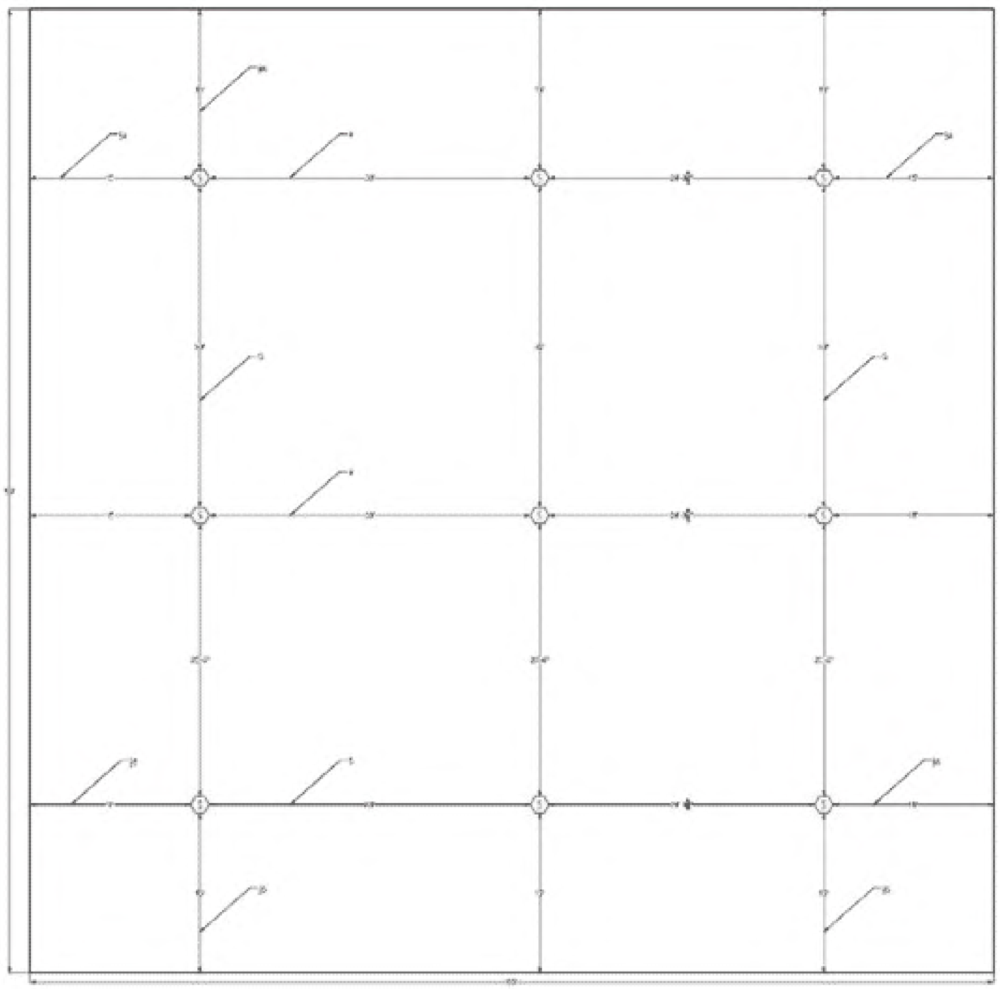


Similar to heat detector spacing, however, the code mandates a 30-ft. spacing requirement...UNLESS performance-based design is being used or the manufacturer has different spacing guidelines.

> Here's what ***NFPA* 72 2016** says about **spot-type smoke detector** spacing:

If performance-based design criteria is not available, **30-ft. spacing shall be used** for prescriptive designs. There are two optional methods for spacing of smoke detectors:

- **Section 17.7.3.2.3.1(1)** states that the distance between smoke detectors shall not exceed a **nominal spacing of 30 ft. (9.1 m)** and there shall be detectors within a distance of **one-half the nominal spacing**, measured at **right angles** from all walls or partitions extending upward to within the **top 15% of the ceiling height.**



(Click to enlarge image)

Smoke detector layout/spacing. On a smooth ceiling as shown above, smoke detectors are placed at 1/2S (half of nominal spacing) from the edge of the walls, and spaced at S between detectors within the room. Smoke Detectors do not have LISTED spacing. Smoke detectors are spaced based upon NOMINAL spacing. NOMINAL spacing for a smoke detector is 30'. Thus, at the wall edges the first row of detectors are spaced at 15' from the edge of the wall (1/2S). each detector is spaced 30' apart, with the exception of the detector found on the right of the first row. This one is spaced at approximately 25', as this detector on the right is spaced 1/2S from the right wall in this room. The room is 90' x 90', based upon this layout with spacing, this room should have 9 smoke detectors for coverage.

CONTINUE

NFPA 72 2016, Section 17.7.3.2.3.1

Spacing of smoke detectors (continued):

Section **17.7.3.2.3.1(2)** states that all points on a smooth ceiling shall have a smoke detector within 0.7 times the listed spacing, or 21 ft.

This second option follows the rules for location of heat detectors and is sometimes useful for locating detectors in irregularly shaped areas.

If a **partition extends within 15% of the ceiling** height, it is **treated as a wall** as it relates to smoke detectors.

With a **10-ft. ceiling, an 8.5-ft. partition would be considered as a wall** for spacing of smoke detectors.

JOIST AND BEAM CONSTRUCTION

Joist and Beam Construction

NFPA 72 2016, Section 17.7.3.2.4

- Depending on the depth of the joists or beams, smoke tends to fill up the pockets formed by the beams before travelling to another area.
- Reduced spacing is required for these areas due to this reason.
- The rules for spacing of smoke detectors are the same for beams as they are for solid joist construction.

CONTINUE

For **level beamed ceilings** with the beam depth **less than 10%** of the height of the ceiling, **smooth ceiling spacing** can be used.

Spot-type smoke detectors may be located on the **bottom of the beams or joists**, or on the **ceiling**.

For a **beam or depth greater than 10%** of the ceiling height:

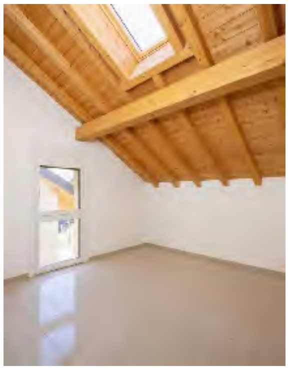
- If **beam spacing** is *equal to or greater than* **40% of ceiling height**, then detectors shall be located in each beam pocket.
- If **beam spacing** is *less than* **40% of ceiling height**, then smooth ceiling spacing in the direction parallel to the beams and at one-half smooth ceiling spacing in the direction perpendicular to the beams shall be used. Detectors can be located on the ceiling or on bottom of the beams.

There are **many different configurations** that can be created by beam construction:

Beams on a slope (parallel or

perpendicular to the slope)

Beam pockets on a slope (parallel or perpendicular to the slope)



Shed ceilings

Corridors

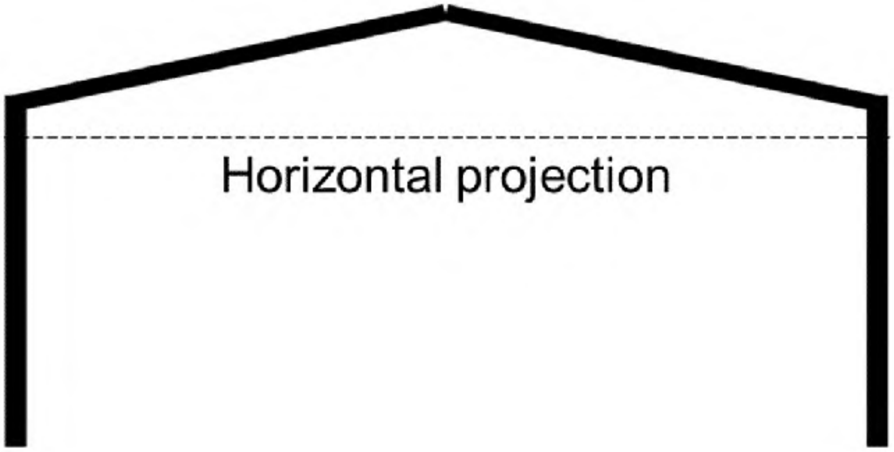
We will not discuss all of the different configurations in detail, but take care to find the appropriate sections starting with **Section 17.7.3.2.4** for your configuration.

NFPA 72 2016, SECTIONS 17.7.3.3 AND 17.7.7.3.4

NFPA 72 2016, Sections 17.7.3.3 and 17.7.7.3.4

For peaked and shed-type ceilings, the first row of detectors shall be located within 36 in. of the high point of the ceiling.

The number and spacing of additional detectors are based upon the horizontal projection of the ceiling.

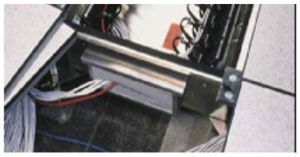


NFPA 72 2016, SECTION 17.7.3.5

NFPA 72 2016, Section 17.7.3.5

Areas above suspended ceilings and under raised floors must be treated as separate areas for detector coverage, if required.

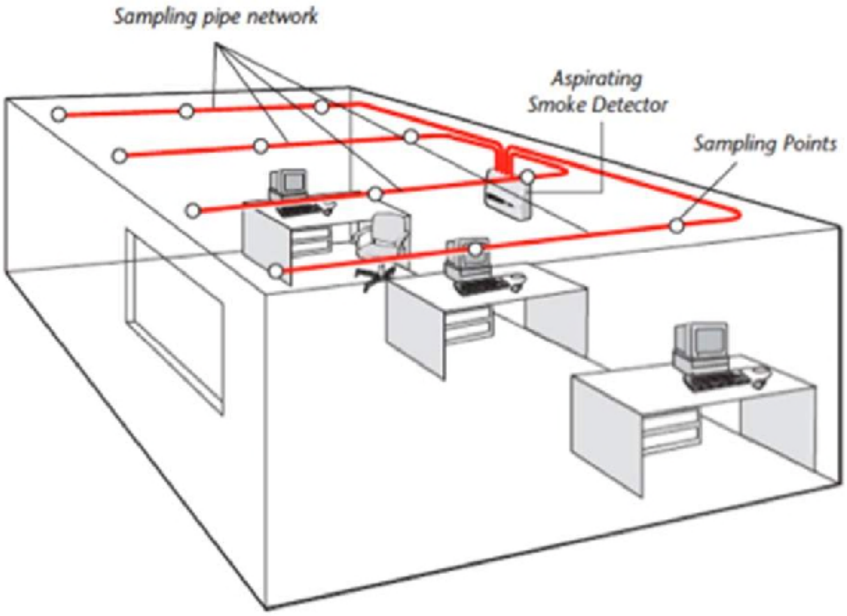
Detectors installed beneath raised floors or above suspended ceilings, or both, including raised floors and suspended ceilings used for environmental air, shall not be used in lieu of providing detection within the room.



AIR SAMPLING-TYPE SMOKE DETECTORS

Air Sampling-Type Smoke Detectors

NFPA 72 2016, Section 17.7.3.6



Each air sampling port shall be treated as a spot-type smoke detector for the purpose of location and spacing of the ports.

The maximum transport time from the furthest sampling port to the control unit **cannot exceed 120 seconds.**

Most manufacturers have software programs to design the piping distribution system to ensure proper operation.

> The sampling pipe network design details shall include calculations showing the flow characteristics of the pipe network and each sample port.
>
> They must generate a trouble signal if the air flow rate is out of range.

CONTINUE

NFPA 72 2016, Section 17.7.3.6 continued

The system piping must be identified with a sign "SMOKE DETECTOR SAMPLING TUBE — DO NOT DISTURB" at:

- Changes in direction or branches in piping

- At each side of a penetration of a wall, floor, or other barrier
- At piping intervals that provide visibility at least every 20 ft.

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CONTINUE

Let's do a quick check about what has been covered so far.

If a partition extends within ___ of the ceiling height, it is treated as a wall as it relates to smoke detectors.

○ 10%

○ 15%

○ 20%

○ 25%

SUBMIT

When spaces under floors and above ceilings are used as plenums or ducts for heating, ventilating, and air conditioning systems, the detectors are required to be listed for the _____ anticipated.

○ air velocities

○ air sampling

SUBMIT

If beam spacing is *equal to or greater than* ____ of ceiling height, then detectors shall be located in each beam pocket.

○ 20%

○ 30%

○ 40%

○ 50%

SUBMIT

The maximum transport time from the furthest sampling port to the control unit cannot exceed _____ seconds.

○ 30

○ 60

○ 90

○ 120

SUBMIT

Complete the knowledge check above before moving on.

Projected Beam-Type Smoke Detectors

NFPA 72, Section 17.7.3.7

Projected beam-type detectors will normally be located with their projected beams parallel to the ceiling and in accordance with the manufacturer's instructions.

Per Annex A, for smooth ceilings, a spacing of 60 ft. can be used as a guide.

Projected beam-type smoke detectors are often a good solution to environments where spot-type detectors cannot be used because of dirt, dust, heat, or humidity.

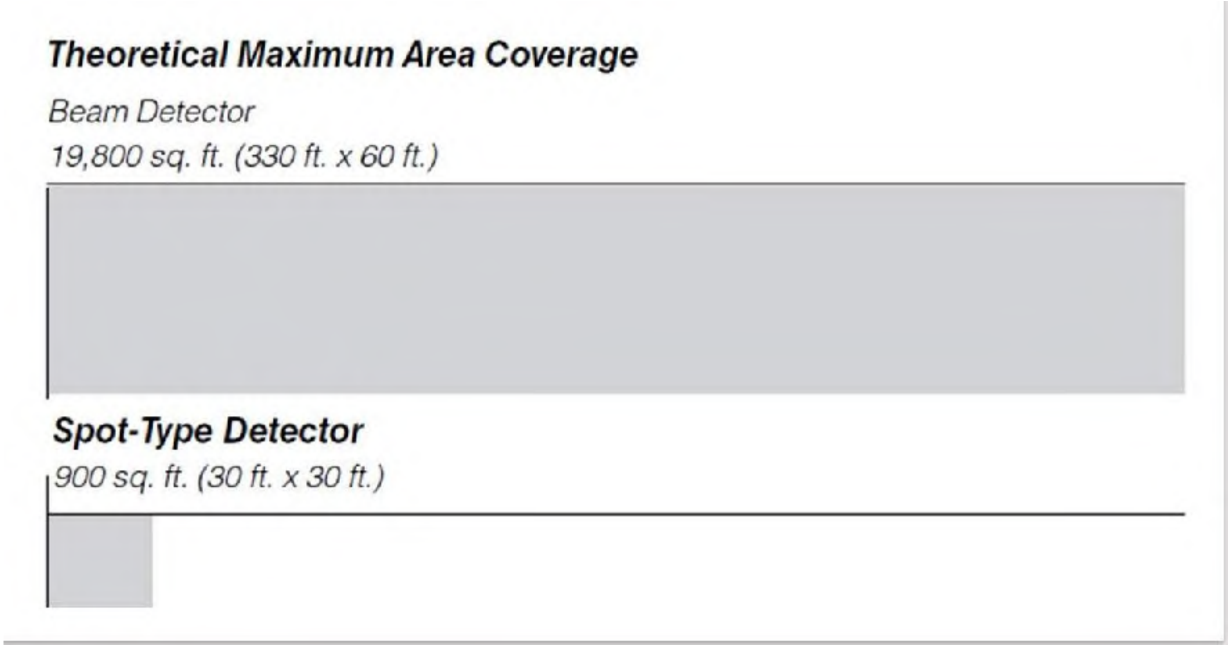
They are not as sensitive to these environmental factors unless those factors are extreme.

They are not recommended for outdoor applications where exposed to rain, snow, sleet, or fog.

CONTINUE

Projected beam-type smoke detectors are also good for high ceiling areas where it would be difficult to test and service spot-type detectors.

They typically have a range of 330 ft, giving them a theoretical maximum coverage of 19,800 ft^2.



A projected beam detector shall be considered as a row of spot-type detectors for level and sloping ceiling locations.

Mounting beam detectors per the manufacturer’s instructions is critical since building structures move with changes in temperature and other factors.

They must be designed such that a small angular movement of the light source or receiver does not inhibit operation or generate a false alarm.

They should also generate a trouble signal if abruptly blocked by a object rather than generating an alarm signal.

SMOKE DETECTORS FOR CONTROL OF SMOKE SPREAD

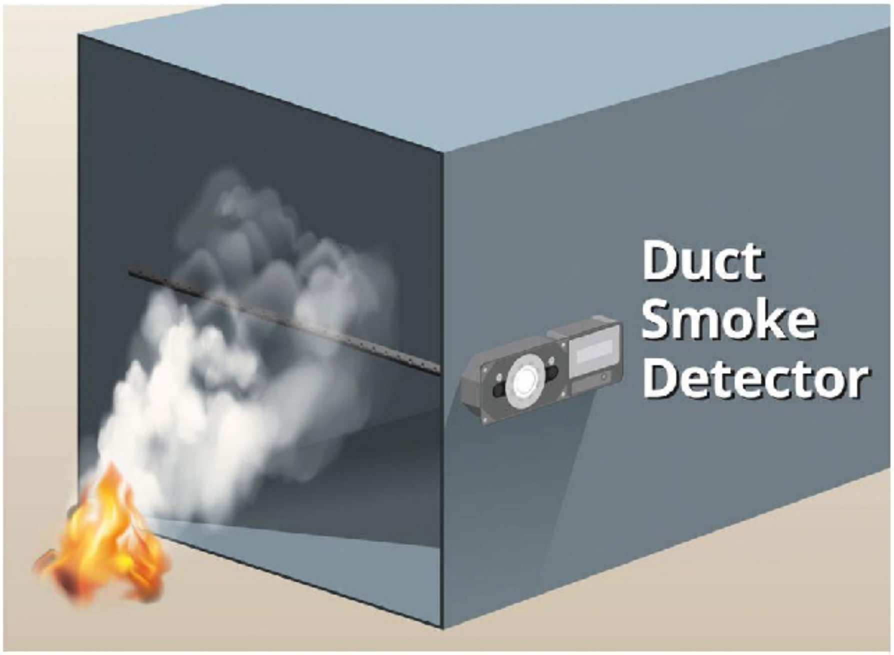
Duct Detectors

NFPA 72 2016, Section 17.7.5

The primary purpose of duct smoke detection is to prevent injury, panic, and property damage by **reducing the spread of smoke**. It also protects the HVAC system from fire and smoke damage.

Smoke detectors installed and used to prevent smoke spread by initiating control of fans, dampers, doors, and other equipment are to classified as follows:

- Area detectors installed in the related smoke compartment
- Detectors installed in air duct systems
- Video image smoke detection installed in related smoke compartments



duct detector (slide 39, location & spacing)

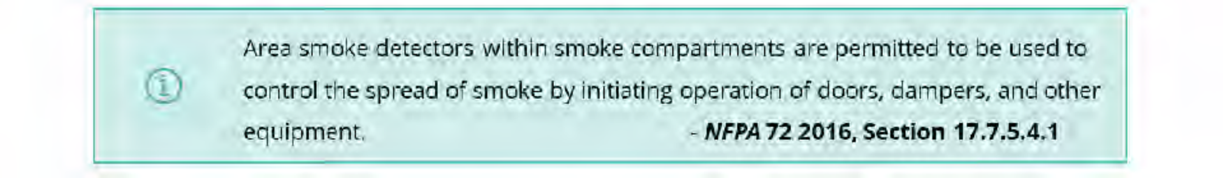
Duct detectors **are not a substitute** for area smoke detection, early warning, or replacing the building fire alarm system.

> Area smoke detectors within smoke compartments are permitted to be used to control the spread of smoke by initiating operation of doors, dampers, and other equipment. - *NFPA 72* 2016, Section 17.7.5.4.1

NFPA 72 2016, SECTION 17.7.5.5.2

Section 17.7.5.5.2 states four methods for installation of duct detectors:

1. Rigid mounting within the duct
2. Rigid mounting to the wall of the duct with the sensing element protruding into the duct
3. Installation outside the duct with rigidly mounted sampling tubes protruding into the duct
4. Installation through the duct with projected light beam



Area smoke detectors within smoke compartments are permitted to be used to control the spread of smoke by initiating operation of doors, dampers, and other equipment. - ***NFPA* 72 2016, Section 17.7.5.4.1**

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NFPA 72 2016, SECTION 17.7.5.5.3 AND 17.7.5.6

NFPA 72 2016, Section 17.7.5.5.3

Duct smoke detectors must be accessible for cleaning and maintenance.

The locations for all duct detectors must be clearly and permanently identified.

The technology normally used for duct detectors is photoelectric to reduce false alarms.

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NFPA 72 2016, SECTION 17.7.5.6

Door Release Service

NFPA 72 2016, Section 17.7.5.6

Smoke detectors are permitted to accomplish door release service, if part of an open area protection system covering the room, corridor, or enclosed space on each side of the smoke door.

If smoke door release is to be accomplished directly from the smoke detectors, then the detectors are required to be listed for releasing service.

Smoke detectors are required to be photoelectric, ionization or other approved types.

Refer to NFPA 72 2016, Section 17.7.5.6 for diagrams of the items below

If doors are intended to close in response to smoke flowing in either direction, then the following applies: (Click each tab below to learn more)

17.7.5.6.5.1(A), part A or B –

If the depth of the wall section above the door is 24 in. or less, one ceiling-mounted smoke detector is required on one side of the doorway only, or two wall-mounted detectors are required, one on each side of the doorway. See Figure **17.7.5.6.5.1(A), part A or B.**

17.7.5.6.1(A), part D –

If the depth of the wall section above the door is greater than 24 in. on one side only, one ceiling-mounted smoke detector is required on the higher side of the doorway only, or one wall-mounted detector is required on both sides of the doorway. See Figure **17.7.5.6.1(A), part D**.

17.7.5.6.1(A), part F –

If the depth of the wall section above the door is greater than 24 in. on both sides, two ceiling-mounted or wall-mounted detectors are required, one on each side of the doorway. See Figure **17.7.5.6.1(A), part F.**

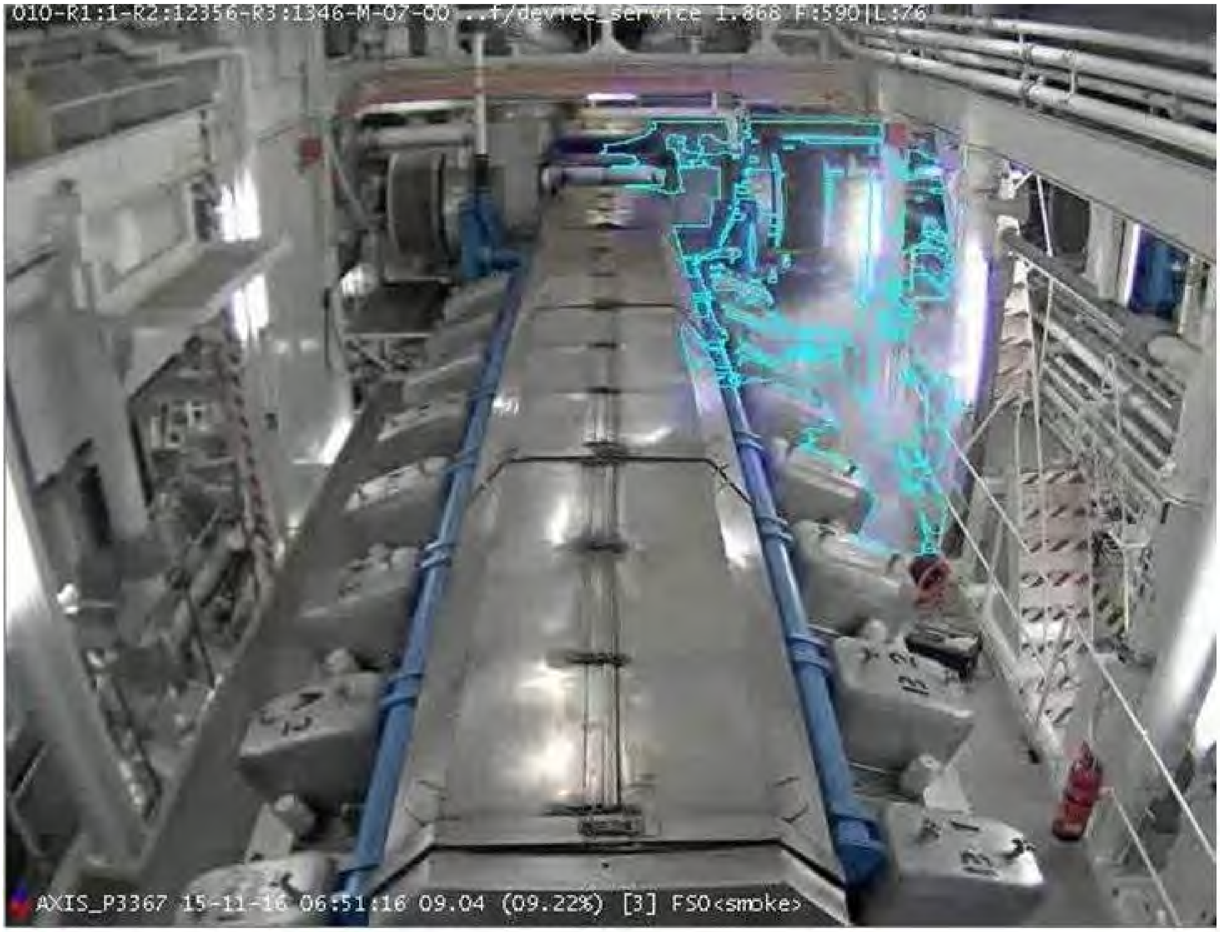
17.5.6.5.1(A), parts A, C, and E –

> If a detector is specifically listed for door frame mounting, or if a listed combination or integral detector-door closer assembly is used, only one detector is required, if installed per the manufacturer's instructions. See Figure **17.5.6.5.1(A), parts A, C, and E.**

VIDEO IMAGE SMOKE DETECTION

Video Image Smoke Detection Systems

Video image smoke detection systems are used in challenging structures or large places that need or want fire protection, where conventional detection devices will not work well for the application. These systems operate by continually capturing and digitally processing an image of the area to be protected, looking for changes that have the mathematical signature for smoke or fire characteristics.



They are based on security surveillance systems digital hardware with computer software to analyze the image.

NFPA 72 2016 states the system components and software must be listed for the purpose of smoke detection.

The images can also be transmitted to other systems, such as a security system, as long as it does not affect the ability of the system to detect the fire condition.

The systems must have passwords or other security protection to prevent unauthorized changes.

They have a fast reaction time, and typical system capabilities include detection of:

- Presence of flames within the field of view of the camera
- Reflected fire light when flames are obstructed
- Presence of pluming smoke clouds
- Presence of ambient smoke

CONTINUE

Let's do a quick check about what has been covered so far.

Smoke detectors installed and used to prevent smoke spread by initiating control of fans, dampers, doors, and other equipment are classified as follows: (Select all that apply)

- ☐ Area detectors installed in the related smoke compartment
- ☐ Detectors installed in air duct systems
- ☐ Video image smoke detection installed in related smoke compartments

SUBMIT

Based on diagrams in *NFPA* 72 2016, Section 17.7.5.6, if doors are intended to close in response to smoke flowing in either direction. If a detector is specifically listed for door frame mounting, or if a listed combination or integral detector-door closer assembly is used, how many detectors are required, if installed per the manufacturer's instructions.

○ one

○ two

○ four

SUBMIT

Video Image Smoke Detection has a fast reaction time, and typical system capabilities include detection of: (Select all that apply)

☐ Presence of flames within the field of view of the camera

☐ Reflected fire light when flames are obstructed

☐ Presence of pluming smoke clouds

☐ Presence of ambient smoke

SUBMIT

Complete the knowledge check above before moving on.

Lesson 4 of 4

Other Types of Detectors

Carbon monoxide detectors are just as important at saving lives as smoke and heat detectors. The location for installation of carbon monoxide detectors is critical to their effectiveness.

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Explain the unique features of sprinkler waterflow alarms and their impact on a fire alarm system.

2. Identify types and purpose of alarm-initiating supervisory devices.

3. Describe the functionality of different types of manually-actuated alarm-initiating devices.

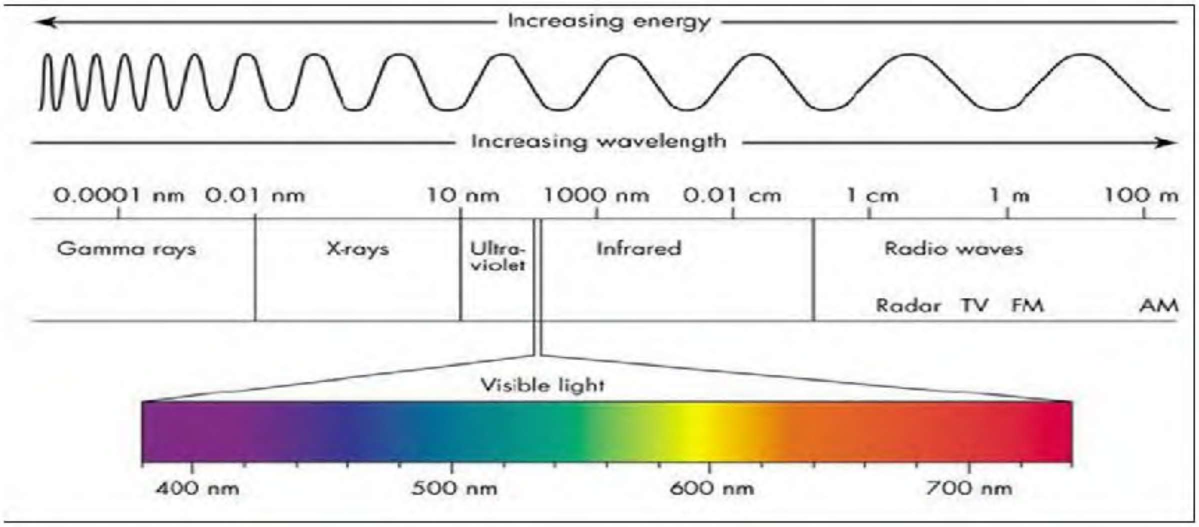
RADIANT ENERGY DETECTORS

Radiant Energy Detectors

When any material burns, it emits light in different frequency wavelengths. A small amount of the light is visible to humans, while the other light coming from the burning material will be in the **infrared and ultraviolet spectrums.**

A flaming fire will generate light in the infrared spectrum of light and **an ember or smoldering fire will generate light in the ultraviolet spectrum.** Radiant energy detectors look for light in these spectrums for instant detection of a flame or spark/ember.

They are normally used with **explosion suppression or prevention systems** such as hazardous material storage, oil rigs, airport facilities, and fuel loading racks.



(Click to enlarge image)

(Click to enlarge image)

Radiant energy detectors are normally designed to filter out visible light and **look for different or multiple frequencies** to minimize false alarms from unusual sources, such as welding or lightning. They are **fast acting** and can detect a fire in seconds rather than waiting for smoke or heat to be detected.

They are a line-of-sight device with a lens and **need to be able to see the fire**. If their field of view is obstructed by an object or the lens is dirty, they will not detect the fire.

CONTINUE

Flame Detectors

Advantages and Disadvantages of Flame Detectors

ADVANTAGES	DISADVANTAGES

Flame detectors are the **fastest of any of our detectors**. In terms of detection or response time, there is nothing that comes close to flame detectors.

ADVANTAGES

DISADVANTAGES

Flame detectors are line-of-sight devices, which have the capability of “seeing” a fire. **Significant maintenance procedures are required** to keep those eyes clean. Flame detectors are also very high in cost.

Flame detectors are famous for **false alarms.** Detectors look at a part of the light spectrum, from natural or human activities; such as, welding, lightning, and even sunlight. This radiates various wavelengths of light within the viewing spectrum of the detector.

Many of these disadvantages can be solved or minimized by **proper design and application techniques.**

The designer must be **selective** and **aware of the hazard** in order to determine the type of flame detector for a specific application. This has to be based on good engineering judgment in terms of the operating characteristics and the anticipated burning characteristics of the hazard.

The disadvantages are significant, but don't matter if time is a factor. For example, when installing an explosion suppression system using manual actuation, thermostats, or photoelectric smoke detection, your hazard is going to be all over the lot. **In this case, flame and pressure detectors are your ONLY choices.**

CONTINUE

Combination, multi-criteria, and multi-sensor detectors

NFPA 72 2016, Section 17.9

While combination, multi-criteria, and multi-sensor detectors all use multiple sensors, they also have differences. *NFPA* 72 2016, Section 17.9 states the requirements for all three types of detectors.

COMBINATION DETECTORS

Combination detectors

System Sensor 5151 thermal detector with fixed and rate of rise detection (Click to enlarge image)

Typical examples of combination detectors include a heat detector with a smoke detector or a combination rate-of-rise and fixed-temperature heat detector. This device has listings for each sensing method employed.

Combination detectors do not utilize a mathematical evaluation principle of signal processing more than a simple “or” function.

These type of detectors were the first to use multiple sensors without the advantage of having the mathematical evaluation of each sensor, but are still commonly used.

MULTI-CRITERIA DETECTORS

Multi-Criteria Detectors

An example of a multi-criteria detector is the System Sensor 2251-COPTIR Advanced Multi-Criteria Fire Detector with four unique sensing elements:

1. Photoelectric chamber **senses airborne particulate** for smoke detection.
2. Electrochemical cell technology **monitors carbon monoxide** (CO) produced by smoldering fires.
3. Infrared (IR) sensing **measures ambient light levels and flame signatures**.
4. Thermal detection **monitors temperature**.

System Sensor 2251-COPTIR (Click to enlarge image)

A multi-criteria detector **contains multiple sensors that separately respond to heat, smoke, or gases**. It can also be a detector that has **more than one sensor to detect the same condition** such as a heat detector with a fixed temperature sensor and a rate-of-rise sensor.

The sensor output is mathematically evaluated to determine when an alarm signal is warranted. The detector is capable of generating only one alarm signal and has a single listing that establishes the primary function of the detector.

Multi-Sensor Detectors

Multi-Sensor Detector (Click to enlarge image)

This type of detector contains **multiple sensors that separately respond to heat, smoke, or gases**. However, this device is capable of generating **multiple alarm signals independently or in combination**. The sensor output signals are mathematically evaluated to determine when an alarm signal is warranted.

This device has listings for each sensing method employed.

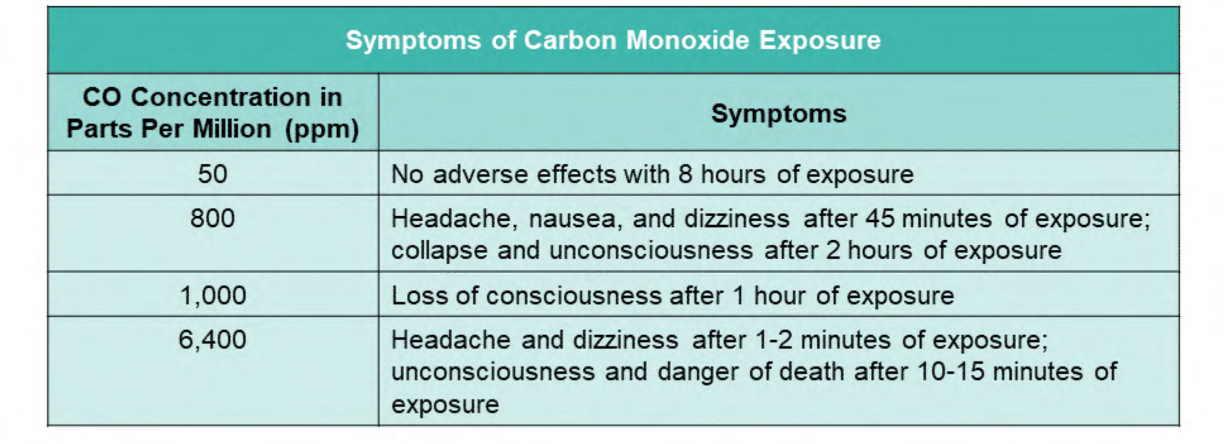
Typical examples of multi-sensor detectors are a **combination of a heat detector with a smoke detector**, or a **combination rate-of-rise and fixed-temperature heat detector** that evaluates both signals using an algorithm to generate an output such as pre-alarm or alarm.

CARBON MONOXIDE DETECTORS

Carbon monoxide detectors

Section 17.10 was added to *NFPA* 72 2016 in the 2010 edition and covers gas detection. **Carbon monoxide (CO) is a gas produced by incomplete combustion of fossil fuels including natural gas.**

CO poses a hazard because it is **tasteless, odorless, and it interferes with oxygen in the blood supply**, possibly causing injury, incapacitation, and even death.



Symptoms of Carbon Monoxide Exposure	
CO Concentration in Parts Per Million (ppm)	**Symptoms**
50	No adverse effects with 8 hours of exposure
800	Headache, nausea, and dizziness after 45 minutes of exposure; collapse and unconsciousness after 2 hours of exposure
1,000	Loss of consciousness after 1 hour of exposure
6,400	Headache and dizziness after 1-2 minutes of exposure; unconsciousness and danger of death after 10-15 minutes of exposure

CONTINUE

The most common sources for CO exposure are:

- Heating systems
- Power tools
- Charcoal grills or other charcoal sources
- Gas ranges or ovens
- Camp stoves or lanterns
- Other or multiple appliances
- Emergency electrical generators

CONTINUE

Gas detectors are used as life safety devices, but **are not commonly connected to the fire protection system**.

NFPA 72 2016 does not require carbon monoxide detectors. **The requirements come from building codes, life safety codes, and *NFPA 720:*** *The Standard for the Installation of CO Detection and Warning Equipmen*t, 2012 edition. This standard defines requirements for both commercial and residential installations of CO detectors.

Gas Detection Systems are typically seen in commercial kitchens. They consist of two components.

The component on the **left** is a local sounder and “sniffer” for fuel sources.

The component on the **right** is generally hooked up upstream from the gas shutoff valve to detect any leaking. This component has a solenoid connection (black area) to a relay, that when a leak is detected or under general alarm, can drop this solenoid to stop gas flow to the gas-powered device like a cooking range.

(Click to enlarge image)

CONTINUE

System Sensor COSMO-2W Carbon Monoxide Detector (Click to enlarge image)

There are three technologies for detecting CO. The most common is an **electrochemical sensor with a platinum electrode and acid combination** to promote a reaction between CO and the oxygen in the air, which then produces an electric current. When CO is present in the air over time, **if the current increases beyond specific thresholds, the alarm is sounded.** This is a similar concept to the way ionization smoke detectors operate.

CO detectors have a specific limited life. Some are rated for a life of six years after manufacture. When these detectors are connected to a fire alarm system, they must generate a **trouble signal** at the end of the specified life.

CONTINUE

Let's do a quick check about what has been covered so far.

While combination, multi-criteria, and multi-sensor detectors all use multiple sensors, they also have differences. Match their unique capabilities below.

Combination Detector	does not have the advantage of having the mathematical evaluation of each sensor.
Multi-Criteria Detector	has more than one sensor to

	detect the same condition.
Multi-Sensor Detector	is capable of generating multiple alarm signals independently or in combination.

SUBMIT

🔒 Complete the knowledge check above before moving on.

Sprinkler waterflow alarms

The **waterflow alarm** from a sprinkler system **indicates that there is water flowing in the sprinkler system**. It is the only signal from a sprinkler system that actually **generates a fire alarm** just as a heat or smoke detector. The other signals from a sprinkler system generate a supervisory signal as we will discuss later.

Sprinkler waterflow alarm (Click to enlarge image)

Waterflow alarms can have a major impact on the requirements of the fire alarm system. The International Building Code **eliminates the requirement for manual pull stations** in many cases if there is a waterflow alarm from a sprinklered building.

It must react **within 90 seconds** to a flow equal to or greater than that from the smallest orifice sprinkler in the sprinkler system.

> Movement of water due to waste, surges, or variable pressure shall not initiate an alarm signal.
>
> — *NFPA 72* 2016, Section 17.12.3

MANUALLY ACTUATED ALARM-INITIATING DEVICES

Manually Actuated Alarm-Initiating Devices

There are several different types of manually actuated alarm-initiating devices (pull stations):

1. **A coded or non-coded signal:** type of signal which is sent from the signaling device.

   A coded manual fire alarm box sends a distinct or special signal from the box, and is required to repeat its fire signal a minimum of 3 times. **A non-coded box** does not have that capability.

2. **A pre-signal box:** a signal that is specifically designed for a given location and only notifies specified areas, such as a guard's tower or a central station of a problem condition.

These signals must be applied and used carefully because **further manual action is necessary** to generate a general evacuation signal.

3. **A general alarm box:** a signal which causes an overall evacuation signal to be sent immediately.

4. **Breakglass:** this type of device requires that a glass window or rod be broken prior to a signal being generated. The broken indicator must be replaced when the system is put back in service.

5. **Non-breakglass:** This type of device is self-explanatory. The initiating device does not utilize the broken glass indicator.

6. **Single-action:** with a single action station, there is only one activity which is needed to initiate the signal.

7. **Dual-action:** A double-action box requires two steps, such as push in, then pull down.

While you may come across a coded or pre-signal manual device (pull station) in the field, they are rare since most manufacturers no longer produce them.

PULL STATIONS

Pull stations shall only be used for alarm- initiating purposes.

Manual fire alarm boxes must be **RED** in color unless they are installed in an environment that prevents them from being plastic or painted. Pull stations may be permitted to be used for other than fire alarm purposes, if the devices are differentiated from manual fire alarm pull stations by colors other than red and labeling.

Pull stations must be mounted on a surface of **contrasting color**.

(Click to enlarge image)

(Click to enlarge image)

Combination pull stations and guard's tour signaling stations **shall** be permitted.

Pull stations must be **securely mounted** to their surfaces.

The operable part of the pull station (handle, lever, push button, etc.) shall be **no less than 42 in.** and **no more than 48 in. above floor level**.

Pull stations must be **accessible** and **unobstructed** at all times.

CONTINUE

Pull stations shall be located **within 5 ft. of each exit opening** at each exit on **each floor**.

Pull stations must be installed **on each side of grouped openings over 40 ft. in width** and **within 5 ft. of each side** of the opening.

Additional pull stations must be installed so that the travel distance between any two pull stations on the same floor is **not more than 200 ft.**

Clear protective covers are permitted for manual fire alarm boxes to help prevent false alarms. (The cover must be listed for use with fire alarm systems and the pull station it is used with).

(Click to enlarge image)

Some protective covers have a tamper switch that activates an audible device inside the box when the cover is removed. The Ohio Fire Code Section 907.4.2.5 states the audible cover alarm is only permitted if approved by the Fire Official.

Supervisory Alarm-Initiating Devices

NFPA 72 2016, Section 17.16

A **supervisory signal** indicates the need for action in connection with the supervision of guard tours, the fire suppression systems or equipment, or the maintenance features of related systems. Its primary function is to tell us if there is a need for action regarding the equipment or function which the supervisory circuit is monitoring.

***NFPA* 72 2016, Section 17.16** lists a number of different kinds of alarm and supervisory signals which are included with many fire alarm systems. *NFPA* 72 2016 **does not define what supervisory signals must be used** for a fire alarm system, but **it describes the requirements** for these supervisory signals if they are required.

Other NFPA codes such as *NFPA 13* for sprinkler systems, along with state, local, and AHJ requirements **dictate which supervisory signals are required on a given system.**

CONTINUE

Let's do a quick check about what has been covered so far.

Additional pull stations must be installed so that the travel distance between any two pull stations on the same floor is not more than ____ ft.

○ 50

○ 100

○ 150

○ 200

SUBMIT

🔒 Complete the knowledge check above before moving on.

Water Control Valves

NFPA 72 2016, Section 17.16.1

(Click to enlarge image)

The main sprinkler control valve **must be turned in the open position** in order for the supervisory signals to operate effectively.

When supervised, *NFPA* 72 2016 requires that there be a **distinctive signal for valves that are not in the proper position**. For example, there will be a signal if a hand wheel valve has been turned more than two turns or if a lever-operated valve has been moved approximately one-fifth of the distance from its normally open position.

A distinctive signal will also be generated when the valve is returned to its normal position.

PRESSURE SUPERVISION FOR PRESSURE TANKS

Pressure Supervision for Pressure Tanks

NFPA 72 2016, Section 17.16.2.2.1

Some automatic sprinkler systems use pressure tanks to maintain or supplement their water supply requirements. The tanks must maintain a specified design pressure to assure that the sprinkler system will operate properly. This pressure is necessary to make sure that the appropriate number of gallons per minute will be supplied to each of the operating sprinkler heads.

(Click to enlarge image)

For this supervisory function, *NFPA* 72 2016 allows a plus or minus 10 psi allowance from the design pressure. If this allowance is exceeded, a signal must be generated.

Example: If the required pressure is 40 psi and the pressure actually exceeds 50 psi or drops below 30 psi, a supervisory signal must be sent to the central station or area where the signals are received and processed.

Pressure Supervision for Dry Pipe Sprinkler Systems

NFPA 72 2016, Section 17.16.2.2.2

(Click to enlarge image)

Similar to the pressure tank supervisory signals, **a pressure supervisory signal-initiating device** for a dry pipe sprinkler system is required to indicate both high- and low-pressure conditions.

For this supervisory function, *NFPA* 72 2016 allows a **plus or minus 10 psi allowance** from the design pressure. If this allowance is exceeded, a signal must be generated.

CONTINUE

Water Level Supervision

Supervising and monitoring the water supply levels are important to make certain that there is a reliable water supply for our automatic sprinkler system.

A **supervisory signal** must result if the level **varies 3 inches in either the high or low direction.**

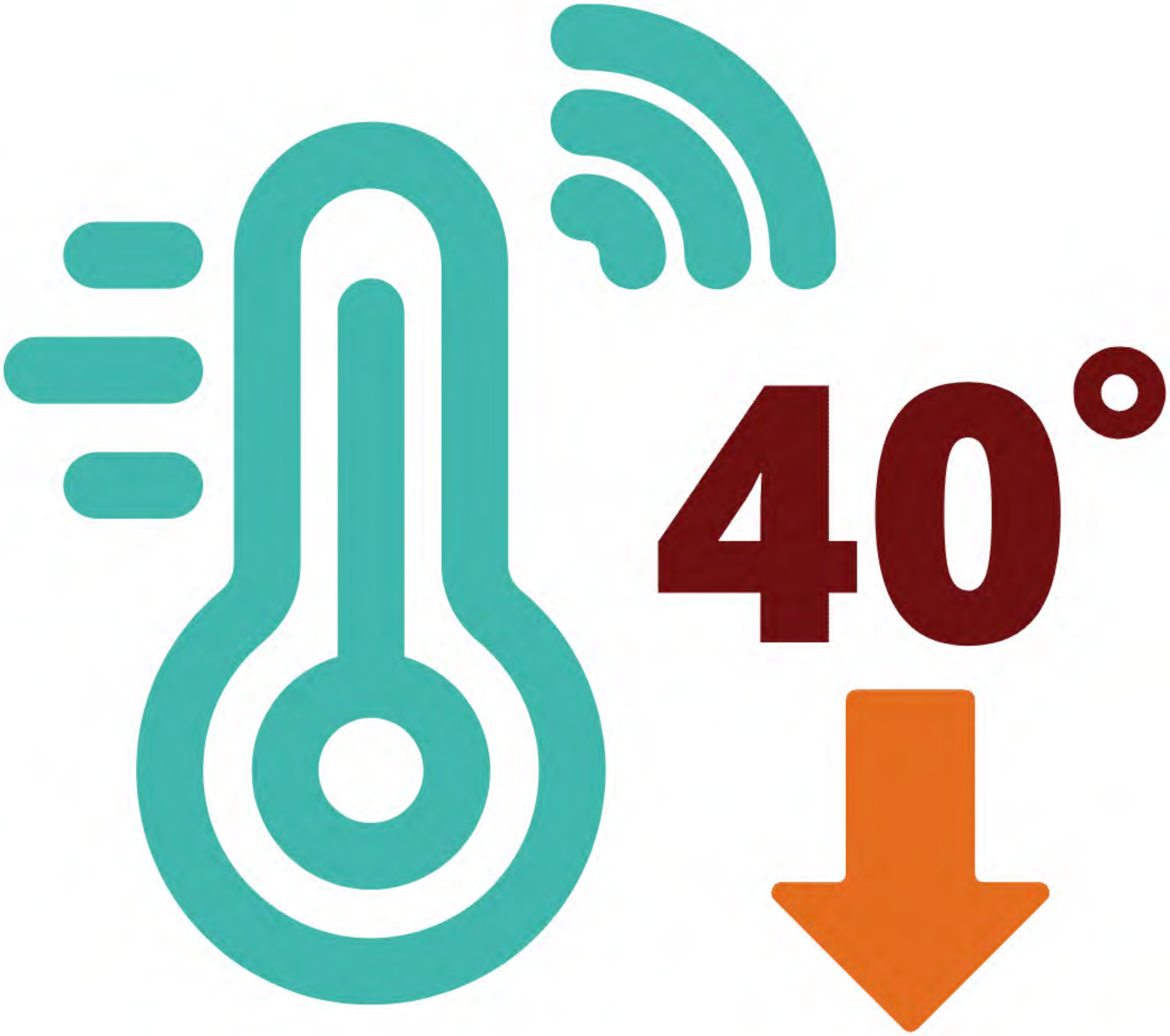
The "high water" requirement recognizes that a certain amount of air volume is required in a pressure tank to discharge properly. If the pressure tank was completely full of water and pressurized to 150 psi, opening the tank valve would only yield a very brief "spurt" of water. Minimal flow would be maintained.

On the other hand, in a water tower (gravity tank) there has to be a supervisory signal sent if the water level sinks below 12 in. of the design level.

(Click to enlarge image)

CONTINUE

Water Temperature Supervision



A supervisory signal must be generated if the **water temperature *falls* to 40°F**.

Water freezes at approximately 32°F, but various minerals and other contaminants can vary that number. Given that, a **40°F response temperature is required by *NFPA* 72 2016**.

PUMP SUPERVISION

Pump Supervision

If a sprinkler system requires a water pump/fire pump, the status of that pump has to be monitored by supervising its power supply.

If the power supply to the pump is interrupted for any reason, a **supervisory signal** is required.

A **pump running signal** can be **supervisory** or an **alarm signal**. **All other fire pump signals shall be supervisory** per *NFPA* 72 2016, Section 23.8.5.9.2.

A fire pump can have several components that shall be supervised by the FACP. In the example below, to the left of the pump there is a control valve for this riser that is being supervised in addition to the flow switches.

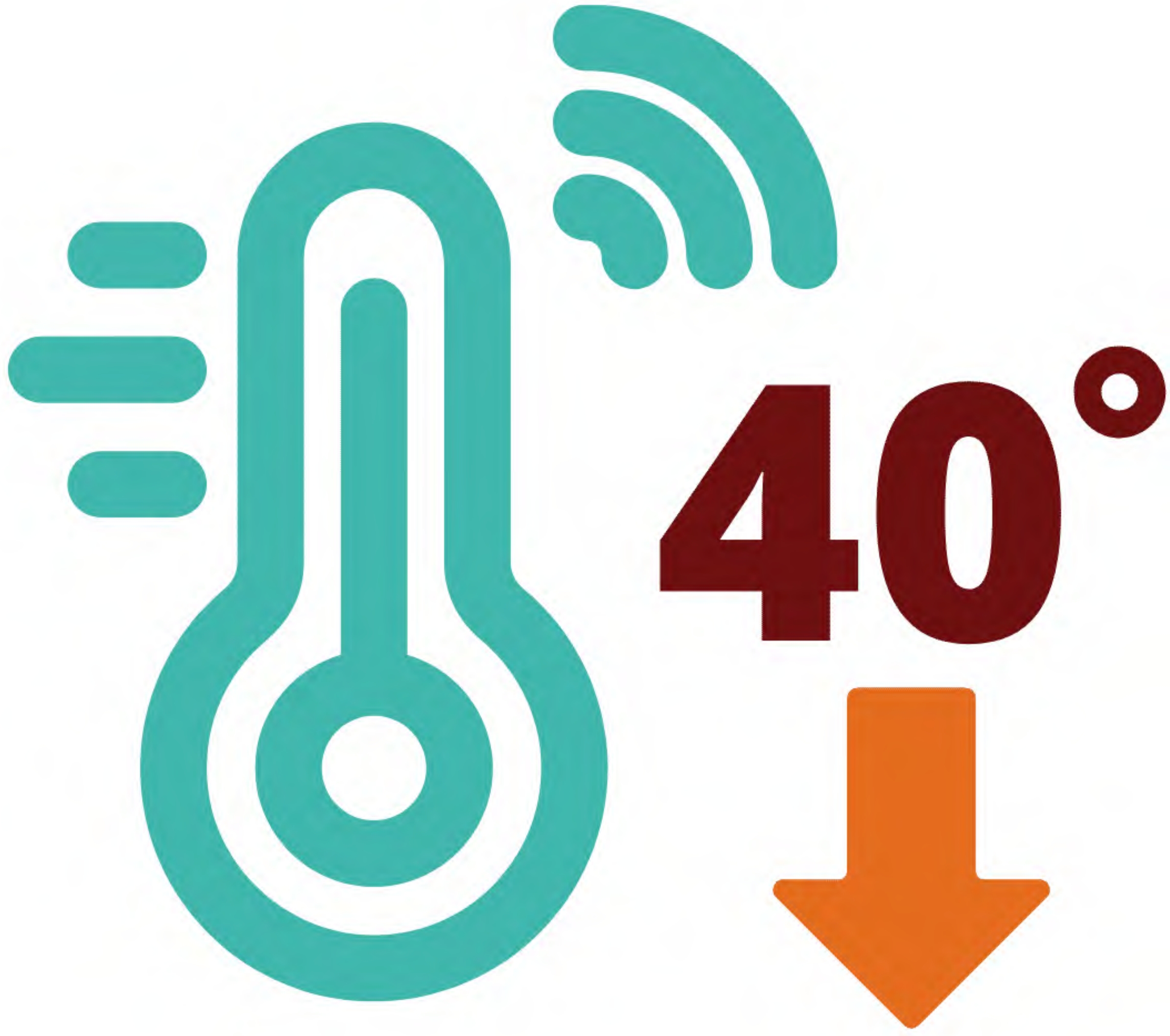
To the right of the pump is the main from the pump that provides the pumped water to the system. The 2 shut-off valves in between the main control are supervised to ensure that water is charged into the system. When the shutoffs are closed, this should cause a supervisory signal at the panel. The device to the right of the shutoffs is a backflow prevention device that shall be tested annually to ensure that there is no cross contamination from the pump water supply to the domestic water supply of the building, as the pump water supply is not generally a potable water supply.

(Click to enlarge image)

In addition to these points relating to water that are supervised, electrically, phase reversal is supervised (pumps are powered 3-phase, 408V), as well as pump fault, and loss of power. If a Jockey pump is provided, similar points shall also be supervised. A jockey pump is sometimes used to provide additional water pressure to a pump.

CONTINUE

Room temperature supervision



Some systems monitor room temperature required by the Authority Having Jurisdiction. If the temperature is too low, the sprinkler system will not function properly.

A supervisory signal must be generated if the **room temperature gets *down* to 40°F** and its **restoration to *above* 40°F**.

CONTINUE

With all supervisory functions, NFPA 72 2016 requires two distinct signals:

1. **For abnormal conditions**
2. **For the return to normal conditions**

CONTINUE

Let's do a quick check about what has been covered so far.

Supervising and monitoring the water supply levels are important to make certain that there is a reliable water supply for our automatic sprinkler system.

A ________ must result if the level varies 3 inches in either the high or low direction.

Type your answer here

SUBMIT

A pump running signal can be supervisory or an alarm signal. All other fire pump signals shall be _____ per *NFPA* 72 2016, Section 23.8.5.9.2.

Type your answer here

SUBMIT

Complete the knowledge check above before moving on.

After completing this module, you should now have a better understanding of the different types of detection and supervisory devices for fire alarm systems.

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

Ohio Fire Alarm and Detection Equipment-Location and Spacing

FIRE TECH PRODUCTIONS

Welcome to the Location and Spacing module of the Ohio Fire Alarm and Detection Systems Course.

By the end of this module, you will be able to do the following:

- Calculate proper spacing of heat detectors based on room size.
- Apply heat detector location and spacing rules for complex ceiling construction scenarios (beams, joists, slopes, and combinations).
- Properly protect smoke detectors when installed during construction.
- Apply smoke detector location and spacing rules for different types of detectors and various ceiling construction schemes.
- Identify location and spacing considerations for flame detectors and spark/ember detectors.
- Apply location and spacing rules for manual fire alarms.

Key References for this module:

- *NFPA* 72 - National Fire Alarm and Signaling Code, Chapter 17, 2016

- Ohio Fire Code (https://codes.iccsafe.org/content/OHFCJAN2019E/ohio-administrative-code-1301-7-7-09-fire-protection-systems)

When you are ready to begin, click on the button above to start the course.

Heat Detector Location and Spacing

Smoke Detector Location and Spacing

Radiant Energy-Sensing Detector Location and Spacing

Lesson 1 of 3

Heat Detector Location and Spacing

Is one detector enough for a whole house? Can one smoke detector and one heat detector per floor of a building meet the requirements? Location and spacing of fire alarm detection devices is critical for safety in the event of a fire. This module will explain the proper locations and spacing for fire alarm detection devices.

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Identify General Requirements for initiating devices
2. Calculate proper spacing of heat detectors based on room size.

3 Apply heat detector location and spacing rules for complex ceiling construction scenarios (beams, joists, slopes, and combinations).

CONTINUE

Due to the fact that fire detectors respond to various fire signatures such as **heat, smoke, and radiant energy**, it is necessary for them to be located where they are most likely to encounter these stimuli.

It is also necessary for there to be **enough detectors** in a given hazard location to assure that the **heat, smoke, and/or radiant energy** are **detected in the quickest practical time**.

> **Careful consideration should be given to detector *spacing*.**

GENERAL REQUIREMENTS FOR INITIATING DEVICES

General Requirements for Initiating Devices

***NFPA* 72 2016, Section 17.4**

First, we will review the general requirements for detectors of all kinds based on ***NFPA* 72 2016, Section 17.4**

- Devices shall be supported independently of their attachment to conductors.

- Devices shall be installed in such a manner that provides accessibility for periodic maintenance.
- Duplicate leads, terminals, or connectors that provide for the connection of installation wiring shall be provided to monitor the integrity of the signaling and power wiring.

Refer to ***NFPA* 72 2016, Figure A.17.4.6(a)**, Correct (and Incorrect) Wiring Methods, Page 210

- When a protective guard is used to prevent mechanical damage to a device it must be listed for the application.

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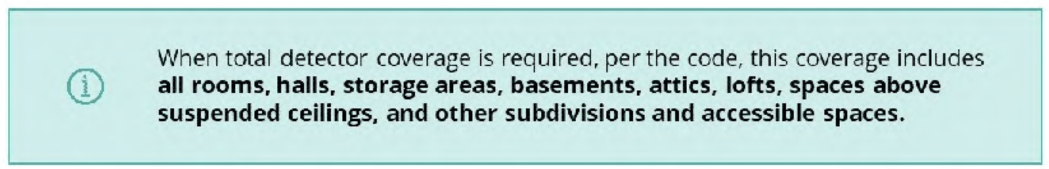
Requirements for Smoke and Heat Detectors

NFPA 72 2016, Section 17.5

Total coverage is defined in ***NFPA* 72 2016, Section 17.5.3.1**. Total (complete) coverage is only required if specified by the local Authority

Having Jurisdiction (AHJ) or codes.


When total detector coverage is required, per the code, this coverage includes **all rooms, halls, storage areas, basements, attics, lofts, spaces above suspended ceilings, and other subdivisions and accessible spaces.**

There are exceptions in the total coverage requirements listed in the code.

- If a detector is to be recess mounted, it must be tested and listed for recessed mounting.
- If a partition extends within 15% of the ceiling height, the spaces separated by the partitions shall be considered separate rooms.

CONTINUE

Let's do a quick check about what has been covered so far.

When total detector coverage is required, per the code, this coverage includes all of the following: (Select all that apply)

☐ Rooms

☐ Halls

☐ Storage areas

☐ Basements

☐ Attics

☐ Lofts

☐ Spaces above suspended ceilings

SUBMIT

🔒 Complete the knowledge check above before moving on.

Spacing

NFPA 72 2016, Section 17.6.3.1.1

The type of ceiling construction can definitely impact the flow of the convection currents carrying the heat across the ceiling.

With **smooth ceilings**, we have **two options** with regard to spacing our detectors. These two rules will apply:

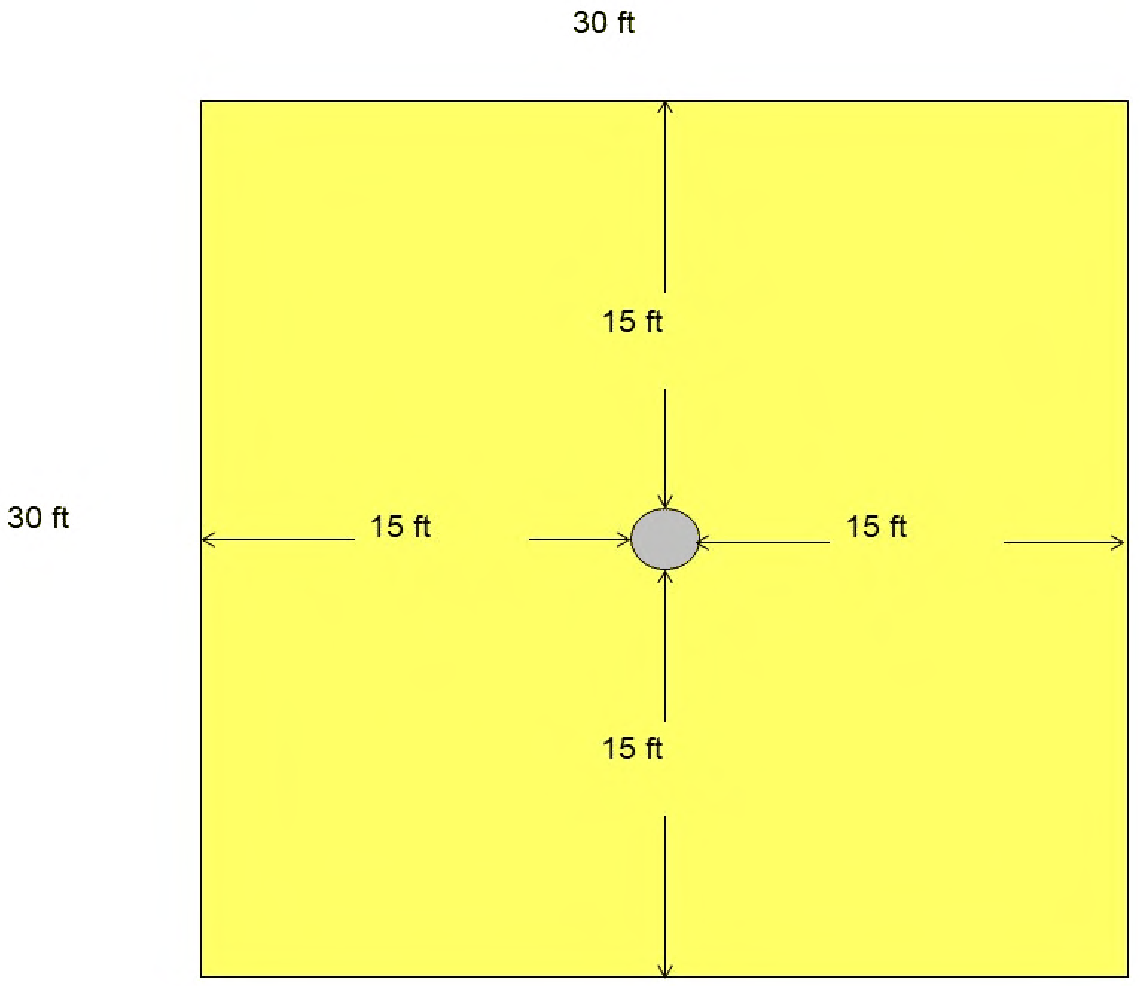
1. **The distance between detectors shall not exceed their listed spacing**. This option also requires that there shall be detectors within a distance of one-half the listed spacing, measured at a right angle, from all walls or partitions extending to within the top 15% of the ceiling.

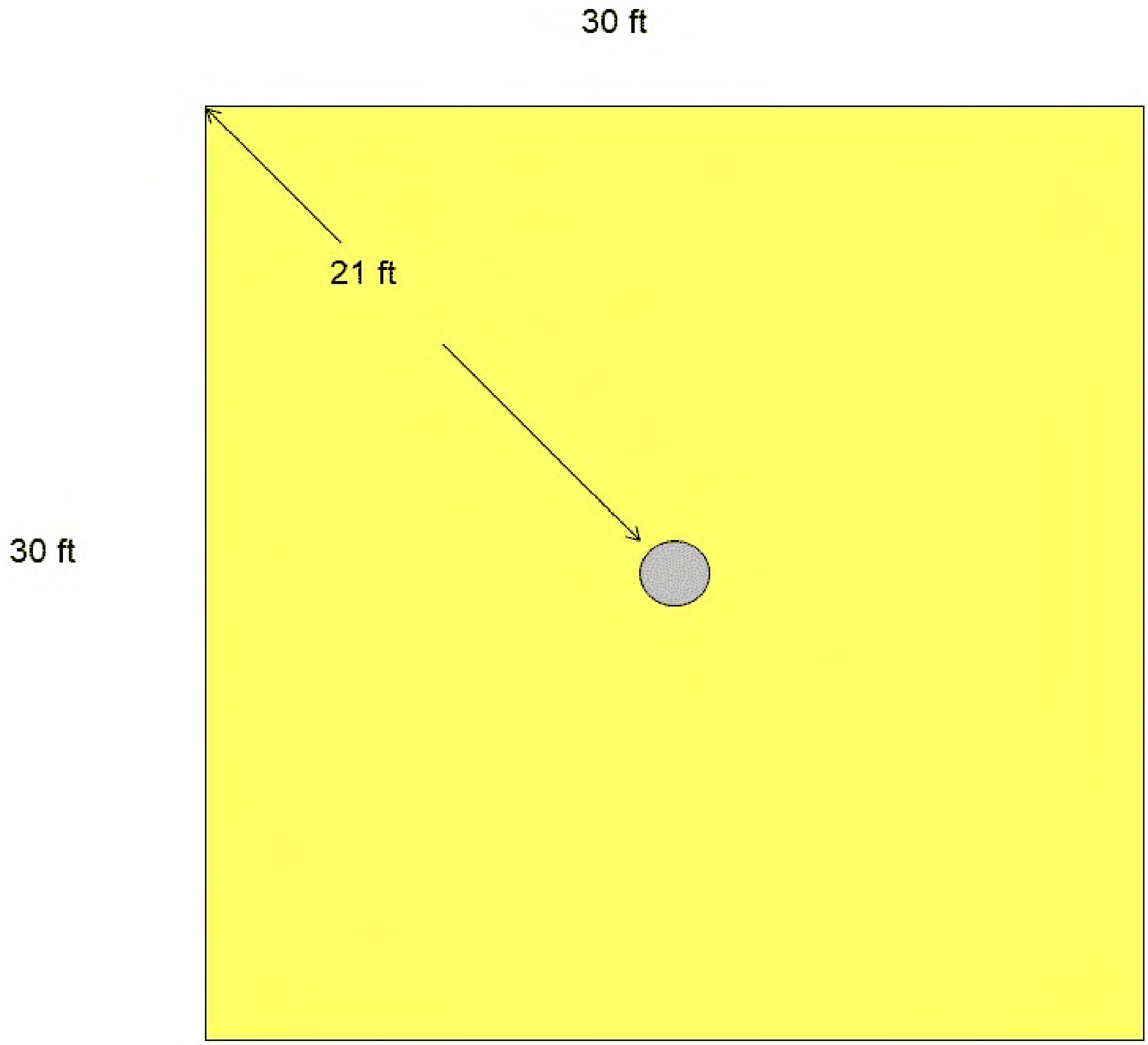
2. All points on the ceiling shall have a detector within a distance equal to or less than 0.7 times the listed spacing (0.7S)

30 x 30-FOOT ROOM

This diagram shows that for a 30 x 30-ft. room (900 foot^2):

- Heat detector is listed at 30-ft. spacing.
- If the detector is located at half the listed spacing from the walls, the detector will end up in the center of a room (15 ft. from each wall).


30 ft
30 ft
15 ft
15 ft
15 ft
15 ft



This diagram shows the same space and detector as the previous example.

If the detector is located at a 45° angle from any of the corners, the detector will end up in the center of a room. This also happens to be 15 ft. from each wall. Within this space, all points on the ceiling will be within 21 ft. of the detector.

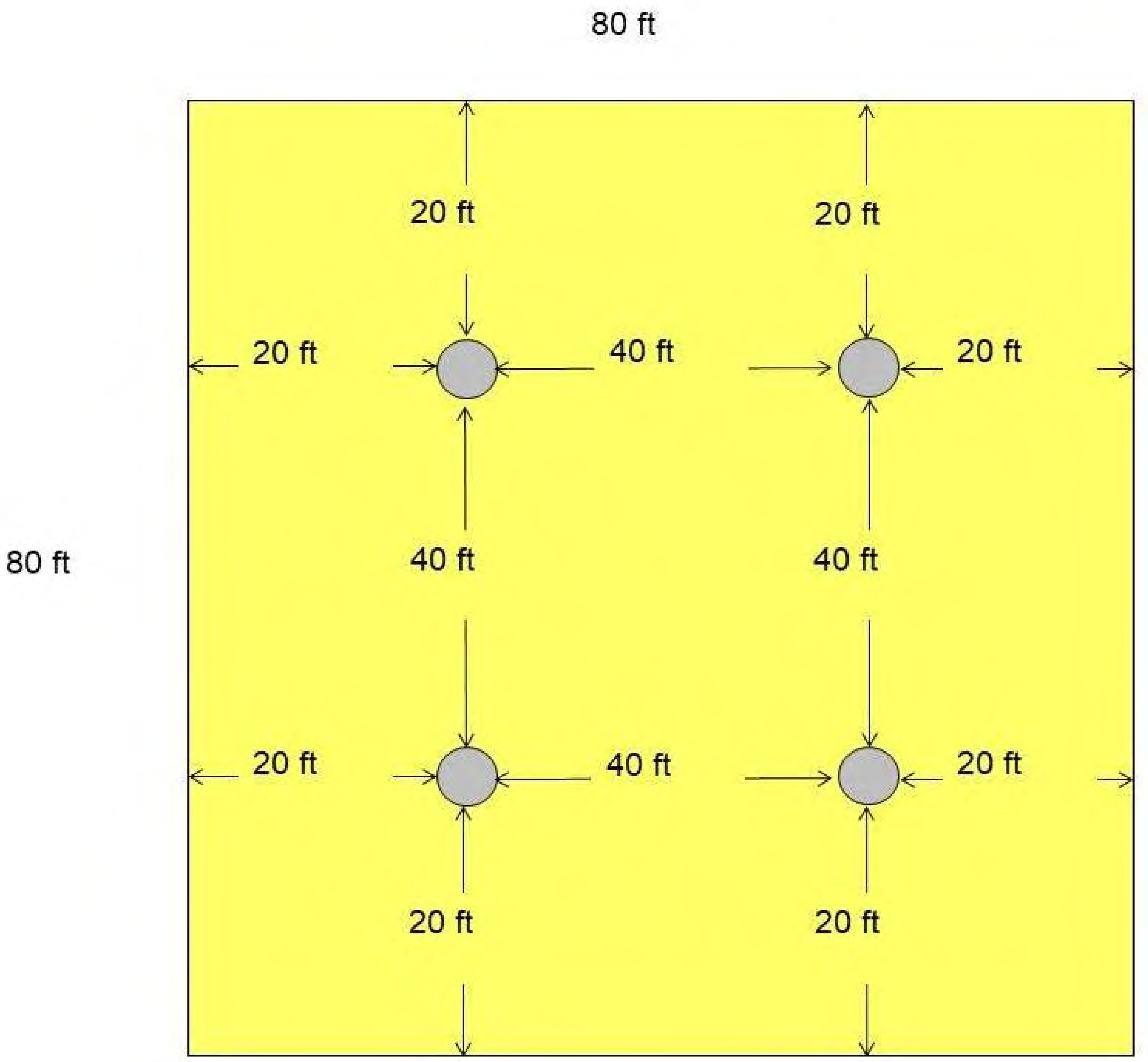
0.7 x 30 ft. = 21 ft. (that is a radius).

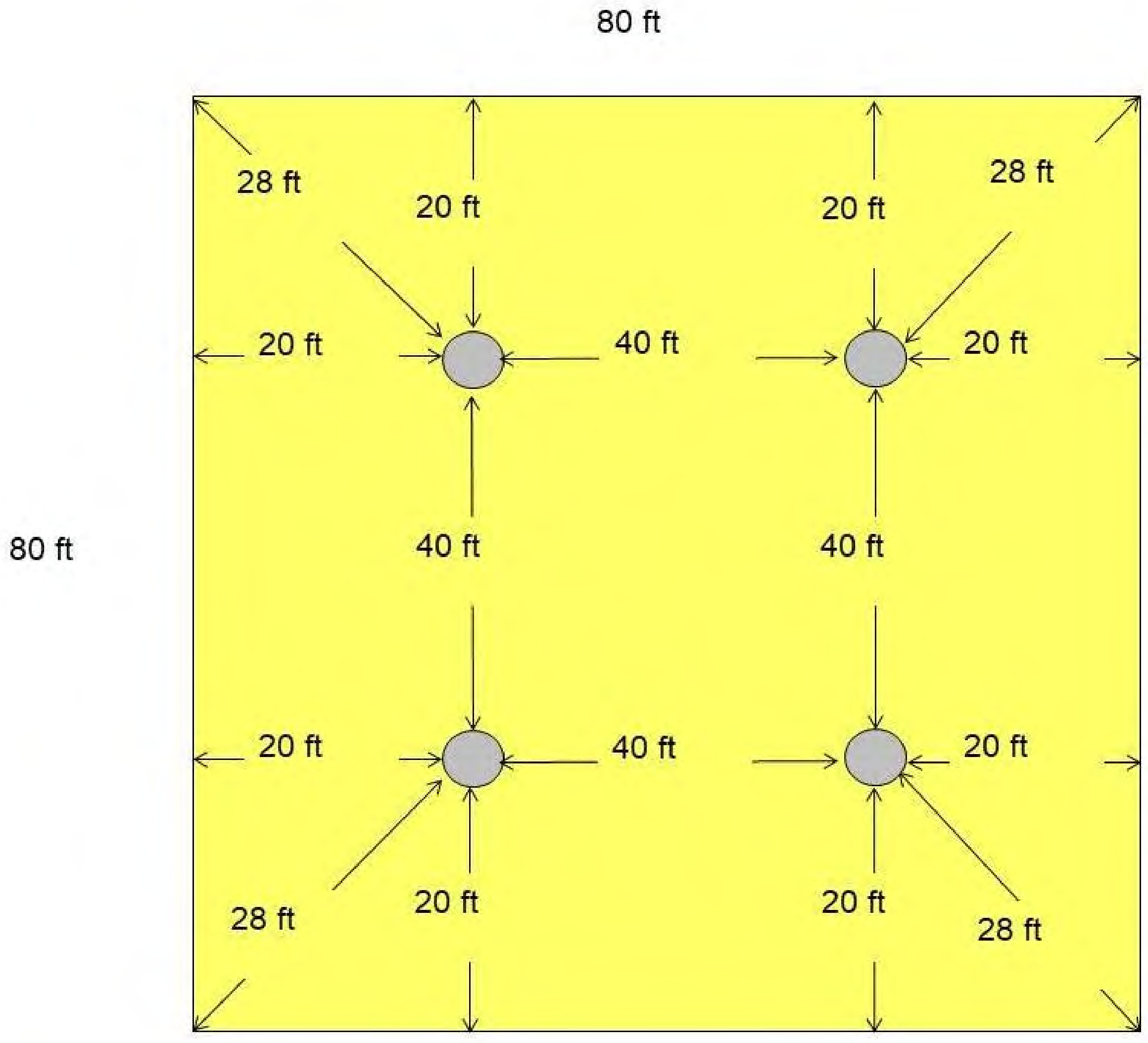
80 x 80 FOOT ROOM

Detector spacing is 40 ft.

The top left detector is located at half its spacing from top and left walls (20 ft). The same process is followed for the remaining 3 corners.

The distance between the top 2 detectors and bottom 2 detectors is 40 ft.


80 ft
20 ft
20 ft
20 ft
40 ft
20 ft
80 ft
40 ft
40 ft
20 ft
40 ft
20 ft
20 ft
20 ft



Same room and detectors using the 0.7 spacing rule.

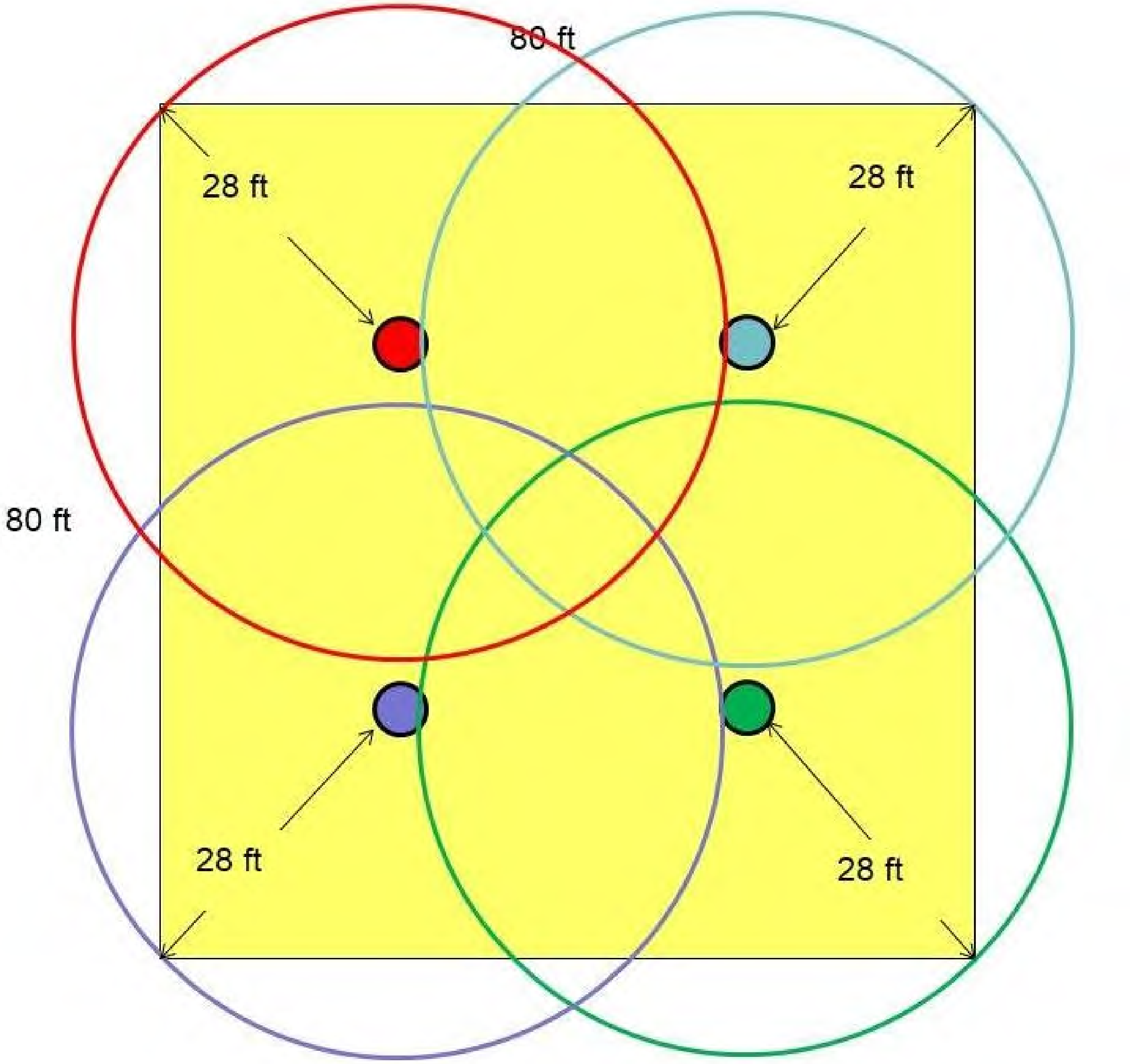
The first detector is located 28 ft. diagonally (45°) from the nearest corner.

The same process is followed for the remaining 3 corners.

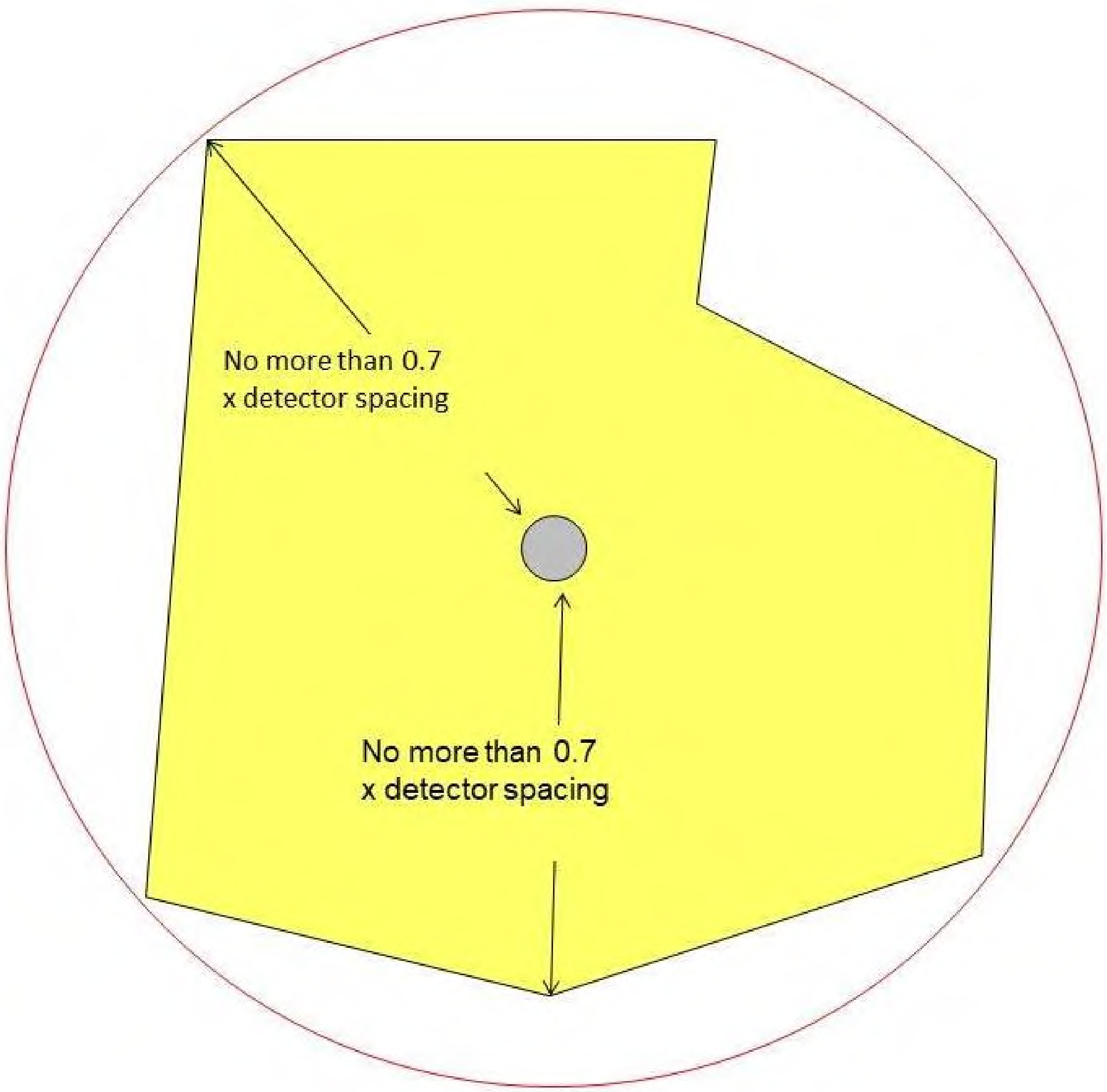
We end up with the same dimensions as using Rule 1.

Same room using the 0.7 spacing rule (Rule 2)

Each circle represents a 28-ft. radius to see where each detector's area of coverage is located.



IRREGULAR SHAPED SPACE



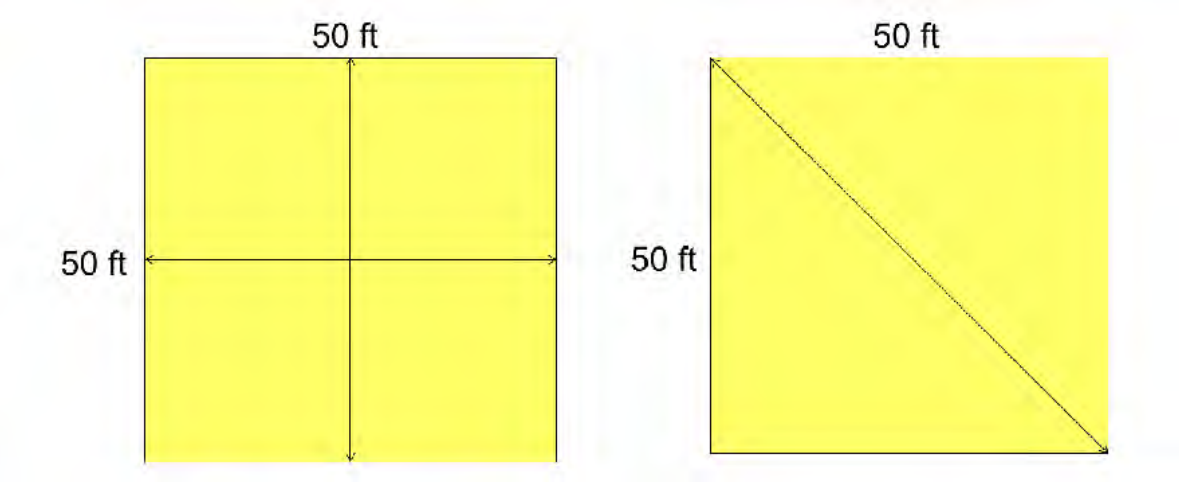
The 0.7 spacing rule is very useful for irregularly shaped spaces such as the example (on the left).

Per ***NFPA* 72 2016**, no space on the ceiling may be more than 0.7 x the detector’s spacing (0.7S) away from the nearest detector.

CONTINUE

Let's do a quick check about what has been covered so far.

The 0.7 spacing rule says that all points on the ceiling shall have a detector within a distance equal to 0.7 times the listed spacing. Based on this rule, if the detector is listed at 30 ft. spacing, how many detectors are required for a 2500 (ft^2) room?



○ One

○ Two

○ Four

SUBMIT

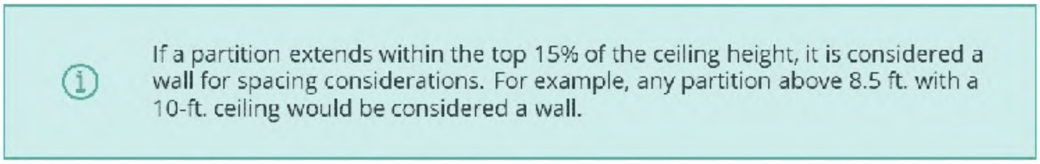
Complete the knowledge check above before moving on.

Location

NFPA 72 2016, Section 17.6.3.1.3

Spot-type detectors shall be located on the ceiling not less than 4 in. from the side wall or on the side walls *between* 4 in. and 12 in. from the ceiling.

Line-type heat detectors shall be located on the ceiling or on the sidewalls not more than 20 in. from the ceiling.



If a partition extends within the top 15% of the ceiling height, it is considered a wall for spacing considerations. For example, any partition above 8.5 ft. with a 10-ft. ceiling would be considered a wall.

SOLID JOIST CONSTRUCTION

Solid Joist Construction

NFPA 72 2016, Section 17.6.3.2

The location and spacing rules for heat detectors become more complex when you have ceilings with beams, joists, slopes, and combinations of those constructions.

Joists are solid projections, whether structural or not, **extending downward from the ceiling** that are **more than 4 in. in depth and are spaced on centers of 36 in. or less**. The 2 in. by 10 in. rafter installed on 16 in. centers supporting a roof deck is typical of solid joist construction.

If a joist is less than 4 in. in depth, it is considered a smooth ceiling for detector spacing purposes.

The spacing of heat detectors, when measured at right angles to a solid joist, shall not exceed 50% of the smooth ceiling spacing (derating is a factor if the ceiling height is above 10 ft).

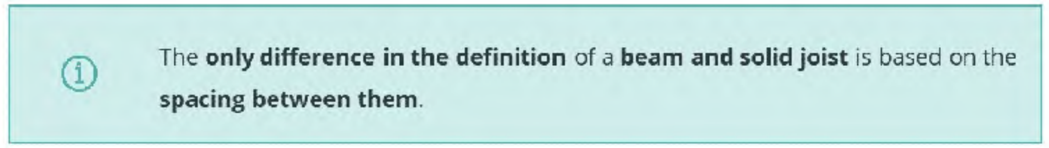
Heat detectors shall be mounted on the bottom of joists.

BEAM CONSTRUCTION

Beam Construction

NFPA 72 2016, Section 17.6.3.3

Beams are solid projections, whether structural or not, **extending downward from the ceiling** that are **more than 4 in. in depth and are spaced on centers of more than 36 in**.



ⓘ The **only difference in the definition** of a **beam and solid joist** is based on the **spacing between them**.

Heat detector spacing on beams can get complicated.

If beams are 4 in. or less in depth, the ceiling is considered a smooth ceiling for spacing purposes.

CONTINUE

If beams are more than 4 in. in depth, detector spacing at right angles to the beams are reduced to 2/3 spacing (66%).

If beams are more than 18 in. in depth and more than 8 ft. on center, place detectors in beam pockets.

If the beams are less than 12 in. in depth and less than 8 ft. on center, detectors may be placed on the bottom of the beams.

CONTINUE

NFPA 72 2016, Section 17.6.3.3 (continued)

The ratio of beam depth to ceiling height and beam spacing to ceiling height can help to determine if the heat detectors should be located in the beam pockets or on the bottom of the beams. The following information comes from ***NFPA* 72 2016, Annex A, Section A.17.6.3.3**:

- If the depth ÷ height is greater than 0.10 AND the spacing ÷ height is greater than 0.40, then the detectors ***SHOULD*** be located in each beam pocket.

- If the depth ÷ height is less than 0.10 OR the spacing ÷ height is less than 0.40, then the detectors ***SHOULD*** be located on the bottom of the beams.

CONTINUE

Let's do a quick check about what has been covered so far.

______ are solid projections, whether structural or not, extending downward from the ceiling that are more than 4 in. in depth and are spaced on centers of 36 in. or less.

○ Joists

○ Beams

SUBMIT

If beams are ______ or less in depth, the ceiling is considered a smooth ceiling for spacing purposes.

○ 2 in.

○ 4 in.

○ 8 in.

SUBMIT

If the beams are less than 12 in. in depth and less than 8 ft. on center, where should the detectors be placed?

○ in beam pockets

○ on the bottom of the beams

SUBMIT

🔒 Complete the knowledge check above before moving on.

Sloping Ceilings (Peaked and Shed)

NFPA 72 2016, Section 17.6.3.4

The first factor to determine is the angle of the slope of the ceiling.

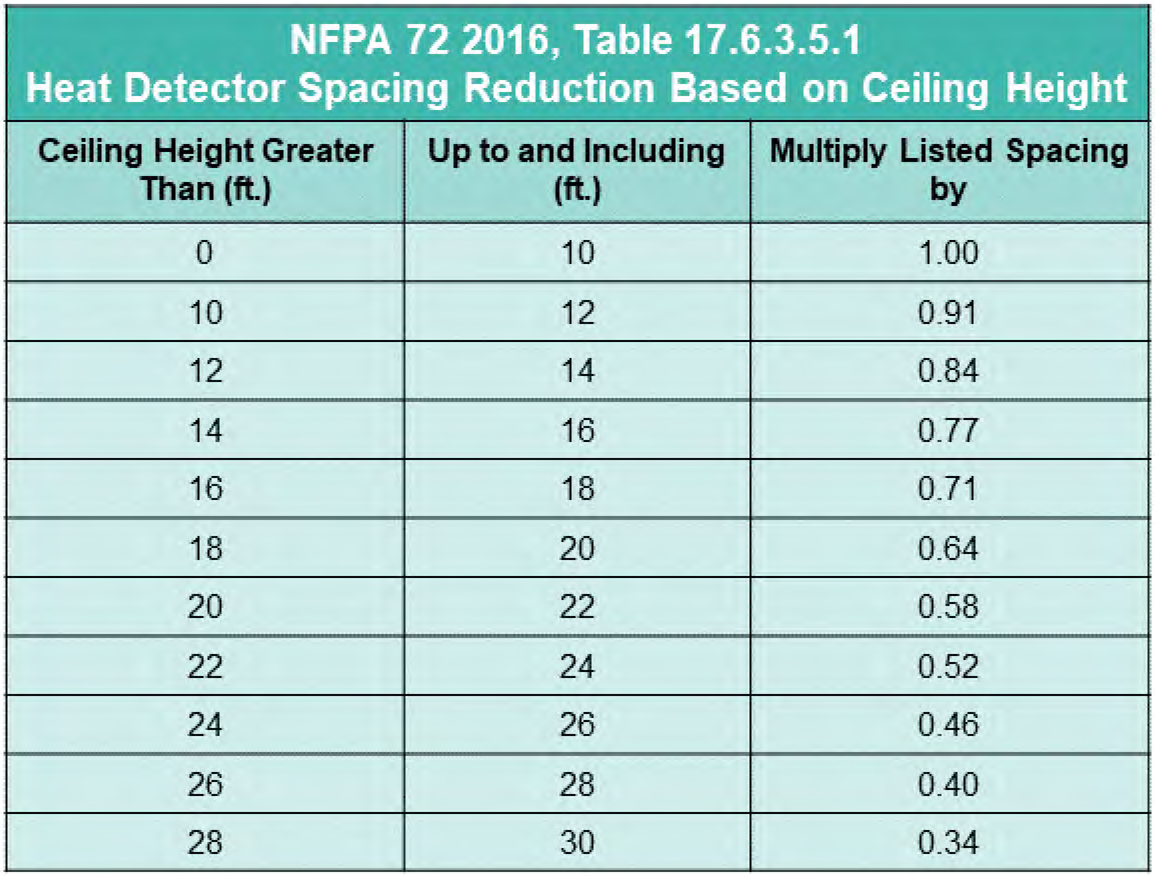
Since heat detector spacing is dependent on the height of the ceiling, we need to determine the height to use for spacing reduction on the sloped ceiling.

If the slope of the ceiling is less than 30 degrees, the height of the peak should be used for spacing determination.

If the slope of the ceiling is equal to or more than 30 degrees, all detectors, other than those located in the peak, shall be spaced using the average slope height or the height of the peak (designer's choice unless local codes determine otherwise).

The first row of detectors shall be located at or within 36 in. from the peak of the ceiling.

The spacing for the remainder of the slope will be determined by using the ceiling height and referring to Table 17.6.3.5.1 (below).



NFPA 72 2016, Table 17.6.3.5.1
Heat Detector Spacing Reduction Based on Ceiling Height

Ceiling Height Greater Than (ft.)	Up to and Including (ft.)	Multiply Listed Spacing by
0	10	1.00
10	12	0.91
12	14	0.84
14	16	0.77
16	18	0.71
18	20	0.64
20	22	0.58
22	24	0.52
24	26	0.46
26	28	0.40
28	30	0.34

NFPA 72 2016, SECTION 17.6.3.5

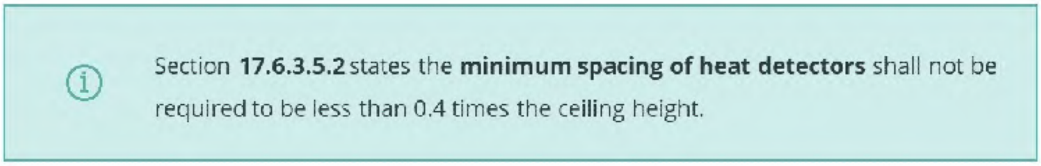
NFPA 72 2016, Section 17.6.3.5

Ceilings 10 to 30 ft. high require reduced spacing for heat detectors. *NFPA* 72 2016, Table 17.6.3.5.1 specifies a reduction factor.

Assuming our heat detector has a listed spacing of 30 feet, calculate for S.

Example 1: 16 ft. ceiling, S = listed spacing x 0.71 (21.3 ft.)

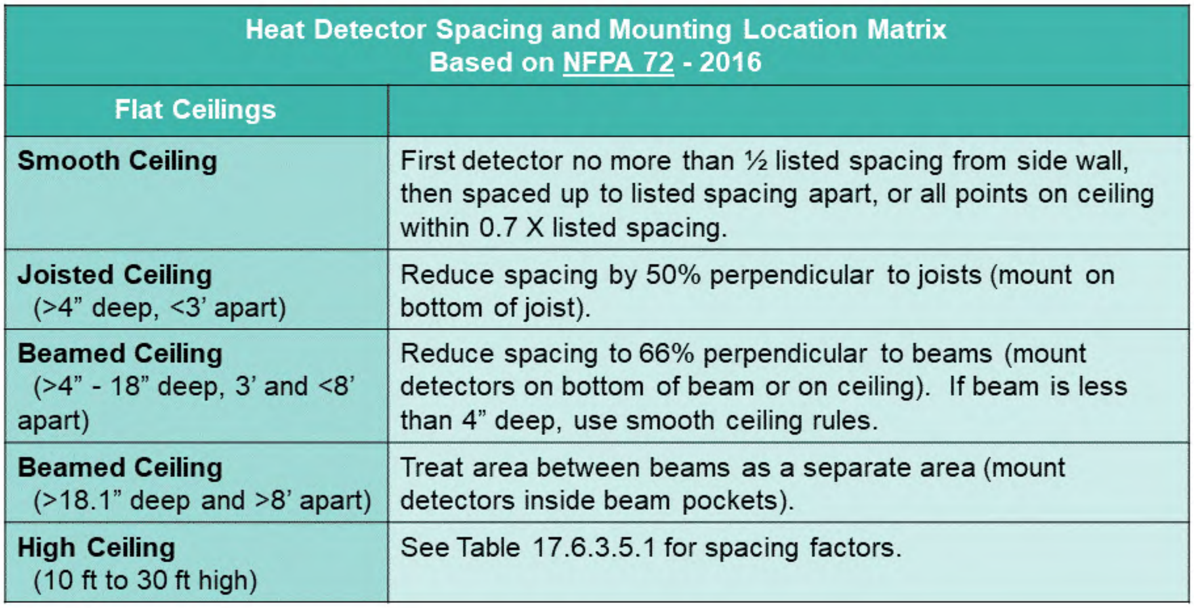
Example 2: 18 ft, 1-in. ceiling, S = listed spacing x 0.64 (19.2 ft.)



ⓘ Section **17.6.3.5.2** states the **minimum spacing of heat detectors** shall not be required to be less than 0.4 times the ceiling height.

SPOT TYPE HEAT DETECTOR SPACING FOR FLAT CEILINGS

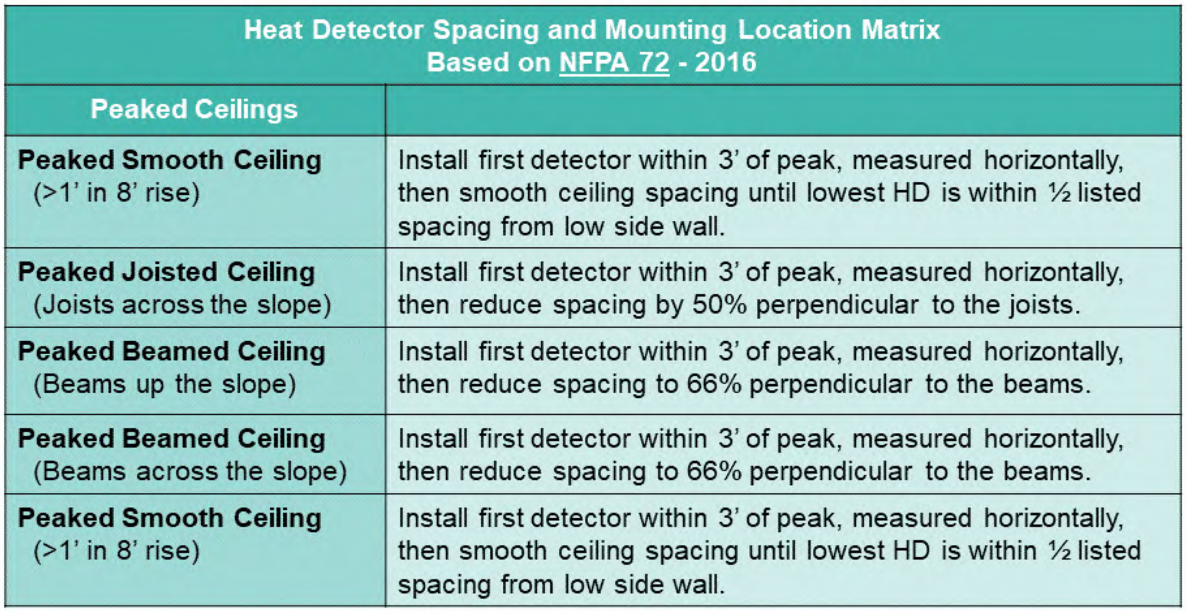
Below is a chart that defines spot type heat detector spacing for the various types of **flat ceiling** configurations.



Heat Detector Spacing and Mounting Location Matrix Based on NFPA 72 - 2016	
Flat Ceilings	
Smooth Ceiling	First detector no more than ½ listed spacing from side wall, then spaced up to listed spacing apart, or all points on ceiling within 0.7 X listed spacing.
Joisted Ceiling (>4" deep, <3' apart)	Reduce spacing by 50% perpendicular to joists (mount on bottom of joist).
Beamed Ceiling (>4" - 18" deep, 3' and <8' apart)	Reduce spacing to 66% perpendicular to beams (mount detectors on bottom of beam or on ceiling). If beam is less than 4" deep, use smooth ceiling rules.
Beamed Ceiling (>18.1" deep and >8' apart)	Treat area between beams as a separate area (mount detectors inside beam pockets).
High Ceiling (10 ft to 30 ft high)	See Table 17.6.3.5.1 for spacing factors.

SPOT TYPE HEAT DETECTOR SPACING FOR PEAKED CEILINGS

Below is a chart that defines spot type heat detector spacing for the various types of **peaked ceiling** configurations.



Heat Detector Spacing and Mounting Location Matrix
Based on NFPA 72 - 2016

Peaked Ceilings	
Peaked Smooth Ceiling (>1' in 8' rise)	Install first detector within 3' of peak, measured horizontally, then smooth ceiling spacing until lowest HD is within ½ listed spacing from low side wall.
Peaked Joisted Ceiling (Joists across the slope)	Install first detector within 3' of peak, measured horizontally, then reduce spacing by 50% perpendicular to the joists.
Peaked Beamed Ceiling (Beams up the slope)	Install first detector within 3' of peak, measured horizontally, then reduce spacing to 66% perpendicular to the beams.
Peaked Beamed Ceiling (Beams across the slope)	Install first detector within 3' of peak, measured horizontally, then reduce spacing to 66% perpendicular to the beams.
Peaked Smooth Ceiling (>1' in 8' rise)	Install first detector within 3' of peak, measured horizontally, then smooth ceiling spacing until lowest HD is within ½ listed spacing from low side wall.

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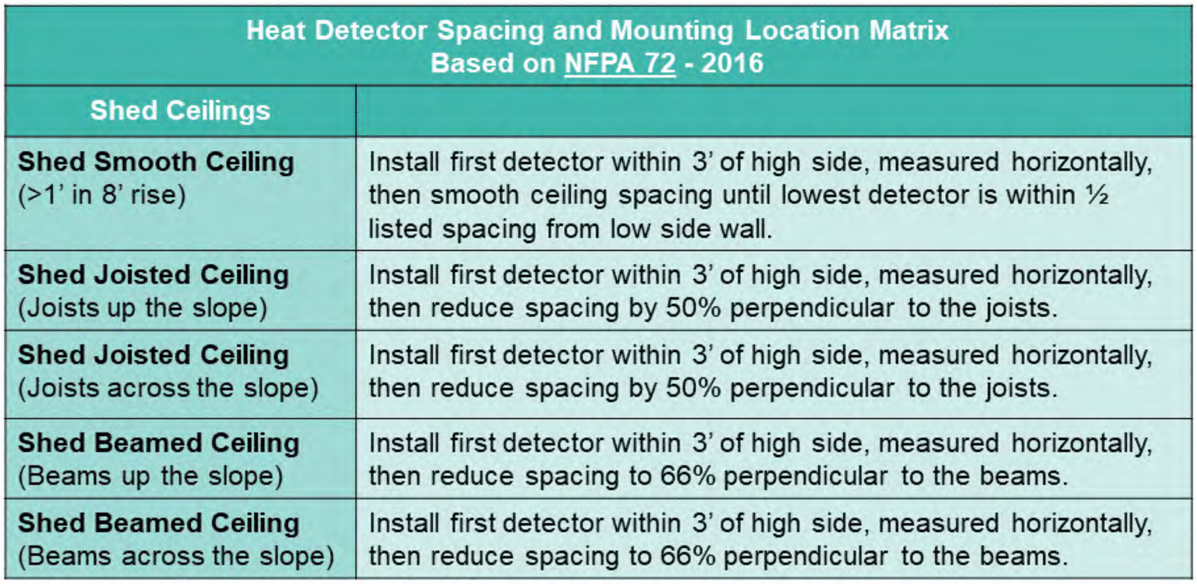
SPOT TYPE HEAT DETECTOR SPACING FOR SHED CEILINGS

Below is a chart that defines spot type heat detector spacing for the various types of **shed ceiling** configurations.



Heat Detector Spacing and Mounting Location Matrix Based on NFPA 72 - 2016	
Shed Ceilings	
Shed Smooth Ceiling (>1' in 8' rise)	Install first detector within 3' of high side, measured horizontally, then smooth ceiling spacing until lowest detector is within ½ listed spacing from low side wall.
Shed Joisted Ceiling (Joists up the slope)	Install first detector within 3' of high side, measured horizontally, then reduce spacing by 50% perpendicular to the joists.
Shed Joisted Ceiling (Joists across the slope)	Install first detector within 3' of high side, measured horizontally, then reduce spacing by 50% perpendicular to the joists.
Shed Beamed Ceiling (Beams up the slope)	Install first detector within 3' of high side, measured horizontally, then reduce spacing to 66% perpendicular to the beams.
Shed Beamed Ceiling (Beams across the slope)	Install first detector within 3' of high side, measured horizontally, then reduce spacing to 66% perpendicular to the beams.

CONTINUE

Let's do a quick check about what has been covered so far with the location of spot type heat detectors on various ceilings.

Sort the cards into the correct categories based on the information for heat detector spacing and mounting for peaked ceilings, keeping in mind that in all situations, the first detector shall be installed within 3 ft. of the peak measured horizontally.

Peaked Smooth Ceiling

Spacing until lowest HD is within 1/2 listed spacing from low side wall

Peaked Joisted Ceiling

Reduce spacing by 50%, perpendicular to the joists

Peaked Beam Ceiling

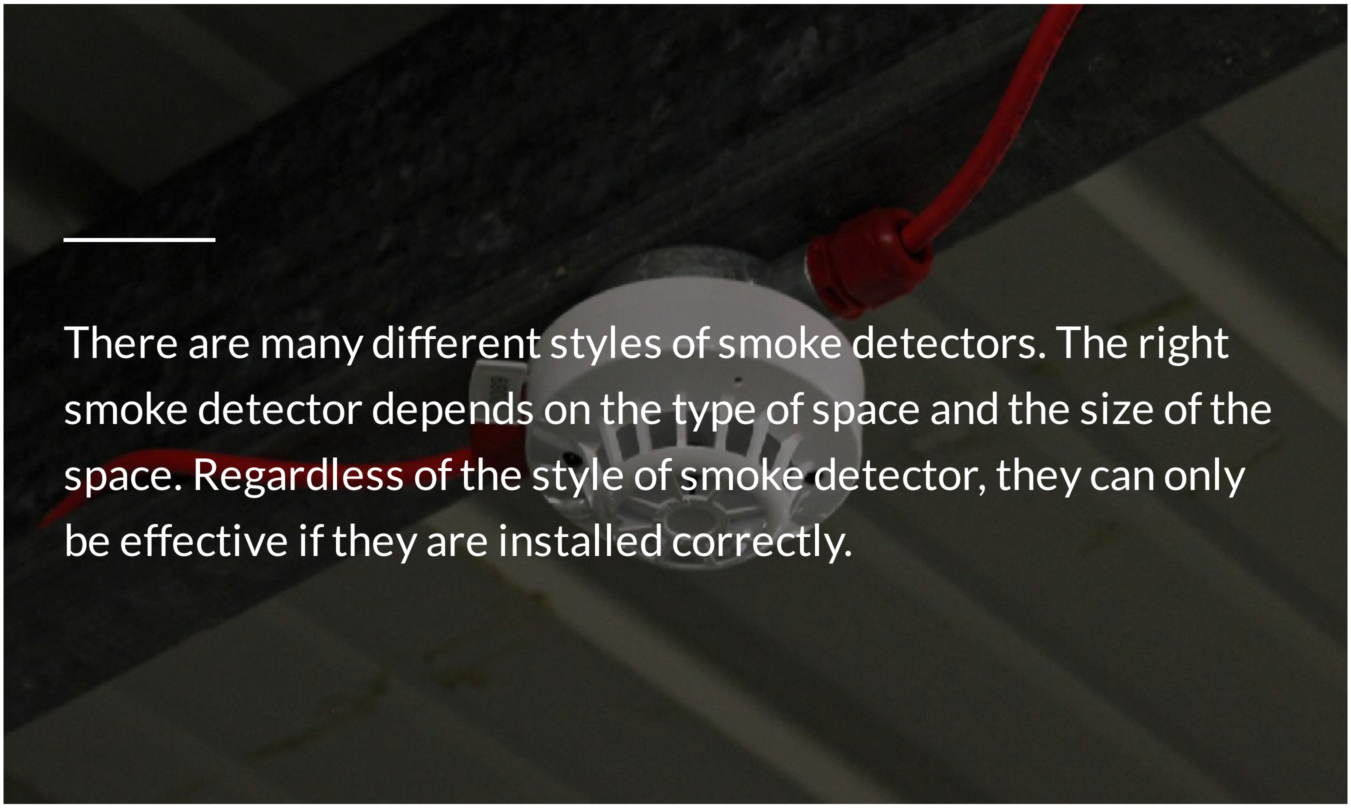
Reduce spacing to 66%

perpendicular to the beams

Complete the knowledge check above before moving on.

Lesson 2 of 3

Smoke Detector Location and Spacing



There are many different styles of smoke detectors. The right smoke detector depends on the type of space and the size of the space. Regardless of the style of smoke detector, they can only be effective if they are installed correctly.

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Properly protect smoke detectors when installed during construction.

2. Apply smoke detector location and spacing rules for different types of detectors and various ceiling construction schemes.

AMBIENT CONDITIONS

Smoke-Sensing Fire Detectors

***NFPA* 72 2016, Section 17.7**

> Where smoke detectors are being installed to control the spread of smoke, they shall be installed in accordance with the requirements of **Section 17.7.5.**

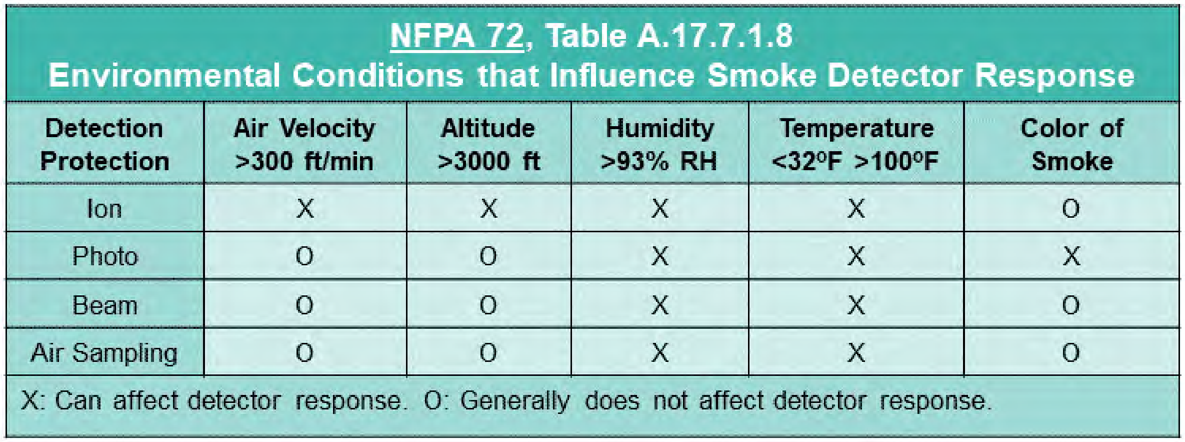
The selection and placement of smoke detectors shall take into account both the performance characteristics of the detector and the areas into which the detectors are to be installed to prevent nuisance and unintentional alarms or improper operation after installation.

Smoke detectors **shall not be installed** if any of the following ambient conditions exist, unless specifically **designed** and **listed** for the expected conditions:

- Temperature below 32^{o}F

- Temperature above 100^{O}F
- Relative humidity above 93%
- Air velocity greater than 300 ft/min (1.5m/sec)

***NFPA* 72 2016, Annex A** has a table that details how different detector technologies' response times are affected by environmental conditions.



NFPA 72, Table A.17.7.1.8
Environmental Conditions that Influence Smoke Detector Response

Detection Protection	Air Velocity >300 ft/min	Altitude >3000 ft	Humidity >93% RH	Temperature <32°F >100°F	Color of Smoke
Ion	X	X	X	X	O
Photo	O	O	X	X	X
Beam	O	O	X	X	O
Air Sampling	O	O	X	X	O

X: Can affect detector response. O: Generally does not affect detector response.

The table shows that **ionization detectors are most affected** by the environment, but **photoelectric spot-type detectors** are affected by the **color of the smoke**. Dark smoke will tend to absorb the light rather than reflect the light, making it harder to detect.

PROTECTION DURING CONSTRUCTION

ⓘ ***NFPA** **72 2016, Section 17.7.1.11,*** This section of the code is concerned with smoke detector chambers collecting dust and dirt during building construction.

Protection During Construction

If smoke detectors are installed and used to detect fires during construction, the smoke detectors shall be cleaned and verified to be operating in accordance with the listed sensitivity, or they shall be replaced prior to the final acceptance of the system.

If smoke detectors are installed but not operational during construction, they shall be protected from construction debris, dust, dirt, and damage in accordance with the manufacturer's recommendations and verified to be operating in accordance with the listed sensitivity, or they shall be replaced prior to the final acceptance of the system.

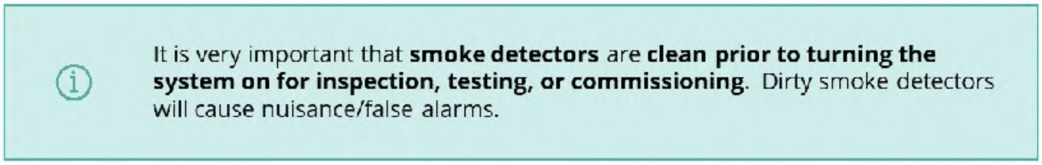
CONTINUE

If the smoke detectors are required to be operational during construction, they **must be cleaned or replaced** after construction is complete.

Another option is to **install approved covers** over the detectors until construction is complete.

Where smoke detection is not required during construction, the detectors shall not be installed until after all other construction trades have completed cleanup.

ⓘ If the detectors are not required to be operational during construction, the detectors shall not be installed until after all other trades have completed cleanup. If they are required for signal initiation during construction, they are required to be *cleaned and verified* to be operating per their listed sensitivity, or replaced prior to final acceptance test of the system. **- *NFPA* 72 2016, Section 17.7.1.11**


ⓘ It is very important that **smoke detectors** are **clean prior to turning the system on for inspection, testing, or commissioning**. Dirty smoke detectors will cause nuisance/false alarms.

CONTINUE

Let's do a quick check about what has been covered so far.

Smoke detectors **shall not be installed** if any of the following ambient conditions exist, unless specifically **designed** and **listed** for the expected conditions: (Select all that apply)

☐ Temperature below 0°F

☐ Temperature above 100°F

☐ Relative humidity above 93%

☐ Air velocity greater than 300 ft/min (1.5m/sec)

SUBMIT

If the smoke detectors are required to be operational during construction, the following must be adhered to: (Select all that apply)

☐ They must be cleaned or replaced after construction is complete.

☐ They must have approved covers installed over the detectors until construction is complete.

☐ They must be tested weekly until construction is complete.

☐ They must be cleaned and verified to be operating in accordance with the listed sensitivity.

SUBMIT

Complete the knowledge check above before moving on.

Location and Spacing

NFPA 72 2016, Section 17.7.3

Section 17.7.3.2 is titled Spot-Type Smoke Detectors. The ionization and photoelectric light scattering detectors are spot-type smoke detectors. This section also covers the different types of ceilings you may encounter and how smoke detectors are to be spaced or located.

Section A.17.7.3.2 states that in high ceiling areas where spot-type detectors are not accessible for maintenance, projected beam or air sampling detectors should be considered where access can be provided.

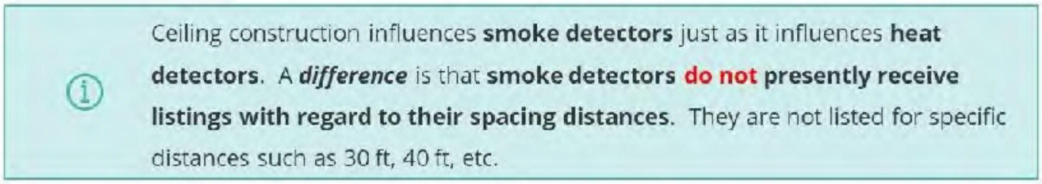
Spot-type smoke detectors must be located on the ceiling or on the wall not more than 12 in. from the ceiling to the top of the detector. Smoke detectors must always be mounted in the orientation that they have been listed for, even if they are installed under a raised floor.

If smoke detectors are used in high rack storage, they should be mounted above each aisle and at intermediate levels in the racks, per **Section A.17.7.6.2.**

SPOT-TYPE SMOKE DETECTORS

Spot-Type Smoke Detectors

NFPA 72 2016, Section 17.7.3.2



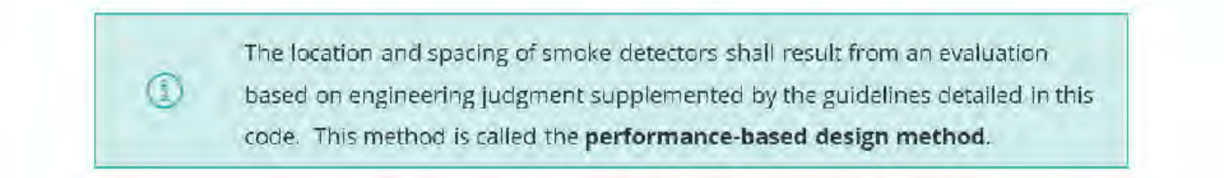
Ceiling construction influences **smoke detectors** just as it influences **heat detectors**. A ***difference*** is that **smoke detectors do not presently receive listings with regard to their spacing distances**. They are not listed for specific distances such as 30 ft, 40 ft, etc.

For **smooth ceiling construction**, the code allows for **30-ft. spacing** to be used as a guide (manufacturer's instructions shall always be followed). Considerations involving spacing may include factors such as **ceiling height** and **special response requirements**.

As with the heat detectors, the **code dictates that any point on the ceiling must be within a distance of 0.7 times the selected spacing**, whatever that may be.

With **projected beam detectors**, the manufacturer's installation instructions must be followed. For **smooth ceilings, a spacing of 60 ft.** can be used as a guide.

CONTINUE



The location and spacing of smoke detectors shall result from an evaluation based on engineering judgment supplemented by the guidelines detailed in this code. This method is called the **performance-based design method**.

The prescriptive requirements of the code apply to ordinary indoor locations.

The spacing requirements and method of layout for spot-type smoke detectors are similar to the spacing we covered for spot-type heat detectors. The difference is that **spacing for spot-type smoke detectors are not required to be reduced for ceiling heights over 10 ft.**

- **Or at least, there is no table in *NFPA* 72 2016 that covers this.**
- **Always consult the manufacturer's published instructions.**

JOIST AND BEAM CONSTRUCTION

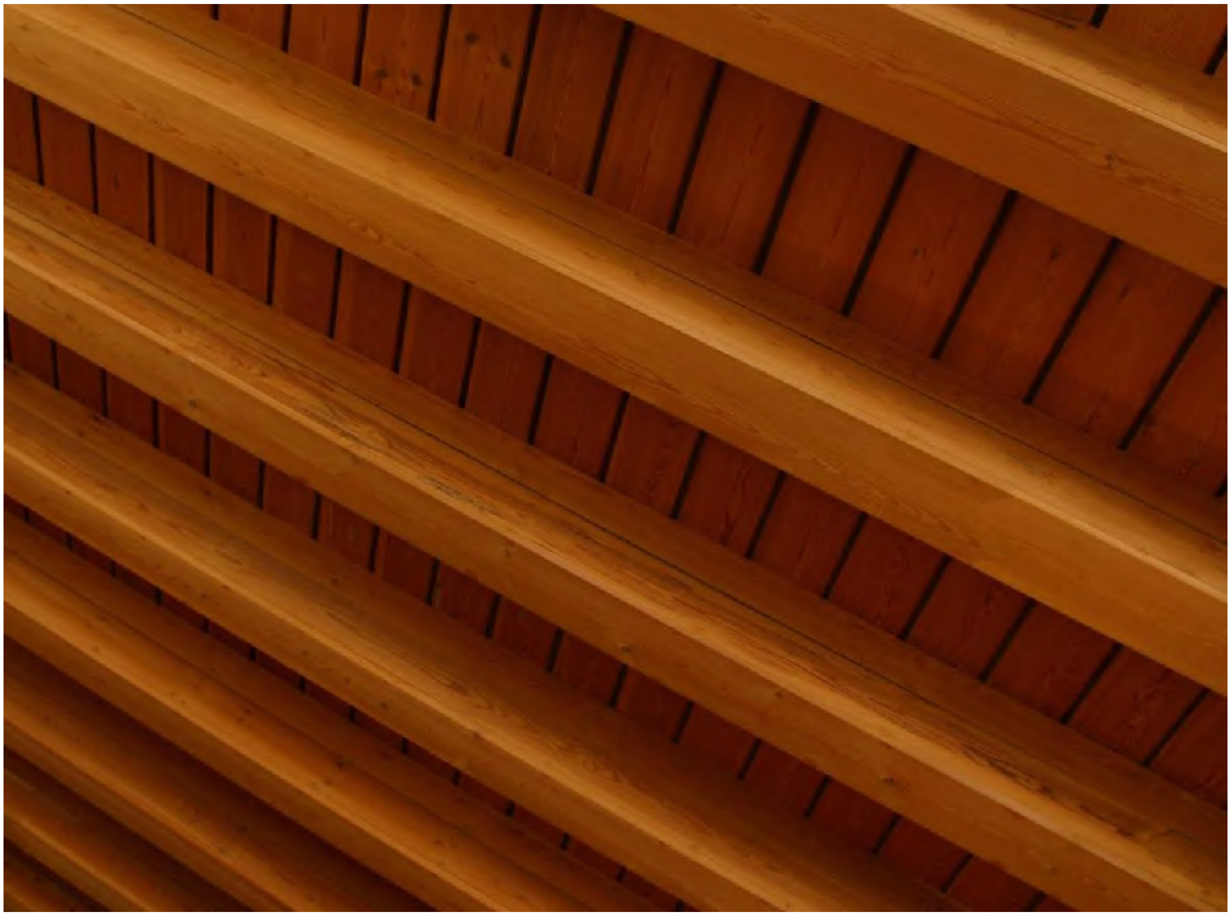
The rules for spacing of smoke detectors are the same for beams as they are for solid joist construction. With solid joist construction, **joists which are 10% of ceiling height or less in depth are permitted to be considered equivalent to a smooth ceiling**.

- Spot-type detectors can be mounted on the bottom of these joists or the ceiling.

Beams and joists that are more than 10% of the ceiling height have different location and spacing rules determined by the spacing of the beams or joists and whether the ceiling is sloped or peaked.

We will not discuss all of the different configurations for joists and beams as we did with heat detectors.   The different scenarios could be a week-long class in and of itself.

Make sure to read the code very carefully for spot-type smoke detector spacing in these applications beginning on page 101.   **The location and spacing requirements deal with ratios of joist or beam depth to ceiling height. Those ratios determine if we mount the smoke detectors on the ceiling or on the bottom of the joist or beam**.



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PEAKED CEILINGS

Peaked Ceilings

NFPA 72 2016, Section 17.7.3.3

Spot-type smoke detectors installed on sloping peaked-type ceilings (peaked ceilings) will have the first detector **spaced** and **located within 3 ft. of the peak** and measured **horizontally**.

The number and spacing of additional detectors, if any, shall be based upon the **horizontal projection of the ceiling** (same requirement as spot-type heat detectors).

SHED CEILINGS

Shed Ceilings

NFPA 72 2016, Section 17.7.3.4

Spot-type smoke detectors installed on sloping shed-type ceilings (shed ceilings) will have the first detector **spaced** and l**ocated within 3 ft. of the high side of the ceiling**, measured **horizontally**.

The number and spacing of additional detectors, if any, shall be based on the **horizontal projection of the ceiling**.

CONTINUE

Let's do a quick check about what has been covered so far.

The difference in location and spacing between heat detectors and smoke detectors is that __________ do not presently receive listings with regard to their spacing distances.

○ heat detectors

○ smoke detectors

SUBMIT

Match the following location and spacing requirements:

Spot-type smoke detectors installed on peaked ceilings will have the first detector

spaced and located within 3 ft. of the peak and measured horizontally.

Spot-type smoke detectors installed on shed ceilings will have the first detector

spaced and located within 3 ft. of the high side of the ceiling, measured horizontally.

Spot-type smoke detectors on a smooth ceiling or on the wall must be located	not more than 12 in. from the ceiling to the top of the detector.

SUBMIT

Complete the knowledge check above before moving on.

Raised Floors and Suspended Ceilings

NFPA 72 2016, Section 17.7.3.5

The **spaces under raised floors** or **above suspended ceilings** shall be **treated as separate areas or rooms** for the purpose of smoke detection.

The **detectors installed under raised floors or above suspended ceilings**, including raised floors or spaces above suspended ceilings used for environmental air, **shall not be used in lieu of smoke detection within the room**.

ⓘ Spacing for smoke detectors used under raised floors or in spaces used for environmental air shall be in accordance with the requirements of **Sections 17.7.3.5.1 and 17.7.3.5.2.**

AIR SAMPLING-TYPE SMOKE DETECTORS

Air Sampling-Type Smoke Detectors

NFPA 72 2016, Section 17.7.3.6

Each air sampling port shall be treated as a spot-type smoke detector for the purpose of location and spacing of the ports.

The maximum transport time from the furthest sampling port to the control unit cannot exceed 120 seconds.

The **Sampling pipe network design** details shall include calculations showing the flow characteristics of the pipe network and each sample port.

The system piping must be identified with a sign “SMOKE DETECTOR SAMPLING TUBE — DO NOT DISTURB” at:

1. Changes in direction or branches in piping
2. At each side of a penetration of a wall, floor, or other barrier
3. At piping intervals that provide visibility at least every 20 ft.

PROJECTED BEAM-TYPE SMOKE DETECTORS

Projected Beam-Type Smoke Detectors

NFPA 72 2016, Section 17.7.3.7

A projected beam detector shall be considered as a row of spot-type detectors for level and sloping ceiling locations.

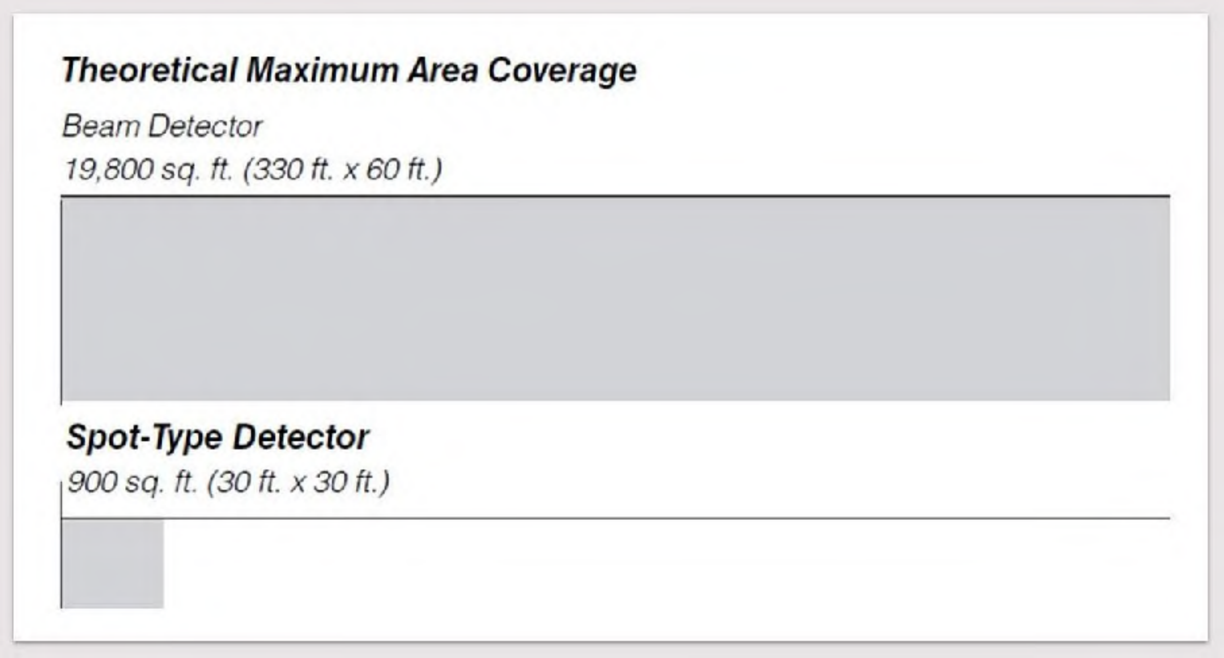
Projected beam detectors are often a good solution to environments where spot-type detectors cannot be used because of dirt, dust, heat, or humidity. They are not as sensitive to these factors unless they are extreme. They are not recommended for outdoor applications where exposed to rain, snow, sleet, or fog.

Mounting beam detectors per the manufacturer’s instructions is critical since building structures move with changes in temperature and other factors. Projected beam-type detectors and mirrors shall be mounted on stable surfaces to prevent false or erratic operation due to movement.

Projected beam-type smoke detectors will normally be located with their projected beams parallel to the ceiling and in accordance with the manufacturer's instructions.

ⓘ **Per Annex A**, for **smooth ceilings**, a **spacing of 60 ft.** can be used as a **guide**.

Projected beam detectors are also good for high ceiling areas where it would be difficult to test and service spot-type detectors. They typically have a range of 330 ft., giving them a theoretical maximum coverage of 19,800 ft^2.



CONTINUE

Let's do a quick check about what has been covered so far.

According to *NFPA* 72, Section 17.7.3.6 the maximum transport time from the furthest air sampling port to the control unit cannot exceed __________.

○ 30 seconds

○ 60 seconds

○ 120 seconds

SUBMIT

The air sampling system piping must be identified with a sign “SMOKE DETECTOR SAMPLING TUBE — DO NOT DISTURB” at: (Select all that apply)

☐ At piping intervals that provide visibility at least every 20 ft.

☐ Changes in ceiling height of more than 12 in.

☐ At each side of a penetration of a wall, floor, or other barrier

☐ Changes in direction or branches in piping

SUBMIT

Complete the knowledge check above before moving on.

Heating, Ventilating, and Air-Conditioning (HVAC)

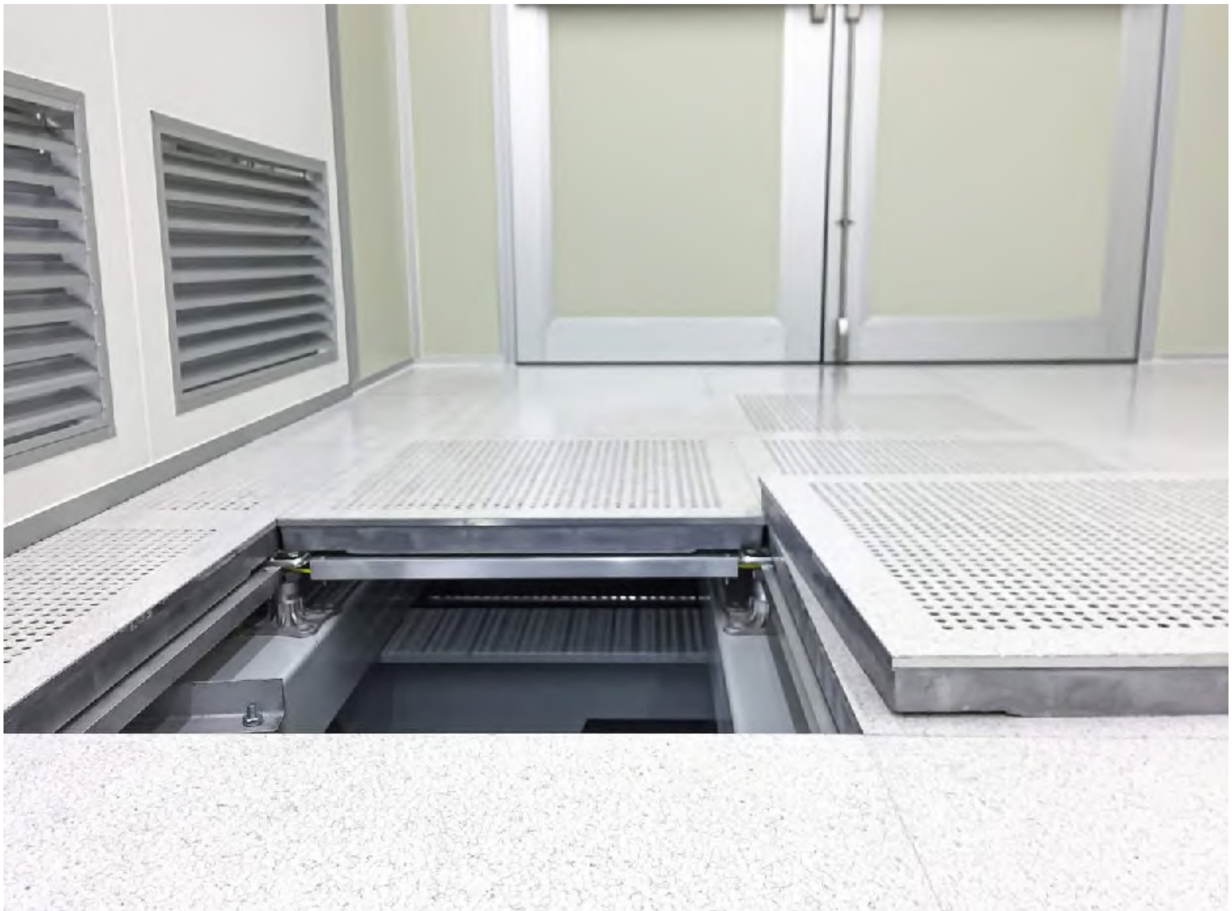
NFPA 72 2016, Section 17.7.4

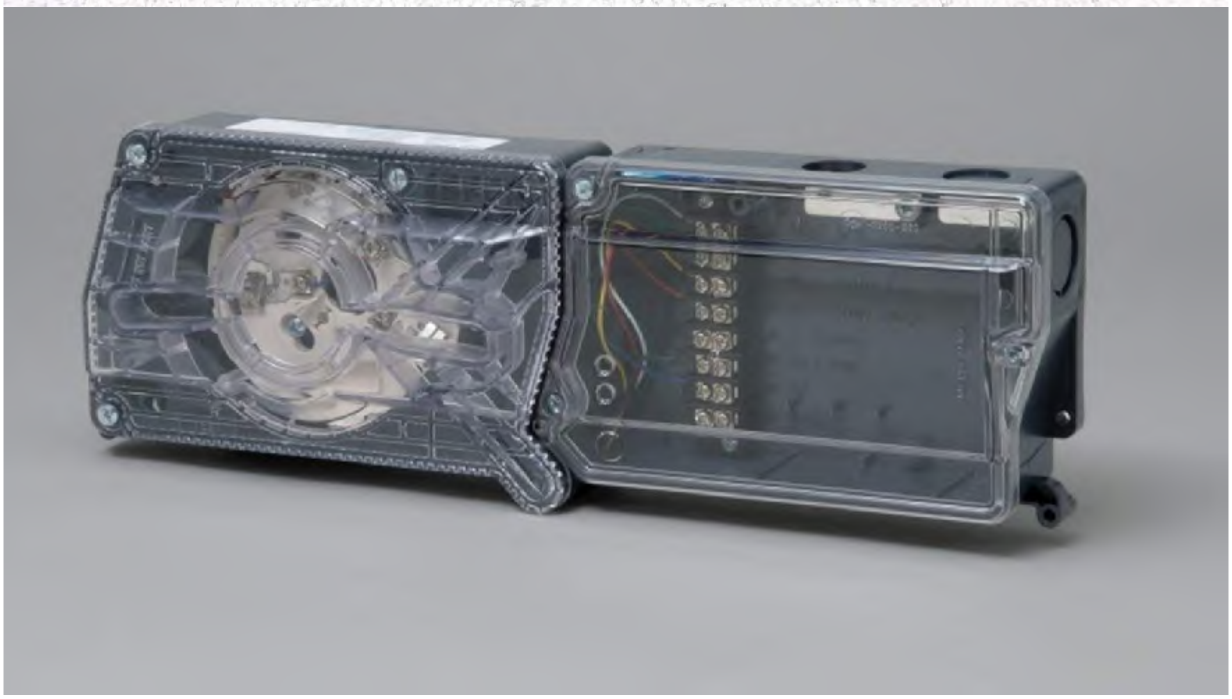
Smoke travels in the direction of the air flow. **We must be careful that the smoke which we are trying to detect will not be taken away or diluted to the point where it will not be effectively detected**.

Considerations must be given to potentially reduce the spacing of the detectors in these areas unless we can be assured that the flow and quantity of air is reasonable for our detector to handle. For example, **a smoke detector should not be located closer than 3 ft. to an air supply diffuser**.

CONTINUE

When spaces under floors and above ceilings are used as plenums or ducts for heating, ventilating, and air conditioning systems, the **detectors are required to be listed for the air velocities anticipated**. These special smoke detectors are not suitable (listed) for use in normal applications.





Duct detector requirements are specified by ***NFPA* 90A** - Standard for the Installation of Air-Conditioning and Ventilating Systems, building codes, and other local standards and codes.

The primary purpose of duct smoke detection is to reduce the spread of smoke. **Duct detectors are not a substitute for area smoke detection.**

ⓘ Smoke detectors for air duct use are required to be **installed on the supply side** of air-handling equipment per ***NFPA* 90A.**

LOCATION AND INSTALLATION OF DETECTORS IN AIR DUCT

Location and Installation of Detectors in Air Duct Systems

NFPA 72 2016, Section 17.7.5.5

Air duct detectors must be installed to obtain a good sample of the airstream. This installation can be any of the following four methods:

1. Rigid mounting within the duct
2. Rigid mounting to the wall of the duct with the sensing element protruding into the duct
3. Installation outside the duct with rigidly mounted sampling tubes protruding into the duct
4. Installation through the duct with projected light beam

Detectors shall be mounted in accordance with the manufacturer’s published instructions and shall be accessible for cleaning by providing access doors or control units.

All penetrations of a return air duct in the vicinity of detectors installed on or in an air duct shall be sealed to prevent entrance of outside air which may dilute or redirect the smoke.

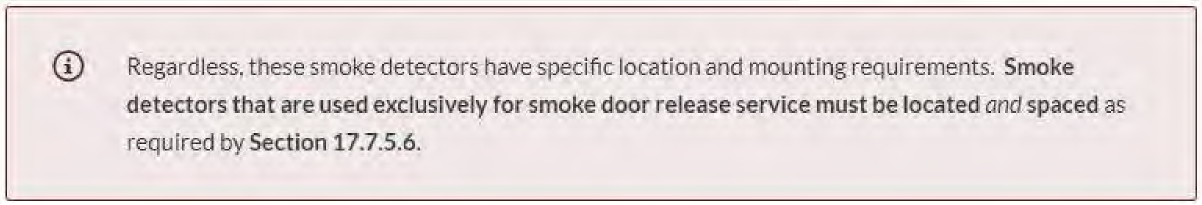
SMOKE DETECTORS FOR DOOR RELEASE SERVICE

Smoke Detectors for Door Release Service

NFPA 72 2016, Section 17.7.5.6

If **smoke door release is accomplished directly from the smoke detectors**, the **detectors *must* be listed for releasing service**.

NFPA 72 2016, Section 17.7.5.6



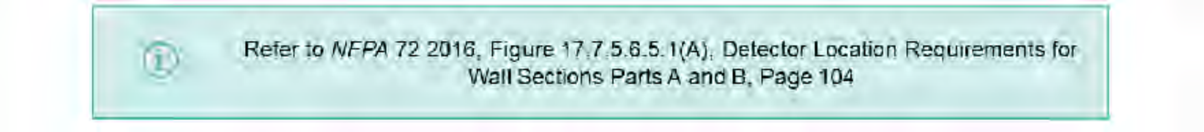
Regardless, these smoke detectors have specific location and mounting requirements. **Smoke detectors that are used exclusively for smoke door release service must be located** *and* **spaced** as required by **Section 17.7.5.6.**

There are some spot-type smoke detectors used to release smoke doors. These detectors are typically four-wire smoke detectors which may or may not be connected into the fire alarm system. That will depend upon local codes and regulations.

If doors are to be closed in response to smoke flowing in either direction, the requirements of Sections 17.7.5.6.5.1(A) through 17.7.5.6.5.1(D) shall apply.

Requirement 1

Section A Parts A & B

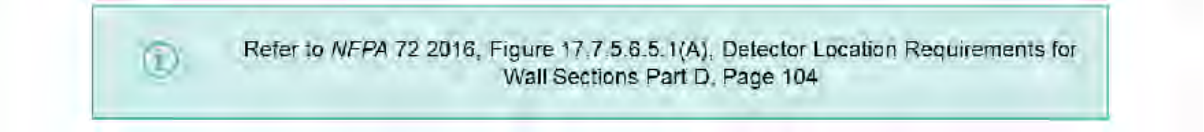


Refer to *NFPA* 72 2016, Figure 17.7.5.6.5.1(A), Detector Location Requirements for Wall Sections Parts A and B, Page 104

(A) If the depth of wall section above the door is 24 in. (610 mm) or less, one ceiling-mounted smoke detector shall be required on one side of the doorway only, or two wall-mounted detectors shall be required, one on each side of the doorway. Figure 17.7.5.6.5.1(A), part A or B, shall apply.

Requirement 2

Section B Part D



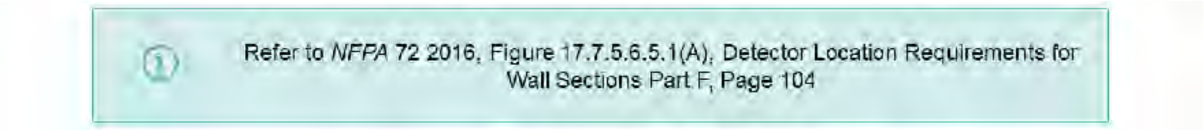
Refer to *NFPA* 72 2016, Figure 17.7.5.6.5.1(A), Detector Location Requirements for Wall Sections Part D, Page 104

(B) If the depth of wall section above the door is greater than 24 in. (610 mm) on one side only, one ceiling-mounted smoke detector shall be required on the higher side of the doorway only, or one wall-mounted detector shall be required on both sides of the doorway.

Figure 17.7.5.6.5.1(A), part D, shall apply.

Requirement 3

Section C Part F

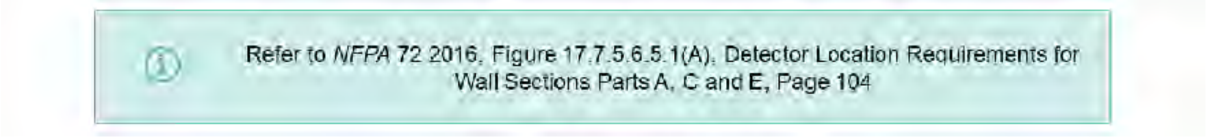


Refer to *NFPA* 72 2016, Figure 17.7.5.6.5.1(A), Detector Location Requirements for Wall Sections Part F, Page 104

(C) If the depth of wall section above the door is greater than 24 in. (610 mm) on both sides, two ceiling-mounted or wall-mounted detectors shall be required, one on each side of the doorway. Figure 17.7.5.6.5.1(A), part F, shall apply.

Requirement 4

Section D Parts A, C, & E



Refer to *NFPA* 72 2016, Figure 17.7.5.6.5.1(A), Detector Location Requirements for Wall Sections Parts A, C and E, Page 104

(D) If a detector is specifically listed for door frame mounting, or if a listed combination or integral detector-door closer assembly is used, only one detector is required if installed in the manner recommended by the manufacturer's published instructions.

Figure 17.7.5.6.5.1(A), parts A, C, and E, shall apply.

Additional Requirements

There are **additional requirements in Section 17.7.5.6** covering the smoke detectors for door release service.

Study and understand Figures:

- 17.7.5.6.5.1(A) – Detector Location Requirements for Wall Sections
- 17.7.5.6.5.3(A) – Detector Location Requirements for Single and Double Doors
- 17.7.5.6.5.3(B) – Detector(s) Location + 24 in. (0.6 m) Requirements for Group Doorways
- 17.7.5.6.5.3(C) – Detector(s) Location + 24 in. (0.6 m) Requirements for Group Doorways over 20 ft (6.1 m) in Width

All figures are located on pages 104 and 105 of *NFPA* 72 2016.

SPECIAL CONSIDERATIONS

Special Considerations

NFPA 72 2016, Section 17.7.6

Combination and multi-sensor smoke detectors with a fixed-temperature heat detector element as part of the unit shall be selected per the guidelines for maximum ceiling temperature expected (see **Table 17.6.2.1**).

Holes in the back of a detector shall be covered by a gasket, sealant, or equivalent means, and the detector shall be mounted so that airflow from inside or around the housing does not prevent the entry of smoke during a fire or test condition.

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HIGH AIR MOVEMENT AREAS

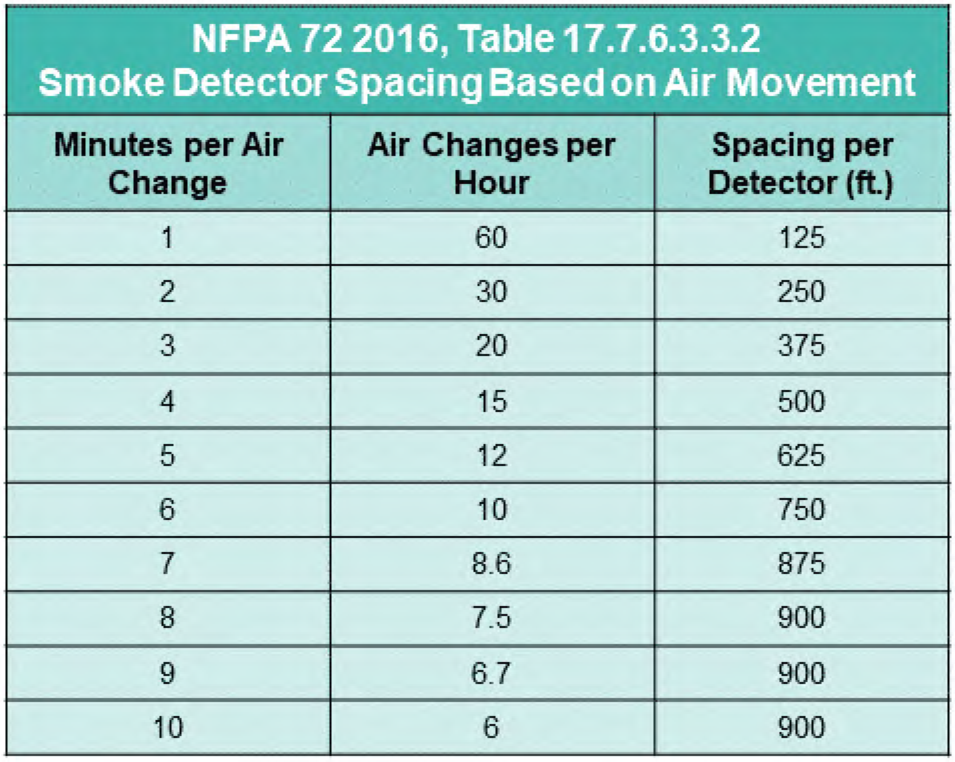
High Air Movement Areas

NFPA 72 2016, Section 17.7.6.3

This section covers spacing and location of smoke detectors used for high air movement areas.

This section does not cover smoke detectors used for control of smoke spread. Those detectors are covered in **Section 17.7.5**.

Smoke detectors shall not be located directly in the airstream of supply registers. This would dilute the smoke or move the smoke away from the detector's sensing chamber. In high air movement areas, spot-type smoke detectors will be spaced in accordance with **Table 17.7.6.3.3.2** (do not use table for under floor or above ceiling spaces).



NFPA 72 2016, Table 17.7.6.3.3.2
Smoke Detector Spacing Based on Air Movement

Minutes per Air Change	Air Changes per Hour	Spacing per Detector (ft.)
1	60	125
2	30	250
3	20	375
4	15	500
5	12	625
6	10	750
7	8.6	875
8	7.5	900
9	6.7	900
10	6	900

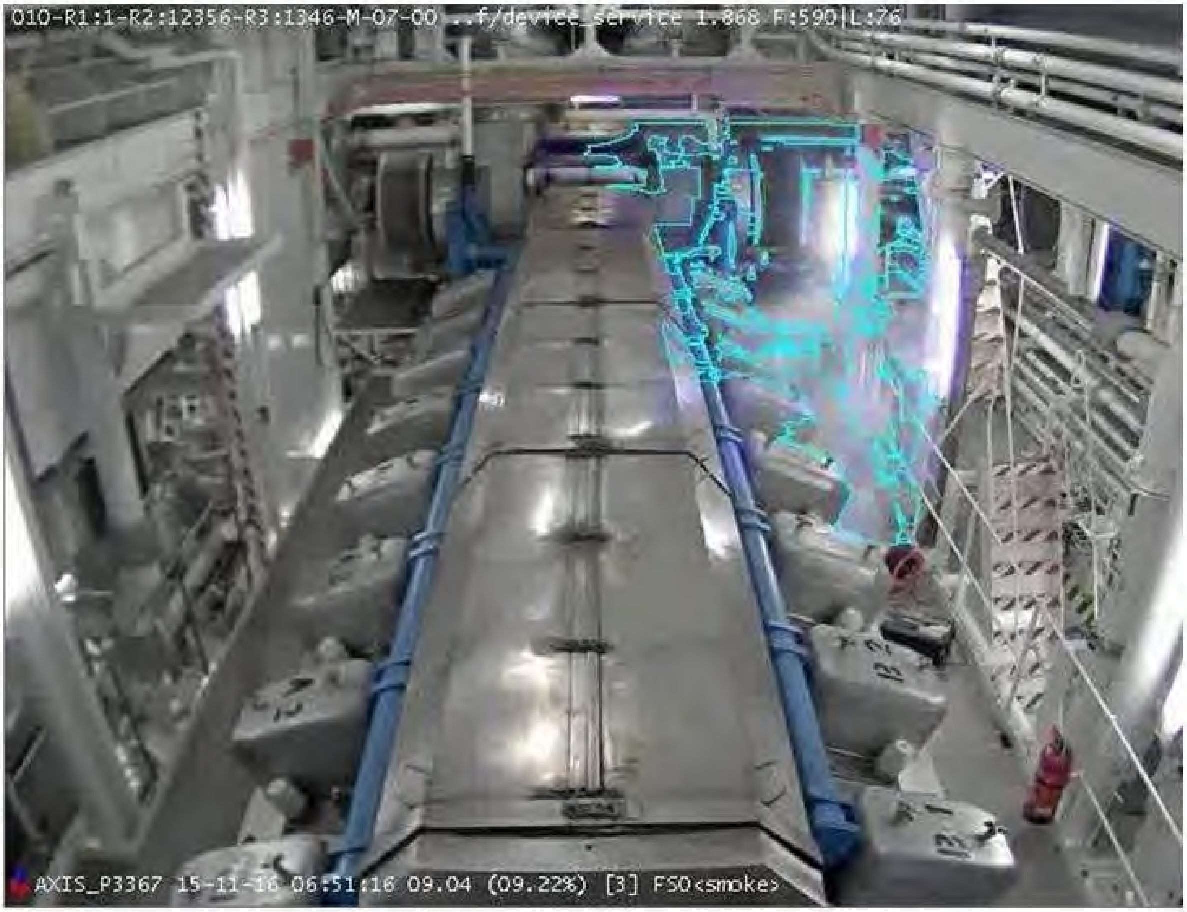
Air-sampling and projected beam-type smoke detectors used in high air movement areas must be installed as per the manufacturer's published instructions.

If an HVAC mechanical room is used as an air plenum for return air, the spacing of smoke detectors (in those areas) is not required to be reduced based upon the number of air changes.

VIDEO IMAGE SMOKE DETECTION

Video Image Smoke Detection

NFPA 72 2016, Section 17.7.7



The location and spacing of video image smoke detection must comply with **Section 17.11.5**, which means:

- The location and spacing of this system shall be based upon the operating principals and an engineering survey of the conditions anticipated.
- Follow the recommendations of the manufacturer’s published instructions for detector use and locations.
- Detectors shall not be spaced beyond their listed or approved maximums.

CONTINUE

Let's do a quick check about what has been covered so far.

Air duct detectors must be installed to obtain a good sample of the airstream.

This installation can be any of the following methods: (Select all that apply)

- ☐ Rigid mounting within the duct
- ☐ Rigid mounting to the wall of the duct with the sensing element protruding into the duct
- ☐ Installation outside the duct with rigidly mounted sampling tubes protruding into the duct
- ☐ Installation through the duct with a heat detector

SUBMIT

If smoke door release is accomplished directly from the smoke detectors, the detectors *must* be listed for ______.

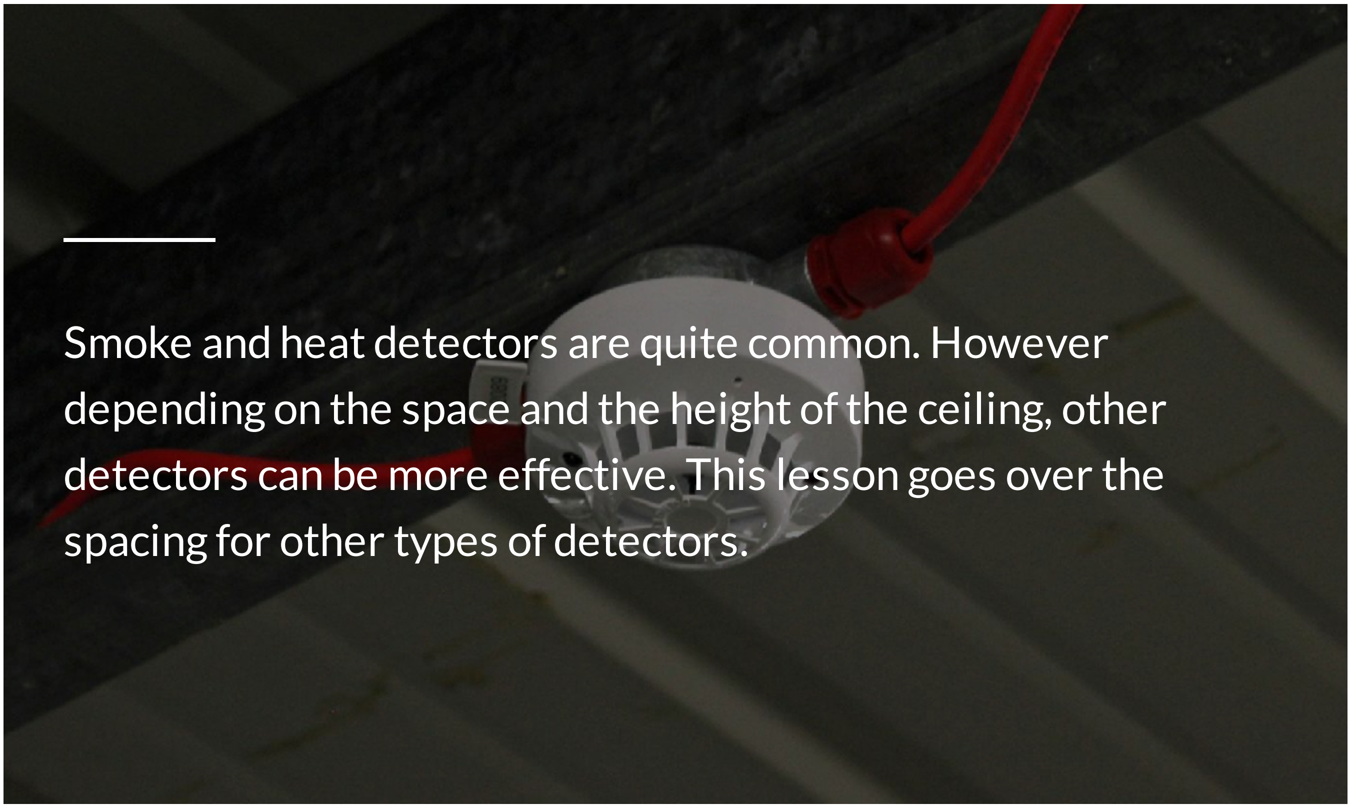
Type your answer here

SUBMIT

Complete the knowledge check above before moving on.

Lesson 3 of 3

Radiant Energy-Sensing Detector Location and Spacing



Smoke and heat detectors are quite common. However depending on the space and the height of the ceiling, other detectors can be more effective. This lesson goes over the spacing for other types of detectors.

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Identify location and spacing considerations for flame detectors and spark/ember detectors.

RADIANT ENERGY-SENSING DETECTORS

Location and Spacing

NFPA 72 2016, Section 17.8

The type and quantity of radiant energy-sensing fire detectors shall be determined on the basis of the performance characteristics of the detector and an analysis of the hazard, which includes the burning characteristics of the fuel, the fire growth rate, the environment, the ambient conditions, and the capabilities of the extinguishing media and equipment.

Basically, an engineer will be the person to figure this out.

The selection of the radiant energy-sensing detectors shall be based on the following:

1. Matching of the spectral response of the detector to the spectral emissions of the fire or fires to be detected
2. Minimizing the possibility of spurious nuisance alarms from non-fire sources inherent to the hazard area

Radiant energy-sensing fire detectors shall be employed **consistent with the listing or approval and the inverse square law**, which defines the fire size versus distance curve for the detector.

Detector quantity shall be based on the detectors being positioned so that **no point requiring detection in the hazard area is obstructed or outside the field of view of at least one detector**.

SPACING CONSIDERATIONS FOR FLAME DETECTORS

Spacing Considerations for Flame Detectors

NFPA 72 2016, Section 17.8.3.2.1

The location and spacing of detectors shall be the result of an engineering evaluation that includes the following:

1. Size of the fire that is to be detected
2. Fuel involved
3. Sensitivity of the Detector
4. Field of view of the detector
5. Distance between the fire and the detector
6. Radiant energy absorption of the atmosphere
7. Presence of extraneous sources of radiant emissions
8. Purpose of the detection system
9. Response time required

CONTINUE

In applications where the **fire to be detected could occur in an area not on the optical axis of the detector**, the distance to the **area covered** by the detector **shall be *reduced* or additional detectors shall be *added* to compensate for the angular displacement of the fire**.

In applications in which the fire to be detected is of a fuel that differs from the test fuel used in the process of listing or approval, the distance between the detector and the fire shall be adjusted consistent with the fuel specificity of the detector as established by the manufacturer.

Because **flame detectors are line-of-sight devices**, their ability to respond to the required area of fire in the zone that is to be protected **shall not be compromised (obstructed) by the presence of intervening structural members or other opaque objects or materials**.

SPACING CONSIDERATIONS FOR SPARK/EMBER DETECTORS

Spacing Considerations for Spark/Ember Detectors

NFPA 72 2016, Section 17.8.3.3.1

The location and spacing of detectors shall be the result of an engineering evaluation that includes the following:

1. Size of the spark or ember that is to be detected
2. Fuel involved
3. Sensitivity of the detector
4. Field of view of the detector
5. Distance between the fire and the detector
6. Radiant energy absorption of the atmosphere
7. Presence of extraneous sources of radiant emissions
8. Purpose of the detection system
9. Response time required

CONTINUE

ⓘ Spark detectors shall be positioned so that all points within the cross section of the conveyance duct, conveyor, or chute where the detectors are located are within the field of view (as **defined in Section 3.3.98**) of at least one detector.

The **location and spacing of the detectors shall be adjusted using the inverse square law**, modified for the **atmospheric absorption and the absorption of nonburning fuel suspended in the air** in accordance with the manufacturer's published instructions.

In applications where the **sparks to be detected could occur in an area not on the optical axis** of the detector, the **distance shall be *reduced* or detectors shall be *added* to compensate for the angular displacement of the fire** in accordance with the manufacturer's published instructions.

MANUAL FIRE ALARM BOXES

Requirements for Manual Fire Alarm Boxes

NFPA 72 2016, Section 17.14

Manually actuated alarm-initiating devices for initiating signals other than for fire alarms shall be permitted if the devices are differentiated from manual fire alarm boxes by a color other than red and labeling.

Manual fire alarm boxes shall be **located not more than 5 ft. from each exit on each floor**. Grouped **openings over 40 ft**. in width **require a manual box within 5 ft. from both sides of the grouped opening**.

Additional manual boxes are **required every 200 horizontal feet of travel distance on each floor**.

The **height** of manual fire alarm boxes **shall be a minimum of 42 in. and a maximum of 48 in**. from the **floor to the operating lever**.

CONTINUE

Let's do a quick check about what has been covered so far.

Radiant energy-sensing fire detectors shall be employed consistent with the listing or approval and the _______ law, which defines the fire size versus distance curve for the detector.

Type your answer here

SUBMIT

Based on *NFPA* 72 2016, Section 17.8.3.2, Spacing Considerations for Flame Detectors, the location and spacing of detectors shall be the result of an engineering evaluation that includes the following: (Select all that apply)

☐ Number of floors in the dwelling

☐ Distance between the fire and the detector

☐ Radiant energy absorption of the atmosphere

☐ Presence of extraneous sources of radiant emissions

SUBMIT

The height of manual fire alarm boxes shall be a minimum of ____ in. and a maximum of ____ in. from the floor to the operating lever.

○ 30 / 36

○ 36 / 42

○ 42 / 48

○ 48 / 54

SUBMIT

Complete the knowledge check above before moving on.

The location and spacing of other detectors such as video flame detection, combination, multi-criteria, and multi-sensor detectors, and gas detectors are not specifically covered in their applicable sections.

Location and spacing of these detectors are accomplished using engineering judgement and/or the manufacturer's published installation instructions.

- For instance, System Sensor® installation instructions requires one of its multi-criteria sensors be spaced 20 or 30 ft. apart depending on which listing agency is being used, or if it has a heat detector as part of the unit.
- Make sure to always follow the manufacturer's published instructions.

Other types of initiating devices such as sprinkler waterflow alarm-initiating devices and supervisory-signal initiating devices also do not have location and spacing requirements spelled out such as heat and smoke detectors.

These initiating devices are placed where they are needed in accordance with applicable codes, laws, or regulations.

SUMMARY

There are many requirements to locating and spacing detectors.

Take some time to review the information and familiarize yourself with the information.

This module should help you to understand these location and spacing requirements.

CONTINUE

After completing this module, you should now have a better understanding of the different requirements for the location and spacing of devices for fire alarm systems.

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

Ohio Fire Alarm and Detection Equipment-Notification Appliances

FIRE TECH
PRODUCTIONS

Welcome to the Notification Appliances module of the Ohio Fire Alarm and Detection Systems Course.

By the end of this module, you will be able to do the following:

- Identify General Requirements for Chapter 18 in *NFPA* 72 2016
- Differentiate between public- and private-mode audible appliance requirements
- Identify sound level requirements for sleeping areas
- Apply location rules for audible notification appliances
- Recognize visual characteristics of visible signaling appliances
- Properly locate wall-mounted and ceiling-mounted appliances at effective intensity levels
- Determine if synchronization is needed in areas with multiple visible signaling devices

Key Reference for this module:

- *NFPA* 72 – National Fire Alarm and Signaling Code, Chapter 18, 2016

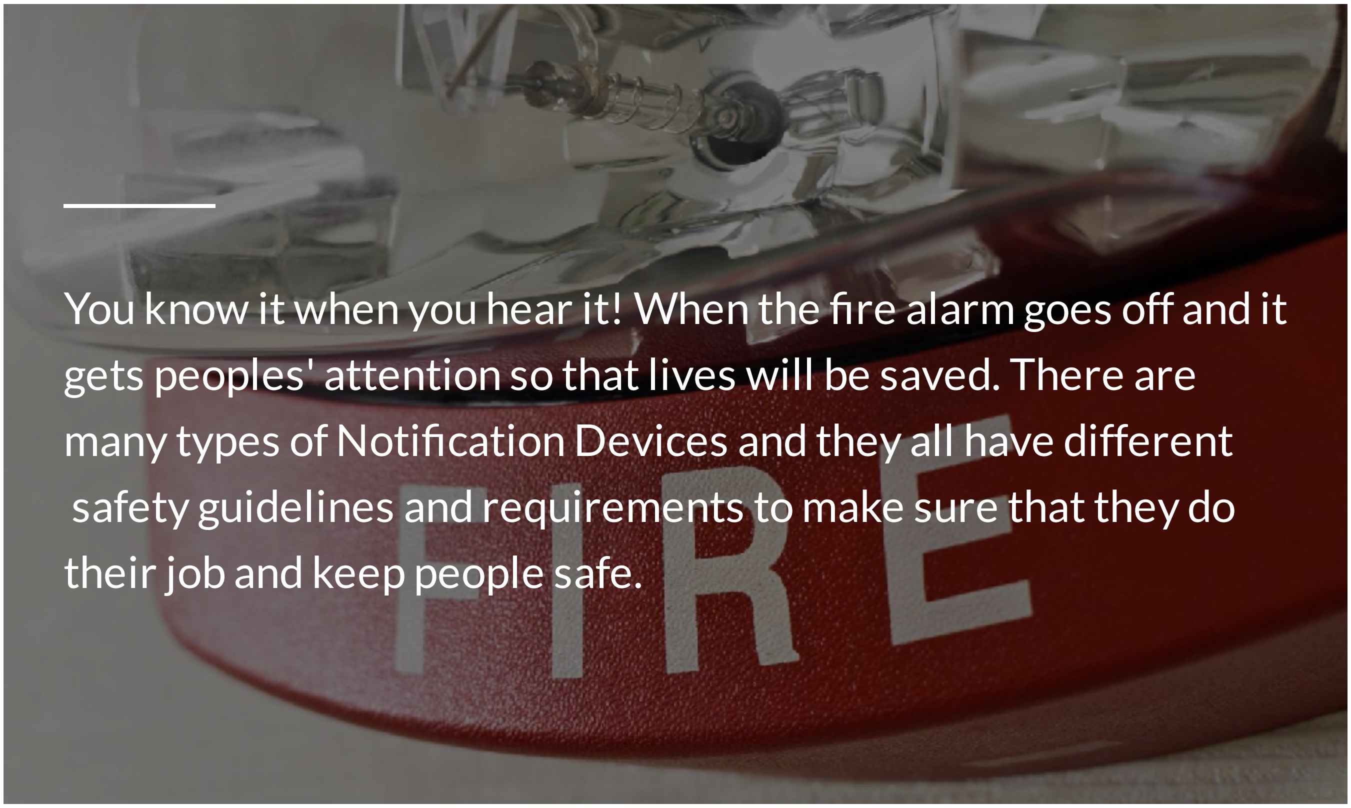
When you are ready to begin, click on the button above to start the course.

Chapter 18 Scope and Audible Appliances

Visible and other Notification Appliances

Lesson 1 of 2

Chapter 18 Scope and Audible Appliances



You know it when you hear it! When the fire alarm goes off and it gets peoples' attention so that lives will be saved. There are many types of Notification Devices and they all have different safety guidelines and requirements to make sure that they do their job and keep people safe.

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Identify General Requirements for Chapter 18 in *NFPA* 72 2016
2. Differentiate between public- and private-mode audible appliance requirements.

3. Identify sound level requirements for sleeping areas.
4. Apply location rules for audible notification appliances.

LET'S GET STARTED

NFPA 72 2016, Chapter 18 Scope

***NFPA* 72 2016 does not have any requirements** to provide **notification to occupants or staff**.

The **requirements for notification are dictated by local codes**, the Authorities Having Jurisdiction (AHJ) and **NFPA 101, Life Safety Code**.

If notification is required, ***NFPA* 72 2016** defines the requirements and methods to accomplish that task.

***NFPA* 72 2016** establishes the **minimum requirements for performance, location, and mounting of notification appliances associated with fire alarm systems.** These devices tell the occupants of the protected property to either evacuate or relocate as the result of a fire condition.

As the code dictates, all of these appliances must be listed for their intended use.

The intent of the **code requirements** focuses on the ability of the appliance to deliver a message. The content of the message is not part of the responsibility of the code.

CODED AND NON-CODED SIGNALS

Coded and Non-Coded Signals

As they are addressed by the code, **notification signals** are classified in the following manner:

A **coded signal** can be either *audible* or *visual*. It conveys discrete bits of information such as a given number of flashes from a light or a given number of tones from a horn that tell what floor and section of the building the alarm was generated from.

A **non-coded** signal conveys only one discrete bit of information.

- A **non-coded perceptually constant signal** is one where the notification appliance, either *visible* or *audible*, is operated continuously.
- A **non-coded perceptually repetitious signal**, however, is where the appliance is interrupted at a continuous uniform

rate.

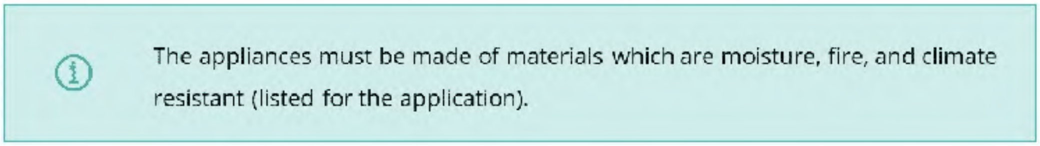
- A **non-coded single event signal** is a single flash of light or a single stroke of a bell. This is not a valid fire alarm signal.

GENERAL REQUIREMENTS

NFPA 72 2016, Section 18.3

Notification appliances are required to have nameplates on them which provide information on the following:

- Their electrical requirements
- Audible or visual performance as listed
- Information or references regarding their parameters



The appliances must be made of materials which are moisture, fire, and climate resistant (listed for the application).

Notification appliances used for **signaling** ***other than fire*** are **not allowed to have the word "FIRE", or any fire symbol**, in any form (i.e., stamped, imprinted, etc.) on the appliance visible to the public.

Notification appliances with **multiple visible elements** are allowed to have **fire markings only on those visible elements that are used for fire signaling.**

Their construction must be damage and tamper resistant and, where subject to conditions where mechanical damage is probable, they must be suitably protected.

CONTINUE

Notification appliances must be **mounted independent of their circuit conductors**.

Notification appliances must be **listed for use with fire alarm systems** as well as the **environment and location where they are installed**.

ⓘ Notification appliances are not required in exit stair enclosures, exit passageways, and elevator cars. -*NFPA* 72 2016, Section 23.8.6.2

If any type of guard, cover, or lens is used with notification appliances, **the guard, cover, or lens must be listed for use with the appliance**.

CONTINUE

Let's do a quick check about what has been covered so far.

Notification appliances are required to have nameplates on them which provide information on the following: (Select all that apply)

- ☐ Their electrical requirements
- ☐ Audible or visual performance as listed
- ☐ Name of manufacturer
- ☐ Information or references regarding their parameters

SUBMIT

🔒 Complete the knowledge check above before moving on.

General Requirements for Audible Appliances

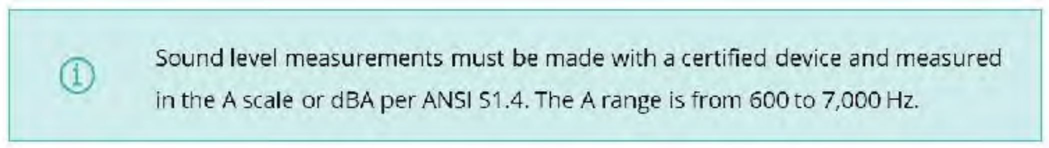
NFPA 72 2016, Section 18.4.1

An **average ambient sound level *greater than 105 dBA* shall require the use of visible notification appliances**.

The **total sound level produced** by combining the ambient sound pressure level with all audible notification appliances operating **shall not exceed 110 dBA at the minimum hearing distance**.

Sound from **normal or permanent sources having a duration greater than 60 seconds shall be included when measuring maximum ambient sound level**.

Sound from temporary or abnormal sources shall not be required to be included when measuring maximum ambient sound level.



Sound level measurements must be made with a certified device and measured in the A scale or dBA per ANSI S1.4. The A range is from 600 to 7,000 Hz.

PUBLIC MODE AUDIBLE REQUIREMENTS

Public Mode Audible Requirements

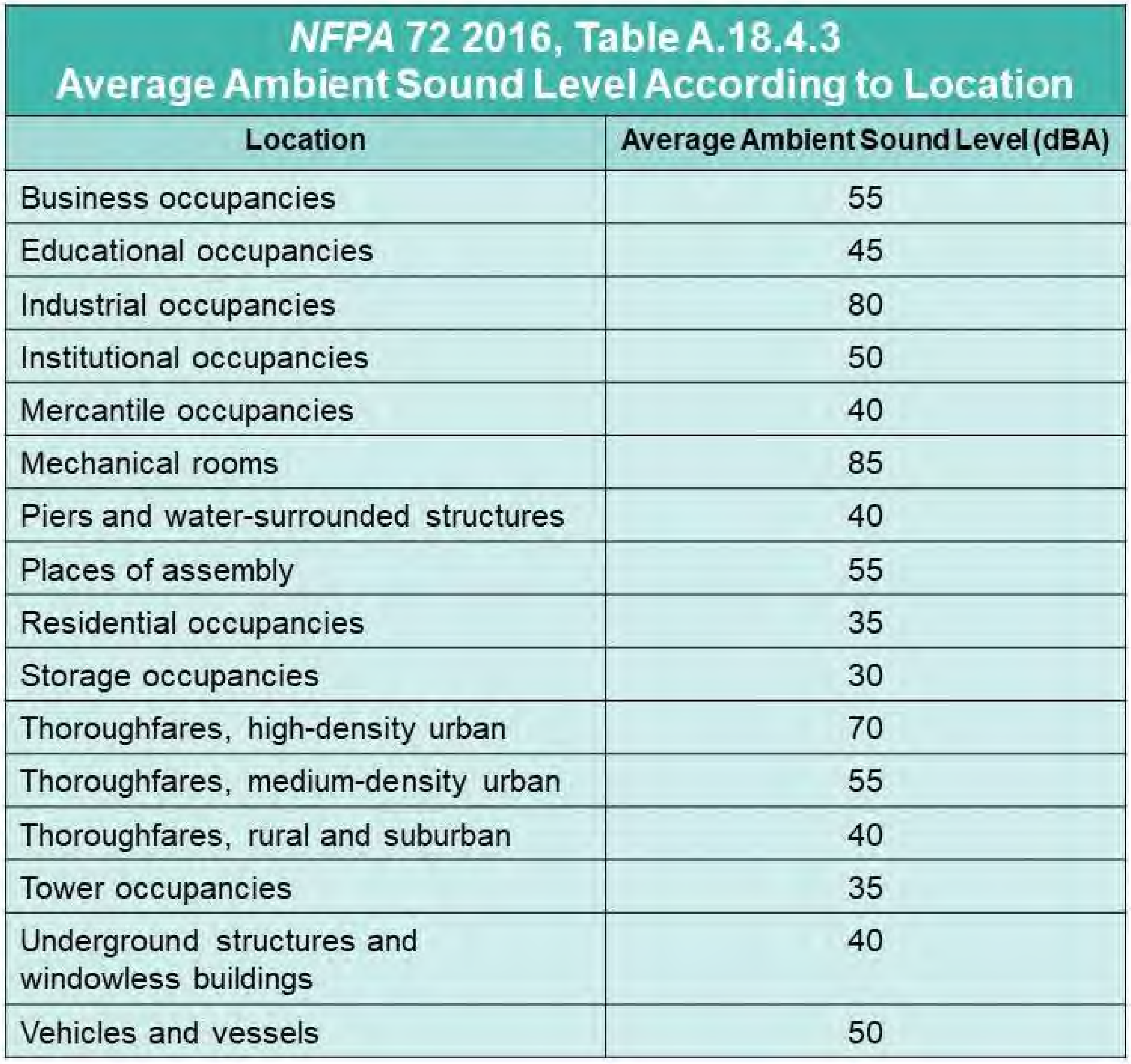
NFPA 72 2016, Section 18.4.3

Public mode audible signals shall have a **sound level of at least 15 dB above the average ambient sound level** or **5 dB above the maximum ambient sound level**, whichever is **greater**.

That level must be **maintained for at least 60 seconds** measured at 5 ft. above the floor.

High sound levels not believed to be typical of the area do not need to be considered in the measurement of maximum sound levels (for example, a vacuum cleaner in an office)

CONTINUE



NFPA 72 2016, Table A.18.4.3
Average Ambient Sound Level According to Location

Location	Average Ambient Sound Level (dBA)
Business occupancies	55
Educational occupancies	45
Industrial occupancies	80
Institutional occupancies	50
Mercantile occupancies	40
Mechanical rooms	85
Piers and water-surrounded structures	40
Places of assembly	55
Residential occupancies	35
Storage occupancies	30
Thoroughfares, high-density urban	70
Thoroughfares, medium-density urban	55
Thoroughfares, rural and suburban	40
Tower occupancies	35
Underground structures and windowless buildings	40
Vehicles and vessels	50

(Click image to enlarge)

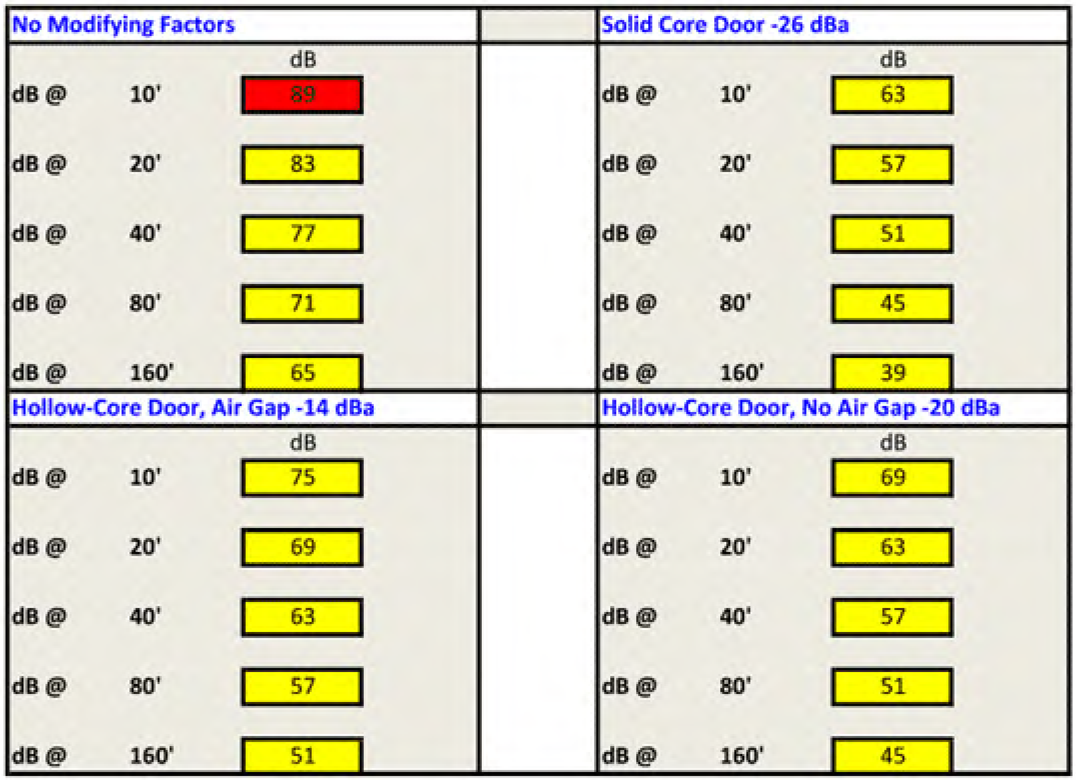
This table provides the average ambient sound of various locations in a building. **The decibel level listed for the device plus the ambient sound of the**

specific location cannot exceed 110db, ***otherwise*** **a visual notification appliance shall be installed.**

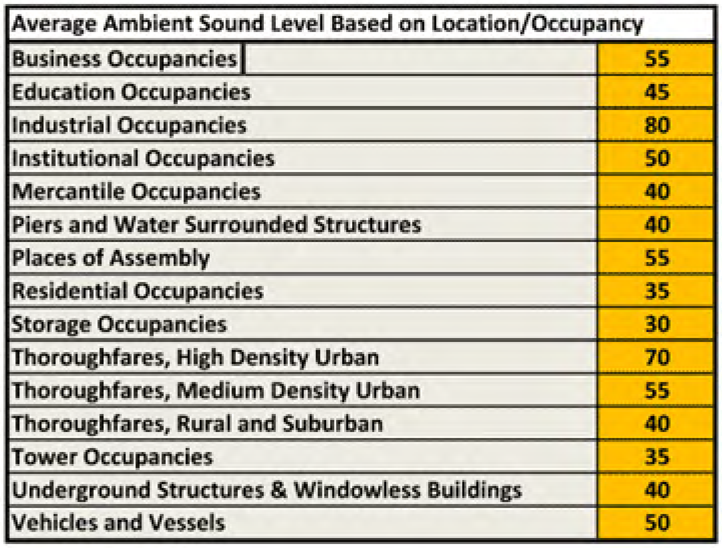
CONTINUE

Other considerations to calculate for is how far a person can be away from the device, as the decibel level drops the distance away from the device, in addition to any door construction from adjacent rooms, (see image below).

Use the tables below to help work through the following example.

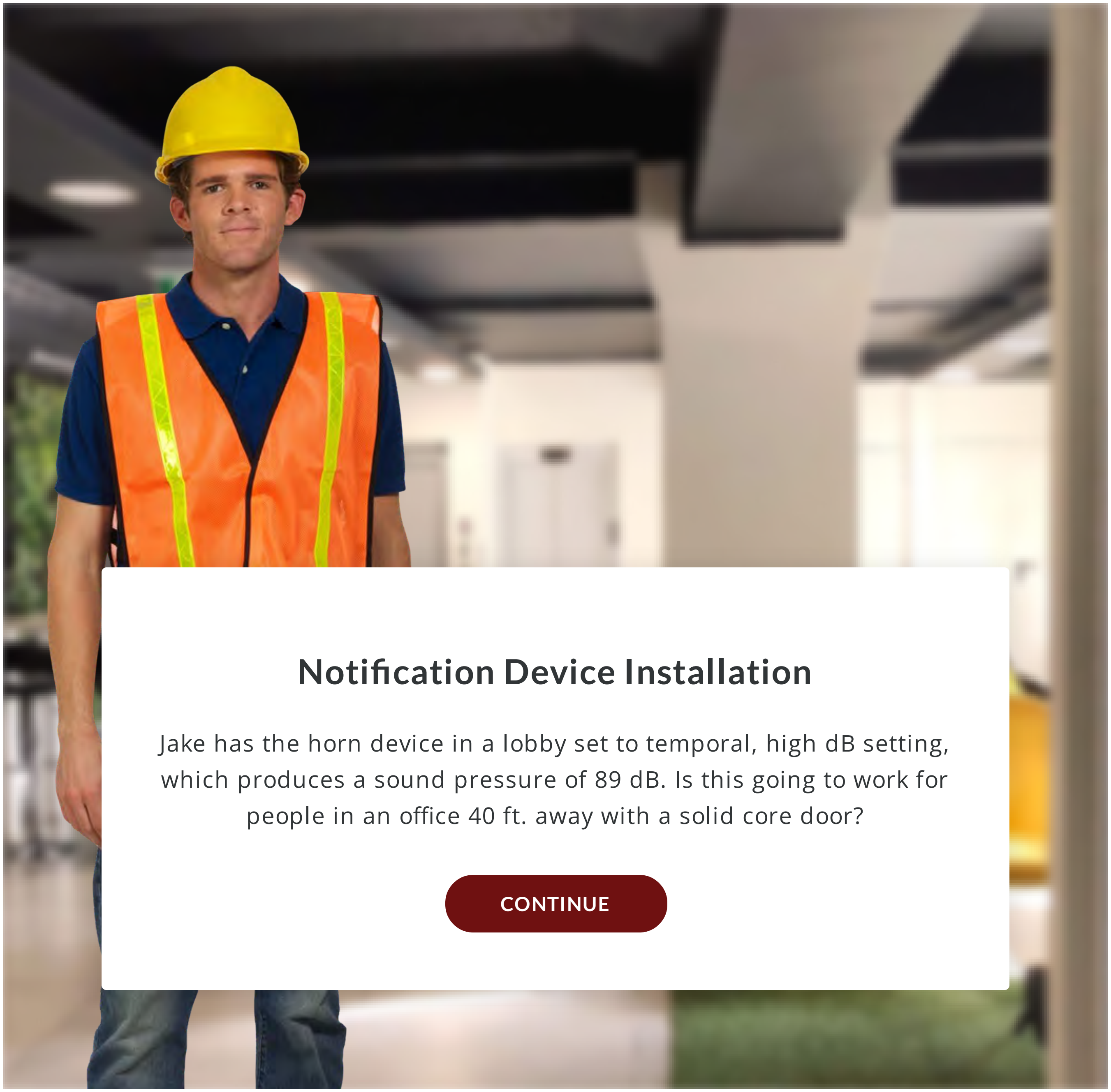


No Modifying Factors				Solid Core Door -26 dBa		
		dB				dB
dB @	10'	89		dB @	10'	63
dB @	20'	83		dB @	20'	57
dB @	40'	77		dB @	40'	51
dB @	80'	71		dB @	80'	45
dB @	160'	65		dB @	160'	39
Hollow-Core Door, Air Gap -14 dBa				**Hollow-Core Door, No Air Gap -20 dBa**		
		dB				dB
dB @	10'	75		dB @	10'	69
dB @	20'	69		dB @	20'	63
dB @	40'	63		dB @	40'	57
dB @	80'	57		dB @	80'	51
dB @	160'	51		dB @	160'	45



Average Ambient Sound Level Based on Location/Occupancy	
Business Occupancies	55
Education Occupancies	45
Industrial Occupancies	80
Institutional Occupancies	50
Mercantile Occupancies	40
Piers and Water Surrounded Structures	40
Places of Assembly	55
Residential Occupancies	35
Storage Occupancies	30
Thoroughfares, High Density Urban	70
Thoroughfares, Medium Density Urban	55
Thoroughfares, Rural and Suburban	40
Tower Occupancies	35
Underground Structures & Windowless Buildings	40
Vehicles and Vessels	50

For the example below, we are installing System Sensor, L-Series Horn Strobe, Part # P2RL. You will need to **refer to the chart above** and **Table A.18.4.3** to determine if this notification device is going to work in this situation.



Notification Device Installation

Jake has the horn device in a lobby set to temporal, high dB setting, which produces a sound pressure of 89 dB. Is this going to work for people in an office 40 ft. away with a solid core door?

Scene 1 Slide 1

Continue → Next Slide

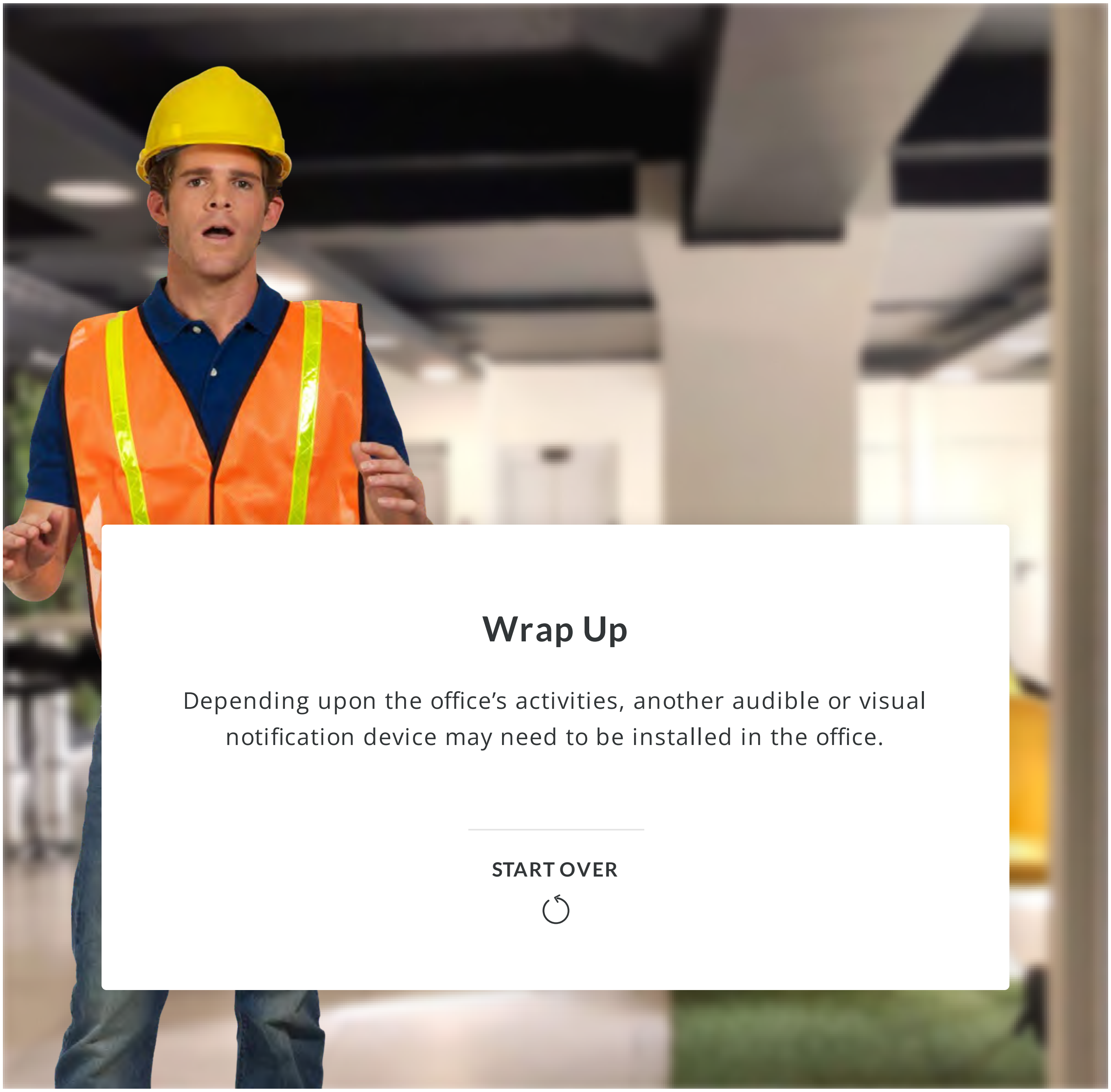
Look at the upper right quadrant for a solid core door on the chart, knowing it's 40 ft. from the horn to the office, & use Table A.18.4.3 to determine business occupancy sound level. Will it work?

1. No, it is not adequate.
2. Yes, it is adequate.

Scene 1 Slide 2

0 → Next Slide

1 → Next Slide



Wrap Up

Depending upon the office’s activities, another audible or visual notification device may need to be installed in the office.

Scene 1 Slide 3

Continue → End of Scenario

Complete the scenario above before moving on.

Exceptions to the public mode requirements:

☐ The requirements for audible signaling shall be permitted to be reduced or eliminated when visible signaling is provided and approved by the AHJ.

☐ Audible alarm notification appliances installed in elevator cars shall be permitted to use the audibility criteria for private mode appliances.

☐ Audible alarm notification appliances installed in restrooms shall be permitted to use the audibility criteria for private mode.

☐ A signaling system arranged to stop or reduce ambient noise shall comply with Sections 18.4.3.5.1 through 18.4.3.5.3. An example of this would be the fire alarm system initiating a signal to shunt trip a circuit breaker to the sound system in a night club.

CONTINUE

In **private mode**, the sound level needs to be a minimum of 10 dB above the average ambient sound level, or 5 dB above the maximum sound level. The 110 dBA maximum at minimum hearing distance also applies.

Audible or visible signaling will alert only those persons directly concerned with the implementation and direction of emergency action initiation and procedure in the area protected by the fire alarm system.

Private operating mode *requires that the system be* ***continuously monitored*** *at* ***one or more locations*** *in the building.*

There are situations where it might not be desirable to have audible or visible notification appliances except in supervised stations.

An example is a ***health care facility*** *where* ***patients could panic by a visible or audible alarm****, but the staff would be alerted to assist the patients. This is permitted in Section 18.4 with the permission of the AHJ.*

CONTINUE

Let's do a quick check about what has been covered so far.

Based on *NFPA* 72 2016, Section 18.4.3, public mode audible signals shall have a sound level of at least 15 dB above the average ambient sound level or 5 dB above the maximum ambient sound level, whichever is greater. That level must be maintained for at least 60 seconds measured at _____ ft. above the floor.

○ 5

○ 6

○ 7

SUBMIT

Complete the knowledge check above before moving on.

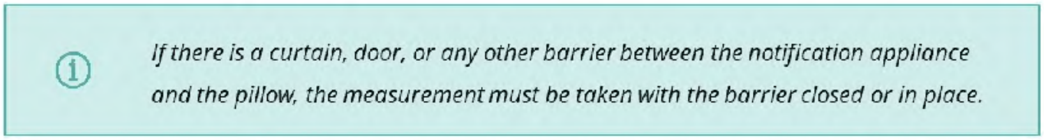
Sleeping Area Requirements

NFPA 72 2016, Section 18.4.5

Sleeping areas are treated separately in the code in regards to notification appliances based on studies on how long it takes to awaken a sleeping person at different sound levels and the amount of time for someone to be alert to respond to the alarm.

The sound level must be measured at the pillow level in the area required to be served.

ⓘ Audible appliances for sleeping areas shall have a sound level of at least **15 dB above the average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds or a sound level of at least 75 dBA**, whichever is greater.



If there is a curtain, door, or any other barrier between the notification appliance and the pillow, the measurement must be taken with the barrier closed or in place.

Audible appliances provided for the sleeping areas shall produce a low frequency alarm signal that complies with the following:

1. The alarm signal shall be a square wave or provide equivalent awakening ability.
2. The wave shall have a fundamental frequency of 520 Hz ± 10%.
3. The notification equipment shall be listed for producing a low frequency waveform.

Research has shown that a low frequency 520 Hz square wave signal can awaken and alert people with hearing loss, as well as alcohol-impaired adults.

The above requirement only applies to audible appliances in sleeping areas that are intended to awaken people. *For example, audible appliances in a hospital would not be intended for the purpose of awakening the patients.*

Location of Audible Appliances in a Building or Structure

NFPA 72 2016, Section 18.4.8

Wall-mounted audible alarm appliances shall be located at **least 90 in. above the floor** if ceiling height permits, and at **least 6 in. below the ceiling**.

Ceiling-mounted and recessed appliances are permitted.

If the device is a combination audible and visible alarm, the location rules for visible appliances shall be used. If the device is part of a detector/alarm unit, the location rules for the detector shall be used.

ⓘ Even though the code has specific mounting heights, **Section 18.4.8.5 states other mounting heights shall be permitted**, provided that the **sound pressure level requirements of Section 18.4.3 for public mode**, **Section 18.4.4 for private mode**, or **Section 18.4.5 for sleeping areas**, based on the application, **are met**.

CONTINUE

Voice Intelligibility

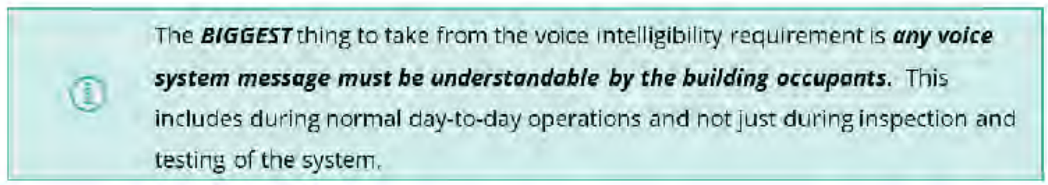
NFPA 72 2016, Section 18.4.10

Within the acoustically distinguishable spaces (ADS) where voice intelligibility is required, voice communications systems shall reproduce prerecorded, synthesized, or live (e.g., microphone, telephone handset, and radio) messages with voice intelligibility.

ADSs shall be determined by the system designer during the planning and design of all emergency communications systems (ECS).

Each ADS shall be identified as requiring or not requiring voice intelligibility.

Where required by the AHJ, ADS assignments must be submitted for review and approval.



The ***BIGGEST*** thing to take from the voice intelligibility requirement is ***any voice system message must be understandable by the building occupants.*** This includes during normal day-to-day operations and not just during inspection and testing of the system.

CONTINUE

Let's do a quick check about what has been covered so far.

According to *NFPA* 72 2016, Section 18.4.5, for sleeping levels, the sound level must be measured at the _____ level in the area required to be served.

Type your answer here

SUBMIT

According to *NFPA* 72 2016, Section 18.4.5, research has shown that a low frequency 520 Hz square wave signal can awaken and alert people with hearing loss, as well as alcohol-impaired adults.

○ True

○ False

SUBMIT

According to *NFPA* 72 2016, Section 18.4.8, wall-mounted audible alarm appliances shall be located at least _____ in. above the floor if ceiling height permits, and at least 6 in. below the ceiling.

○ 70

○ 80

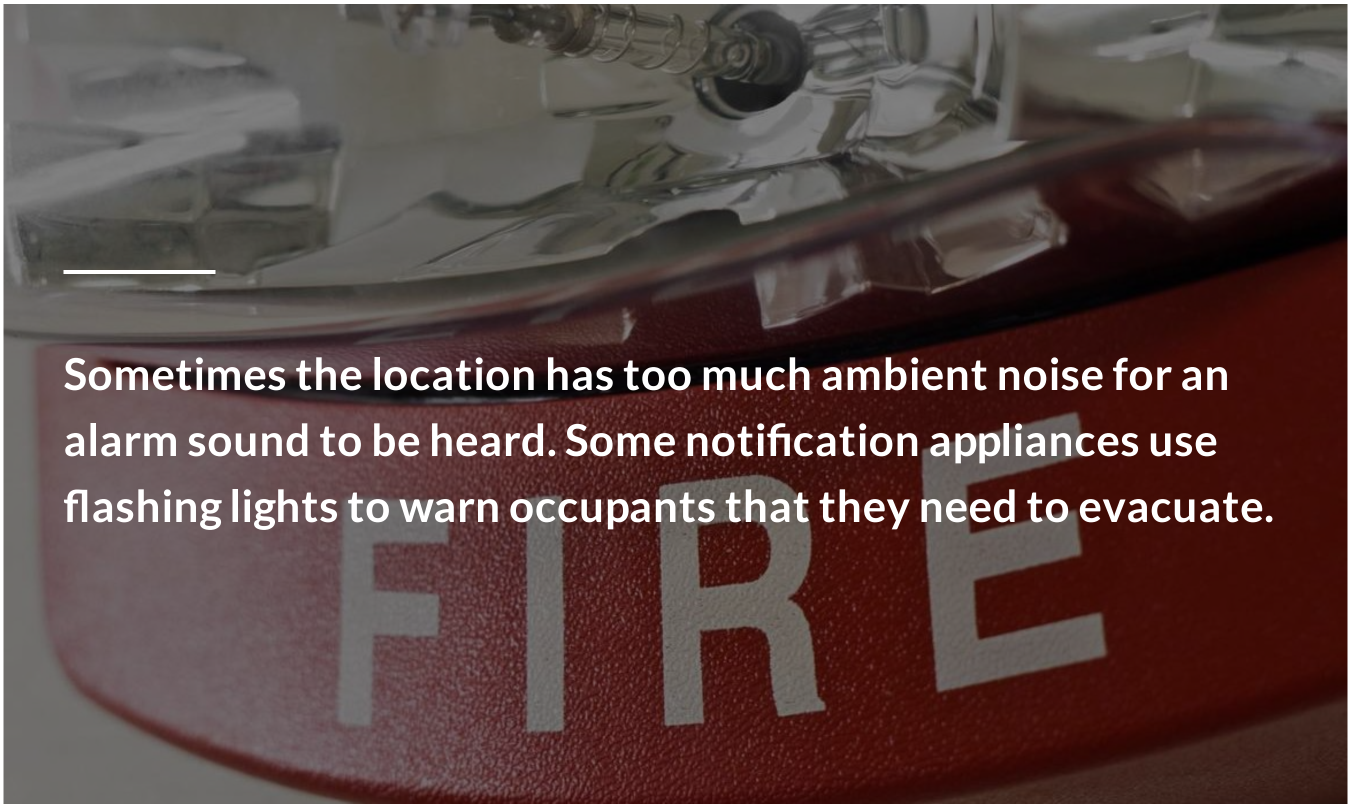
○ 90

SUBMIT

🔒 Complete the knowledge check above before moving on.

Lesson 2 of 2

Visible and other Notification Appliances



Sometimes the location has too much ambient noise for an alarm sound to be heard. Some notification appliances use flashing lights to warn occupants that they need to evacuate.

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Recognize visual characteristics of visible signaling appliances

2. Properly locate wall-mounted and ceiling-mounted appliances at effective intensity levels

3. Determine if synchronization is needed in areas with multiple visible signaling devices

CODED AND NON-CODED SIGNALS

Coded and Non-Coded Signals

As they are addressed by the code, **notification signals** are classified in the following manner:

A **coded signal** can be either *audible* or *visual*. It conveys discrete bits of information such as a given number of flashes from a light or a given number of tones from a horn that tell what floor and section of the building the alarm was generated from.

A **non-coded** signal conveys only one discrete bit of information.

- A **non-coded perceptually constant signal** is one where the notification appliance, either *visible* or *audible*, is operated continuously.

- A **non-coded perceptually repetitious signal**, however, is where the appliance is interrupted at a continuous uniform rate.
- A **non-coded single event signal** is a single flash of light or a single stroke of a bell. This is not a valid fire alarm signal.

VISIBLE CHARACTERISTICS-PUBLIC MODE

Visible Characteristics – Public Mode

NFPA 72 2016, Section 18.5

Just as was the case with audible appliances, the requirement to provide visible notification comes from ***NFPA 101*** or other state, local, or AHJ requirements.

ⓘ The only requirement for visible appliances in ***NFPA 72*** is in the case where audible notification is required and the ambient sound level is too high to use audible appliances. If this is the case, then visible appliances must be used.

These requirements are normally only for occupiable areas. You would not want to put visible appliances in closets. However, you might have a file room the size of a large closet where you may want to provide notification.

Our main discussion will focus on the visible characteristics required of visible signaling appliances in the public mode.

LIGHT, COLOR AND PULSE CHARACTERISTICS

NFPA 72 2016, Section 18.5.3

The flash rate of the device **cannot exceed two flashes per second** nor can it be **less than one flash per second**.

The code defines a flash or pulse duration as the time interval between initial and final points of 10% of maximum signal.

The **maximum pulse duration is limited to 20 milliseconds** (0.02 seconds) with a maximum duty cycle of 40%.

The **light source can be clear or nominal white**, and must not exceed an effective intensity of more than 1,000 candela (cd).

CONTINUE

Let's do a quick check about what has been covered so far.

A **non-coded** signal conveys only one discrete bit of information. Match the following non-coded signals to their action.

Non-coded perceptually constant signal	is where the notification appliance, either visible or audible, is operated continuously.
Non-coded perceptually	is where the appliance is

Non-coded perceptually repetitious signal	interrupted at a continuous uniform rate.
Non-coded single event signal	is a single flash of light or a single stroke of a bell. Not a valid fire alarm signal.

SUBMIT

Complete the knowledge check above before moving on.

Appliance Location

NFPA 72 2016, Section 18.5.5

Wall-mounted appliances must have the entire lens located between 80 in. and 96 in. above the finished floor.

If the ceiling height is too low to mount the units a minimum of 80 in., the appliances shall be mounted 6 in. below the ceiling.

ⓘ ***NFPA 72 2016*** states the room size covered by a strobe of a given value shall be reduced by twice the difference between the minimum mounting height of 80 in. and the actual lower mounting height.

The minimum mounting height is 80 in. If the appliances were mounted at 70 in., the room size coverage requirements would be reduced by 2 x 10 in., or 20 in.

For a 15 cd appliance that would normally cover a 20 ft. x 20 ft. area, the appliance will now only cover an 18-ft, 4-in. x 18-ft, 4-in. area.

Visible appliances listed for mounting parallel to the floor shall be permitted to be located on the ceiling, or suspended below the ceiling.

Two tables establish the requirements for wall-mounted and ceiling-mounted appliances respectively.

1

1. Table 18.5.5.4.1(a) (wall-mounted appliances):

- Lists room sizes and then tells us that we can choose one appliance for one wall or a single appliance on each wall.
- We are also given the intensity requirements for these potential mounting configurations.

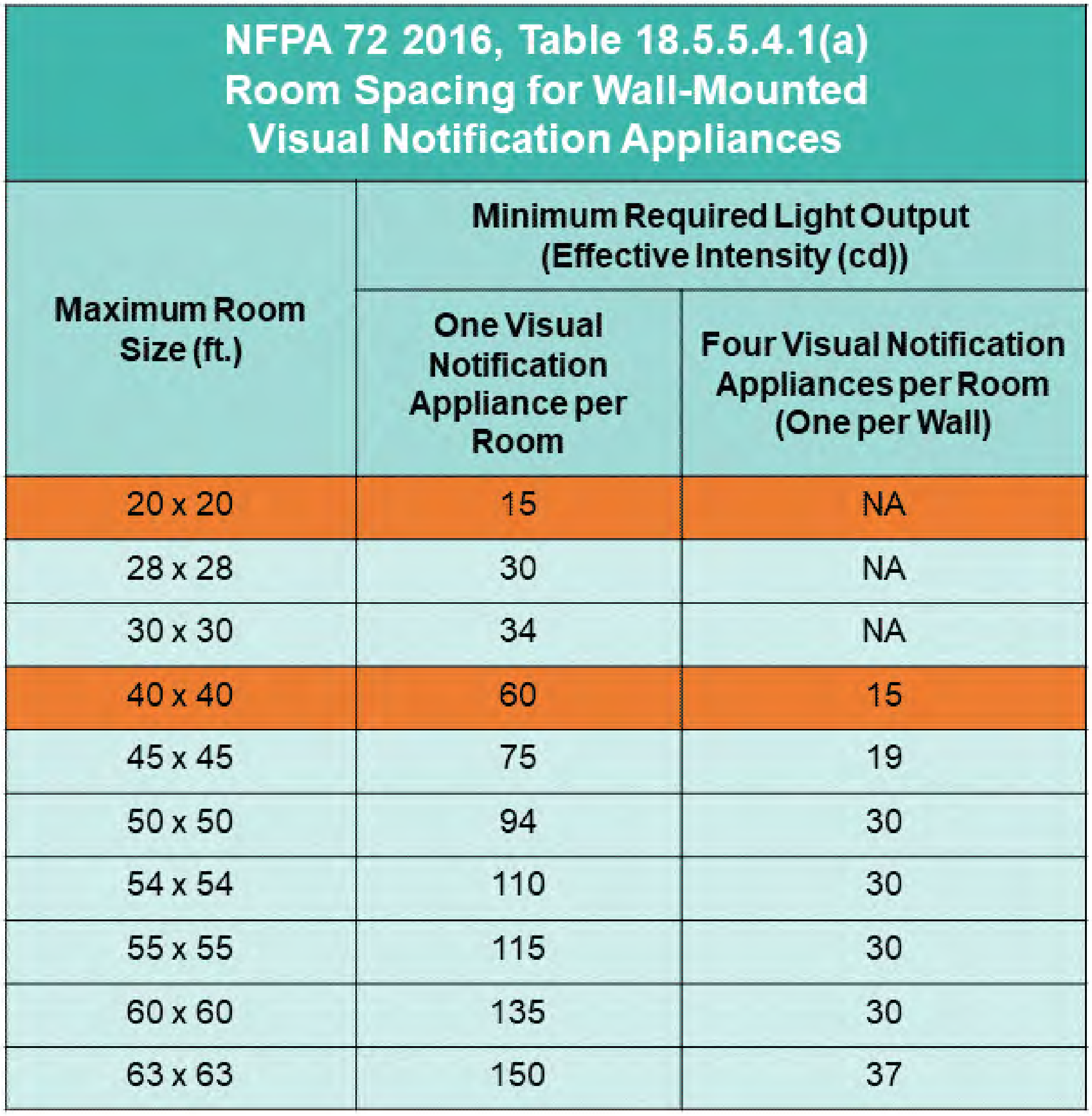
You can use the table to determine what size strobe is needed for a given area.   A 20 ft x 20 ft area requires a single 15 cd strobe.

A 15 cd wall-mounted strobe "covers" a distance of 20 ft. in front of it and 10 ft. to either side of its centerline, for a total 20 ft. x 20 ft. area.

A 40 ft. x 40 ft. area requires a single 60 cd strobe.

40 ft. in front of it and 20 ft. to either side of its centerline.

Keep in mind that if a room is large enough, four strobes may be placed in the room. Each strobe will be offset to ensure maximum coverage.



NFPA 72 2016, Table 18.5.5.4.1(a)
Room Spacing for Wall-Mounted
Visual Notification Appliances

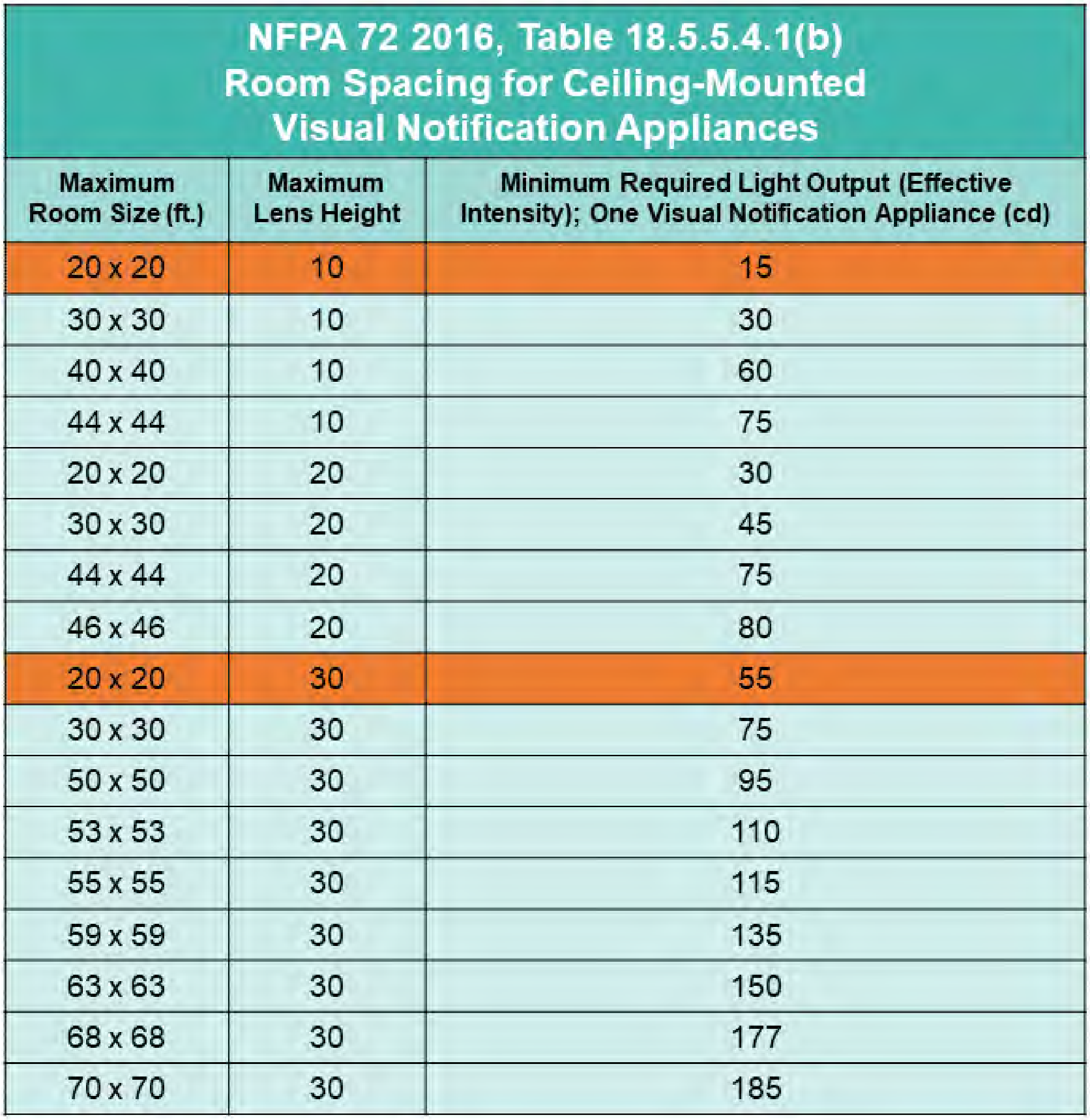
Maximum Room Size (ft.)	Minimum Required Light Output (Effective Intensity (cd))	
	One Visual Notification Appliance per Room	Four Visual Notification Appliances per Room (One per Wall)
20 x 20	15	NA
28 x 28	30	NA
30 x 30	34	NA
40 x 40	60	15
45 x 45	75	19
50 x 50	94	30
54 x 54	110	30
55 x 55	115	30
60 x 60	135	30
63 x 63	150	37

2

2. Table 18.5.5.4.1(b) (ceiling-mounted appliances):

- Brings ceiling height into the equation.
- Maximum ceiling height is 30 ft. If a ceiling-mounted appliance must be installed in a space with a ceiling height greater than 30 ft,

the appliance must be installed so that it is no more than 30 ft. from the floor.



NFPA 72 2016, Table 18.5.5.4.1(b)
Room Spacing for Ceiling-Mounted Visual Notification Appliances

Maximum Room Size (ft.)	Maximum Lens Height	Minimum Required Light Output (Effective Intensity); One Visual Notification Appliance (cd)
20 x 20	10	15
30 x 30	10	30
40 x 40	10	60
44 x 44	10	75
20 x 20	20	30
30 x 30	20	45
44 x 44	20	75
46 x 46	20	80
20 x 20	30	55
30 x 30	30	75
50 x 50	30	95
53 x 53	30	110
55 x 55	30	115
59 x 59	30	135
63 x 63	30	150
68 x 68	30	177
70 x 70	30	185

You can use the table to determine what size strobe is needed for a given area with a ceiling height of 10, 20, or 30 ft.

A 20 ft. x 20 ft. area with a 10 ft. ceiling requires a single 15 cd strobe.

A 15 cd ceiling-mounted strobe “covers” a distance from the ceiling to the floor of 10 ft. and “covers” a distance of 10 ft. in all directions.

A 20 ft. x 20 ft. area with a 30 ft. ceiling requires a single 55 cd strobe.

30 ft. from the ceiling to the floor, but only 10 ft. in all directions.

SPACING IN ROOMS

Spacing in Rooms

NFPA 72 2016, Section 18.5.5.4

Two or more visible signaling devices must be synchronized if they are in the **same field of view**.

Synchronization is not required if it is a household application per Section 29.3.9, or if the indoor visible appliances are viewed from an outdoor location.

Supplementary visible signaling devices are also discussed in Section 18.7.

- These are intended to supplement or enhance an audible or visible appliance.
- Since these are supplemental to the primary system, they are permitted to be mounted lower than 80 in. above the floor.

SPACING IN CORRIDORS

Spacing in Corridors up to 20 ft. in width

NFPA 72 2016, Section 18.5.5.5

The **intensity of the appliances used in corridors** must be **at least 15 cd.**

The **appliances cannot be located more than 15 ft. from the end of the corridor**, and the **separation distance of appliances** is limited to **100 ft**.

If there is an **interruption to the concentrated viewing path**, such as a **fire door, elevation change**, etc., the **area shall be treated as a separate corridor**.

If more than two visible appliances are in any field of view in the corridor, the appliances must be synchronized.

Wall-mounted visible appliances can be mounted on either end of the wall or **the side wall of the corridor**, as long as the **spacing requirements of Section 18.5.5.5.5** are met.

CONTINUE

Let's do a quick check about what has been covered so far.

Based on Table 18.5.5.4.1(a) (room spacing for wall-mounted visible appliances), which of the following requirements must be met for the minimum light output (effective intensity (cd)) for a 60 ft. x 60 ft. area? (Select all that apply)

☐ one light per room (115 cd)

☐ one light per room (135 cd)

☐ four lights per room (one per wall - 30 ft.)

☐ four lights per room (one per wall - 37 ft.)

SUBMIT

Based on Table 18.5.5.4.1(b) (room spacing for ceiling-mounted visible appliances), which of the following requirements must be met for the minimum light output (effective intensity (cd)) and maximum lens height for a 50 ft. x 50 ft. area? (Select all that apply)

☐ maximum lens height (20 ft.)

☐ maximum lens height (30 ft.)

☐ minimum light output (95 cd)

☐ minimum light output (110 cd)

SUBMIT

Complete the knowledge check above before moving on.

Sleeping Areas

***NFPA* 72 2016, Section 18.5.5.7**

Section 18.5.5.7 and Table 18.5.5.7.2 establish minimum intensity requirements for sleeping rooms.

ⓘ **Per Table 18.5.5.7.2, if the distance from the ceiling to the top of the appliance lens is equal to or greater than 24 in, the effective intensity must be at least 110 cd.**

If the distance from the ceiling to the top of the appliance lens is less than 24 in, the effective intensity must be at least 177 cd.

The appliance can be no further than 16 ft. from the pillow.

Several diagrams in the Annex A material related to this section give us some examples of locating visible notification appliances (page 235 - 237).

TEXTUAL AND TACTILE APPLIANCES

Textual Audible Appliances

NFPA 72 2016, Section 18.8

Speaker appliances shall comply with **Section 18.4 (Audible Characteristics)**.

Speaker appliances must meet the same sound pressure level requirements (in dBA) for **private operating mode** **and** **public operating mode** as **audible appliances**.

This is for speakers that may generate signals similar to a bell, horn, chime, or a tone. There are different (intelligibility) requirements when the speaker broadcasts a live or synthesized voice message.

A **textual signal** is one which contains a series of information pieces. These can be either audible or visual. For example, voice communication would be considered to be an audible textual signal. A CRT display or sign would be a visual textual device.

NFPA 72 2016, Section 18.9

Textual visible appliances are permitted if used in addition to audible or visible appliances, or both.

The information produced by textual visible appliances must legible.

Unless otherwise permitted by the AHJ, textual visible appliances used in the private mode must be located in rooms only accessible to personnel directly concerned with implementation and direction of emergency action initiation.

Textual visible appliances used in the public operating mode must be located to ensure readability.

TACTILE APPLIANCES

Tactile Appliances

NFPA 72 2016, Section 18.10

Tactile appliances are permitted if used in addition to audible or visible appliances, or both.

Tactile appliances must meet the requirements of ANSI/UL 1971, Standard for Signaling Devices for the Hearing Impaired, or equivalent.

CONTINUE

Let's do a quick check about what has been covered so far.

Based on *NFPA* 72 2016, Section 18.5.5.7, for sleeping areas, the visual appliance can be no further than ____ ft. from the pillow.

○ 8

○ 12

○ 16

SUBMIT

Complete the knowledge check above before moving on.

Familiarize yourself with requirements for audible appliance sound levels.

The audibility requirements for private and public mode areas have slightly different requirements.

Sleeping areas have their own audibility requirements to include the requirement for the 520 Hz low frequency square wave appliances.

Remember where and why private mode requirements may be needed.

In sleeping areas, don’t forget limitations on how far a visible appliance can be placed from the pillow (16 ft. max).

Ensure you understand visible appliance synchronization requirements.

In addition to audible and visible appliances, there are other appliances such as visible textual or tactile.

CONTINUE

After completing this module, you should now have a better understanding of the different audible and visible appliances for fire alarm systems.

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

Ohio Fire Alarm and Detection Equipment-Household Fire Alarm Systems

FIRE TECH
PRODUCTIONS

Welcome to the Household Fire Alarm Systems module of the Ohio Fire Alarm and Detection Systems Course.

By the end of this module, you will be able to do the following:

- Identify basic requirements for Chapter 29 in *NFPA* 72 2016
- Recognize detection requirements for smoke alarms
- Describe required occupant notification
- Apply the Ohio Building Code, Section 915 to carbon monoxide alarms
- Compare various types of equipment performance
- Recognize operational characteristics of combination systems
- Identify proper installation of fire alarm systems
- Identify requirements for detector location and spacing
- Identify requirements for audible alarms
- Recognize markings and instructions for various components of fire warning systems

Key Reference for this module:

- *NFPA* 72 – The National Fire Alarm and Signaling Code, Chapter 29, 2016

When you are ready to begin, click on the button above to start the course.

Basic Requirements and Smoke Alarms

Power Supplies and Equipment Performance

Installation and Location & Spacing

Lesson 1 of 3

Basic Requirements and Smoke Alarms

We have all heard that we need to check the smoke alarms in our residences. The recommendation is to check them once a month and replace the batteries once or twice a year. Even if the appliance has a ten-year battery, it should still be checked once a month to be sure it is working properly to keep occupants safe.

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Identify basic requirements for Chapter 29 in *NFPA* 72 2016
2. Recognize detection requirements for smoke alarms
3. Describe required occupant notification

LET'S GET STARTED

NFPA 72 2016 defines a **Household Fire Alarm System** as a system of devices that uses a **fire alarm control unit** **to produce an** **alarm signal** in the household for the purpose of **notifying the occupants** of the presence of a fire so that **they will evacuate** the premises.

NFPA 72 2016, Chapter 29 covers the requirements for:

1. One- and two-family dwelling units
2. Sleeping rooms of lodging and rooming houses
3. Individual dwelling units of apartment buildings
4. Guest rooms, sleeping rooms, and living areas within guest suites of hotels and dormitories
5. Day-care homes
6. Residential board and care facilities
7. Other locations where applicable laws, codes, or standards specify a requirement for the installation of smoke alarms

CONTINUE

A **multiple-station alarm device** is **an interconnection of two or more single-station alarm devices which, when one alarms, will alarm all integral or separate alarm devices**.

- If one of your alarms goes off, its connection to the others will give you a chorus of alarms. But, the multiple-station concept does create a situation where a single alarm will alert many people to the presence of smoke, heat, or whatever happens to be the response mode of that particular detector.

A **single-station alarm device** is simply a **unit containing the detection, control, and alarm units**. Power can be either internal or wired at the point of attachment. This could be the type of detector which we can buy at the hardware store. It's the typical smoke detector installed in many older homes.

Remember:

- **Smoke ALARMS** are **single- or multiple-station alarm devices *not normally connected* to a fire alarm system**, that are capable of detecting a fire condition and alerting the occupants**.**
- **Smoke DETECTORS** are **connected to a fire alarm system and *send a signal* to the fire alarm control unit**. The fire alarm control unit then activates the notification appliances to alert the occupants**.**

BASIC REQUIREMENTS

***NFPA* 72 2016, Section 29.3**

Any and all devices and equipment to be installed in conformity with Chapter 29 shall be approved or listed for the purposes for which they are intended.

Fire-warning equipment shall be installed in accordance with the listing and manufacturer's published instructions.

The installation of smoke alarms or fire alarm systems, or combinations of these, shall comply with the requirements of this chapter and shall satisfy the minimum requirements for number and location of smoke alarms or smoke detectors by one of the following:

1. The required minimum number and location of smoke detection devices shall be satisfied (independently) through the installation of smoke alarms. The installation of additional smoke alarms shall be permitted.
2. The required minimum number and location of smoke detection devices shall be satisfied (independently) through the installation of system smoke detectors.

Additional smoke alarms or detectors are permitted to be installed.

Fire-warning equipment to be installed in residential occupancies shall produce the audible emergency evacuation signal described in ANSI S3.41, American National Standard Emergency Evacuation Signal, whenever the intended response is to evacuate the building.

Exception: Where mechanically powered single-station heat alarms are used as supplementary devices, unless required by applicable laws, codes, or standards, such devices shall not be required to produce the emergency evacuation signal described in ANSI S3.41.

> ⓘ The audible emergency evacuation signal shall be permitted to be used for other devices as long as the desired response is immediate evacuation.

CONTINUE

Let's do a quick check about what has been covered so far.

Match the words to their definitions.

Smoke Alarm	single- or multiple-station alarm device not normally connected to a fire alarm system
Smoke Detector	connected to a fire alarm system and sends a signal to the fire alarm control unit

SUBMIT

Complete the knowledge check above before moving on.

Audible fire alarm signals shall meet the performance requirements of Sections 18.4.3, 18.4.5.1, 18.4.5.2, and 29.3.8.

Individuals with Hearing Loss

Visible appliances shall meet the requirements of Section 18.5. If the occupants of the residence have hearing deficits, it is the responsibility of the party with the hearing loss to inform the installer of the hearing deficit.

Where required by governing laws, codes, or standards, **low frequency 520 Hz (+/- 10%) square wave audible appliances** are to be provided for those persons with **mild to severe hearing loss**.

For persons with **profound hearing loss**, **visible appliances** and/or **tactile appliances** are **required to be provided**.

SMOKE ALARMS

Required Detection

***NFPA* 72 2016, Section 29.5.1**

This section defines the detection requirements for smoke alarms in these applications:

1. In all sleeping rooms and guest rooms
2. Outside of each separate dwelling unit sleeping area, within 21 ft of any door to a sleeping room, with the distance measured along a path of travel
3. On every level of a dwelling unit, including basements
4. On every level of a residential board and care occupancy (small facility), including basements and excluding crawl spaces and unfinished attics
5. In the living area(s) of a guest suite
6. In the living area(s) of a residential board and care occupancy (small facility)

The use of **fire alarm system smoke detectors** and **notification appliances** is **permitted to satisfy the requirements of fire-warning equipment for smoke alarms.**

CONTINUE

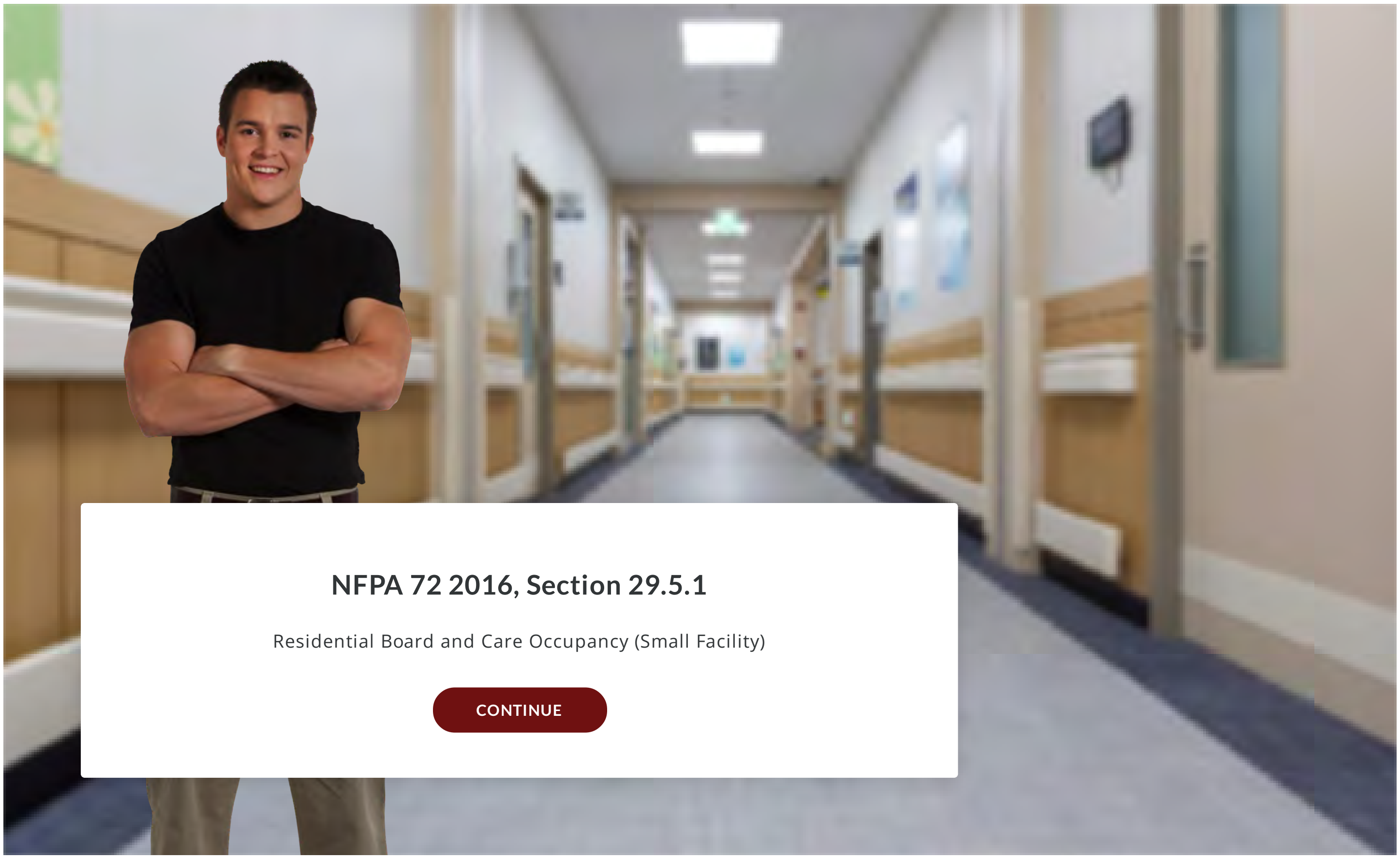
If the area outside the sleeping rooms is separated from the adjacent living areas by a door, a smoke alarm shall be installed in the area between the door and the sleeping rooms, and additional alarms shall be installed on the living area side of the door.

If the interior floor area for a given level of a dwelling unit, excluding garage areas, is greater than 1,000 ft^2, smoke alarms shall be installed per the following:

- All points on the ceiling shall have a smoke alarm within a 30 ft travel distance or shall have an equivalent of one smoke alarm per 500 ft^2 of floor area. One smoke alarm per 500 ft^2 is calculated by dividing the total interior square footage of floor area per level by 500 ft^2.
- Where dwelling units include great rooms or vaulted/cathedral ceilings extending over multiple floors, smoke alarms located on the upper floor that are intended to protect the great room(s) are permitted to be considered as part of the lower floor(s) protection scheme used to meet the requirements of the statement above.

CONTINUE

Try the following scenario to see how you would do in this situation.

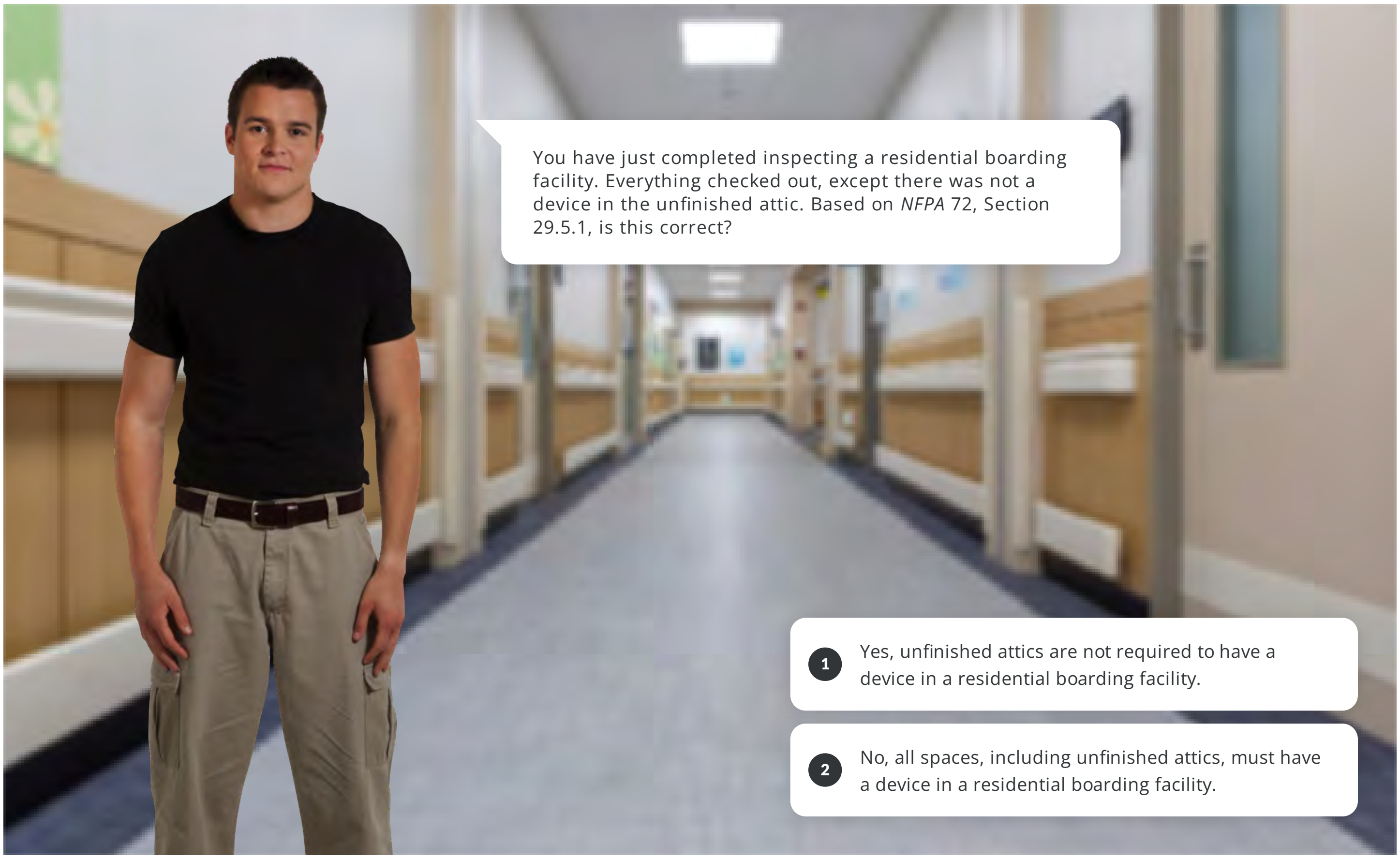


NFPA 72 2016, Section 29.5.1

Residential Board and Care Occupancy (Small Facility)

Scene 1 Slide 1

Continue → Next Slide



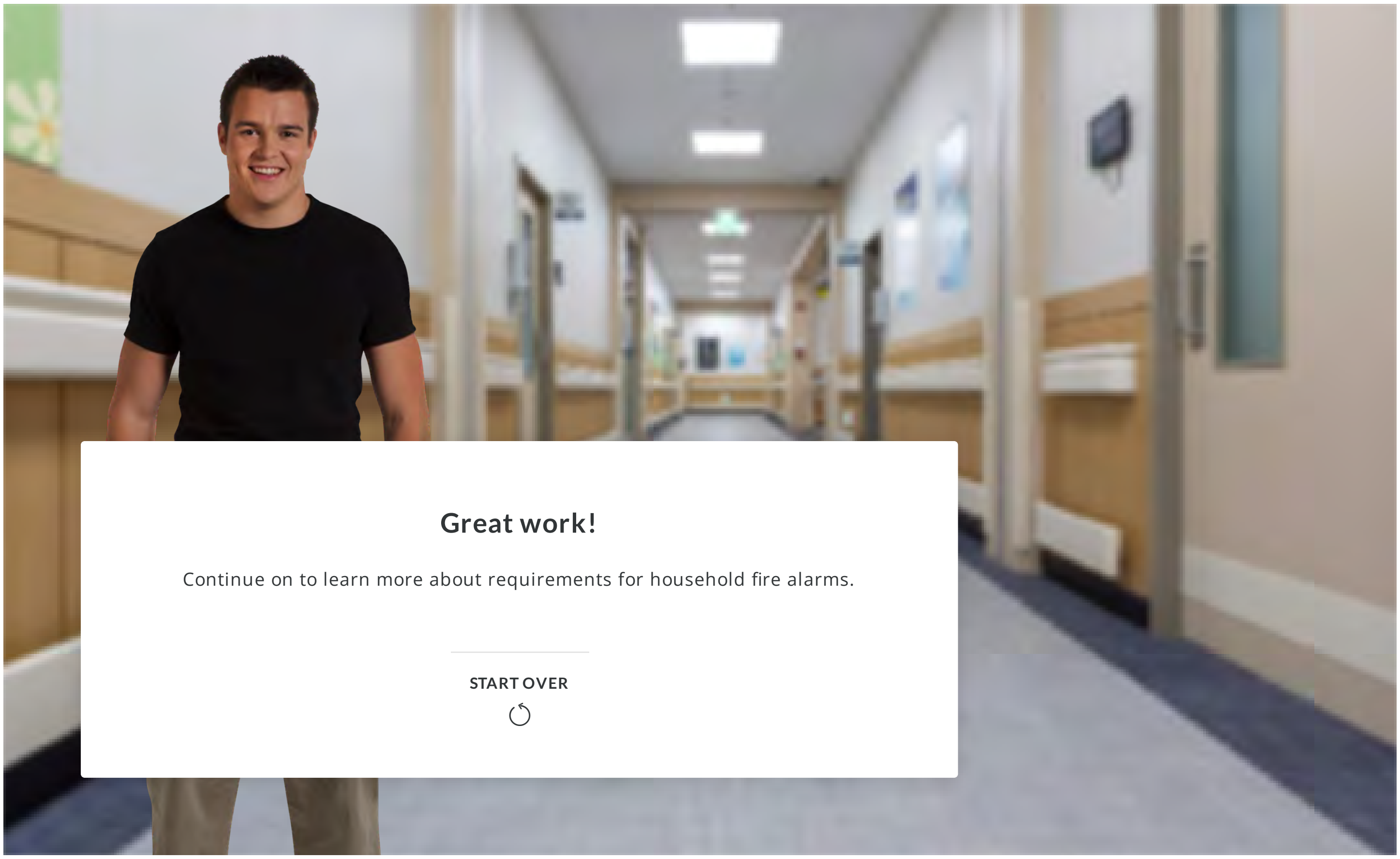
You have just completed inspecting a residential boarding facility. Everything checked out, except there was not a device in the unfinished attic. Based on *NFPA* 72, Section 29.5.1, is this correct?

1. Yes, unfinished attics are not required to have a device in a residential boarding facility.
2. No, all spaces, including unfinished attics, must have a device in a residential boarding facility.

Scene 1 Slide 2

0 → Next Slide

1 → Next Slide



Great work!

Continue on to learn more about requirements for household fire alarms.

START OVER

Scene 1 Slide 3

Continue → End of Scenario

Complete the scenario above before moving on.

Required Occupant Notification

***NFPA* 72 2016, Section 29.5.2**

Fire-warning equipment used to provide required or optional detection shall produce audible fire alarm signals.

Unless exempted by applicable laws, codes, or standards, smoke or heat alarms in a dwelling unit must be installed so that if one smoke or heat alarm sounds, all smoke or heat alarms within a dwelling unit, suite of rooms, or similar area, sound to notify the occupants.

Exception: All alarms do not have to sound if using mechanically powered single-station heat alarms.

Unless otherwise permitted by the authority having jurisdiction (AHJ), audible fire alarm signals shall sound only in an individual dwelling unit, suite of rooms, or similar area and shall not be arranged to operate fire-warning equipment or fire alarm systems outside these locations. Remote annunciation shall be permitted.

CONTINUE TO NEXT LESSON: POWER SUPPLIES & EQUIPMENT PERFORMANCE

Power Supplies and Equipment Performance

Did you know that heat detectors or heat alarms are sensitive to ambient temperatures?

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Apply the Ohio Building Code, Section 915 to carbon monoxide alarms
2. Compare various types of equipment performance
3. Recognize operational characteristics of combination systems

CONTINUE

Carbon Monoxide Alarms

Ohio Building Code, Section 915

Section 915.1 Carbon monoxide alarms: Section 915.1.1-915.6 of the Ohio Building Code states that for new construction, an approved carbon monoxide detector shall be installed in the immediate vicinity of the sleeping units, classrooms, and dwelling units that contain fuel-burning appliances, a fuel-burning fireplace, a fuel-burning forced air furnace, or attached private garages are required to have carbon monoxide detectors.

*Note: There are exceptions for the above-mentioned locations that have either fuel-burning, forced air furnaces, or attached private garages.

Section 915.2 Where required: Where work requiring a permit occurs in existing dwellings that have attached garages or in existing dwellings within which fuel-fired appliances exist, carbon monoxide alarms shall be provided **in accordance with Section 915.1.**

There is an Ohio Building Code and an Ohio Residential Building Code. The Ohio Residential Building Code was updated in 2013 and requires Carbon Monoxide Alarms.

POWER SUPPLIES

NFPA 72 2016, Section 29.6.1

Smoke and Heat Alarms Power Supplies

The power supply requirements for smoke and heat alarms are as follows...

Requirement 1

A commercial light and power source along with a secondary power source that is capable of operating the device for at least **7 days in the normal condition**, followed by **4 minutes of alarm**. Note the 4-minute requirement vs. the normal 5-minute requirement for system power supplies.

Requirement 2

If a commercial light and power source is not normally available, a noncommercial AC power source along with a secondary power source capable of supplying the device for at least **7 days in normal condition** and **4 minutes in alarm**.

Requirement 3

A nonrechargeable, nonreplaceable battery capable of operating the device for **10 years in normal condition**, followed by **4 minutes in alarm**, followed by **7 days in a** *trouble condition*.

Requirement 4

If a battery primary power supply is specifically permitted, a battery meeting the requirements of **Section 29.6.6 (nonrechargeable primary battery)** or the requirements of **Section 29.6.7 (rechargeable primary battery)** is permitted.

Requirement 5

A suitable spring-wound mechanism for the nonelectrical portion of a listed single-station alarm with a visible indication to show that sufficient operating power is not available.

Summary

ⓘ The **commercial power source is always the preferred choice of primary power** since it is the most reliable source of power in most cases. If it is not available, the code defines the requirements for other primary power supplies.

CONTINUE

Let's do a quick check about what has been covered so far.

When was the Ohio Residential Building Code updated to require Carbon Monoxide Alarms for new construction?

○ 2011

○ 2013

○ 2015

○ 2017

SUBMIT

According to Ohio Building Code Section 915.1, an approved carbon monoxide alarm shall be installed in which of the following places? (Choose all that apply)

☐ Outside each separate sleeping area of the dwelling

☐ In dwellings with detached garages

☐ In the immediate vicinity of the bedrooms of the dwelling

☐ In dwellings with fuel fired appliances

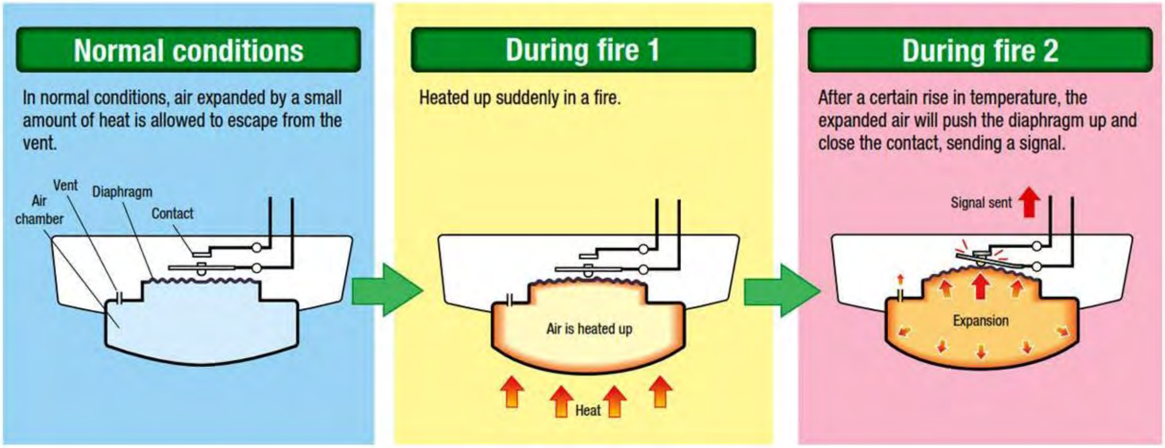
SUBMIT

Complete the knowledge check above before moving on.

Equipment Performance

NFPA 72 2016, Section 29.7

Any failure of any nonreliable or short-life component that renders the detector inoperable shall result in a trouble signal or otherwise be apparent to the occupant of the living unit without the need for test.



Rate of Rise Detector (Click to enlarge image)

Heat detectors and heat alarms, including heat detectors or alarms combined with smoke detectors or smoke alarms may be fixed-temperature or rate-of-rise and shall be **listed for no less than 50 ft. spacing**.

Fixed temperature heat detectors or heat alarms must have a **temperature rating at least 25°F above the normal ambient temperature** and shall **not be rated less than 50°F higher than the maximum expected ambient temperature** in the area where it is installed.

All single-station alarm devices and multiple-station alarm devices must have a convenient means of testing its operability by the occupant, owner, or other responsible party.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

As per the power supply requirements for smoke and heat alarms, a non-rechargeable, non-replaceable battery capable of operating the device for 10 years in normal condition, followed by 4 minutes in alarm, followed by 7 days in a(n) _____ condition.

○ Alarm

○ Supervisory

○ Trouble

SUBMIT

Complete the knowledge check above before moving on.

System Control Equipment

NFPA 72 2016, Section 29.7.5

If a fire alarm system is used for household fire-warning equipment, the control equipment shall be automatically restoring upon restoration of electrical power.

The system control equipment must be of a type that “locks in” (latch) on an alarm condition. Smoke detection circuits are not required to lock in.

If a reset switch is provided, it must be a self-restoring (momentary operation) type.

A means for silencing the trouble notification appliance(s) is permitted only if the following conditions are met:

1. The means is key-operated or located within a locked enclosure, or arranged to provide protection against unauthorized use.
2. The means transfers the trouble indication to an identified lamp or other acceptable visible indicator, such as an LED, and the visible indication stays lit until the trouble condition has been corrected.

A means for turning off activated alarm notification appliances is permitted only if the following conditions are met:

1. The means is key-operated or located within a locked cabinet, or arranged to provide protection against unauthorized use.
2. The means includes the provision of a visible alarm silence indication.

Household fire alarm system smoke detectors, initiating devices, and notification appliances shall be monitored for integrity so that the occurrence of a single open or single ground fault in the interconnection, which prevents normal operation of the interconnected devices, is indicated by a distinctive trouble signal.

> *This is the* ***same requirement*** *as a* ***protected premises fire alarm system****...because basically it* ***is*** *a protected premises system.*

LET'S REVIEW

Let's do a quick check about what has been covered so far.

Smoke detection circuits are not required to lock in.

○ True

○ False

SUBMIT

Complete the knowledge check above before moving on.

Combination System

NFPA 72 2016, Section 29.7.6

Combination systems are **permitted as long as the fire alarm signals take precedence over non-fire alarm signals**, even if the other signals activated first.

Fire alarm signals must be distinctive from non-fire alarm signals so occupants can distinguish from other signals that may require them to respond differently.

Faults in other systems or components cannot affect the operation of the fire alarm portion of the system.

Installations that include the connection of single-station alarm device or multiple-station alarm device with other input or output devices shall be permitted. An open, ground fault, or short circuit of the wiring connecting input or output devices to the single- or multiple-station alarms shall not prevent operation of each individual alarm.

WIRELESS DEVICES

Wireless Devices

NFPA 72 2016, Section 29.7.7

Household fire alarm systems utilizing low-power wireless transmission of signals within the protected dwelling unit shall comply with the requirements of **Section 23.16**.

To ensure adequate transmission and reception capability, nonsupervised, low-power wireless alarms shall be capable of reliably communicating at a distance of 100 ft. indoors.

****There's much more to this requirement that involves formulas. Check *NFPA* 72 2016, page 170 and 171****

Fire alarm signals have priority over all other signals.

The maximum allowable response delay from activation of an initiating device to receipt and alarm/display by the receiver or control unit is 20 seconds.

Wireless interconnected smoke alarms, in the receive mode, shall remain in alarm as long as the originating unit (transmitter) remains in alarm.

A **single fault** that disables a transceiver **shall not prevent** other transceivers in the system from operating.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

To ensure adequate transmission and reception capability, nonsupervised, low-power wireless alarms shall be capable of reliably communicating at a distance of ____ indoors.

○ 50 ft.

○ 100 ft.

○ 150 ft.

SUBMIT

Wireless interconnected smoke alarms shall remain in alarm in the ____ mode as long as the originating unit (transmitter) remains in alarm.

Type your answer here

SUBMIT

Complete the knowledge check above before moving on.

Lesson 3 of 3

Installation and Location & Spacing

Smoke alarms and heat alarms are point of use devices. They need to be installed in the correct location in order to do their job. If they are tucked away because they do not fit the aesthetic feel of a room, it defeats their purpose.

Goals of this Lesson

By the end of this lesson, you will be able to do the following:

1. Identify proper installation of fire alarm systems
2. Identify requirements for detector location and spacing
3. Identify requirements for audible alarms
4. Recognize markings and instructions for various components of fire warning systems

INSTALLATION

Installation

NFPA 72 2016, Section 29.8

The installation of household fire alarm systems has to be done in a manner where they are immune to vibration or jarring.

The detectors and components must be mounted independently of their wiring, and they have to be restored promptly after any alarm or test.

The supplier or installing contractor shall provide the owner or other responsible parties with the following:

1. An instruction booklet illustrating typical installation layouts
2. Instruction charts describing the operation, method, and frequency of testing and maintenance of fire-warning equipment
3. Printed information for establishing an emergency evacuation plan
4. Printed information to inform owners of repair or replacement services and how to find replacements for parts within 2 weeks
5. Information noting both of the following:
    a. Unless manufacturers recommend otherwise, smoke alarms shall be replaced when they fail to respond to tests
    b. Smoke alarms installed in one- and two-family dwellings shall not remain in service longer than 10 years from the date of manufacture

INTERCONNECTION OF DETECTORS OR MULTIPLE STATION ALARMS

Interconnection of Detectors or Multiple Station Alarms

***NFPA* 72 2016, Section 29.8.2**

The interconnection of smoke or heat alarms must comply with the following:

1. Smoke or heat alarms may not be interconnected in numbers that exceed the manufacturer's published instructions.
2. If the interconnecting means is not supervised, no more than 18 initiating devices may be interconnected (of which 12 can be smoke alarms).
3. If the interconnecting means is supervised, no more than 64 initiating devices may be interconnected (of which 42 can be smoke alarms).

4. Smoke or heat alarms shall not be interconnected with alarms from other manufacturers unless listed as being compatible with the specific model.
5. When alarms of different types are interconnected, all interconnected alarms shall produce the appropriate audible response for the phenomena being detected, or remain silent.

A single fault on the interconnecting means between multiple-station alarm devices shall not prevent single-station alarm device operation of any of the interconnected alarms.

Remote notification appliance circuits of multiple-station alarms shall be capable of being tested for integrity by activation of the test feature on any interconnected alarm.

Activation of the test feature shall result in the operation of all interconnected notification appliances.

DETECTOR LOCATION AND SPACING

Smoke Alarms and Smoke Detectors

NFPA 72 2016, Section 29.8.3

Smoke alarms or smoke detectors mounted on a **peaked ceiling shall be located within 36 in. horizontally of the peak, but not closer than 4 in. vertically to the peak**.

Smoke alarms or smoke detectors mounted on a **sloped ceiling** **having a rise greater than 1 ft. in 8 ft. horizontally shall be located within 36 in. of the high side of the ceiling**, but **not closer than 4 in. from the adjoining wall** surface.

Wall mounted smoke alarms or detectors shall be **mounted no more than 12 in. from the ceiling.**

Smoke alarms and smoke detectors **shall not be located in unfinished attics or garages where temperatures may be below 40°F or over 100°F** unless they are rated for the environment.

- If the outside wall could be considerably warmer or cooler than the room temperature, the smoke detection devices shall be mounted on an inside wall.
- Smoke alarms or detectors **shall not be mounted within 10 ft. radial** from a stationary or fixed **cooking appliance**. There are **exceptions to this requirement in Section 29.8.3.4**.

CONTINUE

Let's do a quick check about what has been covered so far.

According to *NFPA* 72, Section 29.8.2, if the interconnecting means is not supervised, no more than ____initiating devices may be interconnected (of which ___ can be smoke alarms).

○ 18 (12)

○ 20 (14)

○ 22 (16)

○ 24 (18)

SUBMIT

According to *NFPA* 72, Section 29.8.2, If the interconnecting means is supervised, no more than ____ initiating devices may be interconnected (of which ____ can be smoke alarms).

- ○ 60 (40)
- ○ 62 (41)
- ○ 64 (42)
- ○ 66 (43)

SUBMIT

Smoke alarms and smoke detectors shall not be located in unfinished attics or garages where temperatures may be below ____°F or over 100°F unless they are rated for the environment.

- ○ 32°F
- ○ 36°F
- ○ 40°F

SUBMIT

Complete the knowledge check above before moving on.

Heat Detectors and Alarms

NFPA 72 2016, Section 29.8.4

On smooth ceilings, heat detectors and heat alarms shall be installed within the strict limitations of their listed spacing.

For **sloped ceilings** having a **rise greater than 1 ft. in 8 ft. horizontally**, the detector or alarm **shall be located within 36 in. of the peak**. The spacing of additional detectors or alarms, if any, shall be based on a horizontal distance measurement, not on a measurement along the slope of the ceiling.

CONTINUE

Heat detectors or alarms shall be mounted on the ceiling at least 4 in. from a wall or on a wall with the top of the detector or alarm not less than 4 in., nor more than 12 in. below the ceiling.

Exception: Where the mounting surface could become considerably warmer or cooler than the room, such as a poorly insulated ceiling below an unfinished attic or an exterior wall, the detectors or alarms shall be mounted on an inside wall.

In rooms with **open joists or beams, all ceiling-mounted detectors or alarms shall be located on the bottom of such joists or beams**.

Detectors or alarms installed on an **open-joisted ceiling shall have their smooth ceiling spacing reduced** where this spacing is measured at right angles to solid joists; **in the case of heat detectors or heat alarms, this spacing shall not exceed one-half of the listed spacing**.

ADDITIONAL CONSIDERATIONS

Additional Considerations

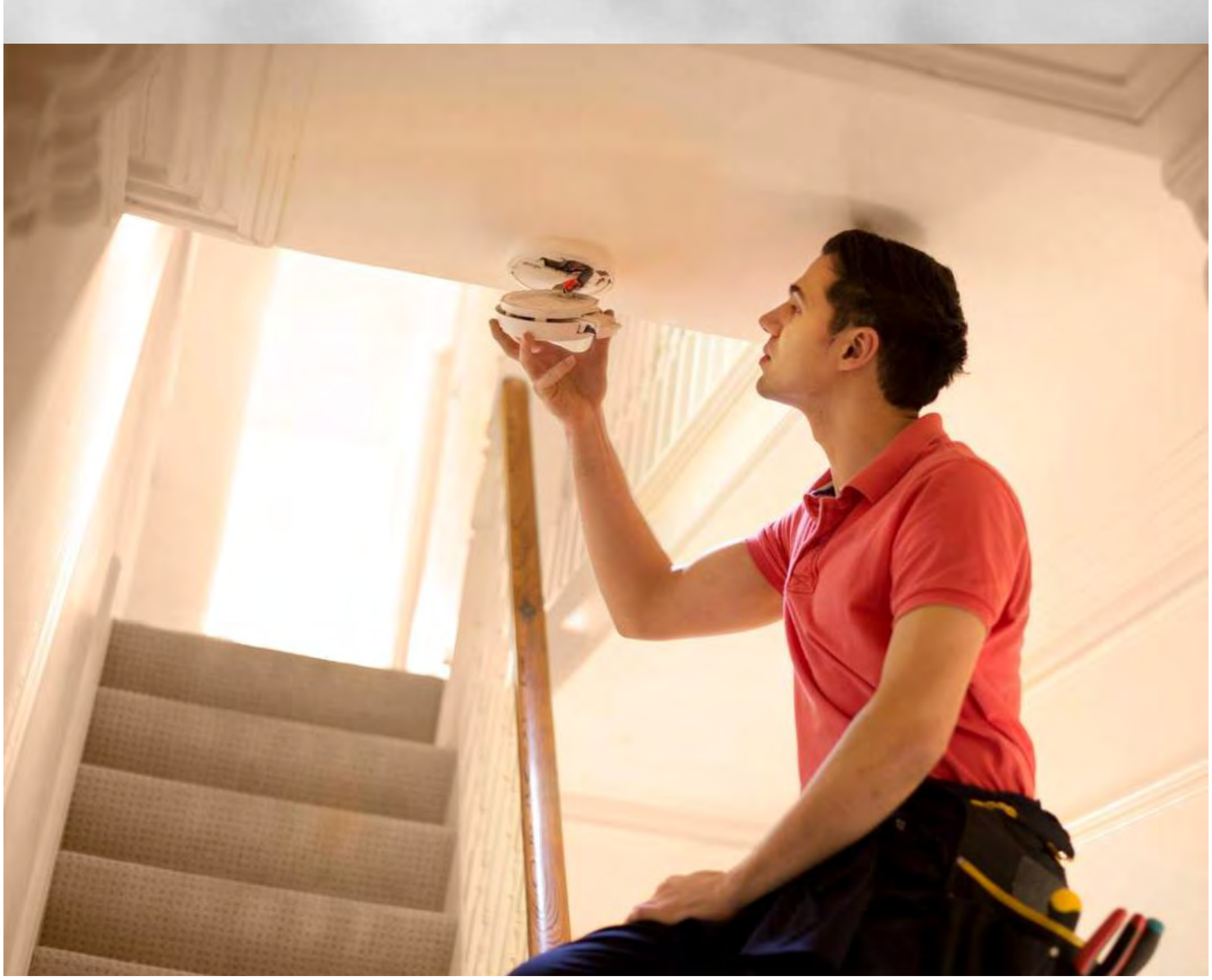
Per Section 29.3.6, fire-warning audible alarms must meet the requirements of Sections 18.4.3 and 18.4.5. They must **be at least 15 dBA above the average ambient sound level**, or 5 dBA above the maximum sound level.

In the **sleeping areas**, the **sound level must be a minimum of 75 dbA** measured at the **pillow level**. The code specifies requirements for notification appliances in sleeping and guest rooms for people with hearing loss in **Section 29.3.8.**

As previously stated, for **mild to severe hearing loss**, the audible appliance must also **produce a low frequency alarm signal with a fundamental frequency of 520 Hz +/- 10%**.

If the **hearing loss is profound**, **visible appliances must be provided**. In the applications that apply to Chapter 29, synchronization of visible appliances in the same field of view is not required.

When we have devices such as smoke alarms and heat alarms, we must realize that they respond only to smoke or heat in their immediate location. **They are point-of-use devices**. If we tuck the alarms away somewhere because we don't like their appearance or their color, we are defeating the purpose of the alarm itself.



A **basement alarm must be close to the connecting stairway.** As the smoke rises, it will approach the stairway and go up to where there are sleeping occupants of the building. **We want to detect the smoke when it gets close to these connecting stairways going up.**

This requirement also holds for other non-sleeping floors. If we have a downstairs living area only, we must mount our alarms close to any stairway leading up to the sleeping areas.

This helps to catch the smoke at the very earliest possible time.

Smoke alarms protecting a sleeping area must be installed close to, but *outside* of, bedrooms.

An alarm installed inside of a bedroom would be a little late in terms of alarming the occupants of other bedrooms, especially if the doors were closed. **Smoke alarms should alert occupants prior to smoke getting inside the bedroom.**

To **avoid dead air space**, it is **required** that **heat alarms be mounted at least 4 in. from a wall, *or* on a wall between 4 and 12 in. from the ceiling.**

Do not place smoke or heat alarms in kitchens, garages, or other areas where the temperature can exceed 100°F or fall below 32°F.

Heat alarms must be installed within their listed spacing. There are many mounting conditions. **Review the requirements in Chapter 17.**

Heat alarms must be installed at or near the ceiling, and at or within 3 ft. of the peak of a sloped ceiling.

WIRING AND MAINTENANCE

Wiring and Maintenance

System wiring must comply with *NFPA* 70, National Electrical Code, and with Article 760, which contains the *NFPA* 70 wiring requirements for protective signaling systems (fire alarms).

Maintenance and testing must be done in accordance with the **manufacturer's instructions and Chapter 14.**

This is a very common requirement throughout most of the NFPA standards.

Single-station alarm device and multiple-station alarm devices must have this done monthly.

MARKINGS AND INSTRUCTIONS

Markings and Instructions

Our last reference involves the required markings and instructions. This is a list of the required markings and instructions which must appear on the various components and systems comprising these fire warning systems for dwelling units.

Extra Notes:

- Read the *NFPA* 72 2016 Annex material, if for no other reason than your own safety.
- Review what you have in your own home.
- Review what you have in your own shop.

- Make certain that you, your family, and your fellow employees are in a situation where you're as well protected and as safe as you can possibly be.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

In the sleeping areas, the sound level must be a minimum of _____ measured at the pillow level.

○ 75 dbA

○ 85 dbA

○ 95 dbA

SUBMIT

Smoke alarms protecting a sleeping area must be installed inside of bedrooms.

○ True

○ False

SUBMIT

Heat alarms must be installed within their listed spacing. There are many mounting conditions. Review the requirements in Chapter ___.

Type your answer here

SUBMIT

Complete the knowledge check above before moving on.

- This completes the Household Fire Alarm Systems module.
- There are many more requirements than we have the time to review in this module.
- Take time to familiarize yourself with the requirements since some of the requirements are unique to household fire-warning systems and components.

***Remember that Chapter 29 does occasionally refer you to other chapters of the code**.

CONTINUE

After completing this module, you should now have a better understanding of the different types of household fire alarm systems.

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

Ohio Fire Alarm and Detection Equipment-Inspection, Testing and Maintenance

Welcome to the Inspection, Testing and Maintenance module of the Ohio Fire Alarm and Detection Systems Course.

By the end of this module, you will be able to do the following:

- Know who and when to notify when system impairments are found
- Determine qualification criteria for service personnel
- Notify the correct parties prior to and upon completion of testing a fire alarm system
- Differentiate between inspection and testing requirements for fire alarm systems and their components
- Identify differences in functional test requirements when software changes occur
- Recognize replacement timeframes for single and multiple station fire alarms
- Identify all inspection, testing, and maintenance information required to be recorded, filed, and distributed

- Distinguish ITM record retention requirements for different types of fire alarm system components

Key Reference for this module:

- *NFPA* 72 – The National Fire Alarm and Signaling Code, Chapter 14, 2016

When you are ready to begin, click on the button above to start the course.

- **General Information**
- **Inspection Frequency and Testing Frequency**
- **Maintenance and Record Keeping**

Lesson 1 of 3

General Information

Who is responsible for inspection, testing, maintenance, or modifications to the system?

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Know who and when to notify when system impairments are found

2. Determine qualification criteria for service personnel
3. Notify the correct parties prior to and upon completion of testing a fire alarm system

LET'S GET STARTED

Performance Verification

NFPA 72 2016, Section 14.2.2.1

To ensure **operational integrity of the system**, an **inspection, testing, and maintenance program is mandatory**.

Inspection, testing, and maintenance programs shall satisfy the requirements of the code and conform to the manufacturer's published instructions, while confirming correct system operation.

IMPAIRMENTS

Impairments

NFPA 72 2016, Section 14.2.2.2

The requirements of **Section 10.20** shall apply when a system has impairments.

System defects must be corrected. **If a system defect cannot be corrected at the end of the inspection or test**, the **owner or owner's designated representative must be notified within 24 hours**.

If equipment is **part of a recall**, the system owner or their representative **must be notified in writing**.

Responsibilities

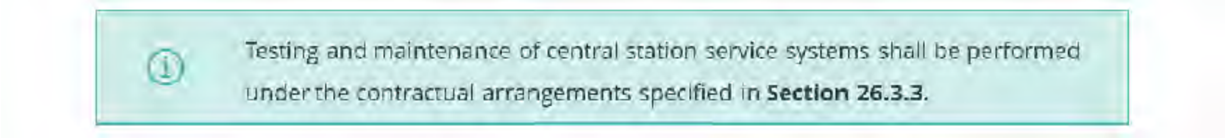
NFPA 72 2016, Section 14.2.3

The property owner, building owner, or system owner is responsible for inspection, testing, maintenance, or modifications to the system.

Where the **property owner is not the occupant**, the property owner is **permitted to delegate the authority and responsibility for inspecting, testing, and maintaining the fire protection systems** to the occupant, management firm, or managing individual **through specific provisions in the lease, written use agreement, or management contract.**

Inspection, testing, or maintenance shall be permitted to be done by the building or system owner, or a person or organization other than the building or system owner if conducted under a written contract.

Where the **building or system owner has delegated any responsibilities for inspection, testing, or maintenance**, a copy of the **written delegation** required by **Section 14.2.3.3** shall be **provided to the Authority Having Jurisdiction** (AHJ) upon request.



Testing and maintenance of central station service systems shall be performed under the contractual arrangements specified in **Section 26.3.3**.

SERVICE PERSONNEL QUALIFICATIONS AND EXPERIENCE

Service Personnel Qualifications and Experience

NFPA 72 2016, Section 14.2.3.6

Service personnel must be qualified and experienced in accordance with the requirements of Section 10.5.3.

Section 10.5.3.3 states service personnel are **qualified** when their knowledge and experience is **acceptable to the AHJ** or **meet one or more of the requirements of Section 10.5.3.4 below:**

1. Personnel who are factory trained and certified for the specific type and brand of system being serviced
2. Personnel who are certified by a nationally recognized certification organization acceptable to the AHJ
3. Personnel, either individually or through their affiliation with an organization that is registered, licensed, or certified by a state or local authority to perform service on systems addressed within the scope of this Code
4. Personnel who are employed and qualified by an organization listed by a nationally recognized testing laboratory for the servicing of systems within the scope of this Code

CONTINUE

Authority Having Jurisdiction (AHJ)

NFPA 72 2016, Section A.3.2.2

The phrase "Authority Having Jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the AHJ may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority.

- There may be multiple AHJs for a given project or property. Any AHJ has the authority to require more stringent standards or rules. *NFPA* 72 2016 is considered the minimum requirement and the AHJ cannot agree to something less stringent than *NFPA* 72 2016, unless it is stated in the code.

- When the various AHJs have different requirements, the most stringent of the requirements shall be followed.

For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the Authority Having Jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the Authority Having Jurisdiction. At government installations, the commanding officer or departmental official may be the Authority Having Jurisdiction. Any given physical property may have multiple Authorities Having Jurisdiction, which may be concerned with life safety, property protection, mission continuity, heritage preservation, and environmental protection. Some Authorities Having Jurisdiction may impose additional requirements beyond those of the Code. If there are conflicting requirements for the installation of a specific fire alarm system, the installer must follow the most stringent requirements.

Watch the video below to learn more about the AHJ (Authority Having Jurisdiction)

Video run time 3:21

CONTINUE

Let's do a quick check about what has been covered so far.

If a system defect cannot be corrected at the end of the inspection or test, how soon must the owner or owner’s designated representative must be notified?

○ Within 1 week

○ Within 2 days

○ Within 24 hours

SUBMIT

Where the property owner is not the occupant, who can the property owner permit to delegate the authority and responsibility for inspecting, testing, and maintaining the fire protection systems through specific provisions in the lease, written use agreement, or management contract. (Select all that apply)

☐ management firm

☐ managing individual

☐ AHJ

☐ occupant

SUBMIT

Section 10.5.3.3 states service personnel are qualified when their knowledge and experience is acceptable to the AHJ or meet one or more of the requirements of Section 10.5.3.4 below: (Select all that apply)

☐ Personnel who are employed by an organization for the servicing of systems

☐ Personnel who are employed and qualified by an organization listed by a nationally recognized testing laboratory for the servicing of systems within the scope of this Code

☐ Personnel who are certified by a nationally recognized certification organization acceptable to the AHJ

☐ Personnel who are factory trained for the specific type and brand of system being serviced

SUBMIT

Complete the knowledge check above before moving on.

Notification

NFPA 72 2016, Section 14.2.4

Before proceeding with any testing, all persons and facilities receiving alarm, supervisory, or trouble signals and all building occupants must be notified of the testing to prevent unnecessary occupant or emergency services response.

At the conclusion of testing, those previously notified (and others, as necessary) shall be notified that testing has been completed.

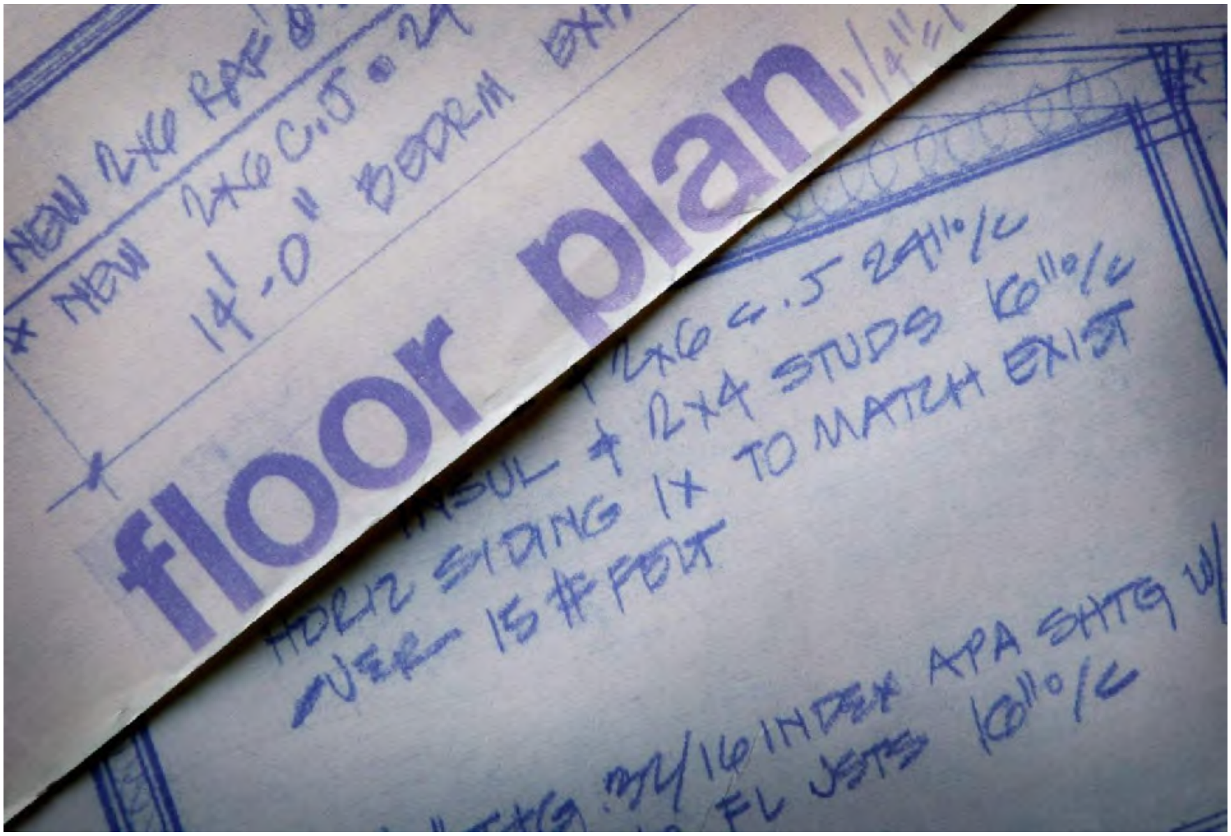
The owner or the owner’s designated representative and service personnel shall coordinate all system testing to prevent interruption of critical building systems or equipment.

SYSTEM DOCUMENTATION

System Documentation

NFPA 72 2016, Section 14.2.5

Prior to any maintenance or testing, the owner or designated representative must provide the system record of completion and information required by **Chapter 7** regarding the system to include specifications, wiring diagrams, and floor plans.



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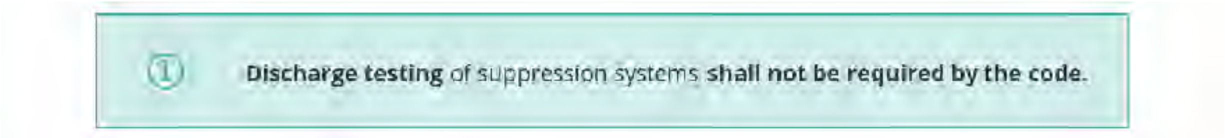
RELEASING SYSTEMS

Releasing Systems

NFPA 72 2016, Section 14.2.6

Testing personnel shall be qualified and experienced in the specific arrangement and operation of a suppression system(s) and a releasing function(s), and shall be cognizant of the hazards associated with inadvertent system discharge.

Occupant notification shall be required whenever a fire alarm system configured for releasing service is being serviced or tested.



① **Discharge testing** of suppression systems **shall not be required by the code.**

Suppression systems shall be secured from inadvertent actuation, including disconnection of releasing solenoids or electric actuators, closing of valves, other actions, or combinations thereof, for the specific system, for the duration of the fire alarm system testing.

Testing shall include verification that the releasing circuits and components energized or actuated by the fire alarm system are electrically monitored for integrity and operate as intended on alarm.

Suppression systems and releasing components shall be returned to their functional operating condition upon completion of system testing.

INTERFACE EQUIPMENT AND EMERGENCY CONTROL FUNCTIONS

Interface Equipment and Emergency Control Functions

NFPA 72 2016, Section 14.2.7

Testing personnel shall be qualified and experienced in the arrangement and operation of interface equipment and emergency control functions.

If unfamiliar with the operation of the emergency control function, such as ***elevator recall****, it is always best to coordinate testing with the responsible agent for the controlled function so that you are onsite at the same time.*

Testing of the interface and emergency control function shall be accomplished in accordance with **Table 14.4.3.2**.

CONTINUE

Let's do a quick check about what has been covered so far.

Prior to any maintenance or testing, the owner or designated representative must provide the system record of completion and information regarding the system to include specifications, wiring diagrams, and floor plans. Where are these requirements found?

○ Chapter 5

○ Chapter 6

○ Chapter 7

SUBMIT

______ systems shall be secured from inadvertent actuation, including disconnection of releasing solenoids or electric actuators, closing of valves, other actions, or combinations thereof, for the specific system, for the duration of the fire alarm system testing.

Type your answer here

SUBMIT

Complete the knowledge check above before moving on.

Automated Testing

NFPA 72 2016, Section 14.2.8

Automated testing arrangements that provide equivalent means of testing devices to those **specified in Table 14.4.3.2** at a frequency at least equivalent to those specified in **Table 14.4.3.2** shall be **permitted to be used to comply with the requirements of this chapter**.

Failure of a device on an **automated test** shall result in an **audible *and* visual trouble signal**.

TEST PLAN

Test Plan

NFPA 72 2016, Section 14.2.10

A test plan must be written to clearly establish the scope of the fire alarm system testing.

The test plan and the results shall be documented with the system testing records.

There are no templates or examples of the test plan in NFPA 72 2016.

CONTINUE

Let's do a quick check about what has been covered so far.

Failure of a device on an automated test shall result in an audible and visual __________ signal.

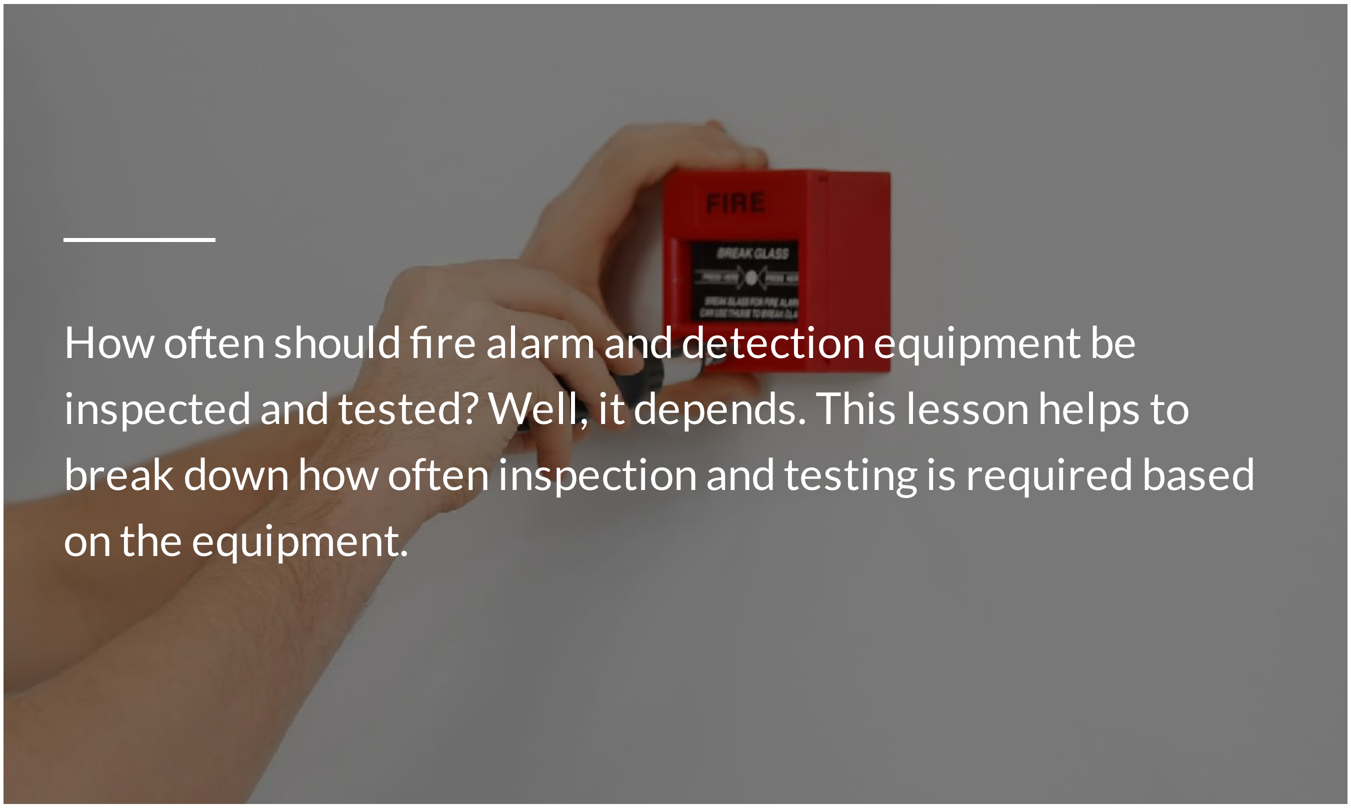
Type your answer here

SUBMIT

Complete the knowledge check above before moving on.

Lesson 2 of 3

Inspection Frequency and Testing Frequency



How often should fire alarm and detection equipment be inspected and tested? Well, it depends. This lesson helps to break down how often inspection and testing is required based on the equipment.

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Differentiate between inspection and testing requirements for fire alarm systems and their components

2. Identify differences in functional test requirements when software changes occur

3. Recognize replacement timeframes for single and multiple station fire alarms

INSPECTION FREQUENCY

Inspection

NFPA 72 2016, Section 14.3

Table 14.3.1 specifies the minimum frequencies required for visual inspections on various components and subsystems of the fire alarm system. The authority having jurisdiction (AHJ) can define testing intervals more frequent than the table if they deem necessary.

The table shows each component of the system has an inspection interval ranging from one week to annually.

Some items just require inspection on the initial installation. The initial inspection applies to all equipment.

Visual inspections must be conducted to verify nothing has changed that will affect system or equipment performance.

CONTINUE

ⓘ Devices that cannot be inspected per the frequencies of **Table 14.3.1**, due to safety concerns, can be inspected at **scheduled shutdown periods if approved by the AHJ**, but the **extended period cannot exceed 18 months**.

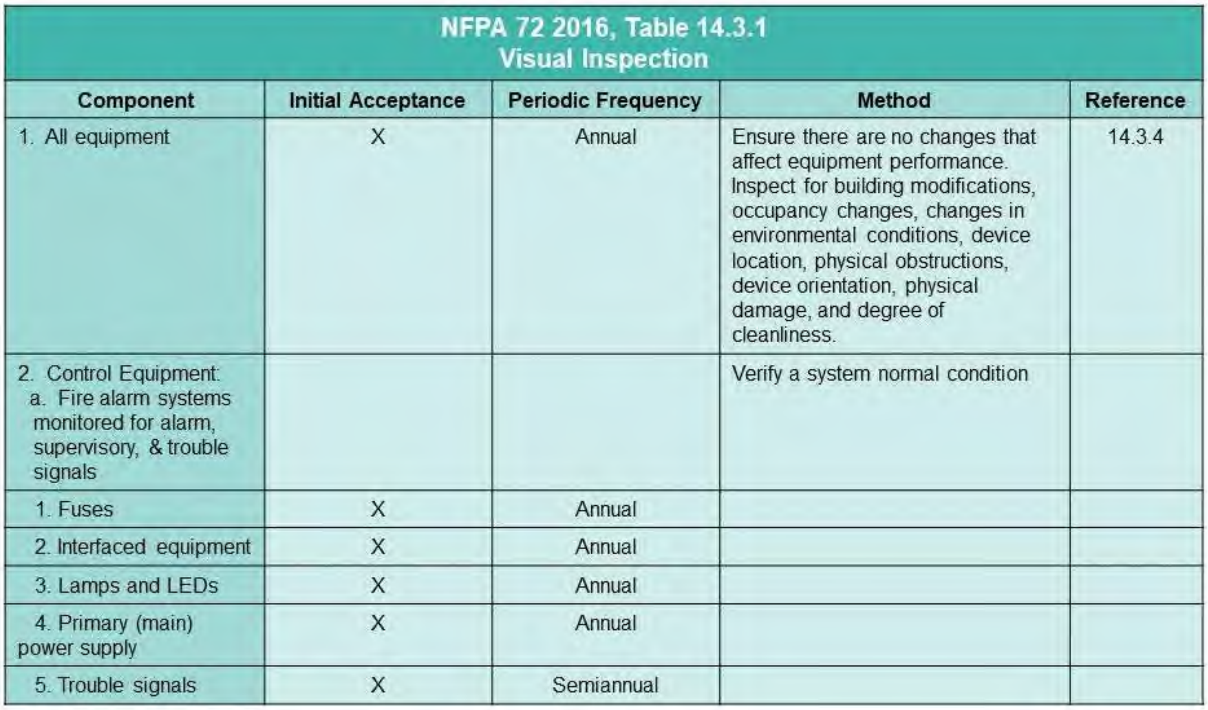
Table 14.3.1 is the visual inspection frequency table. Take some time to review the entire table.

The visual inspection frequencies are marked with an “X” and include:

- Initial/Reacceptance
- Monthly
- Quarterly
- Semiannually
- Annually

Occasionally you will find a “weekly” requirement for a piece of equipment.

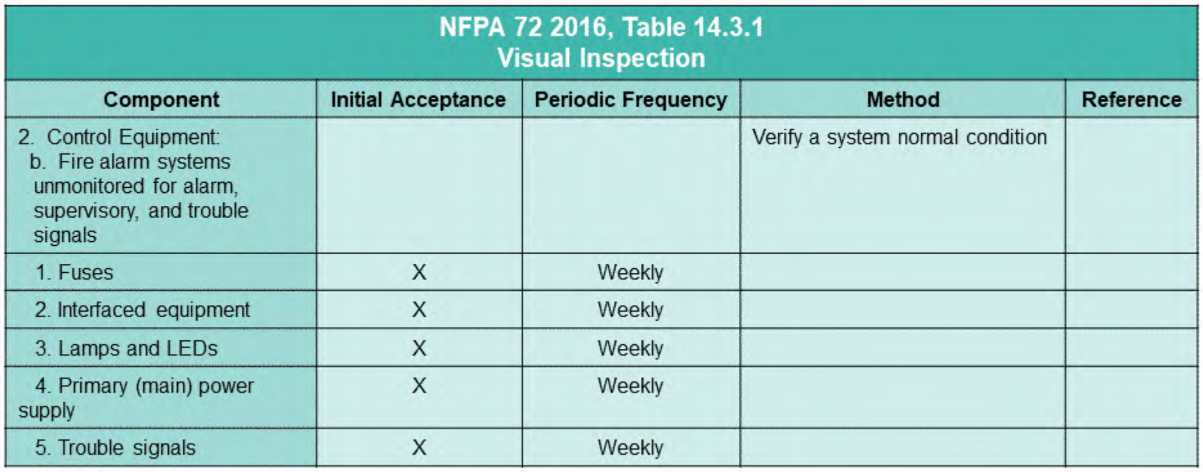
Portions of Table 14.3.1 are shown below.



NFPA 72 2016, Table 14.3.1
Visual Inspection

Component	Initial Acceptance	Periodic Frequency	Method	Reference
1. All equipment	X	Annual	Ensure there are no changes that affect equipment performance. Inspect for building modifications, occupancy changes, changes in environmental conditions, device location, physical obstructions, device orientation, physical damage, and degree of cleanliness.	14.3.4
2. Control Equipment: a. Fire alarm systems monitored for alarm, supervisory, & trouble signals			Verify a system normal condition	
1. Fuses	X	Annual		
2. Interfaced equipment	X	Annual		
3. Lamps and LEDs	X	Annual		
4. Primary (main) power supply	X	Annual		
5. Trouble signals	X	Semiannual		

***NFPA* 72 2016, Page 80**



NFPA 72 2016, Table 14.3.1
Visual Inspection

Component	Initial Acceptance	Periodic Frequency	Method	Reference
2. Control Equipment: b. Fire alarm systems unmonitored for alarm, supervisory, and trouble signals			Verify a system normal condition	
1. Fuses	X	Weekly		
2. Interfaced equipment	X	Weekly		
3. Lamps and LEDs	X	Weekly		
4. Primary (main) power supply	X	Weekly		
5. Trouble signals	X	Weekly		

***NFPA* 72 2016, Page 80**

CONTINUE

Based on ***NFPA* 72 2016, Table 14.3.1-Visual Inspection**, sort the following cards into the correct periodic frequency categories.

Monitored

Control Equipment-a. 1. Fuses (annual)

Control Equipment-a. 2. Interfaced equipment (annual)

Control Equipment-a. 3. Lamps and LED's (annual)

Control Equipment-a. 4. Primary (main) power supplies (annual)

Unmonitored

Control Equipment-b. 1. Fuses (weekly)

Control Equipment-b. 2. Interfaced equipment (weekly)

Control Equipment-b. 3. Lamps and LED's (weekly)

Control Equipment-b. 4. Primary (main) power supplies (weekly)

Control Equipment-b. 5. Trouble signal (weekly)

Complete the card sort above before moving on.

Testing

NFPA 72 2016, Section 14.4

All **new systems** shall have an **initial acceptance test** and the **AHJ shall be notified prior to the initial acceptance test**.

When changes are made to the site specific software, all functions directly affected by the change shall be 100% tested. Additionally, 10% (max of 50) of the initiating devices not directly affected by the change shall be tested.

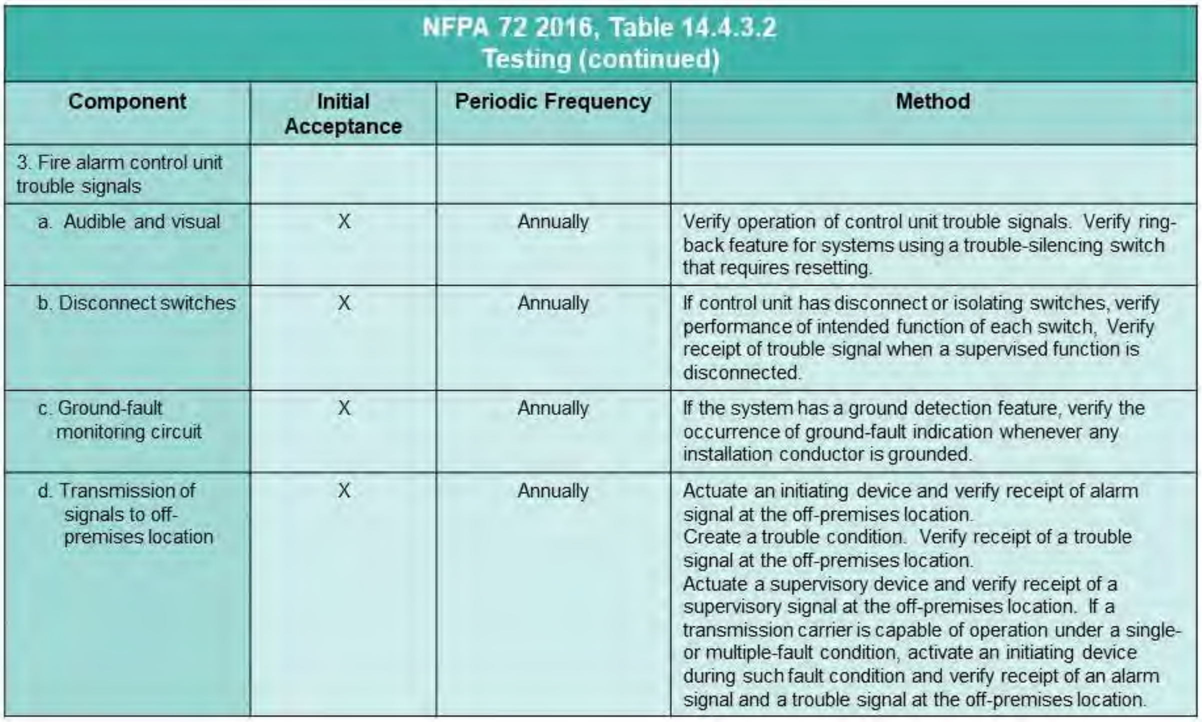
ⓘ **When changes or additions are made to the system, the changes must have reacceptance testing of all added devices, circuits, or control equipment per Table 14.4.3.2.**

CONTINUE

Changes to all control units connected or controlled by the system executive software shall require a 10% functional test of the system. This includes a test of at least one device on each input and output circuit to verify critical system functions, such as notification appliances, control functions, and off-premises reporting.

A revised record of completion must be prepared to reflect all changes.

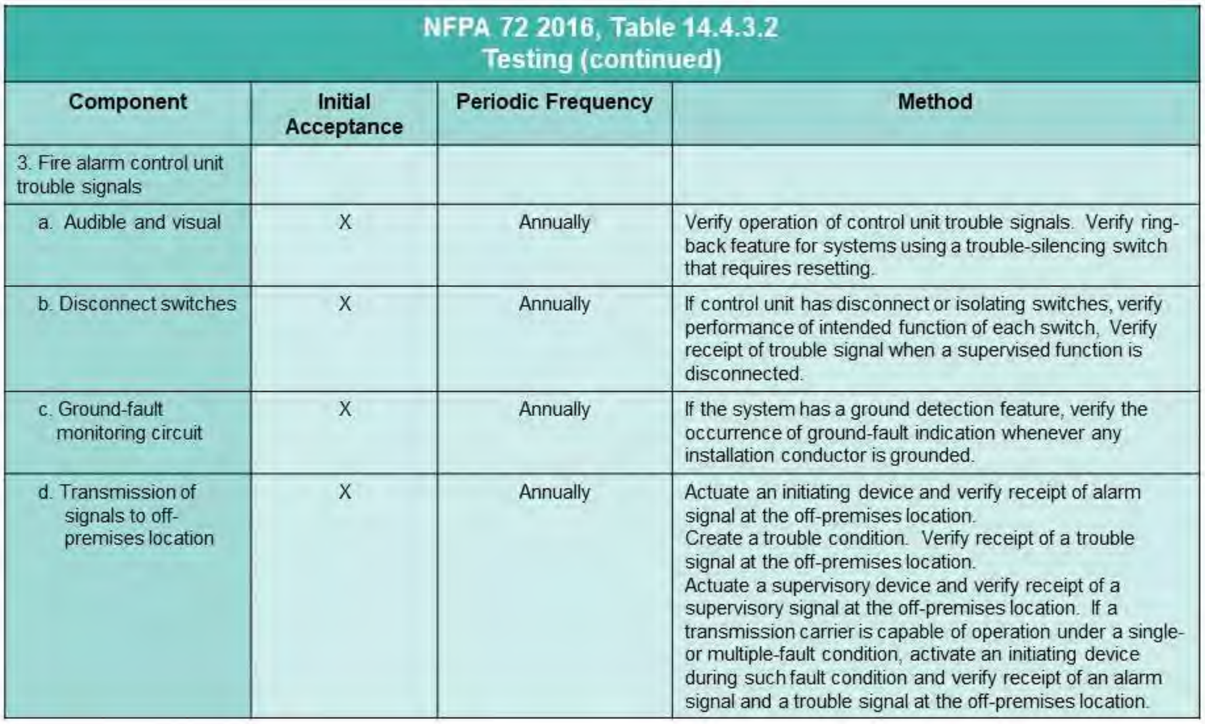
Table 14.4.3.2 provides information on how to test equipment and components. Portions of Table 14.4.3.2 are shown below



NFPA 72 2016, Table 14.4.3.2
Testing (continued)

Component	Initial Acceptance	Periodic Frequency	Method
3. Fire alarm control unit trouble signals			
a. Audible and visual	X	Annually	Verify operation of control unit trouble signals. Verify ring-back feature for systems using a trouble-silencing switch that requires resetting.
b. Disconnect switches	X	Annually	If control unit has disconnect or isolating switches, verify performance of intended function of each switch, Verify receipt of trouble signal when a supervised function is disconnected.
c. Ground-fault monitoring circuit	X	Annually	If the system has a ground detection feature, verify the occurrence of ground-fault indication whenever any installation conductor is grounded.
d. Transmission of signals to off-premises location	X	Annually	Actuate an initiating device and verify receipt of alarm signal at the off-premises location. Create a trouble condition. Verify receipt of a trouble signal at the off-premises location. Actuate a supervisory device and verify receipt of a supervisory signal at the off-premises location. If a transmission carrier is capable of operation under a single- or multiple-fault condition, activate an initiating device during such fault condition and verify receipt of an alarm signal and a trouble signal at the off-premises location.

***NFPA* 72 2016, Page 84**



NFPA 72 2016, Table 14.4.3.2
Testing (continued)

Component	Initial Acceptance	Periodic Frequency	Method
3. Fire alarm control unit trouble signals			
a. Audible and visual	X	Annually	Verify operation of control unit trouble signals. Verify ring-back feature for systems using a trouble-silencing switch that requires resetting.
b. Disconnect switches	X	Annually	If control unit has disconnect or isolating switches, verify performance of intended function of each switch. Verify receipt of trouble signal when a supervised function is disconnected.
c. Ground-fault monitoring circuit	X	Annually	If the system has a ground detection feature, verify the occurrence of ground-fault indication whenever any installation conductor is grounded.
d. Transmission of signals to off-premises location	X	Annually	Actuate an initiating device and verify receipt of alarm signal at the off-premises location. Create a trouble condition. Verify receipt of a trouble signal at the off-premises location. Actuate a supervisory device and verify receipt of a supervisory signal at the off-premises location. If a transmission carrier is capable of operation under a single- or multiple-fault condition, activate an initiating device during such fault condition and verify receipt of an alarm signal and a trouble signal at the off-premises location.

***NFPA* 72 2016, Page 84**

CONTINUE

Let's do a quick check about what has been covered so far.

All new systems shall have an initial acceptance test. Who should be notified prior to the initial acceptance test?

○ Property owner

○ Occupant

○ AHJ

SUBMIT

Changes to all control units connected or controlled by the system executive software shall require what percentage of a functional test of the system?

○ 10%

○ 20%

○ 30%

SUBMIT

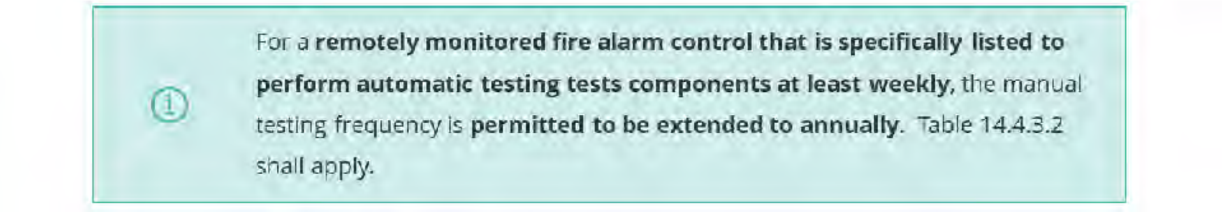
Complete the knowledge check above before moving on.

Testing Frequency

NFPA 72 2016, Section 14.4.4

In this section you will find the testing time interval requirements for various components and systems.

Devices that **cannot be tested per the frequencies of Table 14.4.3.2** due to safety concerns can be inspected at **scheduled shutdown periods if approved by the AHJ**, but the **extended period cannot exceed 18 months**.



For a **remotely monitored fire alarm control that is specifically listed to perform automatic testing tests components at least weekly**, the manual testing frequency is **permitted to be extended to annually**. Table 14.4.3.2 shall apply.

In other than one- and two-family dwelling units, smoke detector and smoke alarm sensitivity testing shall be accomplished as follows:

- Sensitivity testing shall be checked within 1 year after installation.

- Sensitivity testing shall be accomplished every other year thereafter.

- After the second sensitivity test, if the smoke detector or smoke alarm is still within its listed sensitivity range, the tests may be extended to 5 years.

If tests are extended to 5 years, records of nuisance alarms shall be maintained. The records are needed to see if trends exist. If there is a trend of nuisance alarms over a previous year, calibration (sensitivity) tests are required.

CONTINUE

Smoke detector sensitivity testing shall be performed by using any of the following methods:

1. Calibrated test method
2. Manufacturer’s calibrated sensitivity test instrument
3. Listed control equipment arranged for this purpose
4. Smoke detector/fire alarm control unit arrangement whereby the detector causes a signal at the fire alarm control unit where its sensitivity is outside its listed sensitivity range

5 Other calibrated sensitivity test methods approved by the AHJ

CONTINUE

Smoke detectors or smoke alarms **sensitivity shall not be tested or measured using any device that administers an unmeasured concentration of smoke or aerosol** into the smoke detector or smoke alarm.

Test frequencies for interfaced equipment shall be the same as specified by the NFPA standard for the supervised equipment.

Two or more restorable fixed-temperature heat detectors are required to be tested on each circuit annually. Different detectors are to be tested each year. All detectors shall be tested within a 5-year period.

Records must be kept identifying which detectors have been tested.

CONTINUE

Let's do a quick check about what has been covered so far.

In other than one- and two-family dwellings, smoke detector and smoke alarm sensitivity testing shall be accomplished as follows:

Sensitivity testing shall be checked	within 1 year after installation
Sensitivity testing shall be accomplished	every other year thereafter
It is still within its listed sensitivity range	tests may be extended to 5 years

SUBMIT

Smoke detector sensitivity testing shall be performed by using any of the following methods: (Select all that apply)

☐ Administer an unmeasured concentration of smoke or aerosol into the smoke detector or smoke alarm

☐ Listed control equipment arranged for this purpose

☐ Calibrated test method

☐ Manufacturer's calibrated sensitivity test instrument

SUBMIT

How many restorable fixed-temperature heat detectors are required to be tested on each circuit annually?

○ One or more

○ Two or more

○ Three or more

SUBMIT

Complete the knowledge check above before moving on.

Single and Multiple Station Fire Alarms

NFPA 72 2016, Section 14.4.5

The responsibility for inspection, testing, and maintenance of smoke alarms and connected appliances shall be in accordance with **Section 14.2.3**.

Smoke alarms and all interconnected appliances shall be inspected and tested in accordance with the manufacturer's published instructions monthly.

Smoke alarms shall be replaced when they fail to respond to operability tests.

Smoke alarms shall not remain in service longer than 10 years from the date-of-manufacture, *unless* otherwise provided by the manufacturer’s published instructions.

Combination smoke/carbon monoxide alarms shall be replaced when the end-of-life signal activates or 10 years from the date-of-manufacture, whichever comes first, unless otherwise provided by the manufacturer's published instructions.

HOUSEHOLD FIRE ALARM SYSTEMS

Household Fire Alarm Systems

NFPA 72 2016, Section 14.4.6

The installing contractor must provide testing information to the owner.

If the household system is monitored by an offsite monitoring company, the supervising station contractor must provide notice of inspection and testing information to the owner on an annual basis.

Maintenance of household fire alarm systems will be in accordance with the manufacturer's published instructions.

ⓘ **Household fire alarm systems shall be tested by a qualified technician (see Section 10.5.3.3) at least annually according to the methods of Table 14.4.3.2.**

CONTINUE

Let's do a quick check about what has been covered so far.

How often should smoke alarms and all interconnected appliances be inspected and tested in accordance with the manufacturer's published instructions?

○ Monthly

○ Every six months

○ Yearly

SUBMIT

Smoke alarms shall not remain in service longer than ______ from the date-of-manufacture, unless otherwise provided by the manufacturer's published instructions.

○ 1 year

○ 5 years

○ 10 years

SUBMIT

If the household system is monitored by an offsite monitoring company, how often must the supervising station contractor provide notice of inspection and testing information to the owner?

○ Monthly

○ Every six months

○ Yearly

SUBMIT

Complete the knowledge check above before moving on.

In-Building Emergency Radio Communication Systems

NFPA 72 2016, Section 14.4.9

In-building emergency radio communication systems shall be inspected and operationally tested in accordance with the requirements of ***NFPA* 1221**.

VOICE INTELLIGIBILITY

Voice Intelligibility

NFPA 72 2016, Section 14.4.10

Voice communication using prerecorded messages and manual voice announcements shall be **verified as being intelligible** in accordance with the requirements of **Section 18.4.10**.

Intelligibility shall not be required to be determined through quantitative measurements. Quantitative measurements as described in **Annex D** shall be permitted, but are not required.

CONTINUE TO NEXT LESSON: MAINTENANCE AND RECORD KEEPING

Lesson 3 of 3

Maintenance and Record Keeping

How long should maintenance, inspection, and testing records be maintained?

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Identify all inspection, testing, and maintenance information required to be recorded, filed, and distributed

2 Distinguish ITM record retention requirements for different types of fire alarm system components

MAINTENANCE

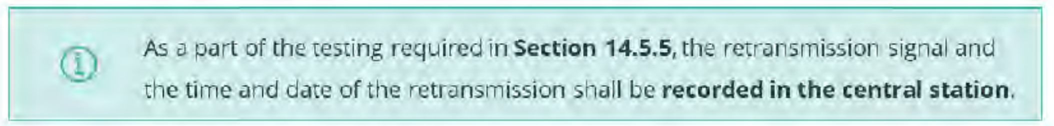
Maintenance

***NFPA* 72 2016, Section 14.5**

The frequency of cleaning system equipment shall depend on the type of equipment and the local ambient conditions.

All apparatus requiring rewinding or resetting to maintain normal operation shall be rewound or reset as promptly as possible after each test and alarm.

ⓘ Unless otherwise permitted by **Section 14.5.6**, the retransmission means as defined in **Section 26.3** (for supervising stations) **shall be tested at intervals of not more than 12 hours**. When the retransmission means is the public-switched telephone network, testing shall be permitted at weekly intervals to confirm its operation to each communications center.



As a part of the testing required in **Section 14.5.5**, the retransmission signal and the time and date of the retransmission shall be **recorded in the central station**.

RECORDS

Records

NFPA 72 2016, Section 14.6

Section 7.8.2 provides sample "Inspection and Testing Forms." If you haven't already done so, **you should review this section**. It identifies all of the information which has to be permanently recorded, filed, and distributed to the appropriate persons.

NFPA 72 2016, Section 14.6

The following are record keeping requirements for ***NFPA* 72 2016, Section 14.6**

Requirement 1

The records must be permanent.

Requirement 2

The owner shall be required to keep all permanent records on paper or electronic media for the life of the system.

Requirement 3

Permanent records include as-built drawings, system operation and maintenance manuals, written sequence of operation, and inspection and testing documentation.

Requirement 4

A copy of site-specific software shall be kept in a non-erasable format, such as a CD-ROM.

Requirement 5

The owner is responsible for maintaining the records for the life of the system.

MAINTENANCE, INSPECTION, AND TESTING RECORDS

Inspection and Testing

NFPA 72 2016, Section 14.6.2

Maintenance, inspection, and testing records shall be **maintained for one year after the next test**.

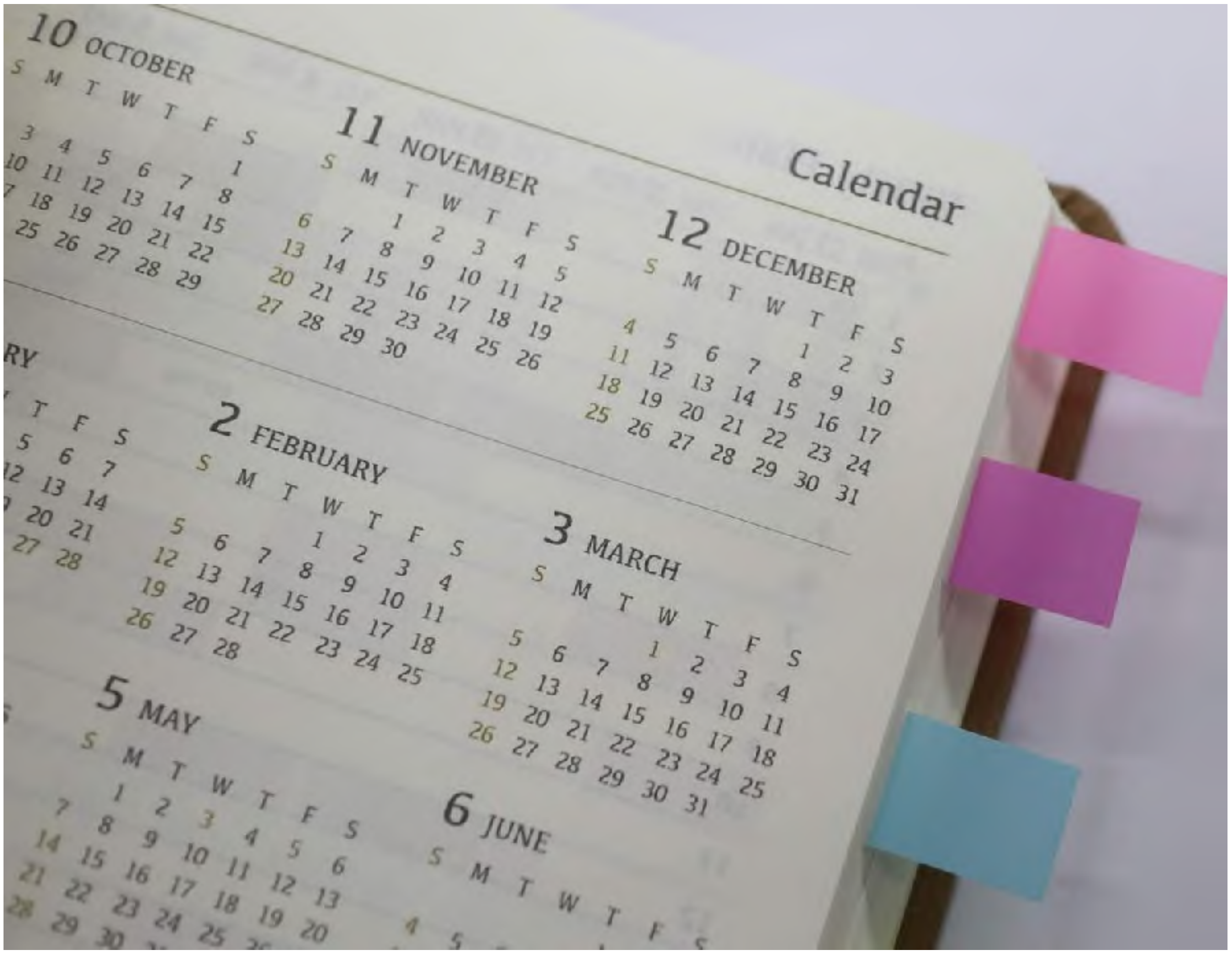
Records for **testing of spot-type heat detectors** shall be **kept for five years and for one year thereafter**.

The records shall be on a medium that will survive the retention period. **Paper or electronic media shall be permitted**.

SUPERVISING STATION RECORDS

Supervising Station Records

NFPA 72 2016, Section 14.6.3



For supervising station alarm systems, records pertaining to signals received at the supervising station that result from maintenance, inspection, and testing shall be **maintained for not less than 12 months.**

Records must be stored on a medium that will survive the retention period.

CONTINUE

Let's do a quick check about what has been covered so far.

The frequency of cleaning system equipment shall depend on ___ (Select all that apply)

☐ the type of equipment

☐ the local ambient conditions

☐ the building owner

☐ the condition of the equipment

SUBMIT

Match the following testing frequency rules for *NFPA* 72 2016, Section 14.6.2.

Maintenance, inspection, and testing records shall be maintained for	one year after the next test
Records for testing of spot-type heat detectors shall be kept for	five years and for one year thereafter
Supervising station alarm systems & records pertaining to signals received are kept for	not less than 12 months.

SUBMIT

Complete the knowledge check above before moving on.

Simulated Operation Note

NFPA 72 2016, Section 14.6.4

If the operation of a device, circuit, fire alarm control unit function, or special hazard system interface is simulated, it shall be noted on the inspection/test form that the operation was simulated.

DO NOT REMOVE BY ORDER OF THE
STATE FIRE MARSHAL (OFC 901.7)

– FIRE ALARM SYSTEM IS IMPAIRED –
DOESN'T MEET STATE STANDARDS

Harbor Security
678 Main Street
Milion, OH 44089
800-555-5535 LIC #55-22-1021

(Date) (Technician signature) (Technician Lic. No.)

List Impairment(s):

On (date) Fire Code Official (name) was notified

DO NOT REMOVE BY ORDER OF THE
STATE FIRE MARSHAL (OFC 901.7)

— FIRE ALARM SYSTEM IS —
OUT OF SERVICE

Harbor Security
678 Main Street
Milion, OH 44089
800-555-5535 LIC #55-22-1021

(Date) (Technician signature) (Technician Lic. No.)

List Conditions:

On (date) Fire Code Official (name) was notified

OHIO FIRE CODE SECTION 901.6.2

Ohio Fire Code Section 901.6.2

DO NOT REMOVE BY ORDER OF THE STATE FIRE MARSHAL (OFC 901.6.2)

FIRE ALARM SYSTEM SERVICE RECORD

Harbor Security
678 Main Street
Milion, OH 44089
800-555-5155 LIC.#55-22-1021

(Date) (Technician signature) (Technician Lic. No.)

List Services/Repairs

DO NOT REMOVE BY ORDER OF THE STATE FIRE MARSHAL (OFC 901.6.2)

FIRE ALARM SYSTEM SERVICE RECORD

Harbor Security
678 Main Street
Milion, OH 44089
800-555-5155 LIC.#55-22-1021

(Date) (Technician signature) (Technician Lic. No.)

List Services/Repairs

Ohio Fire Code Section 901.6.2 requires all records for inspections tests, and maintenance to be retained.

Acceptance testing records are required to be maintained for the life of the system.

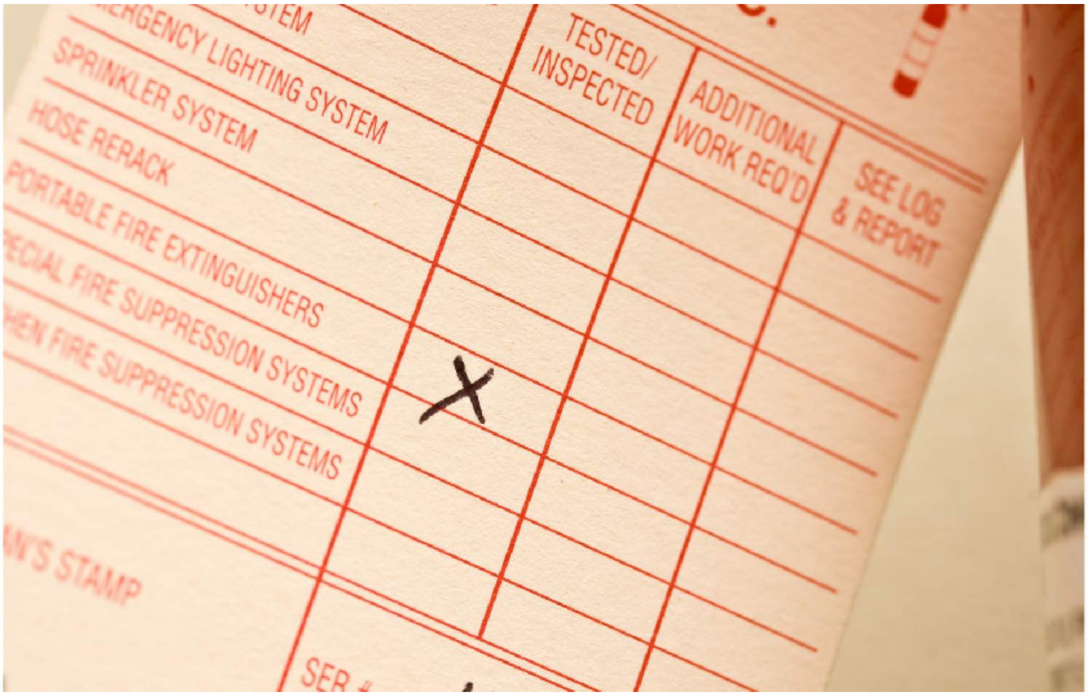
An inspection tag is to be placed on or near the fire alarm control panel or other location as determined by the fire code official. The tag must have the following information:

- The individual performing the work and the individual’s state fire marshal certification number
- Date of the test

- Results of the inspection and test
- Deficiencies or impairments noted “yes/no”

Ohio Fire Code requires a tag to indicate a system or portion of a system has been removed from service or is defective.

The fire official shall specify where the tag is to be placed.



CONTINUE

Let's do a quick check about what has been covered so far.

An inspection tag is to be placed on or near the fire alarm control panel or other location as determined by the fire code official. The tag must have the following information:

☐ Address of the location

☐ Date of the test

☐ Results of the inspection and test

☐ Deficiencies or impairments noted “yes/no”

SUBMIT

Ohio fire Code Section 901.6.2 requires all acceptance testing records be kept for _____.

○ One year

○ A minimum of three years

○ Until the manufacturer's warranty ends

○ The life of the system

SUBMIT

Complete the knowledge check above before moving on.

This completes the Inspection, Testing, and Maintenance module.

NFPA 72 2016, Chapter 14 provides good information on how to inspect and test fire alarm systems, but ***don't forget to follow the manufacturer's published instructions***.

There are many more requirements than we have the time to review in this module. **Take time to familiarize yourself with Chapter 14**.

Inspecting, testing, and maintaining fire alarm systems is of the utmost importance.

By **ensuring these systems are always operational**, we **significantly reduce the chance someone may be injured or killed in a fire**.

Remember that Chapter 14 does occasionally refer you to other chapters of the code.

CONTINUE

After completing this module, you should now have a better understanding of the inspection frequency, testing, maintenance and record keeping of fire alarm systems.

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

Ohio Fire Alarm and Detection Equipment- Emergency Control Functions and Interfaces

FIRE TECH PRODUCTIONS

Welcome to the Emergency Control Functions and Interfaces module of the Ohio Fire Alarm and Detection Systems Course.

By the end of this module, you will be able to do the following:

- Identify different types of emergency control functions
- Determine distances permitted between components controlling the emergency control functions
- Define interconnection methods between a fire alarm system and the controlled system
- Identify smoke detector location and mounting requirements when used for elevator recall purposes
- Determine the purpose and functionality of elevator control circuits connected to smoke detectors
- Be aware of the limitations placed on heat detectors when used in elevator shut down applications

- Identify the *NFPA* 72 2016 requirements for emergency control functions for HVAC systems
- Identify the *NFPA* 72 2016 requirements for emergency control functions for door and shutter release systems

Key Reference for this module:

- *NFPA* 72 – The National Fire Alarm and Signaling Code, Chapter 21, 2016

When you are ready to begin, click on the button above to start the course.

Lesson 1 of 3

General Information

The performance of automatic emergency control functions must not interfere with power for lighting or for operating elevators.

Goals of this Module:

By the end of this lesson, you will be able to do the following:

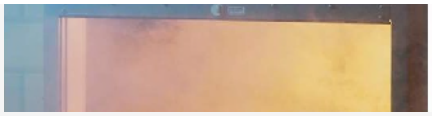
1. Identify different types of emergency control functions

2. Determine distances permitted between components controlling the emergency control functions
3. Define interconnection methods between a fire alarm system and the controlled system

LET'S GET STARTED

Emergency control functions are intended to increase the level of life safety for occupants or to control the spread of the harmful effects of fire. These functions include, but are not limited to:

1. Elevator recall
2. The closing of smoke dampers and fire doors
3. The shutdown of air-handling equipment such as fans and heating, ventilation, and air conditioning systems



These functions can be performed by the protected premises fire alarm system control unit (panel), or the function can be controlled by dedicated system initiating devices, such as smoke detectors.

GENERAL INFORMATION

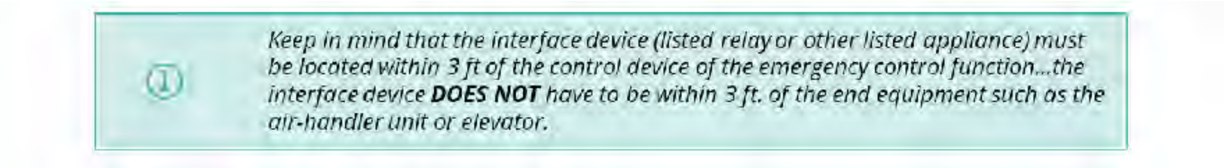
General

NFPA 72 2016, Section 21.2

Emergency control functions are permitted to be performed automatically.

The performance of automatic emergency control functions must not interfere with power for lighting or for operating elevators.

A listed relay or other listed appliance connected to the fire alarm system used to initiate control of the protected premises emergency control functions must be located within 3 ft. of the component controlling the emergency control function.

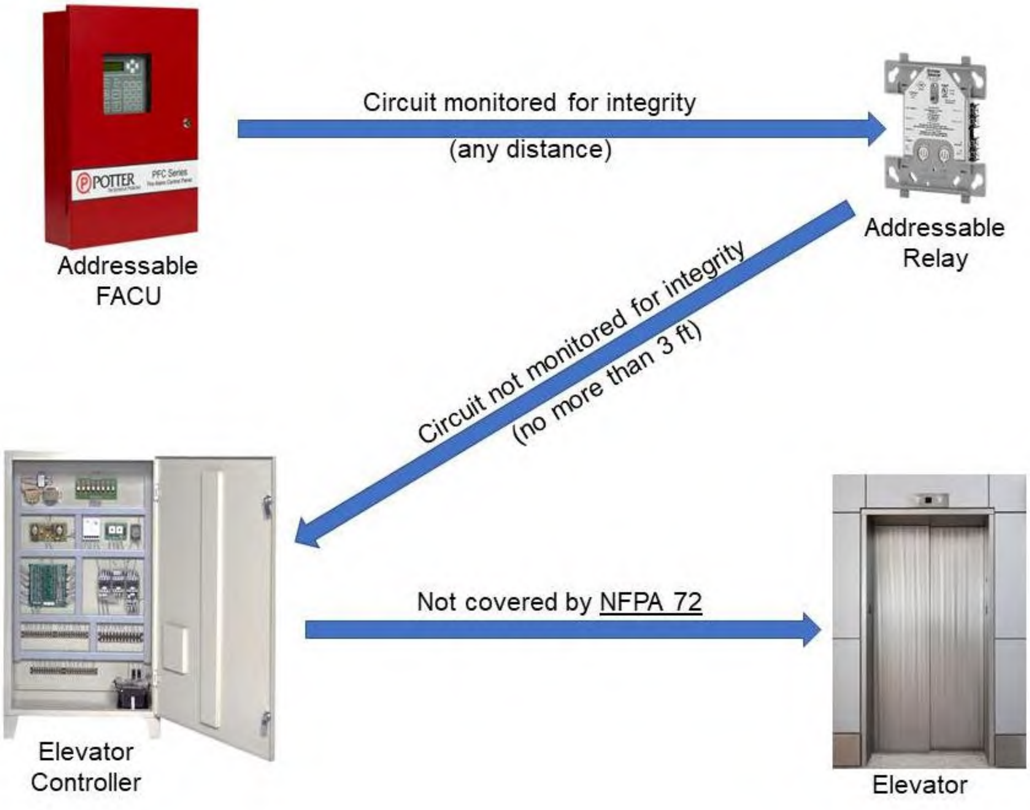


ⓘ *Keep in mind that the interface device (listed relay or other listed appliance) must be located within 3 ft of the control device of the emergency control function...the interface device **DOES NOT** have to be within 3 ft. of the end equipment such as the air-handler unit or elevator.*

CONTINUE

The method(s) of interconnection between the fire alarm system and emergency control function interface device will be monitored for integrity in accordance with **Section 12.6**.

See graphic below.



The relay or other appliance must function within the voltage and current limitations of the fire alarm control unit.

The installation wiring between the fire alarm control unit and the emergency control function interface device shall be Class A, Class B, Class D, Class N, or Class X in accordance with Chapter 12.

Emergency control functions must not interfere with other operations of the fire alarm system.

> ⓘ The method(s) of **interconnection between the fire alarm system and the controlled electrical and mechanical system** *must* **comply** with the applicable provisions of ***NFPA* 70 - National Electrical Code.**

The method(s) of interconnection between the fire alarm system and the controlled electrical and mechanical system shall be achieved by one of the following:

1. Electrical contacts listed for the connected load
2. Data communications over a signaling line circuit(s) dedicated to the fire alarm or shared with other premises operating systems
3. Other listed methods

If a fire alarm system is a component of a life safety network and it communicates data to other systems providing life safety functions, or it receives data from such systems, the following shall apply:

Rule 1

The path used for communicating data shall be monitored for integrity. This includes monitoring the physical communication media and the ability to maintain intelligible communications.

Rule 2

Data received from the network shall not affect the operation of the fire alarm system in any way other than to display the status of life safety network components.

Rule 3

> Where non-fire alarm systems are interconnected to the fire alarm system using a network or other digital communication technique, a signal (e.g., heartbeat, poll, ping, query) shall be generated between the fire alarm system and the non-fire alarm system. Failure of the fire alarm system to receive confirmation of the transmission shall cause a trouble signal to indicate within 200 seconds.

CONTINUE

Let's do a quick check over what we just covered.

The installation wiring between the fire alarm control unit and the emergency control function interface device shall be which of the following classes in accordance with Chapter 12? (Select all that apply)

☐ Class A

☐ Class B

☐ Class C

☐ Class D

☐ Class N

☐ Class X

SUBMIT

The relay or other _____ must function within the voltage and current limitations of the fire alarm control unit.

Type your answer here

SUBMIT

If a fire alarm system is a component of a life safety network and it communicates data to other systems providing life safety functions, or it receives data from such systems, the following rule shall apply: Data received from the network shall not affect the operation of the fire alarm system in any way other than to display the status of life safety network components. Which of the three rules is this?

○ Rule 1

○ Rule 2

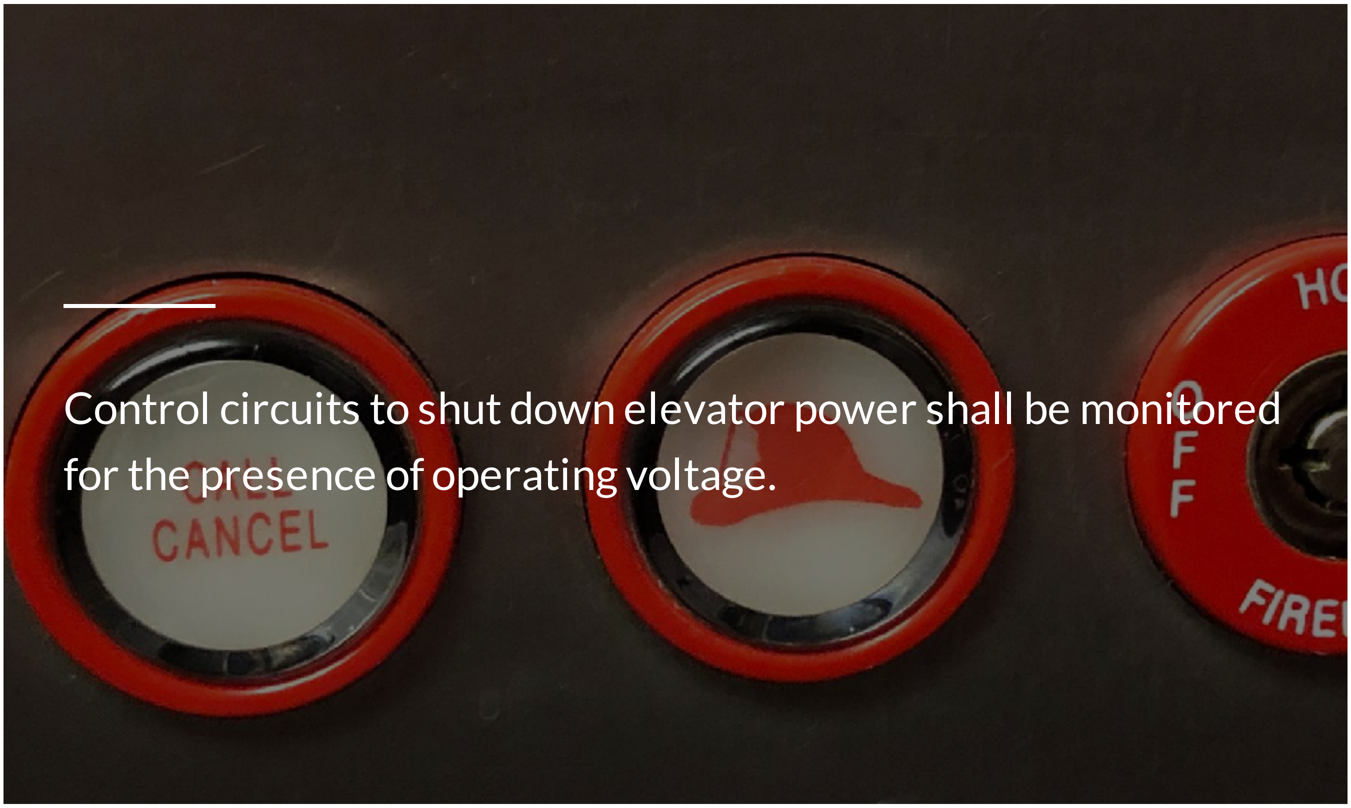
○ Rule 3

SUBMIT

Complete the knowledge check above before moving on.

Lesson 2 of 3

Elevator Recall for Firefighters' Service



Control circuits to shut down elevator power shall be monitored for the presence of operating voltage.

Goals for this Lesson:

By the end of this lesson, you will be able to do the following:

1. Identify smoke detector location and mounting requirements when used for elevator recall purposes

2. Determine the purpose and functionality of elevator control circuits connected to smoke detectors

3. Be aware of the limitations placed on heat detectors when used in elevator shut down applications

CONTINUE

The requirement to install alarm-initiating devices for elevator recall comes from ANSI/ASME A17.1a/CSA B44a, Safety Code for Elevators and Escalators.

Elevator recall is used to take the elevator to a designated level when specific fire detection sensors activate. This allows for safe exit by passengers and use of the elevator for fire fighters.

For fire alarm systems and/or emergency control function circuits that control elevators, there are specific requirements that must be adhered to for the safety of occupants and fire fighters.

ELEVATOR RECALL FOR FIREFIGHTERS' SERVICE

Elevator Recall for Firefighters' Service

NFPA 72 2016, Section 21.3

Initiating devices used to initiate fire fighter’s service (elevator) recall must be connected to the building fire alarm system.

In facilities without a building fire alarm system, initiating devices used to initiate fire fighters’ service recall shall be connected to a dedicated function fire alarm control unit that shall be designated as “elevator recall control and supervisory control unit,” permanently identified on the dedicated function fire alarm control unit and on the record drawings.


DOOR OPEN
DOOR CLOSE
ALARM
RUN
PUSH TO CALL
FLASHES WHEN CALL ANSWERED

CONTINUE

Unless otherwise required by the Authority Having Jurisdiction (AHJ), only the elevator lobby, elevator hoistway, elevator machine room, elevator control room, and elevator control space smoke detectors, or other automatic fire detection as permitted by **Section 21.3.9**, shall be used to recall elevators for fire fighters' service.

> *A waterflow switch shall be permitted to initiate elevator Phase I Emergency Recall Operation upon activation of a sprinkler installed at the bottom of the elevator hoistway (the elevator pit), provided the waterflow switch and pit sprinkler are installed on a separately valved sprinkler line dedicated solely for protecting the elevator pit, and the waterflow switch is provided without time-delay capability.*

CONTINUE

These detectors must be able to perform the recall function when all other devices on the same initiating circuit have been manually or automatically placed in alarm. Detectors are typically four-wire devices to ensure power is always available during an alarm.

A lobby smoke detector must be located on the ceiling within 21 ft of the centerline of each elevator door within the elevator bank under control of the detector.

ⓘ **Exception:** For **lobby ceiling configurations exceeding 15 ft in height** or that are **other than flat and smooth**, detector **locations shall be determined in accordance with Chapter 17**.

CONTINUE

Smoke detectors cannot be installed in unsprinklered elevator hoistways *unless* **they are installed to activate elevator hoistway smoke control equipment or to initiate Phase I recall.**

If ambient conditions do not allow the use of smoke detectors, other automatic fire detectors may be used.

The detector, when actuated, must initiate an alarm condition on the building fire alarm system and must visibly annunciate the circuit or zone from which the alarm originated.

With the **permission of the AHJ**, the hoistway and machine room detectors **need only initiate a supervisory signal** *instead* of an **alarm signal**.

Activation of the smoke detector(s) or other automatic fire detectors for the elevator hoistway, elevator machine room, elevator machinery space, elevator control space, or elevator control room as permitted by Section 21.3.9, shall cause separate and distinct visible annunciation at the building fire alarm control unit, or the fire alarm control unit described in Section 21.3.2.

There must be separate outputs from the fire alarm systems to the elevator controller(s) to implement elevator Phase I Emergency Recall Operation in accordance with Section 2.27 of ANSI/ASME A17.1a/CSA B44, Safety Code for Elevators and Escalators.

CONTINUE

Let's do a quick check over what we just covered.

The detector, when actuated, must initiate an _____ condition on the building fire alarm system and must visibly annunciate the circuit or zone from which the alarm originated.

○ alarm

○ supervisory

SUBMIT

Complete the knowledge check above before moving on.

Designated Level Recall, Alternate Recall Level, Visual Warning

NFPA 72 2016, Sections 21.3.13.1, 21.3.13.2, 21.3.13.3

For each group of elevators, a minimum of three elevator control circuits must be provided to the elevator controller in the group's elevator machine room.

The smoke detectors must be connected to the control units in the following way: (Click on each tab to learn more)

SECTION 21.3.14.1	SECTION 21.3.14.2	SECTION 21.3.14.3

The fire detection device(s) located in the lobby of the designated level (and other areas) shall activate the first elevator control circuit sending the elevator(s) to the alternate recall level.

SECTION 21.3.14.1	SECTION 21.3.14.2	SECTION 21.3.14.3

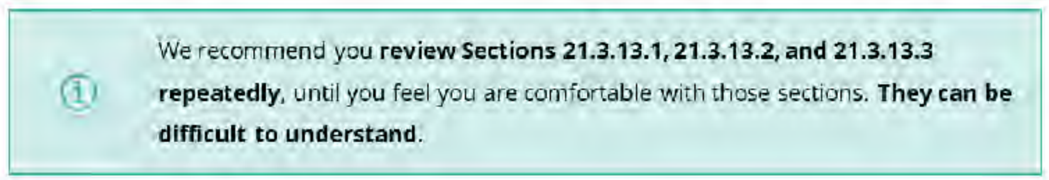
The fire detection device(s) located on any other level (and the other areas) shall activate the second elevator control circuit sending the elevator(s) to the primary recall level.

SECTION 21.3.14.1

SECTION 21.3.14.2

SECTION 21.3.14.3

The third circuit is for each cab warning light. An additional circuit is required for each additional hoistway to indicate to the fire fighter the alarm signal is coming from that particular elevator machine room, elevator machinery space, elevator control space, or elevator control room, so that the elevator is not used for service.



We recommend you **review Sections 21.3.13.1, 21.3.13.2, and 21.3.13.3 repeatedly**, until you feel you are comfortable with those sections. **They can be difficult to understand**.

CONTINUE

The best way to explain it is that for **each group of elevators, a minimum of two control circuits are required** (*one* for the **designated level recall** and *one* for the **alternate level recall**) *PLUS* **one visual warning circuit for all elevator cabs**.

1

Example 1: There is one elevator for the building. There shall be one circuit for the designated level recall, one circuit for the alternate level recall, and one circuit for the visual warning indicator inside the elevator cab to signify the hoistway may be compromised by a fire condition (3 circuits).

2

Example 2: There are three separate elevators, hoistways, machine rooms, etc. for the building. For each elevator, there shall be one circuit for the designated level recall, one circuit for the alternate level recall, and one circuit for the visual warning indicator inside the elevator cabs to signify the elevator(s) hoistway(s) may be compromised by a fire condition (9 circuits).

ELEVATOR SHUTDOWN

Elevator Shutdown

NFPA 72 2016, Section 21.4

If heat detectors are used to shut down elevator power prior to sprinkler activation, the **heat detector must have a lower temperature rating and a higher sensitivity compared to the sprinkler**.

If heat detectors are used to shut down elevator power prior to sprinkler operation, they **shall be placed within 24 in. of each sprinkler head** and be installed in accordance with the requirements of Chapter 17.

Alternatively, engineering methods such as those specified in Annex B, shall be permitted to be used to select and place heat detectors to ensure response prior to any sprinkler head operation under a variety of fire growth rate scenarios.

CONTINUE

Let's do a quick check over what we just covered.

There is one elevator for the building. Select which of the circuits below would be used for this elevator. (Select all that apply)

- ☐ one circuit for the designated level recall
- ☐ one circuit for halting elevator cab service
- ☐ one circuit for the visual warning indicator
- ☐ one circuit for alternate level recall

SUBMIT

According to *NFPA* 72 2016, Sections 21.3.13.1, 21.3.13.2, 21.3.13.3, the smoke detectors must be connected to the control units in the following way:

SUBMIT

🔒 Complete the knowledge check above before moving on.

If **heat detectors** are used to **shut down elevator power** prior to sprinkler operation, they shall be **placed within 24 in. of each sprinkler head** and be installed in accordance with the requirements of **Chapter 17.**

If pressure or waterflow switches are used to shut down elevator power immediately upon, or prior to, the discharge of water from sprinklers, the use of devices with time-delay switches or time-delay capability is not permitted.

CONTINUE

Control circuits to shut down elevator power shall be monitored for the presence of operating voltage. Loss of voltage to the control circuit for the disconnecting means must cause a supervisory signal to be indicated at the building fire alarm control unit or at the control unit described in **Section 21.3.2.**

ⓘ The **initiating devices described in Sections 21.4.2 and 21.4.3** (for elevator power shut off and control circuits to shut down elevator power) must be **monitored for integrity** by the **fire alarm control unit**.

FIRE SERVICE ACCESS ELEVATORS

Fire Service Access Elevators

***NFPA* 72 2016, Section 21.5**

Where there are one or more elevators specifically designated and marked as fire service access elevators, the requirements of **Section 21.5.1 and 21.5.2** shall apply.

1. Status of elevator(s), including location within the hoistway, direction of travel, and whether the elevator(s) are occupied, shall be permitted to be displayed on a building fire alarm system annunciator located at the fire command center.

2. Temperature and presence of smoke in associated lobbies, machine rooms, control rooms, machinery spaces, or control spaces shall be continuously monitored and displayed on a building fire alarm system annunciator located at the fire command center.

ⓘ **The conditions shall be displayed on a standard emergency services interface complying with Section 18.11.**

OCCUPANT EVACUATION ELEVATORS

Occupant Evacuation Elevators

NFPA 72 2016, Section 21.6

Click each "**+**" below to learn more about **NFPA 72 2016, Section 21.6**

Sections 21.5 and 21.6 –

Where one or more elevators are specifically designated and marked for use by occupants for evacuation during fires, they shall comply with all of the provisions of **Sections 21.5 and 21.6.**

Sections 21.6.2.1 and 21.6.2.2 –

The outputs from the fire alarm system to the elevator controller(s) shall be provided to implement elevator occupant evacuation operation in accordance with Section 2.27 of ASME A17.1/CSA B44 (2013), Safety Code for Elevators and Escalators, as required in **Sections 21.6.2.1 and 21.6.2.2**.

Sections 21.6.2.1.1 through 21.6.2.1.4 –

Where an elevator or group of elevators is designated for use by occupants for evacuation, the provisions of **Sections 21.6.2.1.1 through 21.6.2.1.4** shall apply for partial evacuation.

- Sections 21.6.2.1.1 through 21.6.2.1.4 covers the requirements for initiation, floor identification, manual floor selection, and occupant notification.
- While we will not cover the requirements in this module, we recommend you study/review this information.

CONTINUE

Let's do a quick check over what we have covered so far.

If heat detectors are used to shut down elevator power prior to sprinkler operation, they shall be placed within ___ of each sprinkler head and be installed in accordance with the requirements of Chapter 17.

○ 12 in.

○ 24 in.

○ 12 ft.

○ 24 ft.

SUBMIT

Complete the knowledge check above before moving on.

Lesson 3 of 3

HVAC Systems and Door & Shutter Release

All detection devices used to cause the operation of HVAC systems smoke dampers, fire dampers, fan control, smoke doors, and fire doors must be monitored for integrity

Goals of this Lesson:

By the end of this lesson, you will be able to do the following:

1. Identify the *NFPA* 72 2016 requirements for emergency control functions for HVAC Systems

2 Identify the *NFPA* 72 2016 requirements for emergency control functions for Door and Shutter Release systems

HVAC SYSTEMS

Heating, Ventilating and Air-Conditioning (HVAC) Systems

NFPA 72 2016, Section 21.7

The provisions of **Section 21.7** apply to fire alarm systems with interfaces with HVAC systems.

If connected to the fire alarm system serving the protected premises, all detection devices used to cause the operation of HVAC systems smoke dampers, fire dampers, fan control, smoke doors, and fire doors must be monitored for integrity in accordance with **Section 12.6.**

Connections between fire alarm systems and the HVAC system, for the purpose of monitoring and control, shall operate and be monitored in accordance with the applicable NFPA standards.

CONTINUE

2 Identify the *NFPA* 72 2016 requirements for emergency control functions for Door and Shutter Release systems

HVAC SYSTEMS

Heating, Ventilating and Air-Conditioning (HVAC) Systems

NFPA 72 2016, Section 21.7

The provisions of **Section 21.7** apply to fire alarm systems with interfaces with HVAC systems.

If connected to the fire alarm system serving the protected premises, all detection devices used to cause the operation of HVAC systems smoke dampers, fire dampers, fan control, smoke doors, and fire doors must be monitored for integrity in accordance with **Section 12.6.**

Connections between fire alarm systems and the HVAC system, for the purpose of monitoring and control, shall operate and be monitored in accordance with the applicable NFPA standards.

CONTINUE

Smoke detectors mounted in the air ducts of HVAC systems shall initiate a supervisory signal.

Smoke detectors mounted in the air ducts of HVAC systems in a fire alarm system without a constantly attended location or supervising station shall be permitted to initiate an alarm signal.

Smoke detectors mounted in the air ducts of HVAC systems shall be permitted to initiate an alarm signal where required by other governing laws, codes, or standards.

If the fire alarm control unit actuates the HVAC system for the purpose of smoke control, the automatic alarm-initiating zones shall be coordinated with the smoke control zones they actuate.

CONTINUE

If carbon monoxide detection or a dedicated carbon monoxide system initiates a ventilation response, a smoke control response of the fire alarm system shall take precedence over the response of the carbon monoxide detectors during a fire alarm condition.

Where interconnected as a combination system, a fire fighter’s smoke control station (FSCS) shall be provided so that firefighters may perform manual control over the automatic operation of the system’s smoke control strategy.

Where interconnected as a combination system, the smoke control system programming shall be designed such that normal HVAC operation or changes do not prevent the intended performance of the smoke control strategy.

CONTINUE

Let's do a quick check over what we have covered so far.

Smoke detectors mounted in the air ducts of HVAC systems in a fire alarm system without a constantly attended location or supervising station shall be permitted to initiate what type of signal?

○ Supervisory

○ Alarm

SUBMIT

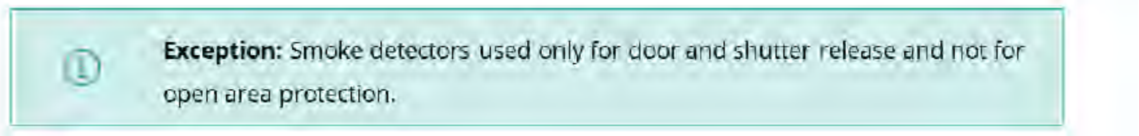
Complete the knowledge check above before moving on.

Door and Shutter Release

NFPA 72 2016, Section 21.8

The provisions of **Section 21.8** shall apply to the **methods of connection of door and shutter hold-open release devices** and to **integral door and shutter hold-open release, closer, and smoke detection devices**.

All detection devices used for door and shutter hold-open release service shall be monitored for integrity in accordance with **Section 12.6.**



Exception: Smoke detectors used only for door and shutter release and not for open area protection.

CONTINUE

All door and shutter hold-open release and integral door and shutter release and closure devices used for release service shall be monitored for integrity in accordance with **Section 12.6**.

Exception: **Pathways installed as Class D circuits in accordance with Section 12.3.4.**

Magnetic door and shutter holders that allow doors to close upon loss of operating power shall not be required to have a secondary power source.

ELECTRICALLY LOCKED DOORS

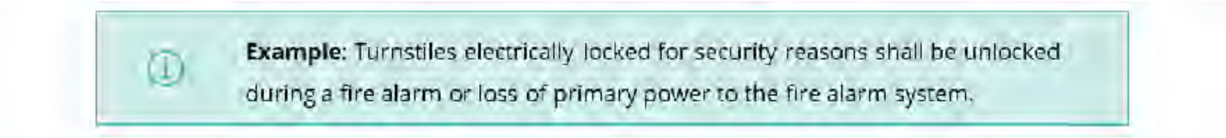
Electrically Locked Doors

NFPA 72 2016, Section 21.9

Electrically locked doors in a required means of egress shall unlock in the direction of egress where required by other laws, codes, and governing standards.

All means of egress doors are to be connected in accordance with Section 21.9.1 where secondary power supplies of fire alarm control units are used. They shall comply with Section 10.6.7.

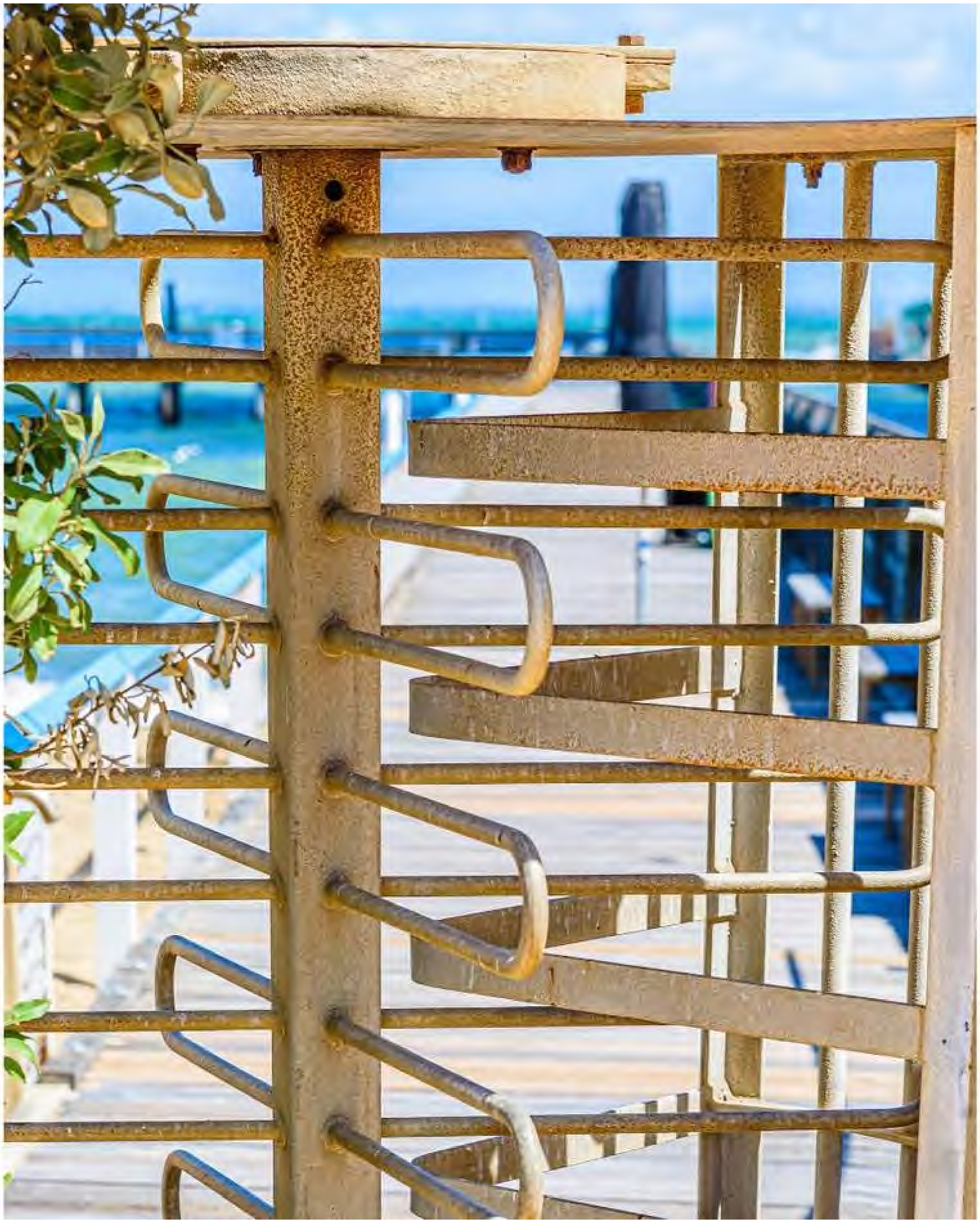
Locks powered by independent power supplies dedicated to lock power and access control functions, and that unlock upon loss of power, are not required to comply with the statement above.


Example: Turnstiles electrically locked for security reasons shall be unlocked during a fire alarm or loss of primary power to the fire alarm system.

CONTINUE

Fire alarm control unit secondary power supplies cannot be used to maintain egress doors in the locked condition, unless the fire alarm control unit is arranged with circuitry and sufficient secondary power to ensure the egress doors will unlock within 10 minutes of loss of primary power.

If egress doors are unlocked by the fire alarm system, the unlocking function shall occur prior to, or concurrent with, activation of any public-mode notification appliances in the area(s) served by the normally locked egress doors.



All doors that are required to be unlocked by the fire alarm system must remain unlocked until the fire alarm condition is manually reset.

CONTINUE

Let's do a quick check over what we just covered.

Magnetic door and shutter holders that allow doors to close upon loss of operating power shall _____ to have a secondary power source.

○ be required

○ not be required

SUBMIT

If egress doors are unlocked by the fire alarm system, the unlocking function shall occur _______, activation of any public-mode notification appliances in the area(s) served by the normally locked egress doors. (Select all that apply)

☐ prior to

☐ concurrent with

☐ post alarm

SUBMIT

Complete the knowledge check above before moving on.

This completes the Emergency Control Functions and Interfaces module.

Chapter 21 is not a large chapter, but it does have information that may have to be reviewed quite a few times to ensure you become familiar with the requirements.

There will be times when Chapter 21 refers you to other chapters for monitoring of integrity requirements or annunciation requirements.

Remember, for elevator control there are specific requirements for the automatic fire detectors/circuits used for elevator recall:

- Designated level, alternate level, warning indicator
- Lobby smoke detectors
- Hoistway heat detectors when sprinklers are present

CONTINUE

After completing this module, you should now have a better understanding of the different types of emergency control functions related to elevator controls and door releases.

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

Ohio Fire Alarm and Detection Equipment-Ohio Fire Code

FIRE TECH PRODUCTIONS

Welcome to the Ohio Fire Code module of the Ohio Fire Alarm and Detection Systems Course.

This module will provide information on SOME of the Ohio Fire Code requirements for fire alarm systems.

You can reference the Ohio Fire Code at: http://codes.ohio.gov/oac/1301:7-7-09.
Key Reference for this module:

- Ohio Fire Code – Chapter 9, Fire Protection Systems (https://codes.iccsafe.org/content/OHFCJAN2019E/ohio-administrative-code-1301-7-7-09-fire-protection-systems)

Sections 508.1, 901, 902, 903.4.1 and 904.3.5

Sections 907, 914, and 1009.6.5.1

Lesson 1 of 2

Sections 508.1, 901, 902, 903.4.1 and 904.3.5

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Gain a working knowledge of Ohio Fire Alarm Code requirements for fire alarm systems.

2. Determine inspection tag information and placement.
3. Follow proper procedures for preplanned impairment programs and verify correct system restoration processes.

LET'S GET STARTED

Many of the requirements are the same or very similar to requirements from *NFPA* 72 2016, *The National Fire Alarm and Signaling Code*, 2016 edition.

In other instances, the Ohio Fire Code will refer you back to *NFPA* 72 2016 for either installation requirements, or inspection and testing requirements.

Ohio Fire Code

Click the button on the right to reference the fire protection systems portion of the Ohio Fire Code.

OHIO FIRE CODE

1301:7-7-80

Click on the button to take a look at the table that lists all of the sections that deal with fire alarm systems in the Ohio Fire Code.

CLICK HERE

The information we are looking for is on the *NFPA* table under the "Standard Reference Number" column and titled "72-16."

Per the *NFPA* table, the sections of the building code covering fire alarm systems are:

- Section 508.1
- Table 901.6.1
- Section 903.4.1
- Section 904.3.5
- Section 907
- Section 1009.6.5.1

We will **not** cover every section listed above, but will provide information so that you get a feel for what the Ohio Fire Code entails.

SECTION 508.1 AND 508.1.6

Section 508 Fire Command Center provides information with regard to fire command centers, if required.

Ohio Fire Code, Section 508.1

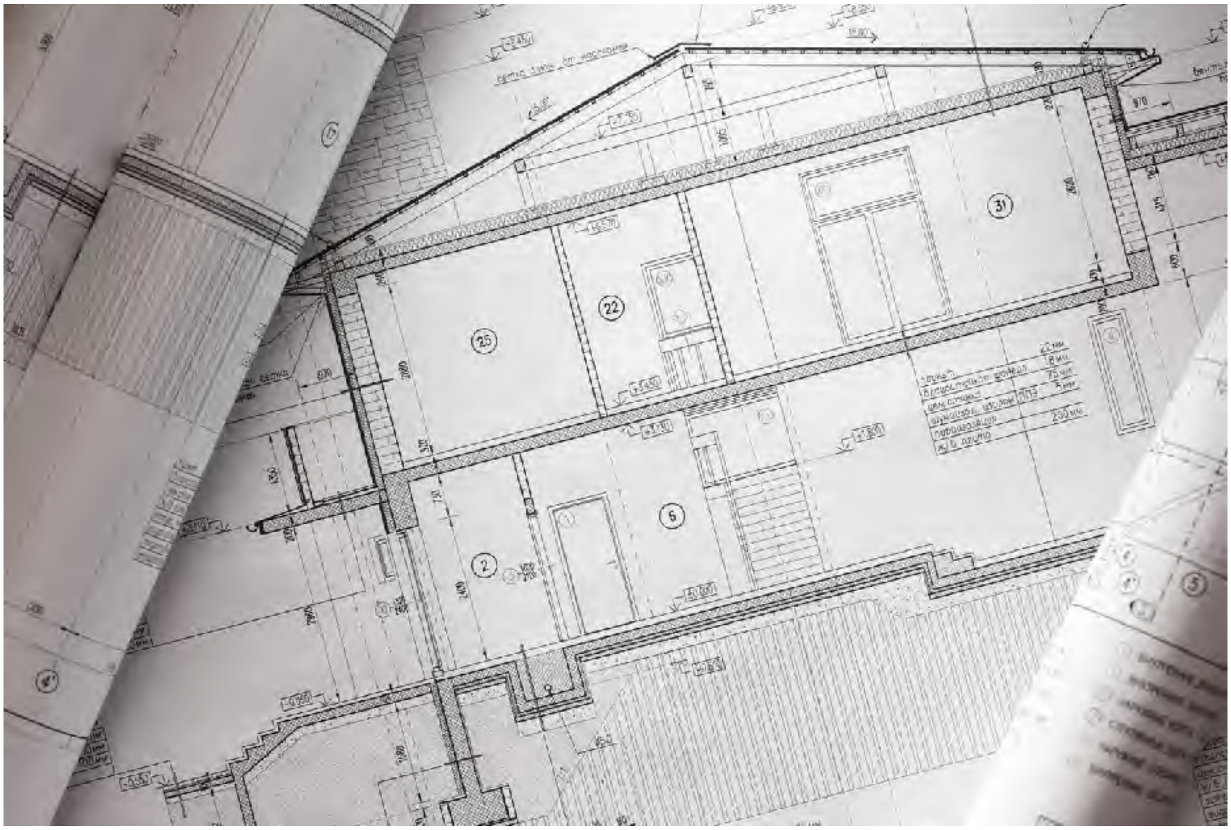
Where Required

Where required by other paragraphs of this code and in all buildings classified as high-rise buildings by the building code as listed in rule 1301:7-7-80 of the Administrative Code, a fire command center for fire department operations shall be provided and comply with paragraphs (H)(1)(a)(508.1.1) to (H)(1)(f)(508.1.6) of this rule.

ⓘ ***NFPA* 72 2016 provides additional information for the Fire Command Center in Section A.3.3.104**

Ohio Fire Code, Section 508.1.6

Required Features



Some of the features the fire alarm installer may be interested in include:

- The emergency voice/alarm communication system unit
- Fire-detection and alarm system annunciator
- Schematic building plans indicating the typical floor plan and detailing among other features the fire protection systems

SECTION 901.1

Section 901 General provides information with regard to all fire protection systems.

Ohio Fire Code, Section 901.1

Scope

The provisions of this rule shall specify where fire protection systems are required and **shall apply to the design, installation, inspection, operation, testing and maintenance of all fire protection systems**. The requirements in this rule for fire protection systems in structures regulated by the building code as listed in **rule 1301:7-7-80** of the **Administrative Code** submitted for plan review in accordance with this paragraph are **subject to and do not supersede or otherwise conflict with the requirements of paragraph (D)(2)(a)(104.2.1) of rule 1301:7-7-01 of the Administrative Code**.

SECTION 901.4

Ohio Fire Code, Section 901.4

Installation

Fire protection systems shall be maintained in accordance with the original installation standards for that system. Required fire protection systems shall be extended, altered, or augmented as necessary to maintain and continue protection whenever the building is altered, remodeled, or added to. Alterations to fire protection systems shall be done in accordance with the building code as listed in rule 1301:7-7-80 of the Administrative Code and applicable standards.

Ohio Fire Code, Section 901.6

Inspection, Testing, and Maintenance

Fire detection, alarm, and extinguishing systems shall be maintained in an operative condition at all times, and shall be replaced or repaired where defective. Nonrequired fire protection systems and equipment shall be inspected, tested, and maintained, or removed. Any discontinuance or removal of nonrequired fire protection equipment shall be approved by the fire code official. Such approval shall be conditioned upon receipt of verification of building official determination that such fire protection equipment is nonrequired.

SECTION 901.6.1 - 901.6.2

Ohio Fire Code, Section 901.6.1

Standards

Fire protection systems shall be inspected, tested, and maintained in accordance with the referenced standards listed in Table 901.6.1 of this rule.

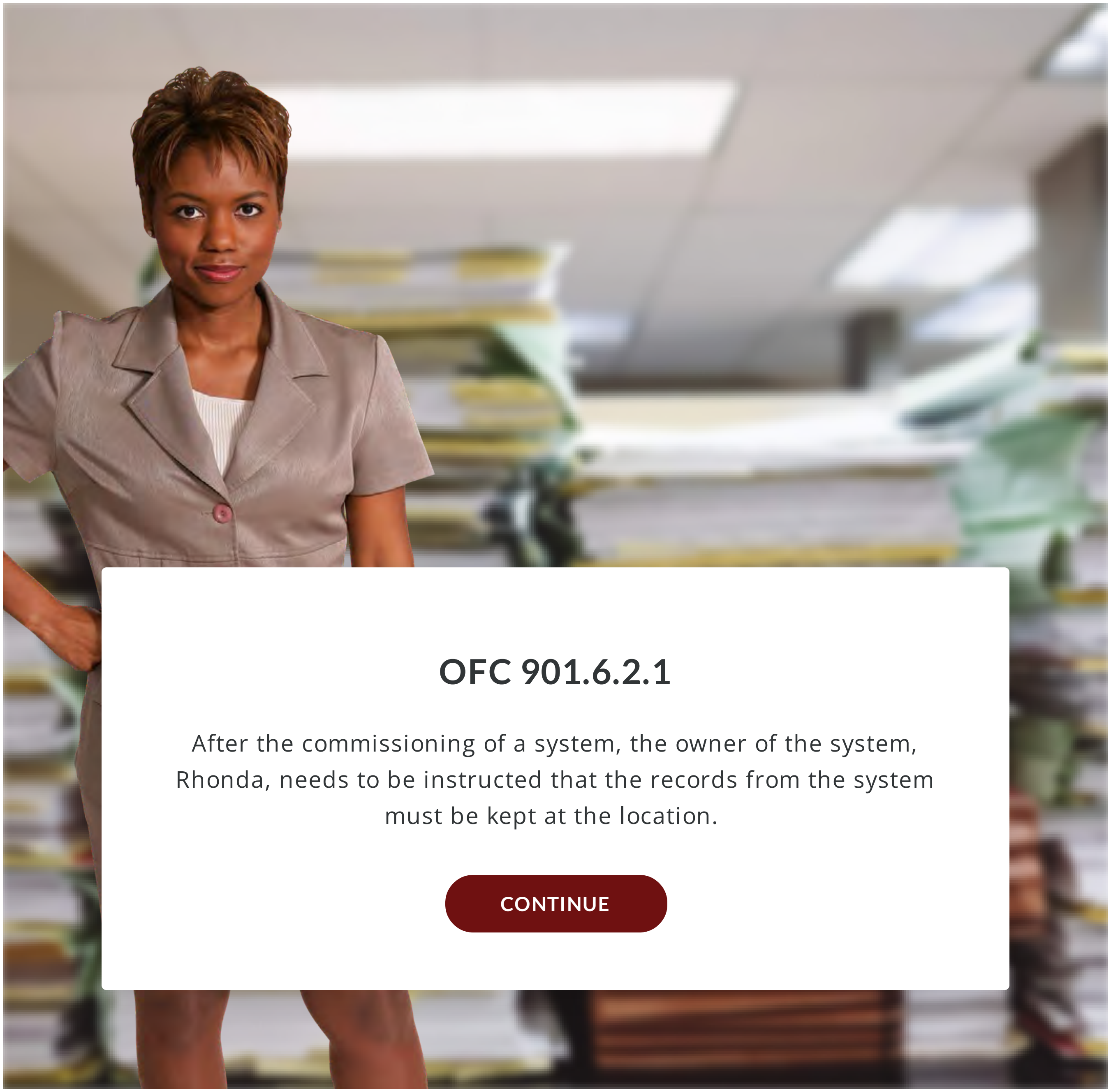
Ohio Fire Code, Section 901.6.2

Records

Records of all system inspections, tests, and maintenance required by the referenced standards shall be maintained. Find out more about the responsibility of the owner in the scenario below.

SECTION 901.6.2.1

Ohio Fire Code, Section 901.6.2.1



OFC 901.6.2.1

After the commissioning of a system, the owner of the system, Rhonda, needs to be instructed that the records from the system must be kept at the location.

Scene 1 Slide 1

Continue → Next Slide

How long must Rhonda keep the records from the system acceptance test, list of equipment by floor, make, model, and manufacturer information and instructions at the location?

1. A minimum of 1 year until the next inspection is performed
2. A minimum of 2 years or until the first smoke detector sensitivity test records are available
3. For the life of the system

Scene 1 Slide 2

0 → Next Slide

1 → Next Slide

2 → Next Slide

Records Information

Initial records shall include the name of the installation contractor, type of components installed, the manufacturer of the components, and the location and number of components installed per floor. Records shall also include the manufacturer's operation and maintenance instruction manuals, and be maintained on the premises. **Acceptance testing records (original documents) shall be retained for the life of the system**.

Complete the scenario above before moving on.

Ohio Fire Code, Section 901.6.3

Annual Inspection Tag for Fire Protection Systems

An inspection tag shall be attached to each fire protection system near the main control valve, main panel, or other such appropriate and visible location as determined by the fire code official. The annual inspection tag shall contain the following information:

1. The individual performing the work and the state fire marshal installer certification number(s), when applicable
2. Date of test
3. Results of inspection and test
4. Deficiencies or impairments noted (yes or no)

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LET'S REVIEW

Let's do a quick check about what has been covered so far.

According to Ohio Fire Code Section 508.1.6, some of the features the fire alarm installer may be interested in include: (Select all that appy)

☐ The budget for the project

☐ The emergency voice/alarm communication system unit

☐ Schematic building plans indicating the typical floor plan and detailing among other features the fire protection systems

☐ Fire-detection and alarm system annunciator

SUBMIT

According to Ohio Fire Code Section 901.6.3, an inspection tag shall be attached to each fire protection system near the main control valve, main panel, or other such appropriate and visible location as determined by the fire code official. The annual inspection tag shall contain the following information:

(Select all that apply)

- ☐ The individual performing the work and the state fire marshal installer certification number(s), when applicable
- ☐ Deficiencies or impairments noted (yes or no)
- ☐ Date to return for follow-up
- ☐ Results of inspection and test
- ☐ Date of test

SUBMIT

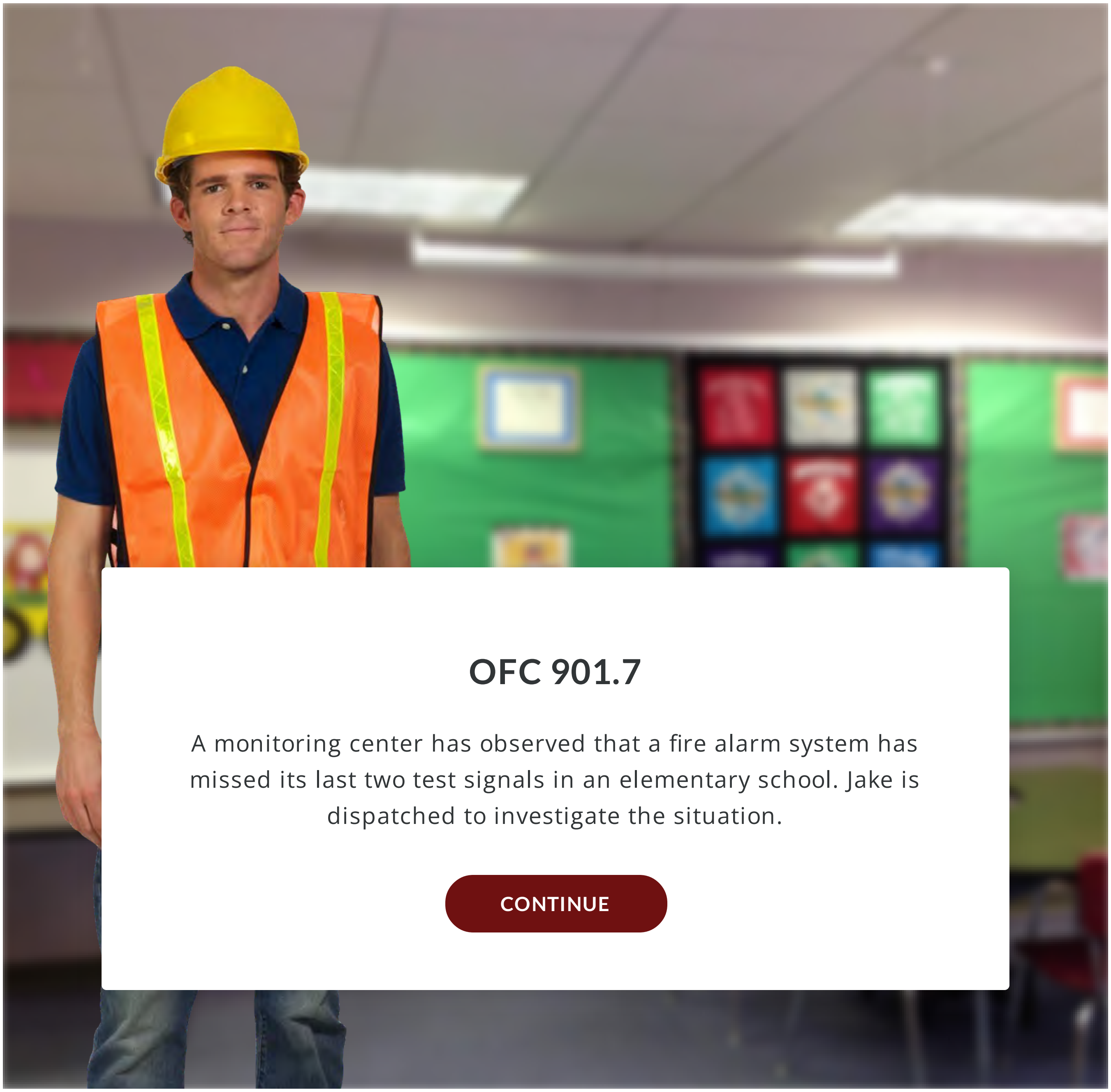
Complete the knowledge check above before moving on.

Ohio Fire Code, Section 901.7

Systems Out of Service

Where a required fire protection system is out of service, the fire department and the fire code official shall be notified immediately and, where required by the fire code official, the building shall either be evacuated or an approved fire watch shall be provided for all occupants left unprotected by the shutdown until the fire protection system has been returned to service.

Where utilized, fire watches shall be provided with at least one approved means for notification of the fire department, and their only duty shall be to perform constant patrols of the protected premises and keep watch for fires.



OFC 901.7

A monitoring center has observed that a fire alarm system has missed its last two test signals in an elementary school. Jake is dispatched to investigate the situation.

Scene 1 Slide 1

Continue → Next Slide

When he arrives, he finds that the power supply board on the main fire alarm controller is non-functional & will need to be replaced. The part is available in a warehouse that is out of town.

Scene 1 Slide 2

The part can be shipped next-day air and will be available tomorrow to be installed. What must Jake do to comply with Ohio Fire Code regulations?

1. Notify the school personnel that the part is on the way and he will have the system back in service within 24 hours.
2. Do everything in choice #1, but he must also tell school personnel that the fire official must be contacted immediately to request instructions.
3. Do everything in choice #1, but he must also tell the school personnel that a building evacuation will be required until the system can be repaired.

Scene 1 Slide 3

0 → Scene 1 Slide 1

1 → Next Slide

2 → Next Slide

Complete the scenario above before moving on.

Ohio Fire Code, Section 901.7.2

Tag Required

A tag shall be used to indicate that a system, or portion thereof, has been removed from service.

Ohio Fire Code, Section 901.7.3

Placement of Tag

The tag shall be posted at each fire department connection (FDC), system control valve, fire alarm control unit, fire alarm annunciator, and fire command center, indicating which system, or part thereof, has been removed from service.

The fire code official shall specify where the tag is to be placed.

SECTION 901.7.4

Ohio Fire Code, Section 901.7.4

Preplanned Impairment Programs

Preplanned impairments shall be authorized by the impairment coordinator. Before authorization is given, a designated individual shall be responsible for verifying that all of the following procedures have been implemented:

☐ The extent and expected duration of the impairment have been determined.

☐ The areas or buildings involved have been inspected and the increased risks determined.

☐ Recommendations have been submitted to management or building owner/manager.

☐ The fire department has been notified.

☐ The insurance carrier, alarm company, building owner/manager, and other AHJs have been notified.

☐ The supervisors in the areas to be affected have been notified.

☐ A tag impairment system has been implemented.

☐ Necessary tools and materials have been assembled on the impairment site.

SECTION 901.7.5 - 901.7.6

Ohio Fire Code, Section 901.7.5

Emergency Preplanned Impairment

When unplanned impairments occur, appropriate emergency action shall be taken to minimize potential injury and damage. The impairment coordinator shall implement the steps outlined in paragraph (A)(7)(d)(901.7.4) of this rule.

Ohio Fire Code, Section 901.7.6

Restoring Systems to Service

OFC 901.7.6 (v)

The power supply board for the elementary school finally arrived and Jake just finished repairing the main fire alarm control panel's power supply.

Scene 1 Slide 1

Continue → Next Slide

After repairing the power supply of the main fire alarm control panel’s power supply which of the following is **NOT** a requirement.

1 For the record, the impairment tag needs to be kept in place but draw a red or black diagonal line across the tag to show the condition doesn't exist.

2 The impairment coordinator needs to verify that the insurance carrier for the building has been contacted to let them know the system is repaired.

3 School Personnel, the fire official, alarm company, & all other involved parties need to be notified that repairs are complete and the alarm is fixed.

Scene 1 Slide 2

0 → Next Slide
1 → Next Slide
2 → Next Slide

Complete the scenario above before moving on.

When impaired equipment is restored to normal working order, the impairment coordinator shall verify that all of the following procedures have been implemented:

☐ Necessary inspections and tests have been conducted to verify that affected systems are operational.

☐ Supervisors have been advised that protection is restored.

☐ The fire department has been advised that protection is restored.

☐ The building owner/manager, insurance carrier, alarm company, and other involved parties have been advised that protection is restored.

☐ The impairment tag has been removed.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

According to Ohio Fire Code Section 901.7.3, A tag shall be posted at each fire department connection (FDC), system control valve, fire alarm control unit, fire alarm annunciator, and fire command center, indicating which system, or part thereof, has been removed from service. Who shall specify where the tag is to be placed?

○ The manufacturer

○ The owner of the building

○ The fire code official

○ The *Ohio Building Code,* 2017

SUBMIT

According to Ohio Fire Code Section 901.7.6, a tag shall be used to indicate that a system, or portion of a system, has been removed from service. When impaired equipment is restored to normal working order, the impairment coordinator shall verify that the following procedures have been implemented: (Select all that apply)

☐ The impairment tag has been removed.

☐ Supervisors have been advised that protection is restored.

☐ Allow employees who may have been impacted that they may return to work.

☐ The fire department has been advised that protection is restored.

SUBMIT

🔒 Complete the knowledge check above before moving on.

Ohio Fire Code, Section 901.8

Removal of or Tampering with Equipment

It shall be unlawful for any person to remove, tamper with, or otherwise disturb any fire hydrant, fire detection and alarm system, fire suppression system, or other fire appliance required by this code except for the purpose of extinguishing fire, training purposes, recharging, making necessary repairs, or when approved by the fire code official.

Ohio Fire Code, Section 901.8.1

Removal of or Tampering with Appurtenances

Locks, gates, doors, barricades, chains, enclosures, signs, tags, or seals that have been installed by or at the direction of the fire code official shall not be removed, unlocked, destroyed, tampered with, or otherwise vandalized in any manner.

SECTION 901.10

Ohio Fire Code, Section 901.10

Recall of Fire Protection Components

Any fire protection system component regulated by this code that is the subject of a voluntary or mandatory recall under federal law shall be replaced with approved, listed components in compliance with the referenced standards of this code. The fire code official shall be notified in writing by the building owner when the recalled component parts have been replaced.

There are other requirements in Section 901 that may apply to your particular situation. It is highly recommended that you look through Section 901 in its entirety to make sure you have all the information you may need.

SECTION 902

Ohio Fire Code, Section 902

Definitions

We will not cover the definitions of Section 902.

Many are similar to the definitions you may find in *NFPA* 72 - *The National Fire Alarm and Signaling Code*.

Be aware that the definitions are there. We recommend familiarizing yourself with them.

SECTION 903.4.1

Ohio Fire Code, Section 903.4.1

Monitoring

Alarm, supervisory, and trouble signals shall be distinctly different and shall be automatically transmitted to an approved supervising station or, when approved by the fire code official pursuant to paragraph (A)(1)(901.1) of this rule, shall sound an audible signal at a constantly attended location. At locations or in structures not regulated by the building code as listed in rule 1301:7-7-80 of the Administrative Code, the constantly attended location shall be approved by the fire code official prior to system installation.

Exceptions:

1. Underground key or hub valves in roadway boxes provided by the municipality or public utility are not required to be monitored.

2. Backflow prevention device test valves located in limited area sprinkler supply piping shall be locked in the open position. In occupancies required to be equipped with a fire alarm system, the back-flow preventer valves shall be electrically supervised by a tamper switch installed in accordance with *NFPA* 72 as listed in rule 1301:7-7-80 of the Administrative Code and separately annunciated.

SECTION 904.3.5

Ohio Fire Code, Section 904.3.5

Monitoring

Where a building fire alarm system is installed, automatic fire-extinguishing systems shall be monitored by the building fire alarm system in accordance with ***NFPA*** **72 as listed in rule 1301:7-7-80 of the Administrative Code**.

There are other requirements in Section 904 that may apply to your particular situation. **It is highly recommended that you look through Section 904 in its entirety to make sure you have all the information you may need**.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

According to Ohio Fire Code Section 903.4.1, there are two exceptions to monitoring.

Is the following exception true or false?

Underground key or hub valves in roadway boxes provided by the municipality or public utility are required to be monitored.

○ True

○ False

SUBMIT

According to Ohio Fire Code Section 904.3.5, where a building fire alarm system is installed, automatic fire-extinguishing systems shall be monitored by the _____ in accordance with *NFPA* 72 as listed in rule 1301:7-7-80 of the Administrative Code.

○ building fire alarm system

○ authority having jurisdiction

○ supervising station

SUBMIT

Complete the knowledge check above before moving on.

Sections 907, 914, and 1009.6.5.1

Goals for this Lesson

By the end of this lesson, you will be able to do the following:

1. Specify occupancies that require the installation of fire alarms, as well as exceptions to these requirements.

2. Determine correct placement of manual fire alarm boxes.
3. Identify acceptable sound pressure levels for audible alarm notification appliances.
4. Recognize where fire protection systems are required based on special use and occupancy details.

SECTION 907

Section 907 is titled Fire Alarm and Detection Systems.

It covers the application, installation, performance, and maintenance of fire alarm systems and their components in new and existing buildings and structures.

The general information covered in this section is similar to the requirements in *NFPA* 72 and you should take the time to familiarize yourself with the requirements.

Some of the requirements include:

- Construction documents

- Shop drawings showing location of systems components, ceiling heights, equipment ratings, etc
- Listing of equipment used in fire alarm systems
- Where manual fire alarm systems or boxes (pull stations) shall be installed, in which occupancy group, and any exceptions to those rules

ⓘ **You should become familiar with the comprehensive list of requirements found in Section 907.**

SECTION 907.2

Ohio Fire Code, Section 907.2

Where Required - New Buildings and Structures

An approved fire alarm system installed in accordance with the provisions of this code and ***NFPA* 72 as listed in rule 1301:7-7-80 of the Administrative Code shall be provided in new buildings and structures in accordance with paragraphs (G)(2)(a)(907.2.1) to (G)(2)(w)(907.2.23)** of this rule and **provide occupant notification in accordance with paragraph (G)(5)(907.5)** of this rule, unless other requirements are provided by another paragraph of this code.

A minimum of **one manual fire alarm box shall be provided in an approved location to initiate a fire alarm signal for fire alarm systems employing automatic fire detectors or waterflow detection devices.** Where other paragraphs of this code allow elimination of the fire alarm boxes due to sprinklers, a single fire alarm box shall be installed.

There are two exceptions to the previous requirement:

1. The manual fire alarm box is not required for fire alarm systems dedicated to elevator recall control and supervisory service.

2. The **manual fire alarm box is not required for Group R-2 occupancies unless required by the fire code official and in accordance with the building code as listed in rule 1301:7-7-80 of the Administrative Code to provide a means for fire watch personnel to initiate an alarm during a sprinkler system impairment event**. The fire code official shall provide notice to the building official when the manual fire alarm box is required. Where provided, the manual fire alarm box shall not be located in an area that is accessible to the public.

ⓘ A manual fire alarm is not required in an Educational Group occupancy with an occupant load of less than 50 persons. (Ohio Building Code 2017, Section 907.2.3(1))

SECTION 907.2.6

Ohio Fire Code, Section 907.2.6

Group I

A manual fire alarm system that activates the occupant notification system shall be installed in Group I occupancies. An **automatic smoke detection system that activates the occupant notification system shall be provided in accordance with paragraphs (G)(2)(f)(i)(907.2.6.1), (G)(2)(f)(ii)(907.2.6.2), and (G)(2)(f)(iii)(c)(907.2.6.3.3) of this rule**.

Exceptions:

1. Manual fire alarm boxes in resident or patient sleeping areas in Group I-1 and I-2 occupancies **shall not** be required at exits if located at all nurses' control stations or other constantly attended staff locations, provided such stations are visible and continuously accessible and that travel distances required in paragraph (G)(4)(b)(i)(907.4.2.1) of this rule are not exceeded.

2. Occupant notification systems are **not** required to be activated where private mode signaling installed in accordance with *NFPA* 72 as listed in rule 1301:7-7-80 of the Administrative Code is approved by the fire code official and in accordance with the building code as listed in rule 1301:7-7-80 of the Administrative Code.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

According to Ohio Building Code 2017, Section 907.2.3(1), a manual fire alarm is not required in an Educational Group occupancy with an occupant load of less than 50 persons.

○ True

○ False

SUBMIT

Complete the knowledge check above before moving on.

Ohio Fire Code, Section 907.2.11.3

Installation Near Cooking Appliances

Smoke alarms are not permitted in the following locations, unless this prevents placement of a smoke alarm in a location otherwise required by this Code:

- Ionization smoke alarms shall not be installed less than 20 ft. horizontally from a permanently installed cooking appliance.
- Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet horizontally from a permanently installed cooking appliance.
- Photoelectric smoke alarms shall not be installed less than 6 feet horizontally from a permanently installed cooking appliance.

ⓘ **Note these important requirements above.**

SECTION 907.2.11.4

Ohio Fire Code, Section 907.2.11.4

Installation Near Bathrooms

For bathrooms, smoke alarms are required to be installed no less than 3 feet horizontally from a door or opening of a bathroom that contains a bathtub or shower, unless this prevents placement of a smoke alarm required by this Code.

SECTION 907.2.13

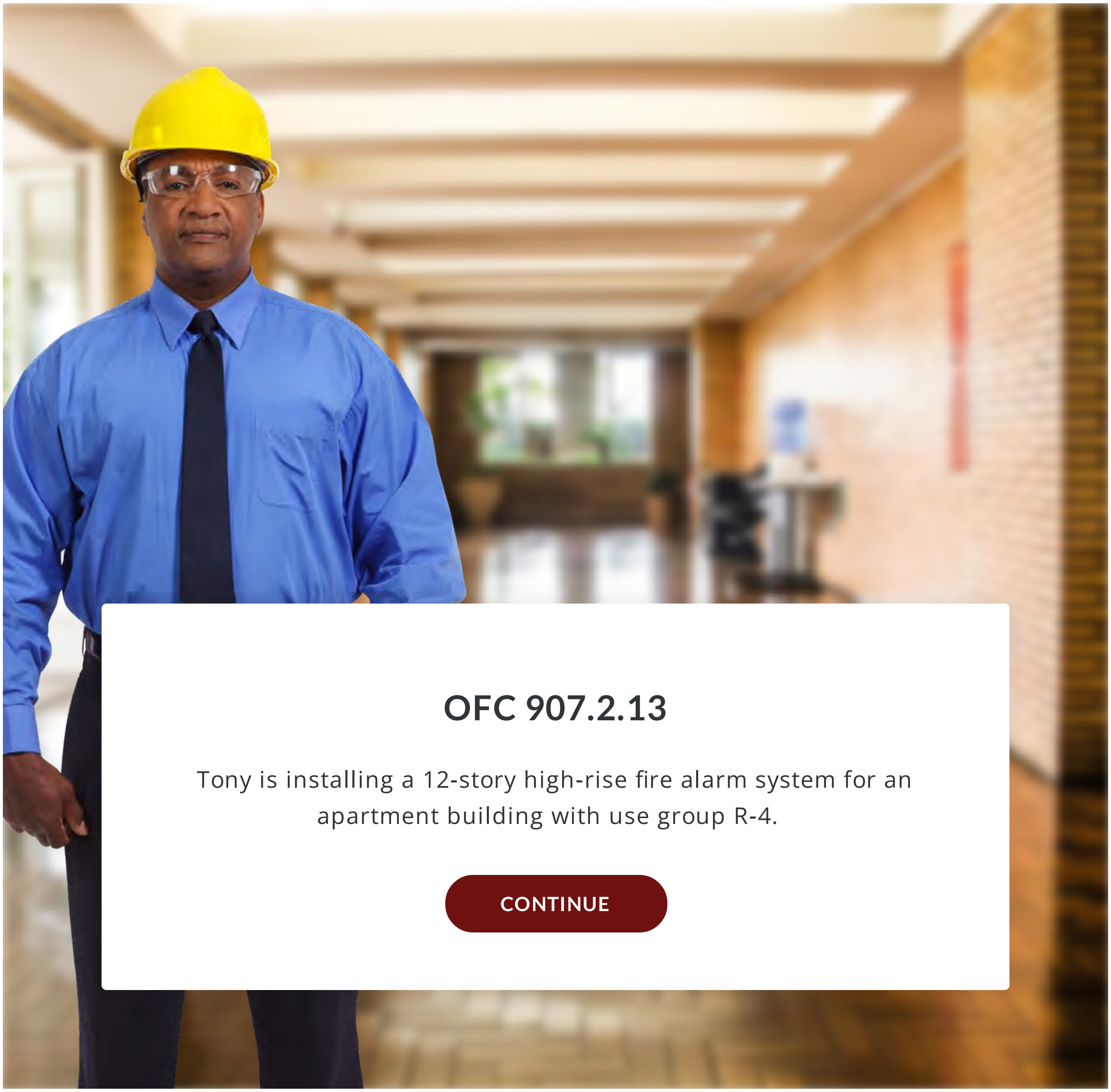
Ohio Fire Code, Section 907.2.13

High-Rise Buildings

High-rise buildings are required to be provided with an automatic smoke detection system, a fire department communication system, and an emergency voice/alarm communication system.

Note the exceptions:

- Airport traffic control towers
- Open parking garages
- Buildings with a Group A-5 occupancy
- Low-hazard special occupancies
- Buildings with occupancies in Group H-1, H-2, and H-3
- In Group I-1 and I-2 occupancies, the alarm is required to sound at a constantly attended location, and notification shall be broadcast by the emergency voice/alarm communication system.

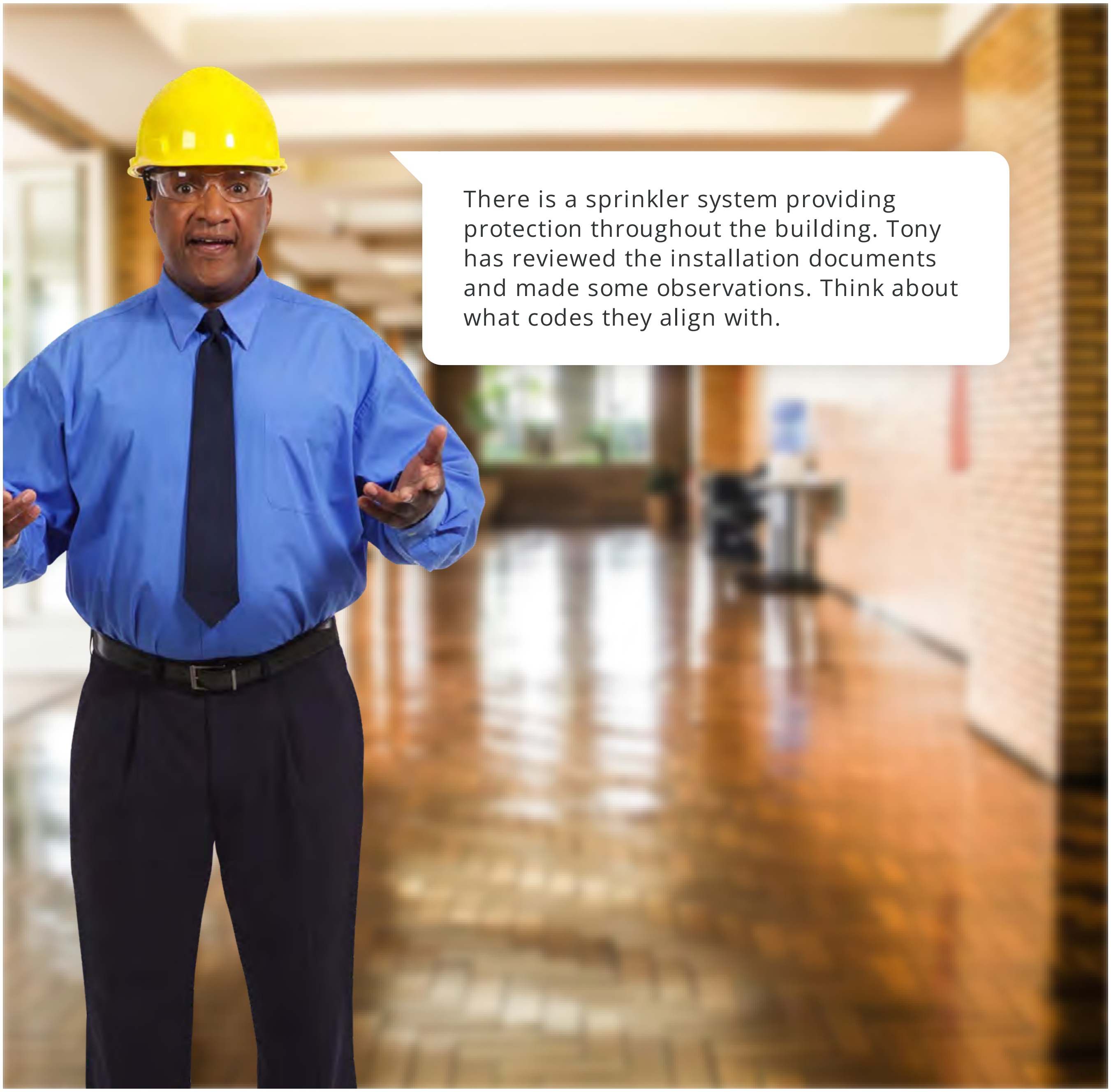


OFC 907.2.13

Tony is installing a 12-story high-rise fire alarm system for an apartment building with use group R-4.

Scene 1 Slide 1

Continue → Next Slide



There is a sprinkler system providing protection throughout the building. Tony has reviewed the installation documents and made some observations. Think about what codes they align with.

Scene 1 Slide 2

There is no dedicated fire department communication system because the building has been equipped with a Bi-Direction Amplified that is monitored by the FAS insuring first-responder radio coverage.

1 Since the building is equipped with a radio coverage system, a dedicated fire department communication system would not be required.

2 Even if the building is equipped with a radio coverage system, a dedicated fire department communication system would be required.

Scene 1 Slide 3

0 → Next Slide

1 → Scene 1 Slide 1

In addition to the smoke detector over the control panels and in the electrical rooms, smoke detection is also installed in corridors, waiting areas, lobbies, and elevator machine & control rooms.

Scene 1 Slide 4

However, there is no additional smoke detection in the mechanical rooms other than duct smoke detectors.

1. Mechanical rooms are required to have smoke detection even if the entire building is fire sprinkled.
2. It is not a problem that the mechanical rooms do not have smoke detection because the entire building is fire sprinkled.

Scene 1 Slide 5

0 → Next Slide

1 → Next Slide

Each apartment unit is heated and cooled by dedicated electric HVAC units. However, the common areas and corridors are served by a central heating and cooling unit.

Scene 1 Slide 6

These units are equipped with duct smoke detection in the main return air & exhaust air plenums. Detectors are specified for installation at serviceable locations, no unit serves more than two floors.

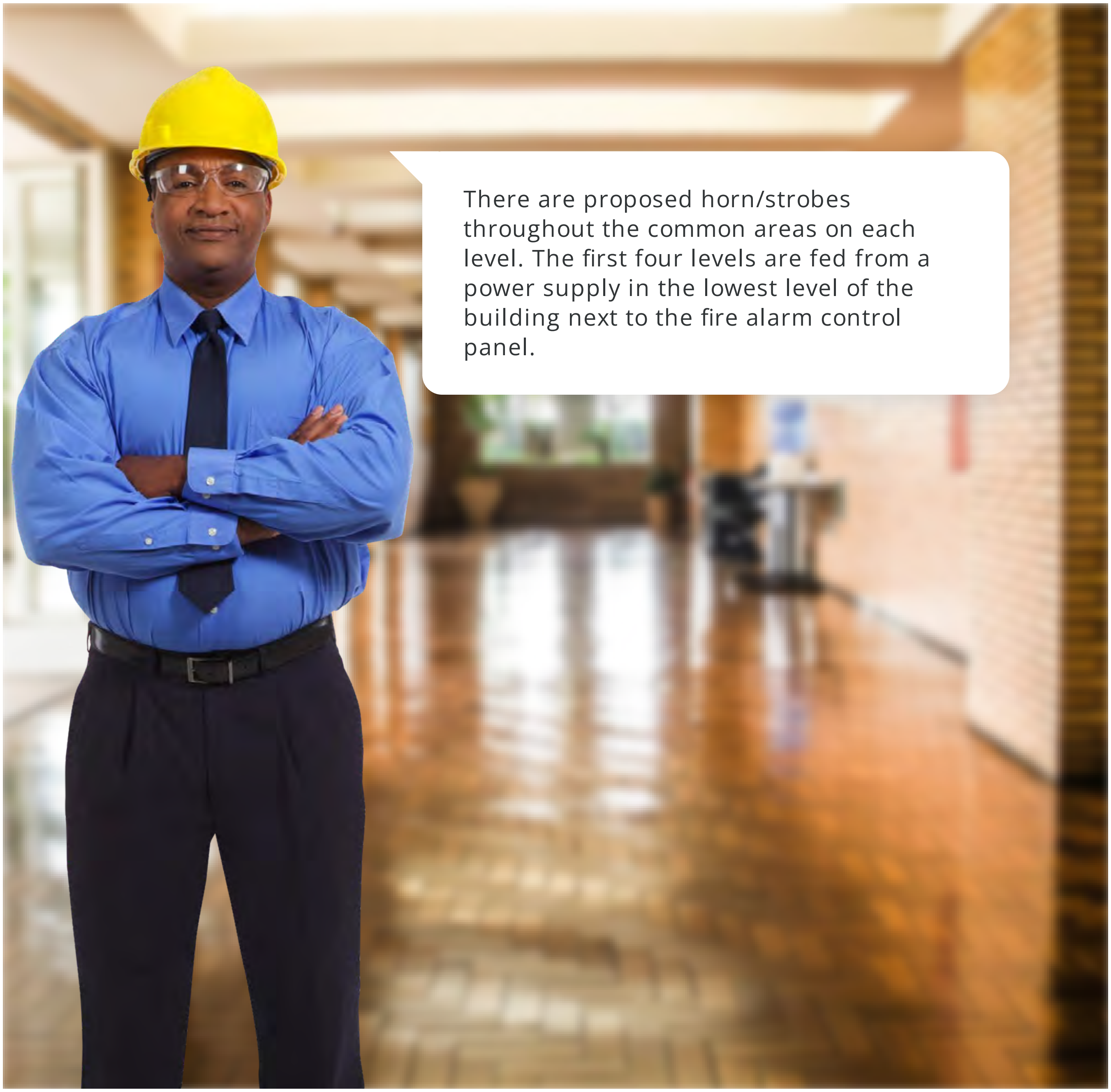
① Additional duct smoke detection would be required in any vertical duct or riser for each floor covered by the HVAC system.

② Since no HVAC system serves more than two floors, additional duct smoke detection would not be required in any vertical duct or riser.

Scene 1 Slide 7

0 → Next Slide

1 → Next Slide



There are proposed horn/strobes throughout the common areas on each level. The first four levels are fed from a power supply in the lowest level of the building next to the fire alarm control panel.

Scene 1 Slide 8

Floors 5-8 are fed from a power supply in the 5th floor electrical room. Floors 9-12 are fed from a power supply in the 9th floor electrical room. All levels are equipped with a smoke detector.

1 Horn/strobes suggest the system is NOT considered an emergency voice/alarm communication system.

2 Horn/strobes suggest the system is considered an emergency voice/alarm communication system.

Scene 1 Slide 9

0 → Next Slide

1 → Next Slide

Complete the scenario above before moving on.

Ohio Fire Code, Section 907.2.14

OFC 907.2.14

Alice knows that many buildings are required by use group to have smoke detection installed as part of a fire alarm system.

Scene 1 Slide 1

Continue → Next Slide

When she is inspecting buildings, which condition would **NOT** require additional smoke detection equipment?

1. When the building is considered a high-rise.
2. When the building has an atrium open to two stories.
3. When the building is an air traffic control tower.

Scene 1 Slide 2

0 → Next Slide

1 → Next Slide

2 → Next Slide

Complete the scenario above before moving on.

Let's do a quick check about what has been covered so far.

Ionization smoke alarms with an alarm-silencing switch shall not be installed more than 10 ft. horizontally from a permanently installed cooking appliance.

○ True

○ False

SUBMIT

According to Ohio Fire Code, Section 907.2.13, high-rise buildings are required to be provided with an automatic smoke detection system, a fire department communication system, and an emergency voice/alarm communication system with the following buildings as exceptions: (Select all that apply)

☐ Buildings with a Group A-1 occupancy

☐ Airport traffic control towers

☐ Open parking garages

☐ Low-hazard special occupancies

SUBMIT

🔒 Complete the knowledge check above before moving on.

Ohio Fire Code, Section 907.4

Initiating Devices

If annual or automatic alarm initiation is required as part of a fire alarm system, the initiating devices are required to be installed per Sections 907.4.1 – 907.4.3.1.

Protection of Fire Alarm Control Unit

In areas not continuously occupied, a single smoke detector is required at the location of each fire alarm control unit, notification appliance circuit power extenders, and supervising station transmitting equipment.

ⓘ **Note the exception: If ambient conditions prohibit installation of a smoke detector, a heat detector is permitted.**

Ohio Fire Code, Section 907.4

Manual Fire Alarm Boxes

MFAB 1

Location

Manual fire alarm boxes are required to be located no more than 5 ft. from the entrance to each exit. If the building is not protected by an automatic sprinkler system, additional manual fire alarm boxes shall be located so that the exit access travel distance to the nearest box does not exceed 200 ft.

MFAB 2

Height

The height of manual fire alarm boxes shall be no less than 42 inches and no more than 48 in. measured vertically, from the floor level to the activating handle or lever of the box.

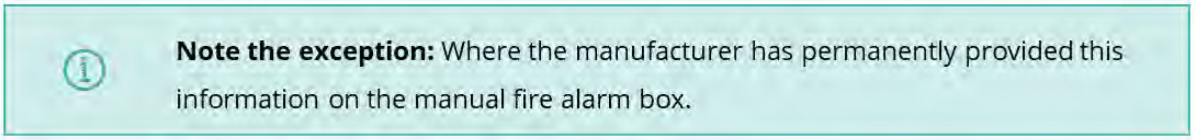
MFAB 3

Color

Manual fire alarms boxes shall be red in color.

MFAB 4

Signs



Note the exception: Where the manufacturer has permanently provided this information on the manual fire alarm box.

Where fire alarm systems are not monitored by a supervising station, an approved permanent sign shall be installed adjacent to each manual fire alarm box that reads:

WHEN ALARM SOUNDS CALL FIRE DEPARTMENT

MFAB 5

Protective Covers

The building official is authorized to require the installation of listed manual fire alarm box protective covers to prevent malicious false alarms or to provide the manual fire alarm box with protection from physical damage. This cover shall be transparent or red with a transparent face to permit visibility of the manual fire alarm box.

MFAB 6

Unobstructed and Unobscured

Manual fire alarm boxes are required to be accessible, unobstructed, and unobscured at all times.

SECTION 907.4.1

Ohio Fire Code, Section 907.4.1

OFC 907.4.1

Michelle is installing a fire sprinkler monitoring fire alarm panel to a business not otherwise required to have a fire alarm system.

Scene 1 Slide 1

Continue → Next Slide

The sprinkler system’s waterflow devices as well as tamper switches will be interconnected to the system. The panel will be installed near the main sprinkler risers by a rear exit door.

Scene 1 Slide 2

An annunciator will also be installed near the building’s main entrance. A horn/strobe will be placed above the panel and just outside the sprinkler riser room on the outside near the building's FDC.

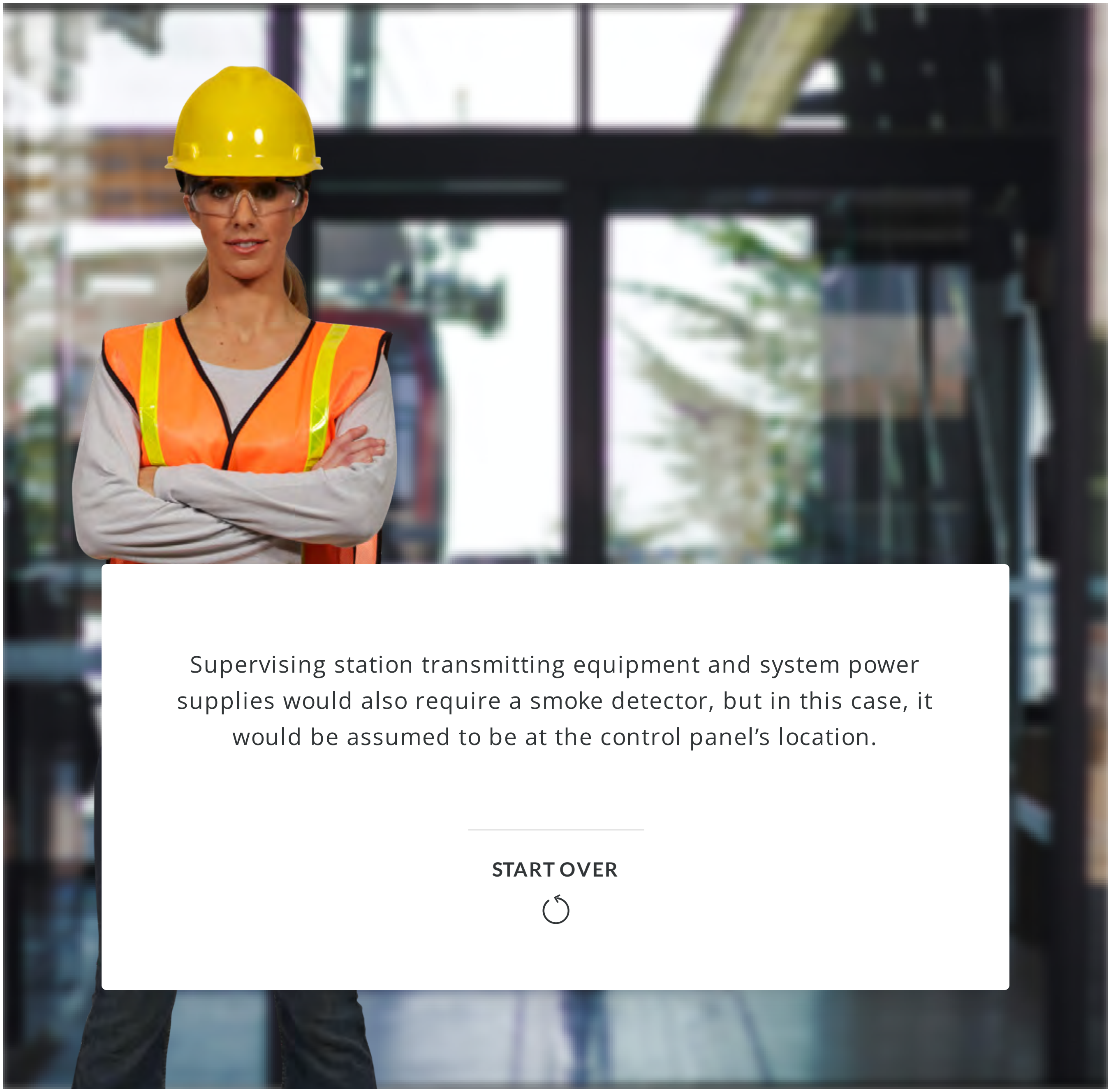
Scene 1 Slide 3

You happen to notice that no other equipment is shown on your prints and work orders and question this. What other device(s) will also most likely be required?

1. One Manual Fire Alarm Box for manual activation of the system & a smoke detector over the fire alarm control panel.
2. Horn/Strobes throughout the facility to initiate an evacuation should the system detect system water flow.
3. A smoke detector over the fire alarm annunciator & one Manual Fire Alarm Box for manual activation of the system.

Scene 1 Slide 4

0 → Next Slide
1 → Next Slide
2 → Next Slide



Supervising station transmitting equipment and system power supplies would also require a smoke detector, but in this case, it would be assumed to be at the control panel's location.

START OVER

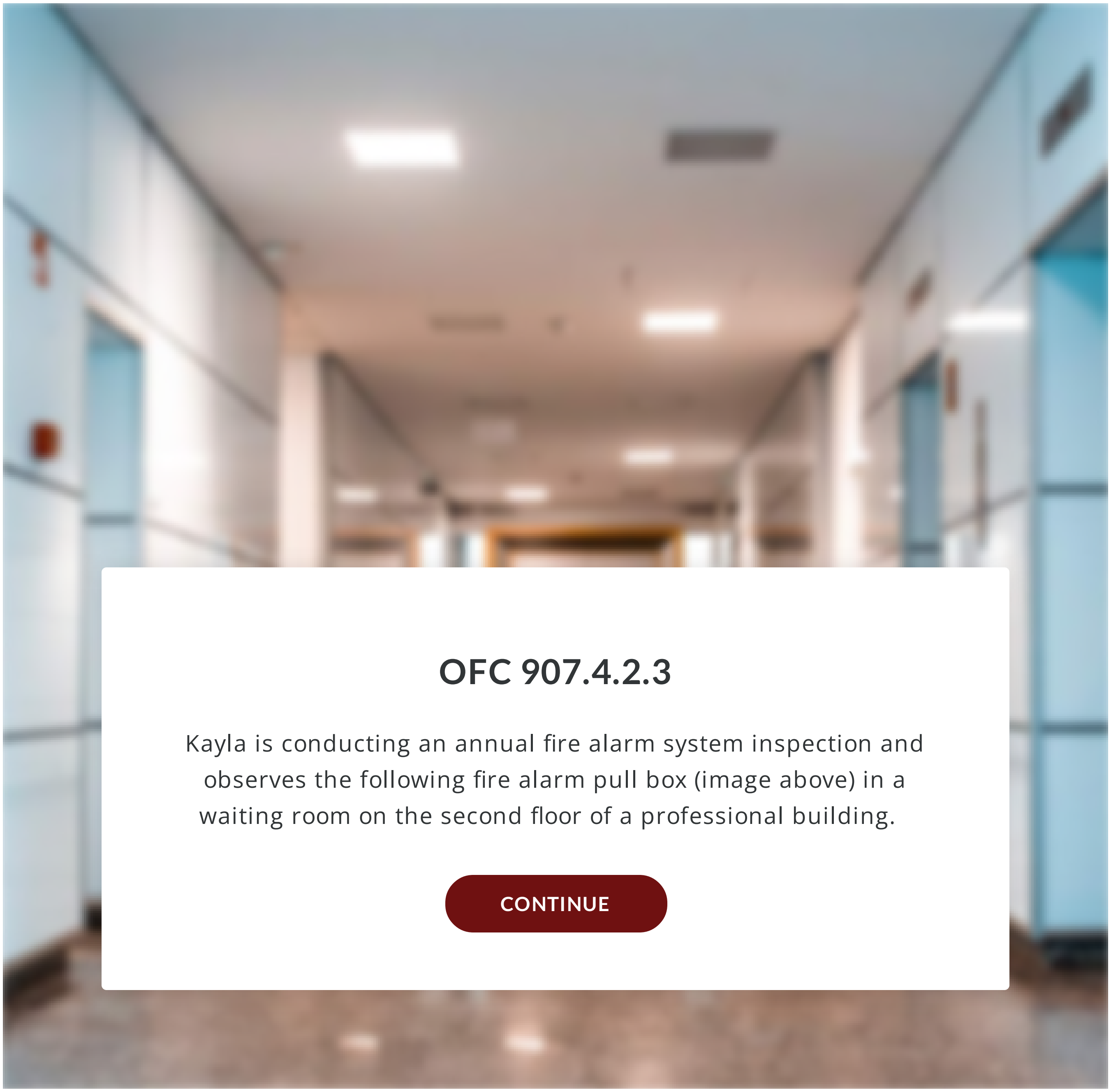
Scene 1 Slide 5

Continue → End of Scenario

Complete the scenario above before moving on.

Ohio Fire Code, Section 907.4.2.3

Use the image below to reference for the following scenario.

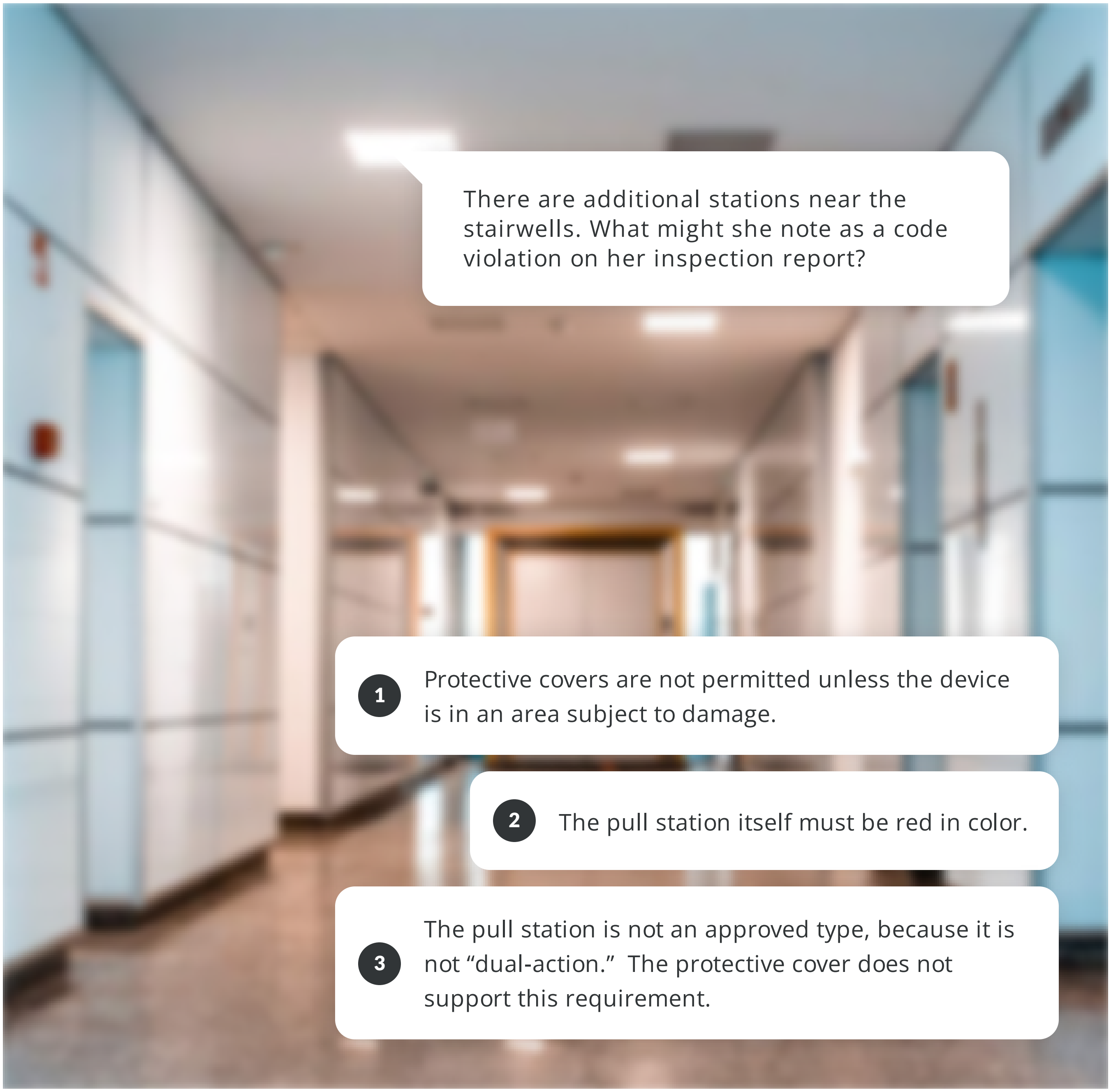


OFC 907.4.2.3

Kayla is conducting an annual fire alarm system inspection and observes the following fire alarm pull box (image above) in a waiting room on the second floor of a professional building.

Scene 1 Slide 1

Continue → Next Slide



There are additional stations near the stairwells. What might she note as a code violation on her inspection report?

1. Protective covers are not permitted unless the device is in an area subject to damage.
2. The pull station itself must be red in color.
3. The pull station is not an approved type, because it is not “dual-action.” The protective cover does not support this requirement.

Scene 1 Slide 2

0 → Next Slide
1 → Next Slide
2 → Next Slide

Complete the scenario above before moving on.

Ohio Fire Code, Section 907.5

Occupant Notification Systems

A fire alarm system shall annunciate at the fire alarm control unit, initiating occupant notification upon activation. If a fire alarm system is required by another section of the Ohio Building Code, it shall be activated by:

- Automatic fire detectors
- Automatic sprinkler system waterflow devices
- Manual fire alarm boxes
- Automatic fire-extinguishing systems

Note the exception: Where notification systems are permitted elsewhere in Section 907 to annunciate at a constantly attended location.

A presignal feature shall not be installed unless approved by the building official and the fire department. If a presignal feature is provided, the signal shall be annunciated at a constantly attended location approved by the fire department so that occupant notification can be activated in the event of a fire or other emergency.

SECTION 907.5.2.1.1

Ohio Fire Code, Section 907.5.2.1.1

Average Sound Pressure

The audible alarm notification appliances shall provide a **sound pressure level of 15 dBA above the average ambient sound level**, or **5 dBA above the maximum sound level** having a duration of not less than 60 seconds, whichever is greater, **in every occupiable space** within the building.

SECTION 907.5.2.1.2

Ohio Fire Code, Section 907.5.2.1.2

Maximum Sound Pressure

The maximum sound pressure for audible alarm notification appliances shall be 110 dBA at the minimum hearing distance from the audible appliance. Where the average **ambient noise is greater than 95 dBA, visible alarm notification appliances shall be provided in accordance with *NFPA* 72** and audible alarm notification appliances shall not be required.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

According to Ohio Fire Code, Section 907.4, manual fire alarm boxes are required to: (Select all that apply)

☐ be red in color.

☐ be located no more than 5 ft. from the entrance to each exit.

☐ be no less than 42 in. and no more than 48 in. measured vertically, from the floor level to the activating handle or lever of the box.

☐ be accessible, unobstructed, and unobscured at all times.

SUBMIT

According to Ohio Fire Code, Section 907.5.2.1.1, the audible alarm notification appliances shall provide a sound pressure level of 15 dBA above the average ambient sound level, or 5 dBA above the maximum sound level having a duration of not less than _____ seconds, whichever is greater, in every occupiable space within the building.

○ 30

○ 60

○ 90

○ 120

SUBMIT

Complete the knowledge checks above before moving on.

Ohio Fire Code, Section 907.6.1

Installation and Monitoring Wiring

Wiring for a fire alarm system is required to comply with the requirements of *NFPA* 70 and *NFPA* 72. Wireless protection systems using radio-frequency transmitting devices are required to comply with the requirement for supervision of low-power wireless systems in *NFPA* 72.

Power Supply

The primary and secondary power supply for the fire alarm system is to be provided per *NFPA* 72 requirements.

SECTION 914

Ohio Fire Code, Section 914

Fire Protection Based on Special Detailed Requirements of Use and Occupancy

Section 914 specifies where fire protection systems are required based on the detailed requirements of use and occupancy of the building code as listed in rule 1301:7-7-80 of the Administrative Code.

This is a small sample of some of the requirements in **Section 914**.

SECTION 914.2.3

Ohio Fire Code, Section 914.2.3

Emergency Voice/Alarm Communication System

Covered **mall buildings exceeding 50,000 ft^2 (4645 m^2) in total floor area shall be provided with an emergency voice/alarm communication system**. Emergency voice/alarm communication systems serving a mall, required or otherwise, shall be accessible to the fire department.

SECTION 914.7.2

Ohio Fire Code, Section 914.7.2

Automatic Smoke Detection

Special amusement buildings shall be equipped with an automatic smoke detection system in accordance with paragraph (G)(2)(l)(907.2.12) of this rule.

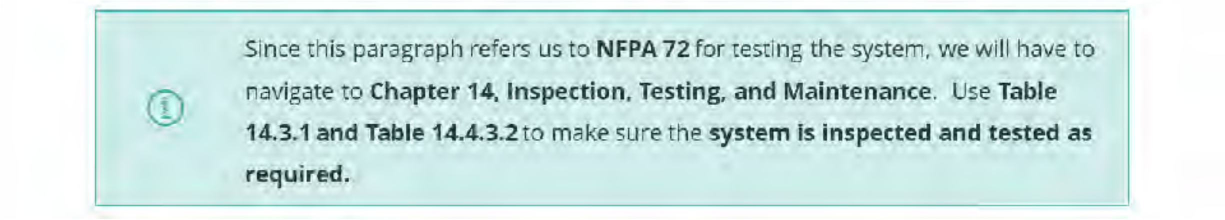
- To see the actual requirements for this paragraph, you will have to navigate to **Paragraph (G)(2)(l)(907.2.12)**.
- **Paragraph (G)(2)(l)(907.2.12)** basically states that activation of a single smoke detector (at the special amusement building) shall immediately cause an alarm signal at the building at a constantly attended location from which an emergency action can be initiated, including the capability of manual initiation of requirements.
- **Paragraph (G)(2)(l)(907.2.12)** also provides information on exit markings and emergency communication messages.

SECTION 1009.6.5.1

Ohio Fire Code, Section 1009.6.5.1

Testing and Maintenance (of Two-way Communication Systems)

All two-way communication systems shall be tested in the presence of the fire code official upon completion of installation. Communication systems shall be inspected and tested in accordance with *NFPA* 72 2016 as listed in rule 1301:7-7-80 of the Administrative Code to verify that all components are operational.



Since this paragraph refers us to **NFPA 72** for testing the system, we will have to navigate to **Chapter 14, Inspection, Testing, and Maintenance.** Use **Table 14.3.1 and Table 14.4.3.2** to make sure the **system is inspected and tested as required.**

LET'S REVIEW

Let's do a quick check about what has been covered so far.

According to Ohio Fire Code, Section 914.7.2 activation of a single _____ (at the special amusement building) shall immediately cause an alarm signal at the building at a constantly attended location from which emergency action can be initiated, including the capability of manual initiation of requirements.

Type your answer here

SUBMIT

All ____ communication systems shall be tested in the presence of the fire code official upon completion of installation.

Type your answer here

SUBMIT

Complete the knowledge check above before moving on.

This completes the Ohio Fire Code module.

Ohio Fire Code Information

Click the button to take a look at the Ohio Administrative Code for Fire Protection Systems.

CLICK HERE

The **Ohio Fire Code will reference other chapters or sections of the code**, just as *NFPA* 70, and *NFPA* 72 2016 does.

There is far too much information in the Ohio Fire Code for this module to be able to cover everything you may have to know. ***Don't be intimidated by that though.***

The idea is to familiarize yourself with where the information is…namely **Chapter 9**, which covers fire protection systems.

There's some information in **Chapter 10** too.

In many cases, the **Ohio Fire Code is not telling you *how to do something*, it is telling you *what the requirements are* and *what capabilities should be in a particular occupancy***.

When it comes to **how to install it or how to test it**, that is where ***NFPA* 70** and/or ***NFPA* 72 2016 come into play.**

CONTINUE

After completing this module, you should now have a better understanding of the Ohio Fire Codes.

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

Study hard and study often. Good luck.

File Attachments for Item:

ER-7 Ohio Fire Pumps (new version, Fire Tech Productions)

All commercial certifications except PPE, PI, and MI (7.5 hours)

Staff Notes: Recommend expanded references to 2017 OBC Chapter 9, inclusion of PPE, PI and MI.

Committee Recommendation:

Fire Tech Productions - Ohio Course Submission

Included in this document: Course Outline, Instructor resume(s)

Course: Ohio Fire Pumps - FPOH 102

Course Outline:

1. Welcome
2. Introduction
3. General Requirements
4. Installation Requirements
5. Acceptance Testing
6. Ohio Fire Code
7. Glossary

Instructor: Tom Doty

THOMAS DOTY
21 Meadowcrest Dr.
Franklin, OH 45005
937-434-3473
tom@firetech.com

Seasoned fire protection professional following strong adherence to the codes and top-notch attention to customer service.

Certifications include: Sprinkler/Standpipe • Fire Alarm and Detection Systems • Fire Pumps • Fire Service Mains • Portable Fire Extinguishers • Pre-Engineered Extinguishers – OTW • State of Kentucky Certified

PROFESSIONAL EXPERIENCE

- CertaSite, 2801 Thunderhawk Court, Dayton, Ohio 45414
  Installation Manager - 2021- Present

- Fire Tech Productions, Inc., 7986B Clyo Rd., Centerville, Ohio 45459
  President - 2015 - 2022
  Instructor/Developer - 2015 - Present

- Craynon Fire Protection Inc., 2801 Thunderhawk Court, Dayton, Ohio 45414
  Partner/Vice-President – 2011 – 2021
  Operations Manager -- 12/11/2005 – 2021

- Guardian Fire Protection, 480 Randy Lane, Monroe, Ohio 45050
  Owner – 11/30/2003 – 12/11/2005

- Sprinkler Inspection Services, Inc., 8 Perkins Drive, Alexandria, KY 41001
  Superintendent / Operations Manager – 10/07/1995 – 11/30/2003

- Bestol Plumbing Company, P.O. Box 4192, Branson, MO

Foreman – 2/1995 – 10/1995

- Grinnell Fire Protection Systems, Inc., San Diego, CA
  Service Foreman – 8/1993 – 2/1995

- Advanced Fire Protection Company, 1657 Monte Vista Drive, Vista, CA 92084
  Owner – 10/1990 – 8/1993

- Ryan Automatic Sprinkler Company, San Marcos, CA
  Superintendent – 4/1988 – 10/1990

- Vanguard Fire Protection, Carlsbad, CA
  Foreman – 3/1985 – 4/1988

- Sentinel Fire Protection, San Diego, CA -- 8/1983 – 3/1985
- Local Union 669 – 5/1981 – 8/1983
- Local #821, Central Florida – 4/1980 – 5/1981
- American Automatic Fire Protection – 1/1979 – 4/1980
- Illinois Central Gulf Railroad – 4/1978 – 12/1978
- Orlando Automatic Sprinkler Company – 10/1976 – 3/1978

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.

[redacted]

APPLICATION

FOR

Continuing Education Course Approval

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

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

COURSE SUBMITTER:

Course Submitter: Julie Miller
(Contact Name)

Organization: Fire Tech Productions
(Organization/Company)

Address: 7976 Clyo Rd.
(Include Room Number, Suite, etc.)

City: Centerville State: OH Zip: 45459

E-Mail: julie@firetech.com

Telephone: 937.434.3473 Fax: NA

Course Sponsor: ______

COURSE INFORMATION:

Course Title: Ohio Fire Pumps - FPOH 102

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

Purpose and Objective:
The Ohio Fire Pumps online self-paced course provides training for the state of Ohio’s Fire Pumps exam so
you can pass your test on the first attempt! Based on NFPA 20 2016 and the Ohio Fire Code 2017.

Number of Instructional Contact Hours that can be obtained upon completion: 7.5

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 ☒

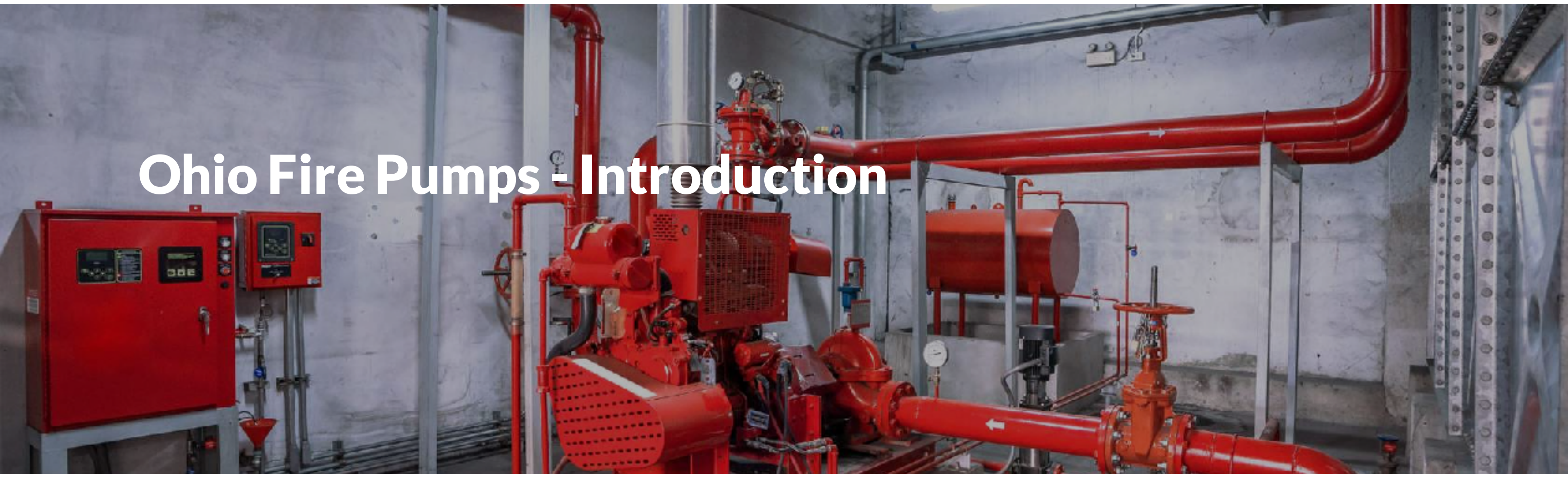
- Res Building Official ☐
- Res Plans Examiner ☐
- Res Building Inspector ☐
- Res Mechanical Inspector ☐
- Res IU Inspector ☐

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	
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.

Form: 1526



Ohio Fire Pumps - Introduction

Welcome to the Fire Pumps course!

This introduction provides a brief overview of what will be covered in the course.

You can come back to this module and reference this information anytime in your menu.

Topics that are covered in this introduction are as follows:

- Key References
- Training Modules
- Preparing for the Practice Exams
- ***NFPA*** 20 2016 Definitions

When you are ready to begin, click on the button above to start the course.

☰ **Overview**

☰ **Glossary**

Lesson 1 of 2

Overview

Welcome

Please review this introduction before getting started on the course.

We will look at key references and study tips. In addition, we will highlight key vocabulary terms in the glossary.

REFERENCES

Key References

As you work through this course, it is important to refer to your standards and **codes** as the following references will be discussed.

OHIO FIRE CODE

NFPA 20

NFPA 24

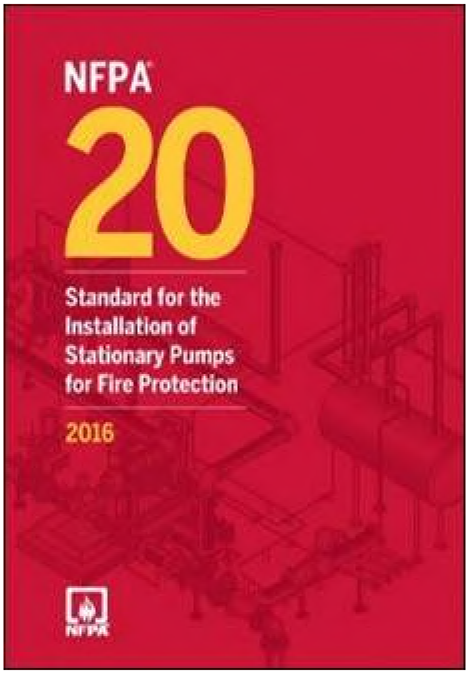
NFPA 25

The **Ohio Fire Code, 2017**, establishes state fire marshal rules for the administration and enforcement of authorities. These rules govern the occupancy and maintenance of all structures and premises for precautions against fire and the spread of fire and general requirements of fire safety.

The Ohio Fire Code can be accessed through this link: https://codes.iccsafe.org/content/OHFCJAN2019E/ohio-administrative-code-1301-7-7-09-fire-protection-systems

OHIO FIRE CODE | NFPA 20 | NFPA 24 | NFPA 25

NFPA* 20 2016 – *Standard for the Installation of Stationary Pumps for Fire Protection: The purpose of the standard is to specify how to install a fire pump properly when one is needed and which components, equipment, and power supplies are acceptable for use in a fire pump installation. In other words, *NFPA* 20 indicates how to properly arrange and install a fire pump and its supporting equipment.



OHIO FIRE CODE | NFPA 20 | NFPA 24 | NFPA 25

NFPA 24 2016 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances: This standard covers the requirements for this type of water supply piping, along with additional system components that are typically associated with underground piping. Designing private fire service mains properly is critical, as this is typically the first section of piping to carry water to a sprinkler or standpipe system after it leaves the municipal water mains. This standard covers the design, installation, and acceptance testing of these private service mains along with the fire hydrants that are connected to them.

NFPA 24
Standard for the
Installation of Private
Fire Service Mains and
Their Appurtenances
2016 Edition

OHIO FIRE CODE | NFPA 20 | NFPA 24 | NFPA 25

NFPA 25 2014 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems: This standard covers the administrative requirements for the periodic inspection, testing, and maintenance (ITM) of water-based fire protection systems. The purpose of the standard is to verify the operational status of a system and to provide a reasonable degree of certainty that the system will perform when needed.

ⓘ **Each *NFPA* standard contains several Annexes with valuable examples and information. It is recommended you study this material as well.**

OHIO CODES

Ohio Codes

The Ohio Building Code has a lot of information in it. However, only a relatively small portion of the code pertains to fire pumps. It ***does*** give the State Fire Marshal the responsibility for administration and enforcement of any matter related to the installation, repair, modification or removal of fire protection equipment.

The Ohio Fire Code states that fire pumps shall be installed, inspected, tested, and maintained per *NFPA* 20 2016 and *NFPA* 25 2014. The code also defines specific rules for Ohio as well as reinforce some of the *NFPA* 20 2016 requirements.

- One of these requirements is to be certified and licensed by the state of Ohio.
- The only exception is for a provisional person in an approved formal apprenticeship program. They are permitted to work under the constant supervision of a certified person. The certified person is only allowed to supervise one provisional person.

CONTINUE

Additional Resources

Below is additional information and resources for the Ohio exam.

Ohio Department of Commerce – Division of State Fire Marshal:

Ohio Department of Commerce

To access the Ohio Department of Commerce – Division of State Fire Marshal, click on this "Click Here" button.

CLICK HERE

Ohio Department of Commerce phone: **(614) 752-7126**

The following downloadable PDF is for the Fire Protection Exam Application through the Ohio Department of Commerce:

PDF **FireProtectionExamApplication.pdf**
548.9 KB

PSI Candidate Information Bulletin

A very important source of information is the PSI Candidate Information Bulletin from PSI Services LLC. Take time to read it below in its **ENTIRETY**.

PDF

OhioCertificationExaminationBulletin.pdf

230.9 KB

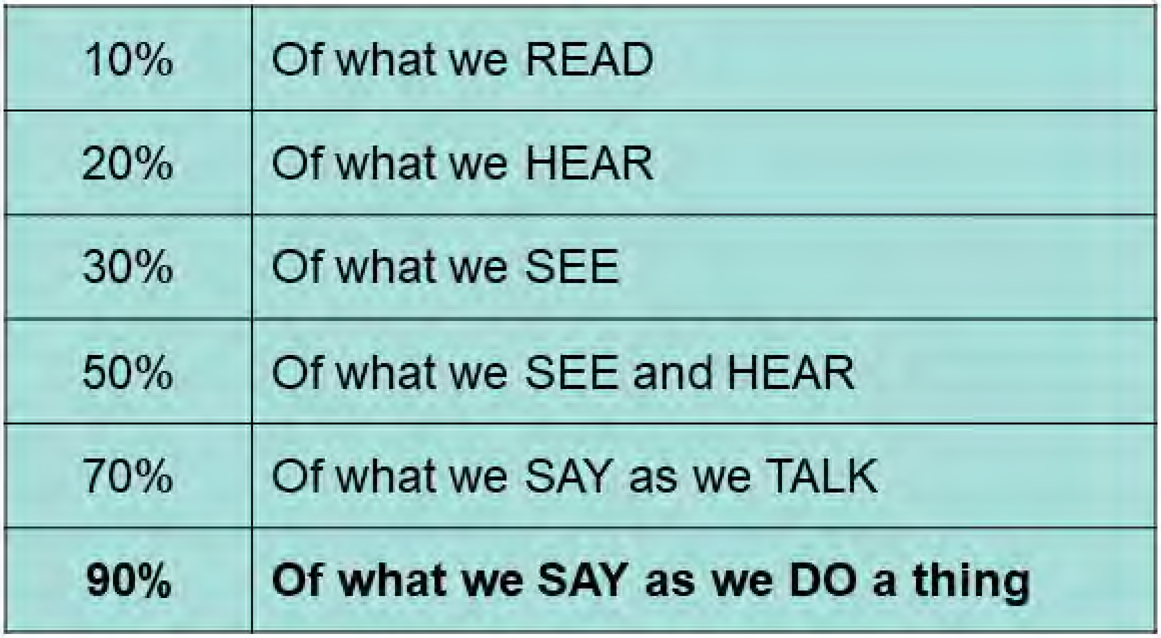
PSI Online Exams

To check for the most updated information on PSI Services, visit their website by clicking on this "Click Here" button.

CLICK HERE

HOW WE LEARN

Thinking about How We Learn



10%	Of what we READ
20%	Of what we HEAR
30%	Of what we SEE
50%	Of what we SEE and HEAR
70%	Of what we SAY as we TALK
90%	**Of what we SAY as we DO a thing**

Source: ***Skill With People*** by Les Giblin

Different people learn in different ways.

It is important to discover what works **best for you** and use your strengths to ensure you retain the material.

Training Modules

As you are studying, be prepared to **refer to your copy of the referenced NFPA standards constantly** throughout these modules. Be comfortable with the technical material.

Each training module is carefully planned and designed to **highlight areas of the standards that you need to know in order to increase your chances of success on the exam.** The goal of these training modules is to help you become knowledgeable of important areas of the standards and to gain a working understanding of how to apply these requirements on the job.

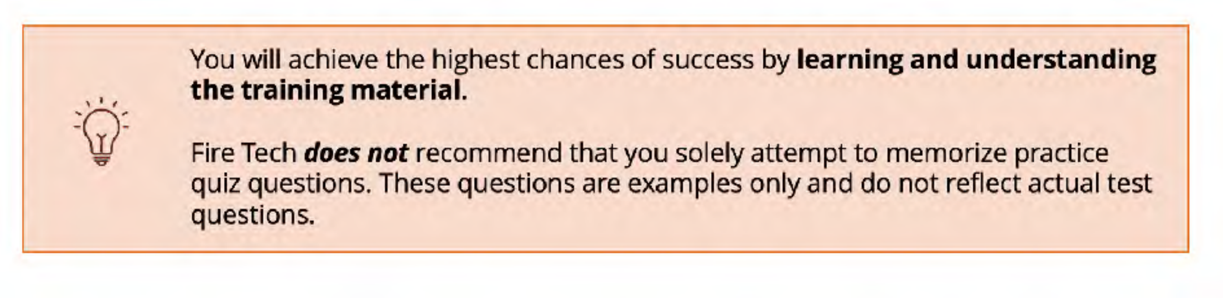
Take notes as you are studying, and **highlight** areas of the standards that are important to know.

The more familiar you are with the requirements, tables, and figures, the better your chances of success on the exam.

QUIZZES

The Quizzes

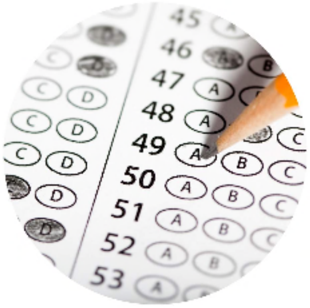
Fire Tech provides a practice quiz associated with each training module, which should be taken following completion of the module. As you take each practice quiz, use your copy of the referenced NFPA standards to **look up every answer to each quiz question**. This will assist you in **becoming more familiar with the requirements and where they are located** in each of the codes and standards.



You will achieve the highest chances of success by **learning and understanding the training material.**

Fire Tech ***does not*** recommend that you solely attempt to memorize practice quiz questions. These questions are examples only and do not reflect actual test questions.

Additionally, **read each question carefully**. Sift through what is pertinent to the question and what is irrelevant information that may be included as a distractor.



Knowledge Checks

To help you apply course material and prepare for the quizzes, **knowledge checks** are sprinkled throughout each course.

Completing these knowledge checks is **required** to proceed further in the lesson. If you're stuck on a question, refer to previous lesson material and use your NFPA standard to find the answer.

True or false: Knowledge checks will help you apply course material and prepare for course quizzes.

○ True

○ False

SUBMIT

Complete the knowledge check above before moving on.

Practice Exams

Once you have read all of the lessons in this course and passed all of the quizzes, you will be ready to take the **Practice Exam**.

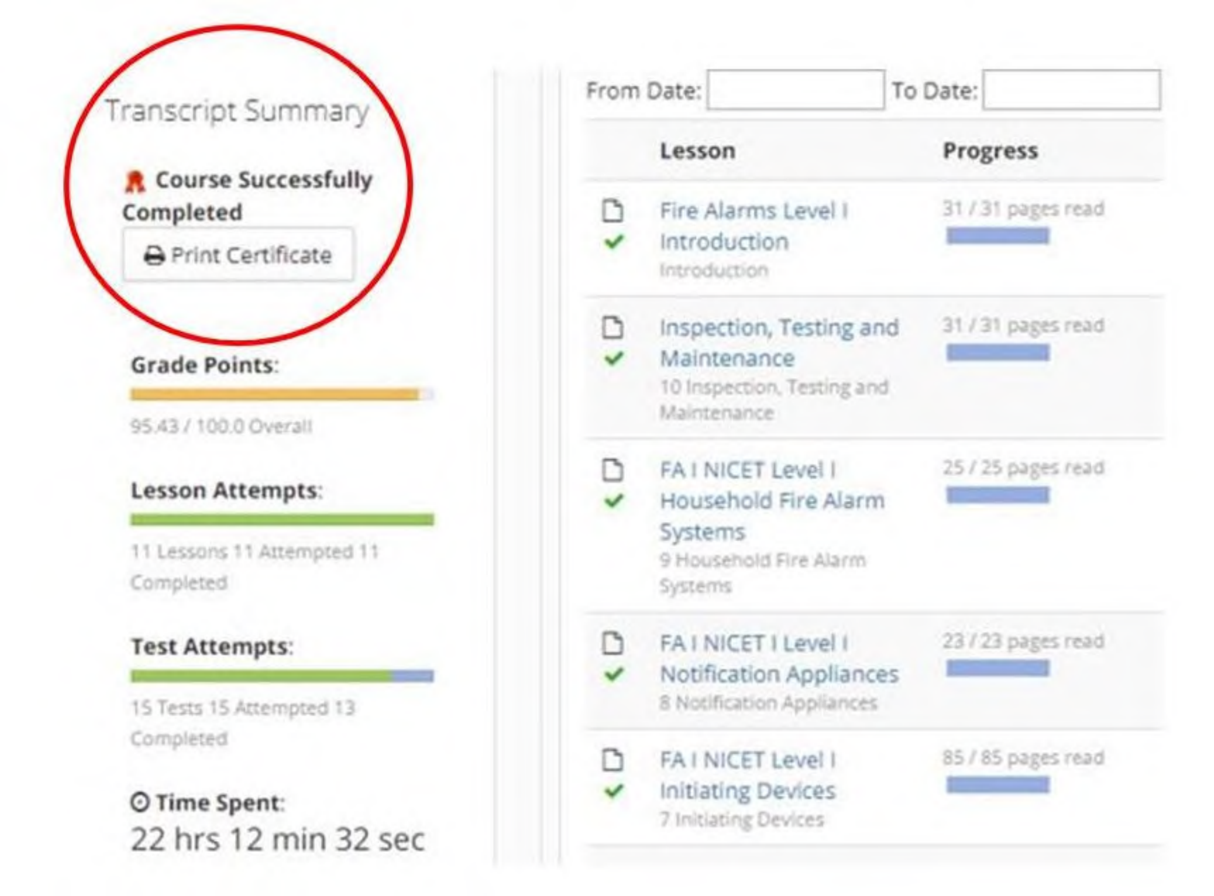
The Practice Exam consists of questions from the quizzes and are presented in a randomized manner. Fire Tech highly recommends that you take each of these practice exams.

Three practice exams are offered:

- Exam #1 is **required** to pass the course
- Exams #2 and #3 are **optional** and are not required to pass the course.

CONTINUE

Course Completion



Transcript Summary

Course Successfully Completed

Print Certificate

Grade Points:

95.43 / 100.0 Overall

Lesson Attempts:

11 Lessons 11 Attempted 11 Completed

Test Attempts:

15 Tests 15 Attempted 13 Completed

Time Spent:

22 hrs 12 min 32 sec

From Date: To Date:

Lesson	Progress
Fire Alarms Level I Introduction Introduction	31 / 31 pages read
Inspection, Testing and Maintenance 10 Inspection, Testing and Maintenance	31 / 31 pages read
FA I NICET Level I Household Fire Alarm Systems 9 Household Fire Alarm Systems	25 / 25 pages read
FA I NICET I Level I Notification Appliances 8 Notification Appliances	23 / 23 pages read
FA I NICET Level I Initiating Devices 7 Initiating Devices	85 / 85 pages read

Upon successful completion of the Practice Exam #1, you can download your **course completion certificate**, as shown in the transcript summary.

GLOSSARY

Lesson 2 of 2

Glossary

Lesson Goals

By the end of this lesson, you will be able to do the following:

☐ Define key terms associated with fire pumps.

Key References

- *NFPA* 20 - *Standard for the Installation of Stationary Pumps for Fire Protection*, 2016

LET'S BEGIN

Key Terms

NFPA 20 2016, Chapter 3

Below are key glossary terms that will be highlighted throughout this course. Click on each **+** symbol to see the definition for each word below.

Additive Pump

A pump that is used to inject additives into the water stream. (*NFPA* 20 2016, Section 3.3.44.1)

Aquifer

An underground formation that contains sufficient saturated permeable material to yield significant quantities of water. (*NFPA* 20 2016, Section 3.3.2)

Authority Having Jurisdiction (AHJ)

An organization, office, or individual responsible for enforcing requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure. (*NFPA* 20 2016, Section 3.2.2)

Can Pump

A vertical shaft turbine-type pump in a can (suction vessel) for installation in a pipeline to raise water pressure. (*NFPA* 20 2016, Section 3.3.44.2)

Cavitation

A complex phenomenon related to pumps which results from suction pressure falling below the vapor pressure corresponding to the water temperature.

Centrifugal Pump

A pump in which the pressure is developed principally by the action of centrifugal force. (*NFPA* 20 2016, Section 3.3.44.3)

Circulation Relief Valve

A valve used to cool a pump by discharging a small quantity of water. This valve is separate from and independent of the main relief valve. (*NFPA* 20 2016, Section 3.3.67.5.1)

Dump Valve

An automatic valve installed on the discharge side of a positive displacement pump to relieve pressure prior to the pump driver reaching operating speed. (*NFPA* 20 2016, Section 3.3.67.1)

End Suction Pump

A single suction pump having its suction nozzle on the opposite side of the casing from the stuffing box and having the face of the suction nozzle perpendicular to the longitudinal axis of the shaft. (*NFPA* 20 2016, Section 3.3.44.4)

Fire Pump

A pump that is a provider of liquid flow and pressure dedicated to fire protection. (*NFPA* 20 2016, Section 3.3.44.5)

Gear Pump —

A positive displacement pump characterized by the use of gear teeth and casing to displace liquid. (*NFPA* 20 2016, Section 3.3.44.7)

High-Rise Building —

A building where the floor of an occupiable story is greater than 75 ft. above the lowest level of fire department vehicle access. (*NFPA* 20 2016, Section 3.3.26)

Horizontal Pump —

A pump with the shaft normally in a horizontal position. (*NFPA* 20 2016, Section 3.3.44.8)

Horizontal Split-Case Pump —

A centrifugal pump characterized by a housing that is split parallel to the shaft. (*NFPA* 20 2016, Section 3.3.44.9)

In-Line Pump —

A centrifugal pump whose drive unit is supported by the pump having its suction and discharge flanges on approximately the same centerline. (*NFPA* 20 2016, Section 3.3.44.10)

Listed

Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose. (*NFPA* 20 2016, Section 3.2.3)

Piston Plunger Pump

A positive displacement pump characterized by the use of a piston or plunger and a cylinder to displace liquid. (*NFPA* 20 2016, Section 3.3.44.13)

Positive Displacement Pump

A pump that is characterized by a method of producing flow by capturing a specific volume of fluid per pump revolution and reducing the fluid void by a mechanical means to displace the pumping fluid. (*NFPA* 20 2016, Section 3.3.44.14)

Pressure Control Valve

A pilot-operated pressure-reducing valve designed for the purpose of reducing the downstream water pressure to a specific value under both flowing (residual) and non-flowing (static) conditions. (*NFPA* 20

2016, Section 3.3.67.3)

Pressure Maintenance (Jockey or Make-Up) Pump

A pump designed to maintain the pressure on the fire protection system(s) between preset limits when the system is not flowing water. (*NFPA* 20 2016, Section 3.3.44.15)

A pressure maintenance pump is also referred to as a Jockey or Make-up Pump.

Pressure-Reducing Valve

A valve designed for the purpose of reducing the downstream water pressure under both flowing (residual) and non-flowing (static) conditions. (*NFPA* 20 2016, Section 3.3.67.4)

Pumping Liquid Level

The level, with respect to the pump, of the body of liquid from which it takes suction when the pump is in operation. Measurements are made the same as with the static liquid level. (*NFPA* 20 2016, Section 3.3.31.1)

Relief Valve

A device that allows the diversion of liquid to limit excess pressure in a system. (*NFPA* 20 2016, Section 3.3.67.5)

Rotary Lobe Pump —

A positive displacement pump characterized by the use of a rotor lobe to carry fluid between the lobe void and the pump casing from the inlet to the outlet. (*NFPA* 20 2016, Section 3.3.44.16)

Rotary Vane Pump —

A positive displacement pump characterized by the use of a single rotor with vanes that move with pump rotation to create a void and displace liquid. (*NFPA* 20 2016, Section 3.3.44.17)

Shall —

Indicates a mandatory requirement. (*NFPA* 20 2016, Section 3.2.4)

Should —

Indicates a recommendation or that which is advised but not required. (*NFPA* 20 2016, Section 3.2.5)

Standard —

An NFPA Standard, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase “standards development process” or “standards development activities,” the term “standards” includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides. (*NFPA* 20 2016, Section 3.2.6)

Static Liquid Level

The level, with respect to the pump, of the body of liquid from which it takes suction when the pump is not in operation. For vertical shaft turbine-type pumps, the distance to the liquid level is measured vertically from the horizontal centerline of the discharge head or tee. (*NFPA* 20 2016, Section 3.3.31.2)

Suction Pressure Regulating Valve

A pilot-operated valve installed in discharge piping that maintains positive pressure in the suction piping, while monitoring pressure in the suction piping through a sensing line. (*NFPA* 20 2016, Section 3.3.67.2)

Total Head, Horizontal Pumps

The measure of the work increase, per pound of liquid, imparted to the liquid by the pump, and therefore the algebraic difference between the total discharge head and the total suction head. Total head, as determined on test where suction lift exists, is the sum of the total discharge head and total suction lift. Where positive suction head exists, the total head is the total discharge head minus the total suction head. (*NFPA* 20 2016, Section 3.3.25.3.1)

Refer to *NFPA* 20 2016, Figure A.3.3.25.3.1

Total Head, Vertical Turbine Pumps

The distance from the pumping liquid level to the center of the discharge gauge plus the total discharge head. (*NFPA* 20 2016, Section 3.3.25.3.2)

Refer to *NFPA* 20 2016, Figure A.3.3.25.3.2

Total Rated Head

The total head developed at rated capacity and rated speed for a centrifugal pump. (*NFPA* 20 2016, Section 3.3.25.4)

Total Suction Head

Suction head exists where the total suction head is above atmospheric pressure. Total suction head, as determined on test, is the reading of a gauge at the suction of the pump, converted to feet of liquid, and referred to datum, plus the velocity head at the point of gauge attachment. (*NFPA* 20 2016, Section 3.3.25.5)

Total Suction Lift

Suction lift that exists where the total suction head is below atmospheric pressure. Total suction lift, as determined on test, is the reading of a liquid manometer at the suction nozzle of the pump, converted to feet of liquid, and referred to datum, minus the velocity head at the point of gauge attachment. (*NFPA* 20 2016, Section 3.3.66)

Tuberculation

The development of small mounds of corrosion products on the inside of iron pipe.

Unloader Valve

A valve that is designed to relieve excess flow below pump capacity at set pump pressure. (*NFPA* 20 2016, Section 3.3.67.6)

Velocity Head

The kinetic energy of a unit weight of fluid moving with velocity (v) determined at the point of the gauge connection. (*NFPA* 20 2016, Section 3.3.25.6)

Velocity head is calculated using the following formula:

$$h_v = v^2 / 2g$$

Where:

v = velocity in the pipe in feet per second

g = acceleration due to gravity (32.17 ft/sec^2 at sea level and 45° latitude)

Vertical Lineshaft Turbine Pump

A vertical shaft centrifugal pump with rotating impeller or impellers and with discharge from the pumping element coaxial with the shaft. The pumping element is suspended by the conductor system, which encloses a system of vertical shafting used to transmit power to the impellers, the prime mover being external to the flow stream. (*NFPA* 20 2016, Section 3.3.44.18)

Wet Pit

A timber, concrete, or masonry enclosure having a screened inlet kept partially filled with water by an open body of water such as a pond, lake, or stream. (*NFPA* 20 2016, Section 3.3.71)

CONTINUE

Click on the “Next” arrow up on the right-hand corner of the screen to continue to the quiz.

Ohio Fire Pumps - Ohio Fire Code

This module will provide information on SOME of the Ohio Fire Code requirements for fire pumps.

It is not meant as a Fire Code course, but to familiarize you with a few of the requirements.

Many of the requirements are the same or very similar to requirements from *NFPA* 20, *Standard for Installation of Stationary Pumps for Fire Protection*, 2016 edition.

In other instances, the Ohio Fire Code will refer you back to *NFPA* 20 2016 and *NFPA* 25 2014 for the necessary requirements, inspection, testing, and maintenance of fire pumps.

You can reference the Ohio Fire Code at: http://codes.ohio.gov/oac/1301:7-7-09.
Key Reference for this module:

- Ohio Fire Code - Fire Protection Systems
  - https://codes.iccsafe.org/content/OHFCJAN2019E/ohio-administrative-code-1301-7-7-09-fire-protection-systems

Ohio Fire Code

Lesson 1 of 1

Ohio Fire Code

Lesson Goal

By the end of this lesson, you will be able to do the following:

☐ Gain a working knowledge of Ohio Fire Alarm Code requirements for fire pumps.

Introduction

This module will provide information on **some** of the Ohio Fire Code requirements for fire pumps.

It is not meant as a Fire Code course, but to **familiarize** you with a few of the requirements. Many of the requirements are the **same or very similar** to requirements from *NFPA* 20, Installation of Stationary Pumps for Fire Protection, 2016 edition.

In other instances, the Ohio Fire Code will refer you back to *NFPA* 25 2014 for the necessary requirements, inspection, testing, and maintenance of fire pumps.

Fire Protection Systems portion

You can reference the Ohio Fire Code and use this button to take you to the fire protection systems portion of the Fire Code

CLICK HERE

CONTINUE

The Ohio Fire Code lists all the sections that deal with fire pumps in Section 1301:7-7-80, Referenced Standards.

Referenced Standards Table

You can take a look at the table by clicking on this button.
The information we are looking for is on the NFPA table under the “Standard Reference Number” column and titled “20-16.”

CLICK HERE

Per the NFPA table, the sections of the building code covering fire pumps are:

- Section 913.1
- Section 913.2
- Section 913.5.1

We will not cover every section listed above but will provide information so that you **get a feel for what the Ohio Fire Code entails**.

SECTION 913

Ohio Fire Code, Section 913

As listed above, Section 913 of the Ohio Building Code contains fire pump requirements. Fire pumps are to installed per *NFPA* 20 2016 requirements.

Ohio Environmental Protection Agency

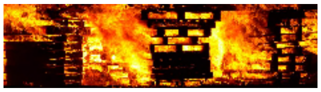
The Ohio Environmental Protection Agency requires one of the following be installed to ensure a **minimum 10 PSI is maintained in the suction line** when the pump is running:

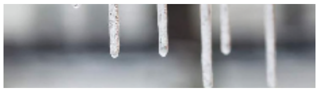
- Low pressure cut-off
- Low suction throttling valve
- Variable speed suction line

NFPA 20 2016

Per *NFPA* 20 2016, the fire pump, driver, and fire pump controller are required to be **protected against the possible interruption** of service that could be caused by the following:

- Explosion
- Fire, flood, or earthquake
- Rodents or insects
- Windstorms or freezing
- Vandalism or other adverse conditions





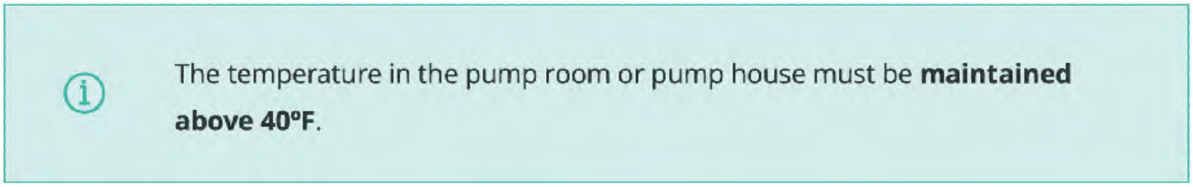
CONTINUE

Fire Pump Location

Fire pumps are to be located in rooms separated from all other areas of the building by a **2-hour barrier** as defined in Section 707, **2-hour assemblies** constructed per Section 711, or both.

There are exceptions for non-high-rise buildings, which requires a **1-hour fire barrier or horizontal assembly (or both)** in buildings that are protected by an automatic sprinkler system.

Cables used for circuit survivability are required to be listed **per UL 2196**.



The temperature in the pump room or pump house must be **maintained above 40°F**.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

The Ohio Environmental Protection Agency requires which of the following be installed to ensure a minimum 10 PSI is maintained in the suction line when the pump is running? (Select all that apply)

- ☐ Backflow preventer
- ☐ Low pressure cut-off
- ☐ Low suction throttling valve
- ☐ Fire barrier

☐ Variable speed suction line

SUBMIT

As defined by Section 707, a ___-hour barrier is required to separate the fire pumps from all other areas of the building.

Type your answer here

SUBMIT

Complete the knowledge checks above before moving on.

Backflow Prevention

Fire pump suction, discharge and bypass valves, and isolation valves on a backflow prevention device or assembly are required to be **supervised by one of the following**:

- Central station, proprietary, or remote-station signaling service

- Local signaling service that will sound an audible signal at a constantly attended location
- Locking valves open
- Sealing of valves and approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner

Fire pump test outlet valves are required to be **supervised, sealed, or locked in the closed position**.

Backflow prevention

CONTINUE

Acceptance Testing

All acceptance testing is required to follow ***NFPA*** **20 2016 requirements and Section 901.5 of the Ohio Building Code (OBC)**. Section 901.5 requires acceptance tests to be conducted in accordance with the requirements of the following at the expense of the owner or the owner's representative:

- The OBC
- The OH Fire Code
- The applicable referenced standards

Additionally, the building official may require acceptance tests be conducted in the **presence of a certified building inspector or certified fire protection system inspector**.

The Ohio Fire Code, Section 901.5 provides additional requirements:

1. The fire code official shall be notified by the responsible person of any scheduled acceptance testing of a fire protection system **not less than 48 hours prior to the start of the test**.
2. When required by the fire code official, all acceptance testing shall be **conducted in the presence of the fire code official**.
3. When required by the fire code official, all acceptance testing shall be **conducted in the presence of the person who installed the equipment** or, if it is not possible for the actual installer to be present, the acceptance testing shall be conducted in the presence of another qualified representative of the company that installed the equipment.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

Fire pump test outlet valves are required to be supervised, sealed, or locked in the ______ position.

○ open

○ closed

SUBMIT

If required by the building official, acceptance tests are to be conducted in the presence of whom?

○ **A.** A certified building inspector

○ **B.** A certified fire protection system inspector

○ **C.** Both A and B

○ **D.** Either A or B

SUBMIT

Complete the knowledge checks above before moving on.

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

File Attachments for Item:

ER-8 Ohio Portable Fire Extinguishers (new version, Fire Tech Productions)

All commercial certifications except PPE, PI, and MI (6.5 hours)

Staff Notes: Recommend expanded references to 2017 OBC Chapter 9, inclusion of PPE, PI and MI.

Committee Recommendation:

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.

[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: Julie Miller (Contact Name)
Organization: Fire Tech Productions (Organization/Company)
Address: 7976 Clyo Rd. (Include Room Number, Suite, etc.)
City: Centerville State: OH Zip: 45459
E-Mail: julie@firetech.com
Telephone: 937.434.3473 Fax: NA
Course Sponsor:

COURSE INFORMATION:

Course Title: Ohio Portable Fire Extinguishers - PEOH 102

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

Purpose and Objective: The Ohio Portable Fire Extinguishers online self-paced course provides training for the state of Ohio's Portable Fire Extinguishers exam so you can pass your test on the first attempt. Preparing both industry novices and veterans with the knowledge to successfully understand the requirements found in NFPA 10 2013. The course contains self-paced lessons and quizzes, allowing you to test your knowledge of the course material.

Number of Instructional Contact Hours that can be obtained upon completion: 6.5

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	
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.

Fire Tech Productions - Ohio Course Submission

Included in this document: Course Outline, Instructor resume(s)

Course: Ohio Portable Fire Extinguishers - PEOH 102

Course Outline:

1. Welcome!
2. Introduction
3. Selection
4. Installation
5. Inspection, Maintenace and Repair
6. Hydrostatic Testing
7. Annex Information
8. Ohio Fire Code
9. Glossary

Instructor: Tom Doty

THOMAS DOTY
21 Meadowcrest Dr.
Franklin, OH 45005
937-434-3473
tom@firetech.com

Seasoned fire protection professional following strong adherence to the codes and top-notch attention to customer service.

Certifications include: Sprinkler/Standpipe • Fire Alarm and Detection Systems • Fire Pumps • Fire Service Mains • Portable Fire Extinguishers • Pre-Engineered Extinguishers – OTW • State of Kentucky Certified

PROFESSIONAL EXPERIENCE

- CertaSite, 2801 Thunderhawk Court, Dayton, Ohio 45414
  Installation Manager - 2021- Present

- Fire Tech Productions, Inc., 7986B Clyo Rd., Centerville, Ohio 45459
  President - 2015 - 2022
  Instructor/Developer - 2015 - Present

- Craynon Fire Protection Inc., 2801 Thunderhawk Court, Dayton, Ohio 45414
  Partner/Vice-President – 2011 – 2021
  Operations Manager -- 12/11/2005 – 2021

- Guardian Fire Protection, 480 Randy Lane, Monroe, Ohio 45050
  Owner – 11/30/2003 – 12/11/2005

- Sprinkler Inspection Services, Inc., 8 Perkins Drive, Alexandria, KY 41001
  Superintendent / Operations Manager – 10/07/1995 – 11/30/2003

- Bestol Plumbing Company, P.O. Box 4192, Branson, MO
  Foreman – 2/1995 – 10/1995

- Grinnell Fire Protection Systems, Inc., San Diego, CA
  Service Foreman – 8/1993 – 2/1995

- Advanced Fire Protection Company, 1657 Monte Vista Drive, Vista, CA 92084
  Owner – 10/1990 – 8/1993

- Ryan Automatic Sprinkler Company, San Marcos, CA
  Superintendent – 4/1988 – 10/1990

- Vanguard Fire Protection, Carlsbad, CA
  Foreman – 3/1985 – 4/1988

- Sentinel Fire Protection, San Diego, CA -- 8/1983 – 3/1985
- Local Union 669 – 5/1981 – 8/1983
- Local #821, Central Florida – 4/1980 – 5/1981
- American Automatic Fire Protection – 1/1979 – 4/1980
- Illinois Central Gulf Railroad – 4/1978 – 12/1978
- Orlando Automatic Sprinkler Company – 10/1976 – 3/1978

Ohio Portable Fire Extinguishers - Introduction

Welcome to the Portable Fire Extinguishers course!

This introduction provides a brief overview of what will be covered in the course.

You can come back to this module and reference this information anytime in your menu.

Topics that are covered in this introduction are as follows:

- Key References
- Training Modules
- Preparing for the Practice Exams
- ***NFPA*** 10 2013 Definitions

When you are ready to begin, click on the button above to start the course.

Overview

Glossary

Lesson 1 of 2

Overview

Welcome

Please review this introduction before getting started on the course.

We will look at key references and study tips. In addition, we will highlight key vocabulary terms in the glossary.

REFERENCES

Key References

NFPA 10
Standard for
Portable Fire
Extinguishers
2013 Edition

NFPA 10 2013

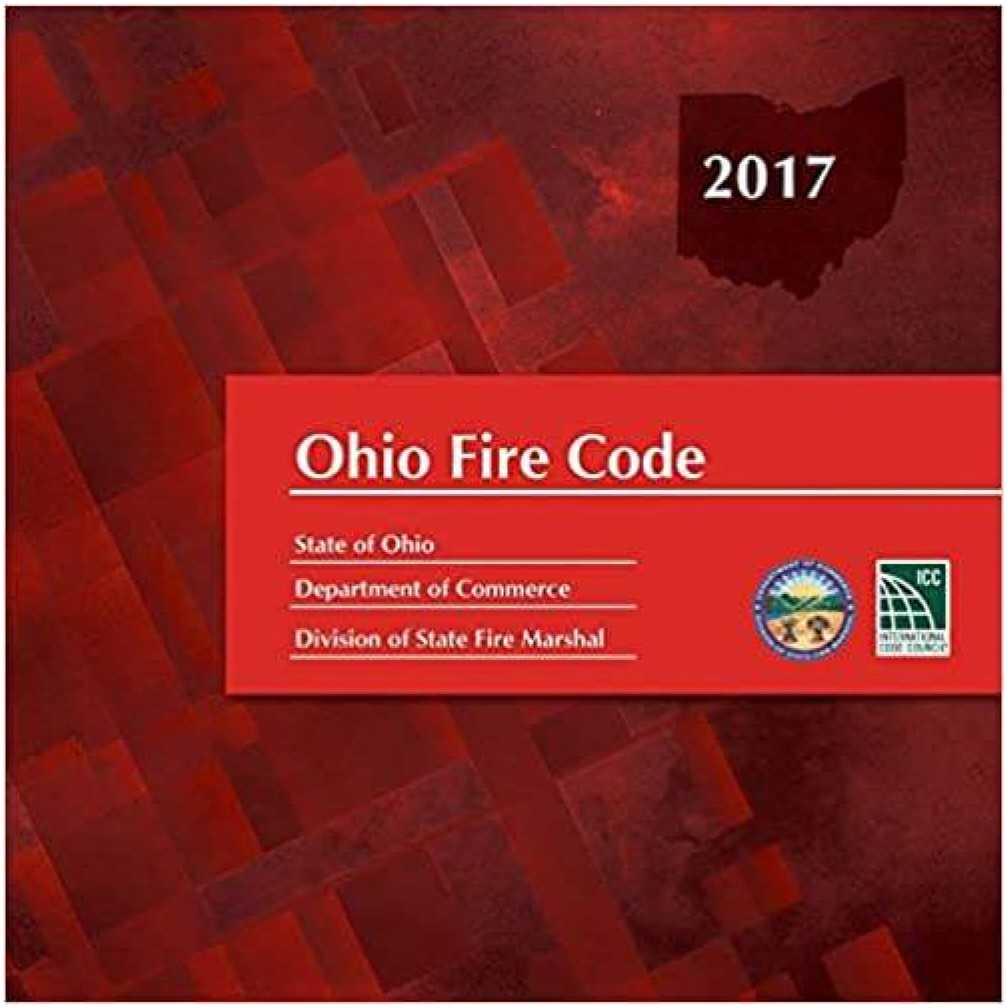
You will want to really focus on *NFPA* 10 – *Standard for Portable Fire Extinguishers,* 2013.

NFPA 10 2013 covers the selection, installation, inspection, maintenance, recharging, and testing of portable fire extinguishers and Class D extinguishing agents.

Ohio Fire Code, 2017

The Ohio Fire Code, 2017, establishes **state fire marshal rules** for the administration and enforcement of authorities.

These rules govern the occupancy and maintenance of all structures and premises for precautions against fire and the spread of fire and general requirements of fire safety.



Ohio Fire Code

The Ohio Fire Code link can be accessed by clicking on this "Click Here" button.

CLICK HERE

OHIO CODES

Ohio Codes

The Ohio Building Code has a lot of information in it. However, only a relatively small portion of the code pertains to portable fire extinguishers. It ***does*** give the State Fire Marshal the responsibility for administration and enforcement of any matter related to the installation, repair, modification or removal of fire protection equipment.

The Ohio Fire Code states that portable fire extinguishers shall be installed, inspected, recharged, and maintained per *NFPA* 10 2013. The code also defines specific rules for Ohio as well as reinforce some of the *NFPA* 10 2013 requirements.

- One of these requirements is to be certified and licensed by the state of Ohio.
- The only exception is for a provisional person in an approved formal apprenticeship program. They are permitted to work under the constant supervision of a certified person. The certified person is only allowed to supervise one provisional person.

CONTINUE

Additional Resources

Below is additional information and resources for the Ohio exam.

Ohio Department of Commerce – Division of State Fire Marshal:

Ohio Department of Commerce

To access the Ohio Department of Commerce – Division of State Fire Marshal, click on this "Click Here" button.

CLICK HERE

Ohio Department of Commerce phone: **(614) 752-7126**

The following downloadable PDF is for the Fire Protection Exam Application through the Ohio Department of Commerce:

PDF

FireProtectionExamApplication.pdf

548.9 KB

PSI Candidate Information Bulletin

A very important source of information is the PSI Candidate Information Bulletin from PSI Services LLC. Take time to read it below in its **ENTIRETY**.

PDF

OhioCertificationExaminationBulletin.pdf
230.9 KB

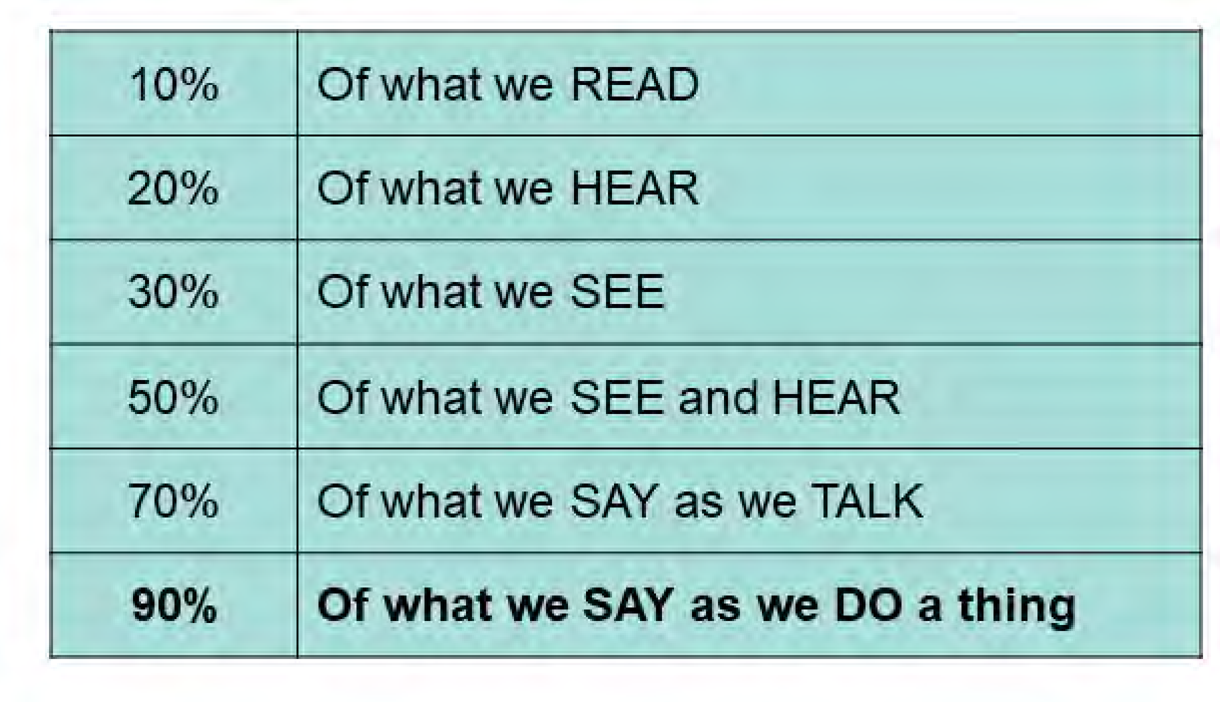
PSI Online Exams

To check for the most updated information on PSI Services, visit their website by clicking on this "Click Here" button.

CLICK HERE

HOW WE LEARN

Thinking about How We Learn



10%	Of what we READ
20%	Of what we HEAR
30%	Of what we SEE
50%	Of what we SEE and HEAR
70%	Of what we SAY as we TALK
90%	**Of what we SAY as we DO a thing**

Source: ***Skill With People*** by Les Giblin

Different people learn in different ways.

It is important to discover what works **best for you** and use your strengths to ensure you retain the material.

TRAINING MODULES

The Training Modules

As you are studying, be prepared to **refer to your copy of the referenced NFPA standards constantly** throughout these modules. Be comfortable with the technical material.

Each **training module** is carefully planned and designed to **highlight areas of the standards that a beginning technician needs to know and understand**. The goal of these training modules is to help you become knowledgeable of important areas of the standards and to gain a working understanding of how to apply these requirements on the job.

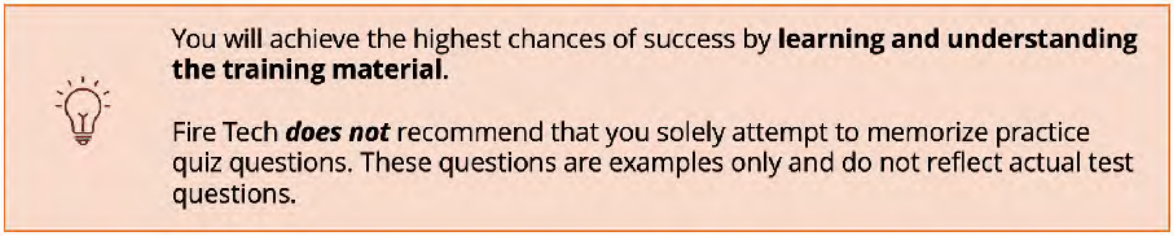
Take notes as you are studying, and **highlight** areas of the standards that are important to know.

The more familiar you are with the requirements, tables, and figures, the better your chances of success.

QUIZZES

The Quizzes

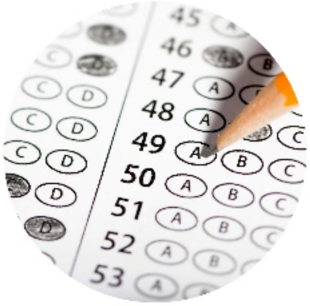
Fire Tech provides a practice quiz associated with each training module, which should be taken following completion of the module. As you take each practice quiz, use your copy of the referenced NFPA standards to **look up every answer to each quiz question**. This will assist you in **becoming more familiar with the requirements and where they are located** in each of the codes and standards.



You will achieve the highest chances of success by **learning and understanding the training material.**

Fire Tech ***does not*** recommend that you solely attempt to memorize practice quiz questions. These questions are examples only and do not reflect actual test questions.

Additionally, **read each question carefully**. Sift through what is pertinent to the question and what is irrelevant information that may be included as a distractor.



Knowledge Checks

To help you apply course material and prepare for the quizzes, **knowledge checks** are sprinkled throughout each course.

Completing these knowledge checks is **required** to proceed further in the lesson. If you're stuck on a question, refer to previous lesson material and use your NFPA standard to find the answer.

True or false: Knowledge checks will help you apply course material and prepare for course quizzes.

○ True

○ False

SUBMIT

Complete the knowledge check above before moving on.

Practice Exam

Once you have read all of the lessons in this course and passed all of the quizzes, you will be ready to take the **Practice Exam**.

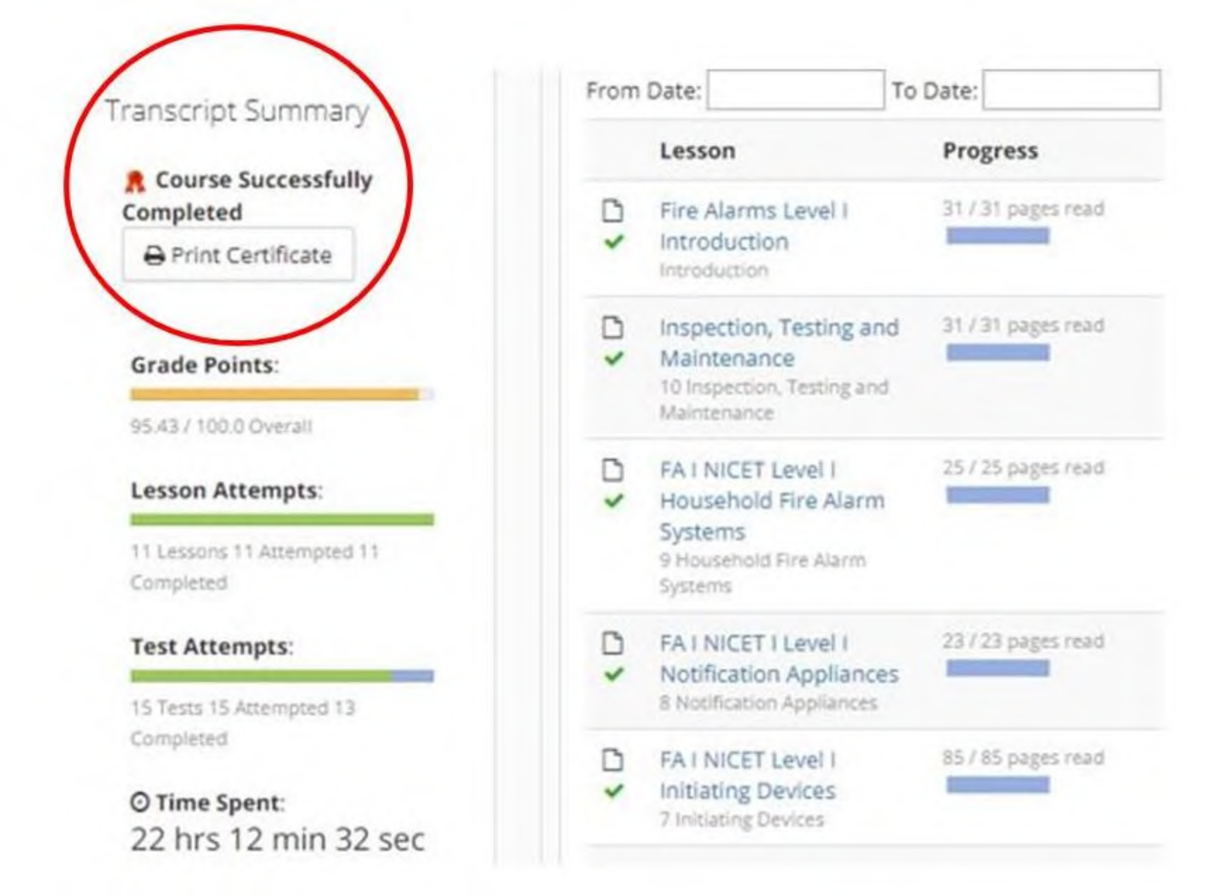
The Practice Exam consists of questions from the quizzes and are presented in a randomized manner. Fire Tech highly recommends that you take each of these practice exams.

Three practice exams are offered:

- Exam #1 is **required** to pass the course
- Exams #2 and #3 are **optional** and are not required to pass the course.

CONTINUE

Course Completion



Transcript Summary

Course Successfully Completed

Print Certificate

Grade Points:

95.43 / 100.0 Overall

Lesson Attempts:

11 Lessons 11 Attempted 11 Completed

Test Attempts:

15 Tests 15 Attempted 13 Completed

Time Spent:

22 hrs 12 min 32 sec

From Date: To Date:

Lesson	Progress
✓ Fire Alarms Level I Introduction Introduction	31 / 31 pages read
✓ Inspection, Testing and Maintenance 10 Inspection, Testing and Maintenance	31 / 31 pages read
✓ FA I NICET Level I Household Fire Alarm Systems 9 Household Fire Alarm Systems	25 / 25 pages read
✓ FA I NICET I Level I Notification Appliances 8 Notification Appliances	23 / 23 pages read
✓ FA I NICET Level I Initiating Devices 7 Initiating Devices	85 / 85 pages read

Upon successful completion of the Practice Exam #1, you can download your **course completion certificate**, as shown in the transcript summary.

NFPA CODES

NFPA Codes

NFPA 10 2013 is the Portable Fire Extinguisher Standard

- **Chapter 1** (Administration) – Introduces the scope, purpose, and administration of *NFPA* 10 2013.
- **Chapter 2** (Referenced Publications) – Lists mandatory referenced publications.
- **Chapter 3** (Definitions) – Defines terms that are used in *NFPA* 10 2013.
- **Chapter 4** (General Requirements) – Contains general requirements for portable fire extinguishers.
- **Chapter 5** (Selection of Portable Fire Extinguishers) – Discusses the selection requirements of fire extinguishers.
- **Chapter 6** (Installation of Portable Fire Extinguishers) – Reviews various installation requirements that are in place for fire extinguishers.
- **Chapter 7** (Inspection, Maintenance, and Recharging) – Explores the procedures for the inspection, maintenance, and recharging of fire extinguishers.
- **Chapter 8** (Hydrostatic Testing) – Explains the requirements and procedures of hydrostatic testing for portable fire extinguishers and their components.

ⓘ ***NFPA*** **10 2013 also contains several Annexes and supplements that have very valuable examples and information. It is recommended you study this material as well.**

GLOSSARY

Lesson 2 of 2

Glossary

Lesson Goals

By the end of this lesson, you will be able to do the following:

☐ Define key terms associated with fire pumps.

Key References

- *NFPA* 10 - *Standard for Portable Fire Extinguishers*, 2013

LET'S BEGIN

Key Terms

NFPA 10 2013, Chapter 3

Below are key glossary terms that will be highlighted throughout this course. Click on each **+** symbol to see the definition for each word below.

Approved

Acceptable to the authority having jurisdiction. (*NFPA* 10 2013, Section 3.2.1)

Authority Having Jurisdiction (AHJ)

An organization, office, or individual responsible for enforcing requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure. (*NFPA* 10 2013, Section 3.2.2)

Dry Chemical

A powder composed of very small particles, usually sodium bicarbonate-, potassium bicarbonate-, or ammonium phosphate-based with added particulate material supplemented by special treatment to provide resistance to packing, resistance to moisture absorption (caking), and the proper flow capabilities. (*NFPA* 10 2013, Section 3.3.4.1)

Dry Powder

Solid materials in powder or granular form designed to extinguish Class D combustible metal fires by crusting, smothering, or heat-transferring means. (*NFPA* 10 2013, Section 3.3.9)

Extinguisher Inspection

A quick check that a fire extinguisher is in its designated place, that it has not been actuated or tampered with, and that there is no obvious physical damage or condition to prevent its operation. (*NFPA* 10 2013, Section 3.3.14)

Extinguisher Maintenance

A thorough examination of the fire extinguisher that is intended to give maximum assurance that a fire extinguisher will operate effectively and safely and to determine if physical damage or condition will prevent its operation, if any repair or replacement is necessary, and if hydrostatic testing or internal maintenance is required. (*NFPA* 10 2013, Section 3.3.15)

Extinguisher Service Pressure

The normal operating pressure as indicated on the nameplate or cylinder of a fire extinguisher. (*NFPA* 10 2013, Section 3.3.22.1)

Factory Test Pressure

The pressure shown on the nameplate at which a shell was tested at time of manufacture. (*NFPA* 10 2013, Section 3.3.22.2)

Halocarbons

Halocarbon agents include hydrochlorofluorocarbon (HCFC), hydrofluorocarbon (HFC), perfluorocarbon (PFC), fluoroiodocarbon (FIC) types of agents, and other halocarbons that are found acceptable under the Environmental Protection Agency Significant New Alternatives Policy program. (*NFPA* 10 2013, Section 3.3.18.1)

Halogenated Agents

Halogenated (clean) agents referenced in this standard are of the following types: Halocarbons and Halons. (*NFPA* 10 2013, Section 3.3.18)

Halons

Halons include bromochlorodifluoromethane (Halon 1211), bromotrifluoromethane (Halon 1301), and mixtures of Halon 1211 and Halon 1301 (Halon 1211/1301). (*NFPA* 10 2013, Section 3.3.18.2)

Halon 1211 and Halon 1301 are included in the “Montreal Protocol on Substances that Deplete the Ozone Layer” that was signed on September 16, 1987.

In compliance with national regulations, the production of halons ceased on January 1, 1994.

High-Pressure Cylinder

Cylinders (and cartridges) containing nitrogen, compressed air, carbon dioxide, or other gases at a pressure higher than 500 psi at 70°F. (*NFPA* 10 2013, Section 3.3.7.1)

Hydrostatic Testing

Pressure testing of the extinguisher to verify its strength against unwanted rupture. (*NFPA* 10 2013, Section 3.3.19)

Listed

Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose. (*NFPA* 10 2013, Section 3.2.4)

Low-Pressure Cylinder

Cylinders containing fire-extinguishing agent (medium), nitrogen, compressed air, or other compressed gases at a service pressure of 500 psi or lower at 70°F. (*NFPA* 10 2013, Section 3.3.7.2)

Mild Steel Shell

All steel shells other than stainless steel and steel shells used for high-pressure cylinders. (*NFPA* 10 2013, Section 3.3.21)

Nonrechargeable (Nonrefillable) Fire Extinguisher

A fire extinguisher that is intended to be used one time and not capable of or intended to be recharged and returned to service. (*NFPA* 10 2013, Section 3.4.2)

Portable Fire Extinguisher

A portable device, carried or on wheels and operated by hand, containing an extinguishing agent that can be expelled under pressure for the purpose of suppressing or extinguishing fire. (*NFPA* 10 2013, Section 3.4.3)

Rechargeable (Refillable) Fire Extinguisher

A fire extinguisher capable of undergoing complete maintenance, including internal inspection of the pressure vessel, replacement of all substandard parts and seals, and hydrostatic testing. (*NFPA* 10 2013, Section 3.4.4)

Servicing

Performing maintenance, recharging, or hydrostatic testing on a fire extinguisher. (*NFPA* 10 2013, Section 3.3.25)

Shall

Indicates a mandatory requirement. (*NFPA* 10 2013, Section 3.2.5)

Should

Indicates a recommendation or that which is advised but not required. (*NFPA* 10 2013, Section 3.2.6)

Standard

A document, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the Manual of Style for NFPA Technical Committee Documents. (*NFPA* 10 2013, Section 3.2.7)

Travel Distance

The actual walking distance from any point to the nearest fire extinguisher fulfilling hazard requirements. (*NFPA* 10 2013, Section 3.3.27)

Water Mist Fire Extinguisher

A fire extinguisher containing distilled or de-ionized water and employing a nozzle that discharges the agent in a fine spray. (*NFPA* 10 2013, Section 3.4.7)

Water-Type Fire Extinguisher

A fire extinguisher containing water-based agents, such as water, film-forming foam agents (AFFF, FFFP), antifreeze, loaded stream, and wet chemical. (*NFPA* 10 2013, Section 3.4.8)

Wet Chemical

Normally an aqueous solution of organic or inorganic salts or a combination thereof that forms an extinguishing agent. (*NFPA* 10 2013, Section 3.3.4.2)

Wetting Agent

A concentrate which, when added to water reduces the surface tension and increases its ability to penetrate and spread. (*NFPA* 10 2013, Section 3.3.28)

Wheeled Fire Extinguisher

A portable fire extinguisher equipped with a carriage and wheels intended to be transported to the fire by one person. (*NFPA* 10 2013, Section 3.4.9)

Refer to *NFPA* 10 2013, Section A.5.3.2.7 for further information.

CONTINUE

Click on the “Next” arrow up on the right-hand corner of the screen to continue to the quiz.

Ohio Portable Fire Extinguishers - Ohio Fire Code

This module will provide information on SOME of the Ohio Fire Code requirements for portable fire extinguishers.

It is not meant as a Fire Code course, but to familiarize you with a few of the requirements.

Many of the requirements are the same or very similar to requirements from *NFPA* 10, *Standard for Portable Fire Extinguishers*, 2013 edition.

You can reference the Ohio Fire Code at: http://codes.ohio.gov/oac/1301:7-7-09.
Key Reference for this module:

- Ohio Fire Code - Fire Protection Systems
  - https://codes.iccsafe.org/content/OHFCJAN2019E/ohio-administrative-code-1301-7-7-09-fire-protection-systems

Ohio Fire Code

Lesson 1 of 1

Ohio Fire Code

Lesson Goal

By the end of this lesson, you will be able to do the following:

☐ Gain a working knowledge of Ohio Fire Alarm Code requirements for portable fire extinguishers.

INTRODUCTION

Introduction

This module will provide information on **some** of the Ohio Fire Code requirements for portable fire extinguishers. This is not meant as a Fire Code course, but to **familiarize** you with a few of the requirements.

Many of the requirements are the **same or very similar** to requirements from *NFPA* 10, Standard for Portable Fire Extinguishers, 2013 edition.

In other instances, the Ohio Fire Code will refer you back to this standard for the necessary requirements, inspection, maintenance, and recharging of portable fire extinguishers.

Fire Protection Systems portion

You can reference the Ohio Fire Code by using this "Click Here" button to take you to the fire protection systems portion of the Fire Code

CLICK HERE

CONTINUE

The Ohio Fire Code lists all the sections that deal with portable fire extinguishers in Section 1301:7-7-80, Referenced Standards.

Referenced Standards Table

You can view these references by clicking on this "Click Here" button. The information you're looking for is in the NFPA table under the "Standard Reference Number" column and titled "10-13."

CLICK HERE

Per the NFPA table, the sections of the building code covering portable fire extinguishers are:

- Section 308.1.4 and 308.1.4.1
- Section 906.2
- Section 906.3.2 and 906.3.4
- Section 3006.3

We will not cover every section listed above but will provide information so that you **get a feel for what the Ohio Fire Code entails**.

OHIO FIRE CODE, SECTION 906

Ohio Fire Code, Section 906

The Ohio Fire Code 2017, Section 906 defines the requirements for portable fire extinguishers, which are to be selected and installed per *NFPA* 10 requirements.

SECTION 906.1

Section 906.1

Section 906.1 defines where portable fire extinguishers are required:

- Group A, B, E, F, H, I, M, R-1, R-2, R-4, and S occupancies (*note the exceptions*)
- Within 30 ft. of commercial cooking appliances and domestic cooking appliances in Group I-2 nursing homes
- In areas that store, use, or dispense flammable or combustible liquids
- On each floor of structures that are under construction, with the exception of R-3 occupancies
- Where required by Table 906.1, Additional Required Fire Extinguishers
- Special-hazards areas, such as laboratories, computer rooms, and generator rooms

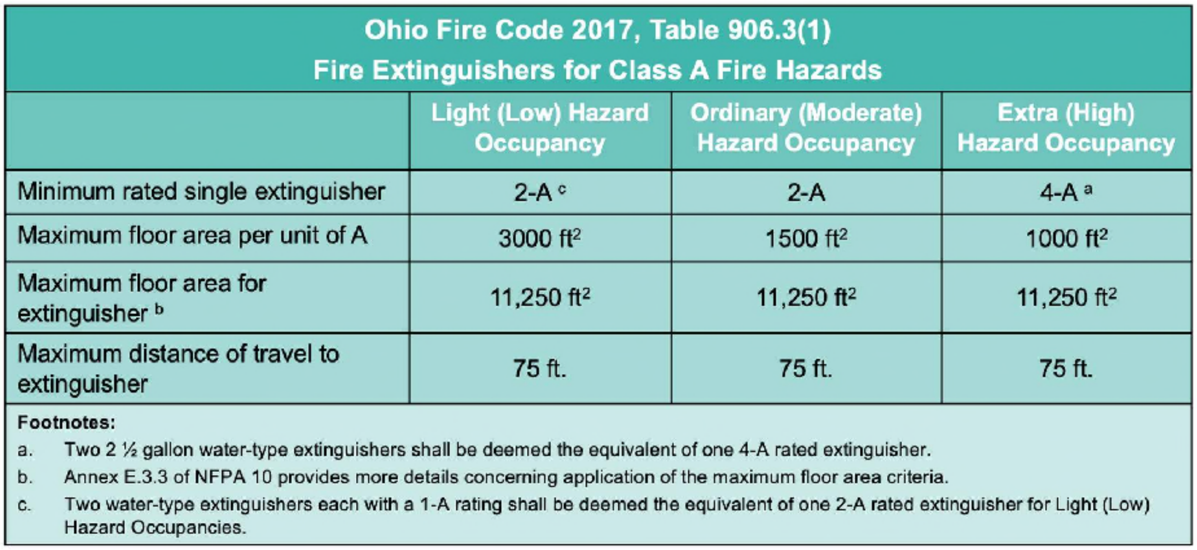
The Ohio Fire Code 2017, Section 906.2.1, requires individuals conducting maintenance on portable fire extinguishers to hold a valid certificate issued for the type of work performed.

SECTION 906.3

Section 906.3

Section 906.3 defines requirements pertaining to the size and distribution of portable fire extinguishers.

Click through the two tables (Table 906.3(1) and Table 906.3(2)) provided in this section.



Ohio Fire Code 2017, Table 906.3(1)
Fire Extinguishers for Class A Fire Hazards

	Light (Low) Hazard Occupancy	Ordinary (Moderate) Hazard Occupancy	Extra (High) Hazard Occupancy
Minimum rated single extinguisher	2-A [c]	2-A	4-A [a]
Maximum floor area per unit of A	3000 ft^2	1500 ft^2	1000 ft^2
Maximum floor area for extinguisher [b]	11,250 ft^2	11,250 ft^2	11,250 ft^2
Maximum distance of travel to extinguisher	75 ft.	75 ft.	75 ft.

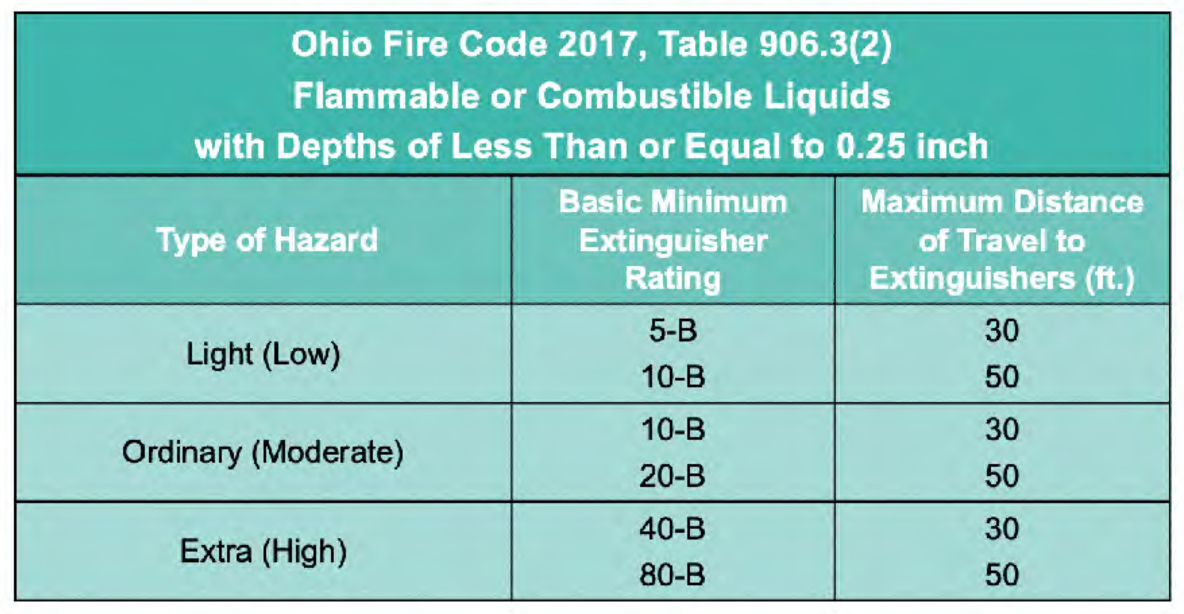
Footnotes:

a. Two 2 ½ gallon water-type extinguishers shall be deemed the equivalent of one 4-A rated extinguisher.

b. Annex E.3.3 of NFPA 10 provides more details concerning application of the maximum floor area criteria.

c. Two water-type extinguishers each with a 1-A rating shall be deemed the equivalent of one 2-A rated extinguisher for Light (Low) Hazard Occupancies.

Table 906.3(1) lists the rating, maximum floor area, and maximum distance of travel for fire extinguishers suitable for Class A hazards



Ohio Fire Code 2017, Table 906.3(2)
Flammable or Combustible Liquids
with Depths of Less Than or Equal to 0.25 inch

Type of Hazard	Basic Minimum Extinguisher Rating	Maximum Distance of Travel to Extinguishers (ft.)
Light (Low)	5-B 10-B	30 50
Ordinary (Moderate)	10-B 20-B	30 50
Extra (High)	40-B 80-B	30 50

Table 906.3(2) lists the extinguisher ratings and maximum travel distances for fire extinguishers based on types of hazard.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

According to Section 906.1, in what locations are portable fire extinguishers required? (Select all that apply)

☐ Group A occupancies

☐ Group B occupancies

☐ Group C occupancies

☐ Within 30 ft. of commercial cooking appliances and domestic cooking appliances in Group I-2 nursing homes

☐ Only on the first floor of structures that are under construction, with the exception of R-3 occupancies

☐ Laboratories

☐ Computer rooms

SUBMIT

____ is the minimum rated single extinguisher for Class A fire hazards in an ordinary hazard occupancy.

○ 2-A

○ 4-A

○ 5-B

○ 10-B

SUBMIT

SECTIONS 906.5 TO 906.8

Sections 906.5 to 906.8

Per Sections 906.5 – 906.8, portable fire extinguishers are to be located such that they are **easily accessible and immediately available** for use, along normal paths of travel, unless otherwise indicated by the building official.

The extinguishers must also **not be obstructed or obscured from view**. If a visual obstruction cannot be avoided, the **location must be indicated by other means**.

.

Extinguisher cabinets that house extinguishers are required to **remain unlocked**.

Note the exceptions:

- In areas where the extinguishers may be used to damage or harm
- In Group I-3 occupancies and mental health areas of Group I-2 occupancies

SECTION 906.9

Section 906.9

Section 906.9 addresses installation requirements.

1. Portable fire extinguishers with a gross weight 40 lbs. or less are required to be installed with their tops no more than 5 ft. above the floor.
2. Hand-held portable fire extinguishers with a gross weight greater than 40 lbs. are required to be installed with their tops no more than 3.5 ft. above the floor.
3. The clearance between the floor and the bottom of an installed hand-held portable fire extinguisher shall be no less than 4 in.

LET'S REVIEW

Let's do a quick check about what has been covered so far.

Cabinets that house fire extinguishers are required to remain unlocked, except in the following areas: (Select all that apply)

☐ In areas where the extinguishers may be used to damage or harm

☐ In Group I-1 occupancies

☐ In mental health areas of Group I-2 occupancies

☐ In Group I-3 occupancies

☐ In Light Hazard Occupancies

SUBMIT

CONTINUE

Click on the "Next" arrow up on the right corner of the screen to continue to the quiz.

File Attachments for Item:

ER-9 Appliances (Independent Electrical Contractors)

EPE, ESI, RBO (4 hours)

Staff Notes: Received after ESIAC submission: Recommend referral to ESIAC for recommendations.

Committee Recommendation:

Sean Clark

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(H)513/347-9054 (C)513/800-4450
sclark@ohiovalleyelectric.com

•••••••••••••••••••••••••••••

A licensed electrician with over twenty years of experience in installing, maintaining, and repairing electrical wiring, equipment, and fixtures, ensuring that work is in accordance with relevant codes, fire alarm installations, electrical control systems, and high voltage terminations. A licensed electrician with three years teaching experience in first and second year electrical.

Summary of Qualifications

- More than twenty years experience.
- Three years experience in teaching first and second year electrical.
- Thorough knowledge of electrical systems including planning additions and modifications on secondary circuits. Controls and low voltage wiring
- Able to read commercial electrical blueprints and apply NEC through the full range of commercial and industrial maintenance and construction work.
- Can use appropriate tools and diagnostic equipment to repair, install, replace, and test electrical circuits, equipment and appliances.
- Excellent ability to diagnose and repair electrical controls, industrial motor control centers, and programmable logic controllers.
- Strong desire to study and comprehend new technology.
- In-depth ability to make mathematical computations.
- Considerable ability to explain instructions and guidelines to others effectively.
- Able to assign work to employees., prioritize the work of others and organize and coordinate the work of the unit. For subs and Primes.

Professional Experience

Ohio Valley Electrical Services	2011-Present
ABC Electrical Teacher	2010-2013
Beacon Electrical Contractors	2007-2011
Ohio Valley Electrical Services	1993-2007

Electrical Superintendant/Foreman/Instructor

- First and Second year electrical instructor
- Supervision of all electrical installations of as many as 50 electricians to assure that work was done safely, efficiently, properly and within time allowed.
- Trained multiple employees in all aspects of electrical work to be able to identify an employee's strengths and weaknesses to better utilize their skills. Traced out short circuits in wiring, using test meter.
- Coordinated and implemented electrical projects within a variety of environments including plants, hospitals, schools, retail stores, public facilities, waste water treatment plants industrial buildings;

projects include both new construction and underground electrical wiring as well as renovation within existing buildings. Parking Garages and Fed Ex Ground Facilities.

- Assemble, install, test, and maintain electrical or electronic wiring, equipment, appliances, apparatus, and fixtures, using hand tools and power tools.
- Connect wires to circuit breakers, transformers, or other components.
- Construct and fabricate parts, using hand tools and specifications.
- Diagnose malfunctioning systems, apparatus, and components, using test equipment and hand tools, to locate the cause of a breakdown and correct the problem.
- Inspect electrical systems, equipment, and components to identify hazards, defects, and the need for adjustment or repair, and to ensure compliance with codes.
- Plan layout and installation of electrical wiring, equipment and fixtures, based on job specifications and local codes.
- Test electrical systems and continuity of circuits in electrical wiring, equipment, and fixtures, using testing devices such as ohmmeters, voltmeters, and oscilloscopes, to ensure compatibility and safety of system.
- Perform business management duties such as maintaining records and files, preparing reports and ordering supplies and equipment.

Education & Certifications

Master Electrician License-State of Kentucky

Journeyman Electrician's License-Hamilton, Ohio

Fire Alarm License-State of Ohio

Certified in high voltage terminations and splices

Lift, Lull, Bobcat, and Boom/scissors lift licenses

OSHA-30 card

Certified in first aid and CPR training

Certified NCCER Core Curricula Instructor

Certified NCCER Electrical Instructor

Completed 4 year apprenticeship program

1 Year Pre-apprentice school (ABC)

High School Diploma (1991)

ARCH FLASH SAFETY TRAINING

PROJECTS-SUPERVISED

$4.5mil.-MASON HIGH SCHOOL ADDITION

$250.000-3CDC-5TH RACE PARKING GARAGE

$250.000-AVONEDALE APT. COMPLEX

$100.000-MAHOGANYS AT THE BANK-

1.2mil. -PATHEON CHEMICALS

$450.000- FED EX GROUND ADDITION

$250.000-LIBERTY WAY PROJECT

$500.000-GE AT THE BANKS

$100.000 - SYCAMORE SCHOOLS/POWER/CONTROL-

$50.000 - NKU RETROFIT

$250.000- UC POWER PLANT ADDITION

$75.000 - 580BLD/ CHEMED, RETROFIT

$4.0mil - DHL- CONVEYERS/SHELL

$90.000- DOUBLE TREE AIRPORT

$2.5mil- TWIN LAKES OF MONTGOMERY

$45.000- STEINMART ANDERSON

And many small T&M jobs.

All on time and under budget

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: Kevin Collins
(Contact Name)
Organization: IEC of Greater Cincinnati
(Organization/Company)
Address: 586 Kings Run Drive
(Include Room Number, Suite, etc.)
City: Cincinnati State: OH Zip: 45232
E-Mail: kcollins@iec-cincy.com
Telephone: 513-542-0400 Fax: —
Course Sponsor: IEC of Greater Cincinnati

COURSE INFORMATION:

Course Title: Appliances

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

Purpose and Objective: Review article 422 of the NEC. We will cover requirements for dishwashers, disposals, water heaters, central vac systems, ranges & dryers. We will also calculate the load required to the service size.

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 ☐
Plumbing Plans Exam. ☐
Electrical Plans Exam. ☒
Mechanical Plans Exam. ☐
Building Inspector ☐
Fire Protection Inspector ☐
Mechanical Inspector ☐
Plumbing Inspector ☐
Non-Res IU Inspector ☐

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

Electrical Safety Inspectors ☒
Location of ESI Course: IEC of Greater Cincinnati Date(s) of ESI Course(s): 2/1/23

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:

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

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

Special Equipment Chapter 6

Appliances

422, 220

Special Equipment

- Chapter 6
- Equipment that are not your everyday items but you will come across from time to time
    - Not receptacles, switches, panels, light fixtures
- Not the structure themselves

Most sections are small (except pools)

Special Equipment

- Chapter 6 – not many questions
- Examples
    - Signs
    - Elevators
    - Welders
    - Pools

Use the index!

Special Equipment

A hot tub installed indoors shall have at least one 125-volt, 15 or 20 ampere receptacle on a general purpose branch circuit located not less than _____ feet from, and not exceeding _____ feet from, the inside wall of the hot tub:

A. 3, 8

B. 6,10

C. 6,12

D. 8,20

Special Equipment

A hot tub installed indoors shall have at least one 125-volt, 15 or 20 ampere receptacle on a general purpose branch circuit located not less than ____ feet from, and not exceeding ____ feet from, the inside wall of the hot tub.

A. 3, 8

B. 6,10

C. 6,12

D. 8,20

680.43(A)

Special Equipment

- Branch circuits that supply neon tubing installations shall be rated not to exceed ____ amps:

A. 15

B. 20

C. 30

D. 40

Special Equipment

Branch circuits that supply neon tubing installations shall be rated not to exceed _____ amps.

A. 15

B. 20

C. 30

D. 40

600.5 (B)(1)

Appliances

- 422
  - Infrared heating appliances (heat lamps)
  - Non motor appliance – water heater
  - Central Vac
  - Dishwasher
  - Trash compactor
  - Range hoods
- You won’t find specific appliances in index!
- Not the big appliances – Ranges and Dryers

Appliances

- 424, 426, 427
  - Deals with heating equipment
    - Minimal questions

Appliances

- The length of cord of a trash compactor is allowed to be:

A. 2 feet

B. 3 feet

C. 6 feet

D. Any of these

Appliances

- The length of cord of a trash compactor is allowed to be:

A. 2 feet

B. 3 feet

C. 6 feet

D. Any of these

422.16 (B) (2) (2)

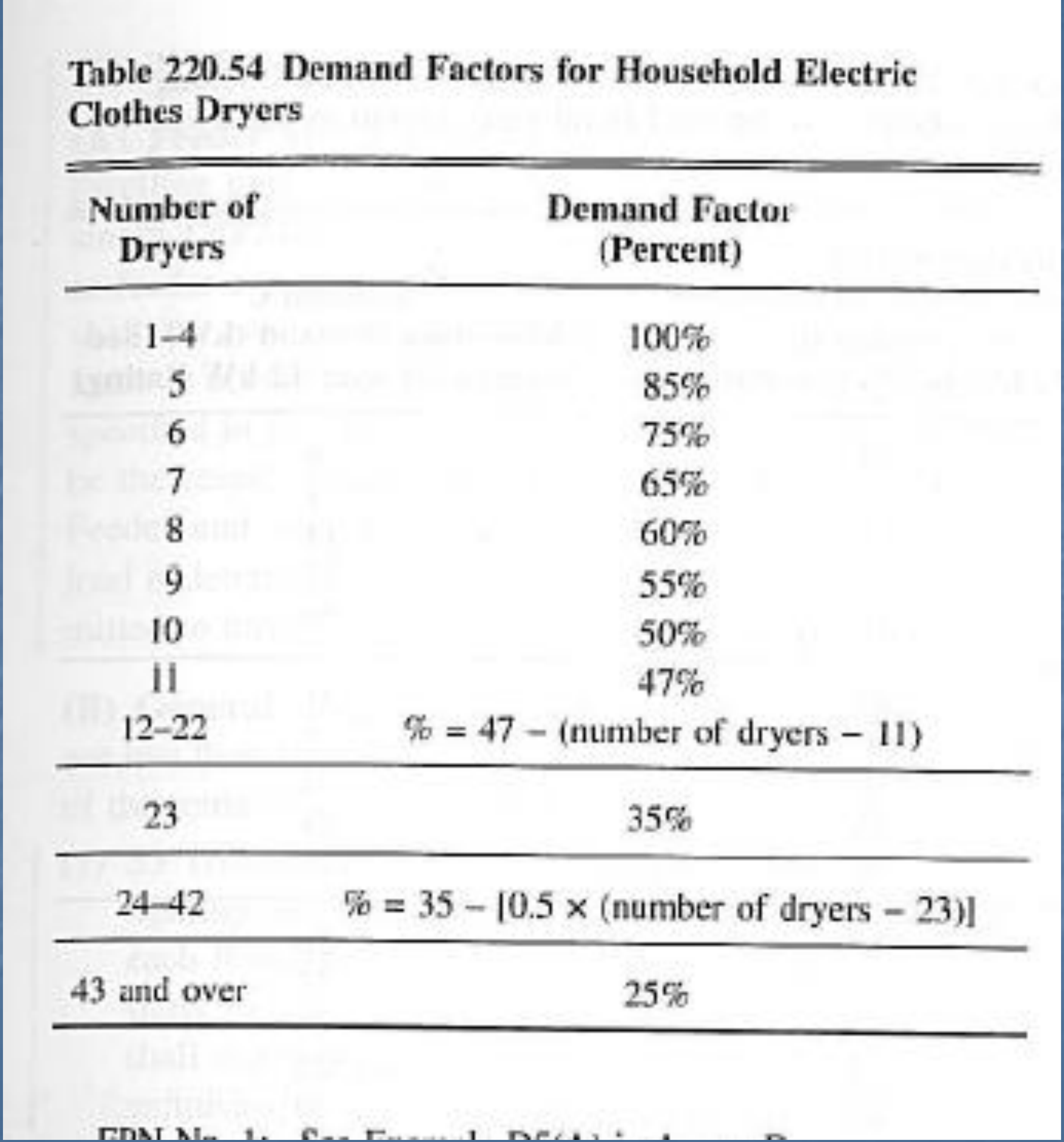


Table 220.54 Demand Factors for Household Electric Clothes Dryers

Number of Dryers	Demand Factor (Percent)
1–4	100%
5	85%
6	75%
7	65%
8	60%
9	55%
10	50%
11	47%
12–22	% = 47 – (number of dryers – 11)
23	35%
24–42	% = 35 – [0.5 × (number of dryers – 23)]
43 and over	25%

Dryer

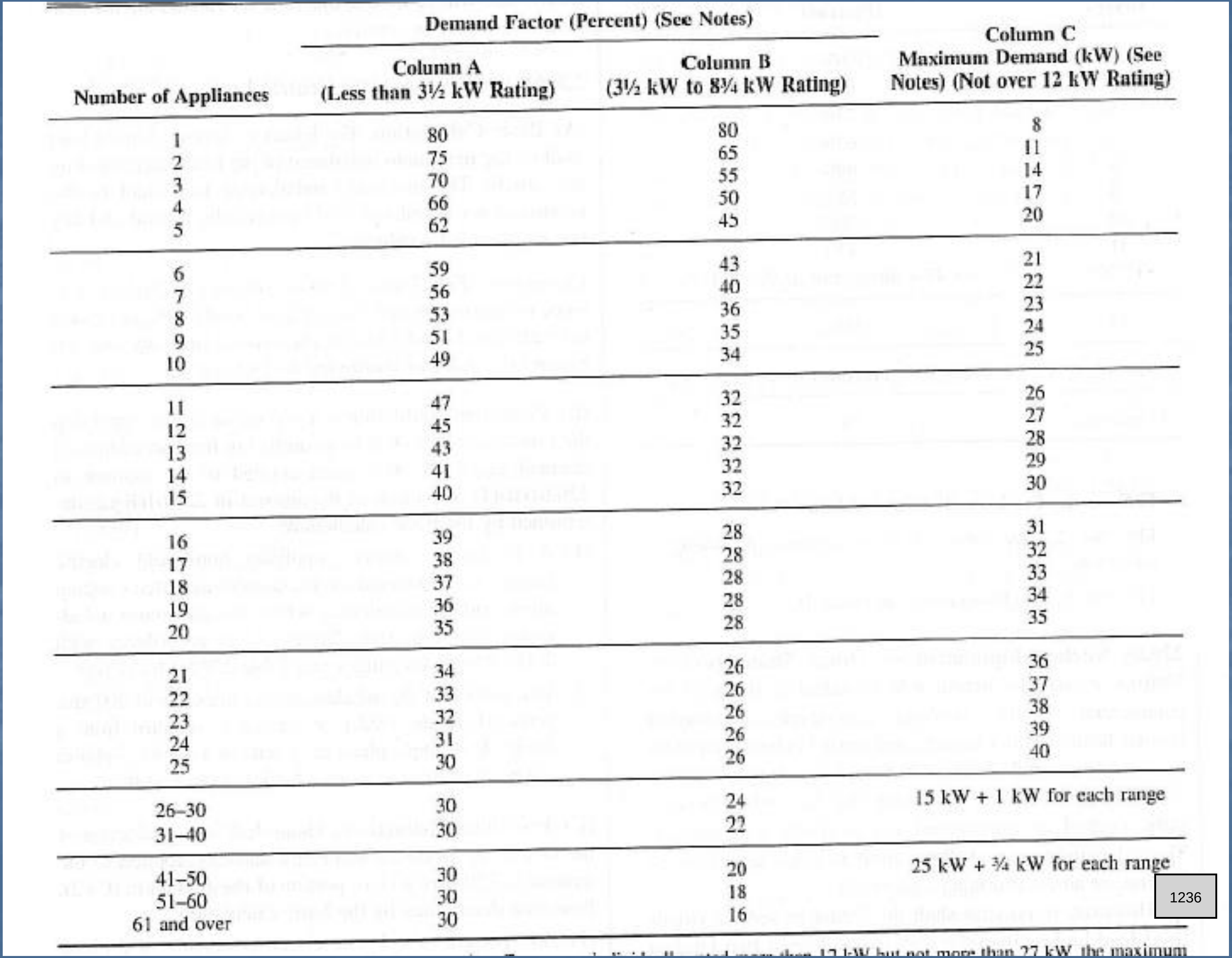
- Dryers are calculated at the greater of
  - 5,000 W
  - The nameplate rating

Demand factors can be applied from 220.54

Ex: I have 5 – 4,500 W Dryers, what is the service demand?

5,000 (minimum required) x 5 x .85 = 21,250 W

This is only for service,
branch is computed separately



	Demand Factor (Percent) (See Notes)		
Number of Appliances	Column A (Less than 3½ kW Rating)	Column B (3½ kW to 8¾ kW Rating)	Column C Maximum Demand (kW) (See Notes) (Not over 12 kW Rating)
1	80	80	8
2	75	65	11
3	70	55	14
4	66	50	17
5	62	45	20
6	59	43	21
7	56	40	22
8	53	36	23
9	51	35	24
10	49	34	25
11	47	32	26
12	45	32	27
13	43	32	28
14	41	32	29
15	40	32	30
16	39	28	31
17	38	28	32
18	37	28	33
19	36	28	34
20	35	28	35
21	34	26	36
22	33	26	37
23	32	26	38
24	31	26	39
25	30	26	40
26–30	30	24	15 kW + 1 kW for each range
31–40	30	22	
41–50	30	20	25 kW + ¾ kW for each range
51–60	30	18	
61 and over	30	16	

than 12 kW but not more than 27 kW, the maximum

Electric Ranges

- 220.55
- For dwelling with no additional information
  - Use 8,000 W
- If you know the kW use the appropriate column
- Column C is already in kW
- Column A and B are percentages

Electric Ranges

What is the demand factor for 6 – 10kW ranges?

Number of appliances = 6

The ranges would fall into Column C

21 kW would be the demand factor

Electric Ranges

What is the demand factor for 5 – 7 kW ranges?

5 x 7,000W (given) = 35,000W

35,000W x 45% = **15,750W**

If the ranges exceed 12 kW or if the ranges fall into different columns – see me later or D.6 in the examples in the back of the book

Electric Ranges

- What is the demand factor for 12 – 2kW ranges?

- What is the demand factor for 7 - 11 kW ranges?

Electric Ranges

- What is the demand factor for 12 –2kW ranges?
  - Use column A
    - Your percentage will be 45%
  - 12 x 2 kW = 24 kW
  - 24kW x 45% (.45) = 10.8 kW or 10,800W (VA)
- What's the demand factor for 7 -11 kW ranges?
  - Use column C
  - 22 kW

Ranges – article 220.55
Calculating the service load for range(s)

Dryers – article 220.54
Calculating the service load for dryer(s)

Article 422
In Sink Waste Disposals
Dishwashers
Range Hoods
Central Vacuums
Water Heaters

File Attachments for Item:

ER-10 Box Fill (Independent Electrical Contractors)

EPE, ESI, RBO (4 hours)

Staff Notes: Received after ESIAC submission: Recommend referral to ESIAC for recommendations.

Committee Recommendation:

Box Fill – 314.16 (A) and (B)

- Number of conductors of the same size in different boxes.
- Number of conductors of different sizes in different boxes.
- Other factors in determining box fill
    - Wire spliced/running straight through
    - Clamps
        - Internal/External
    - Devices
    - Grounds (Regular/Isolated)

Sean Clark

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sclark@ohiovalleyelectric.com

* * *

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Summary of Qualifications

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- In-depth ability to make mathematical computations.
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Professional Experience

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- Inspect electrical systems, equipment, and components to identify hazards, defects, and the need for adjustment or repair, and to ensure compliance with codes.
- Plan layout and installation of electrical wiring, equipment and fixtures, based on job specifications and local codes.
- Test electrical systems and continuity of circuits in electrical wiring, equipment, and fixtures, using testing devices such as ohmmeters, voltmeters, and oscilloscopes, to ensure compatibility and safety of system.
- Perform business management duties such as maintaining records and files, preparing reports and ordering supplies and equipment.

Education & Certifications

Master Electrician License-State of Kentucky

Journeyman Electrician's License-Hamilton, Ohio

Fire Alarm License-State of Ohio

Certified in high voltage terminations and splices

Lift, Lull, Bobcat, and Boom/scissors lift licenses

OSHA-30 card

Certified in first aid and CPR training

Certified NCCER Core Curricula Instructor

Certified NCCER Electrical Instructor

Completed 4 year apprenticeship program

1 Year Pre-apprentice school (ABC)

High School Diploma (1991)

ARCH FLASH SAFETY TRAINING

PROJECTS-SUPERVISED

$4.5mil.-MASON HIGH SCHOOL ADDITION

$250.000-3CDC-5TH RACE PARKING GARAGE

$250.000-AVONEDALE APT. COMPLEX

$100.000-MAHOGANYS AT THE BANK-

1.2mil. -PATHEON CHEMICALS

$450.000- FED EX GROUND ADDITION

$250.000-LIBERTY WAY PROJECT

$500.000-GE AT THE BANKS

$100.000 - SYCAMORE SCHOOLS/POWER/CONTROL-

$50.000 - NKU RETROFIT

$250.000- UC POWER PLANT ADDITION

$75.000 - 580BLD/ CHEMED, RETROFIT

$4.0mil - DHL- CONVEYERS/SHELL

$90.000- DOUBLE TREE AIRPORT

$2.5mil- TWIN LAKES OF MONTGOMERY

$45.000- STEINMART ANDERSON

And many small T&M jobs.

All on time and under budget

[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: Kevin Collins (Contact Name)
Organization: IEC of Greater Cincinnati (Organization/Company)
Address: 586 Kings Run Drive (Include Room Number, Suite, etc.)
City: Cincinnati State: OH Zip: 45232
E-Mail: kcollins@iec-cincy.com
Telephone: 513-542-0400 Fax: —
Course Sponsor: IEC of Greater Cincinnati

COURSE INFORMATION:

Course Title: Box Fill

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

Purpose and Objective: Review article 314 of the NEC. We will calculate the type ~~b~~ of box as well as the minimum size required based of number of conductors, size of conductors & devices/clamps contained in the box.

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 ☐
Plumbing Plans Exam. ☐
Electrical Plans Exam. ☒
Mechanical Plans Exam. ☐
Building Inspector ☐
Fire Protection Inspector ☐
Mechanical Inspector ☐
Plumbing Inspector ☐
Non-Res IU Inspector ☐

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

Electrical Safety Inspectors ☒
Location of ESI Course: IEC of Greater Cincinnati Date(s) of ESI Course(s): 11/30/22

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

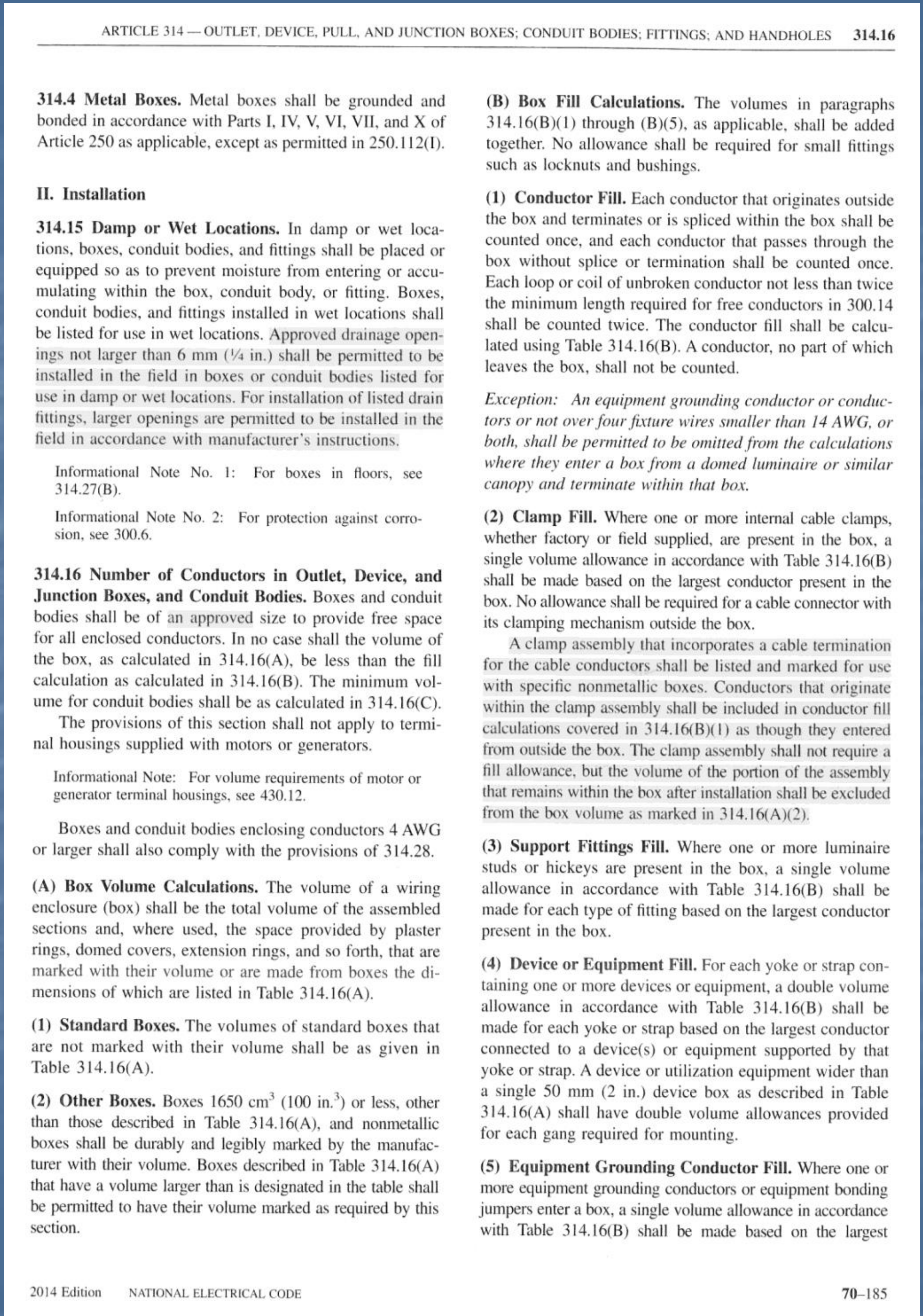
NOTE: The Board does NOT grant retroactive approval for courses presented prior to approval date.

Box Fill

314.16

Box Fill

- 314.16(A) & (B)



314.4 Metal Boxes. Metal boxes shall be grounded and bonded in accordance with Parts I, IV, V, VI, VII, and X of Article 250 as applicable, except as permitted in 250.112(I).

II. Installation

314.15 Damp or Wet Locations. In damp or wet locations, boxes, conduit bodies, and fittings shall be placed or equipped so as to prevent moisture from entering or accumulating within the box, conduit body, or fitting. Boxes, conduit bodies, and fittings installed in wet locations shall be listed for use in wet locations. Approved drainage openings not larger than 6 mm (¼ in.) shall be permitted to be installed in the field in boxes or conduit bodies listed for use in damp or wet locations. For installation of listed drain fittings, larger openings are permitted to be installed in the field in accordance with manufacturer's instructions.

Informational Note No. 1: For boxes in floors, see 314.27(B).

Informational Note No. 2: For protection against corrosion, see 300.6.

314.16 Number of Conductors in Outlet, Device, and Junction Boxes, and Conduit Bodies. Boxes and conduit bodies shall be of an approved size to provide free space for all enclosed conductors. In no case shall the volume of the box, as calculated in 314.16(A), be less than the fill calculation as calculated in 314.16(B). The minimum volume for conduit bodies shall be as calculated in 314.16(C).

The provisions of this section shall not apply to terminal housings supplied with motors or generators.

Informational Note: For volume requirements of motor or generator terminal housings, see 430.12.

Boxes and conduit bodies enclosing conductors 4 AWG or larger shall also comply with the provisions of 314.28.

(A) Box Volume Calculations. The volume of a wiring enclosure (box) shall be the total volume of the assembled sections and, where used, the space provided by plaster rings, domed covers, extension rings, and so forth, that are marked with their volume or are made from boxes the dimensions of which are listed in Table 314.16(A).

(1) Standard Boxes. The volumes of standard boxes that are not marked with their volume shall be as given in Table 314.16(A).

(2) Other Boxes. Boxes 1650 cm^3 (100 in.^{3}) or less, other than those described in Table 314.16(A), and nonmetallic boxes shall be durably and legibly marked by the manufacturer with their volume. Boxes described in Table 314.16(A) that have a volume larger than is designated in the table shall be permitted to have their volume marked as required by this section.

(B) Box Fill Calculations. The volumes in paragraphs 314.16(B)(1) through (B)(5), as applicable, shall be added together. No allowance shall be required for small fittings such as locknuts and bushings.

(1) Conductor Fill. Each conductor that originates outside the box and terminates or is spliced within the box shall be counted once, and each conductor that passes through the box without splice or termination shall be counted once. Each loop or coil of unbroken conductor not less than twice the minimum length required for free conductors in 300.14 shall be counted twice. The conductor fill shall be calculated using Table 314.16(B). A conductor, no part of which leaves the box, shall not be counted.

Exception: An equipment grounding conductor or conductors or not over four fixture wires smaller than 14 AWG, or both, shall be permitted to be omitted from the calculations where they enter a box from a domed luminaire or similar canopy and terminate within that box.

(2) Clamp Fill. Where one or more internal cable clamps, whether factory or field supplied, are present in the box, a single volume allowance in accordance with Table 314.16(B) shall be made based on the largest conductor present in the box. No allowance shall be required for a cable connector with its clamping mechanism outside the box.

A clamp assembly that incorporates a cable termination for the cable conductors shall be listed and marked for use with specific nonmetallic boxes. Conductors that originate within the clamp assembly shall be included in conductor fill calculations covered in 314.16(B)(1) as though they entered from outside the box. The clamp assembly shall not require a fill allowance, but the volume of the portion of the assembly that remains within the box after installation shall be excluded from the box volume as marked in 314.16(A)(2).

(3) Support Fittings Fill. Where one or more luminaire studs or hickeys are present in the box, a single volume allowance in accordance with Table 314.16(B) shall be made for each type of fitting based on the largest conductor present in the box.

(4) Device or Equipment Fill. For each yoke or strap containing one or more devices or equipment, a double volume allowance in accordance with Table 314.16(B) shall be made for each yoke or strap based on the largest conductor connected to a device(s) or equipment supported by that yoke or strap. A device or utilization equipment wider than a single 50 mm (2 in.) device box as described in Table 314.16(A) shall have double volume allowances provided for each gang required for mounting.

(5) Equipment Grounding Conductor Fill. Where one or more equipment grounding conductors or equipment bonding jumpers enter a box, a single volume allowance in accordance with Table 314.16(B) shall be made based on the largest

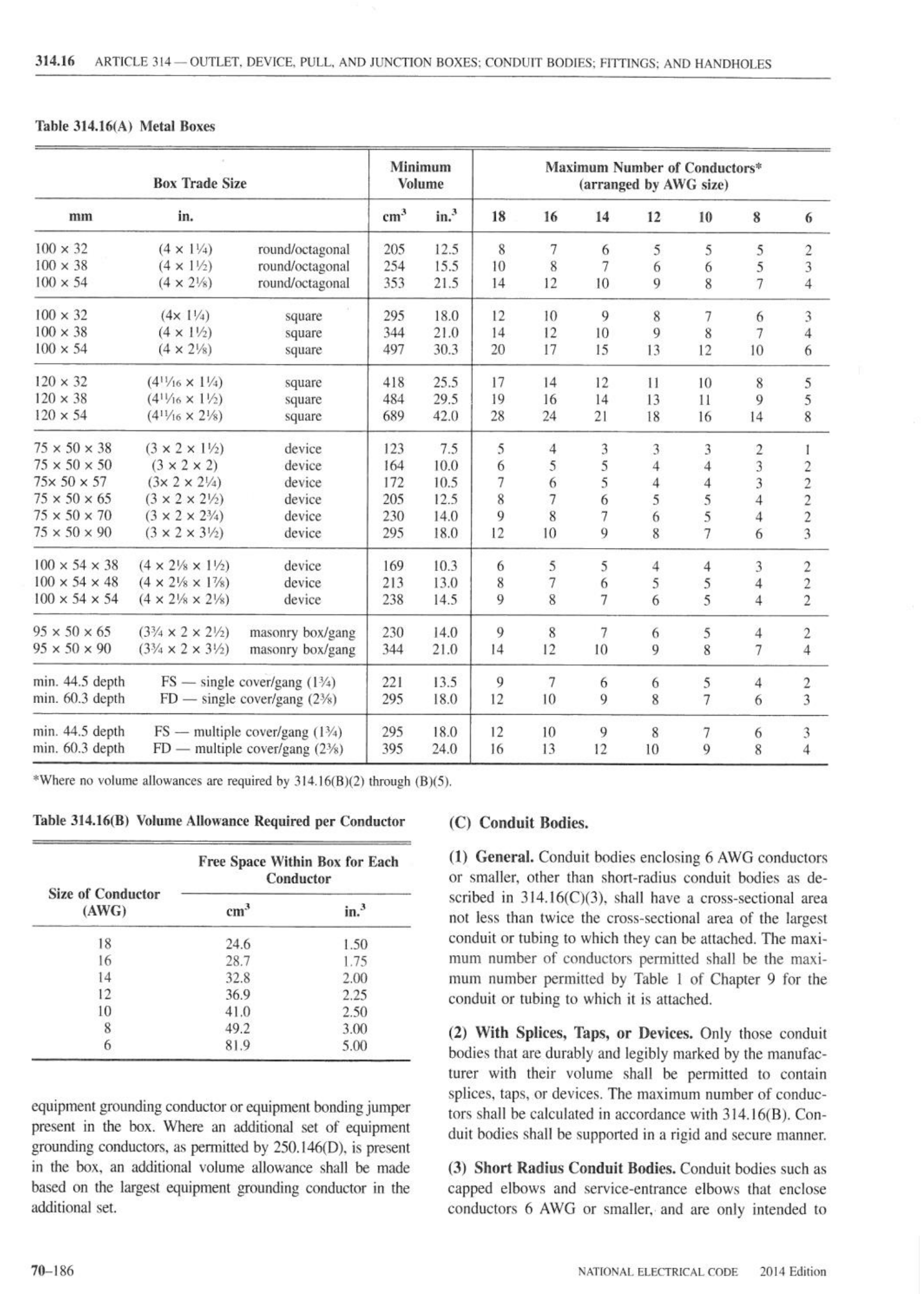


Table 314.16(A) Metal Boxes

Box Trade Size			Minimum Volume		Maximum Number of Conductors* (arranged by AWG size)						
mm	in.		cm^3	in.^{3}	18	16	14	12	10	8	6
100 × 32	(4 × 1¼)	round/octagonal	205	12.5	8	7	6	5	5	5	2
100 × 38	(4 × 1½)	round/octagonal	254	15.5	10	8	7	6	6	5	3
100 × 54	(4 × 2⅛)	round/octagonal	353	21.5	14	12	10	9	8	7	4
100 × 32	(4× 1¼)	square	295	18.0	12	10	9	8	7	6	3
100 × 38	(4 × 1½)	square	344	21.0	14	12	10	9	8	7	4
100 × 54	(4 × 2⅛)	square	497	30.3	20	17	15	13	12	10	6
120 × 32	(4¹¹⁄₁₆ × 1¼)	square	418	25.5	17	14	12	11	10	8	5
120 × 38	(4¹¹⁄₁₆ × 1½)	square	484	29.5	19	16	14	13	11	9	5
120 × 54	(4¹¹⁄₁₆ × 2⅛)	square	689	42.0	28	24	21	18	16	14	8
75 × 50 × 38	(3 × 2 × 1½)	device	123	7.5	5	4	3	3	3	2	1
75 × 50 × 50	(3 × 2 × 2)	device	164	10.0	6	5	5	4	4	3	2
75× 50 × 57	(3× 2 × 2¼)	device	172	10.5	7	6	5	4	4	3	2
75 × 50 × 65	(3 × 2 × 2½)	device	205	12.5	8	7	6	5	5	4	2
75 × 50 × 70	(3 × 2 × 2¾)	device	230	14.0	9	8	7	6	5	4	2
75 × 50 × 90	(3 × 2 × 3½)	device	295	18.0	12	10	9	8	7	6	3
100 × 54 × 38	(4 × 2⅛ × 1½)	device	169	10.3	6	5	5	4	4	3	2
100 × 54 × 48	(4 × 2⅛ × 1⅞)	device	213	13.0	8	7	6	5	5	4	2
100 × 54 × 54	(4 × 2⅛ × 2⅛)	device	238	14.5	9	8	7	6	5	4	2
95 × 50 × 65	(3¾ × 2 × 2½)	masonry box/gang	230	14.0	9	8	7	6	5	4	2
95 × 50 × 90	(3¾ × 2 × 3½)	masonry box/gang	344	21.0	14	12	10	9	8	7	4
min. 44.5 depth	FS — single cover/gang (1¾)		221	13.5	9	7	6	6	5	4	2
min. 60.3 depth	FD — single cover/gang (2⅜)		295	18.0	12	10	9	8	7	6	3
min. 44.5 depth	FS — multiple cover/gang (1¾)		295	18.0	12	10	9	8	7	6	3
min. 60.3 depth	FD — multiple cover/gang (2⅜)		395	24.0	16	13	12	10	9	8	4

*Where no volume allowances are required by 314.16(B)(2) through (B)(5).

Table 314.16(B) Volume Allowance Required per Conductor

Size of Conductor (AWG)	Free Space Within Box for Each Conductor	
	cm^3	in.^{3}
18	24.6	1.50
16	28.7	1.75
14	32.8	2.00
12	36.9	2.25
10	41.0	2.50
8	49.2	3.00
6	81.9	5.00

equipment grounding conductor or equipment bonding jumper present in the box. Where an additional set of equipment grounding conductors, as permitted by 250.146(D), is present in the box, an additional volume allowance shall be made based on the largest equipment grounding conductor in the additional set.

(C) Conduit Bodies.

(1) General. Conduit bodies enclosing 6 AWG conductors or smaller, other than short-radius conduit bodies as described in 314.16(C)(3), shall have a cross-sectional area not less than twice the cross-sectional area of the largest conduit or tubing to which they can be attached. The maximum number of conductors permitted shall be the maximum number permitted by Table 1 of Chapter 9 for the conduit or tubing to which it is attached.

(2) With Splices, Taps, or Devices. Only those conduit bodies that are durably and legibly marked by the manufacturer with their volume shall be permitted to contain splices, taps, or devices. The maximum number of conductors shall be calculated in accordance with 314.16(B). Conduit bodies shall be supported in a rigid and secure manner.

(3) Short Radius Conduit Bodies. Conduit bodies such as capped elbows and service-entrance elbows that enclose conductors 6 AWG or smaller, and are only intended to

Box fill

- 314.16 (A) – simpler chart – metal boxes
- 314.16 (B) - needed when wire sizes are different and factors other than conductors are involved (clamps, devices)
- If conductors are #4 and larger shall also comply with 314.28 (see 314.16)
- 314.17 (C) Non metallic boxes
  - Exception – within 8" of the box

Box fill

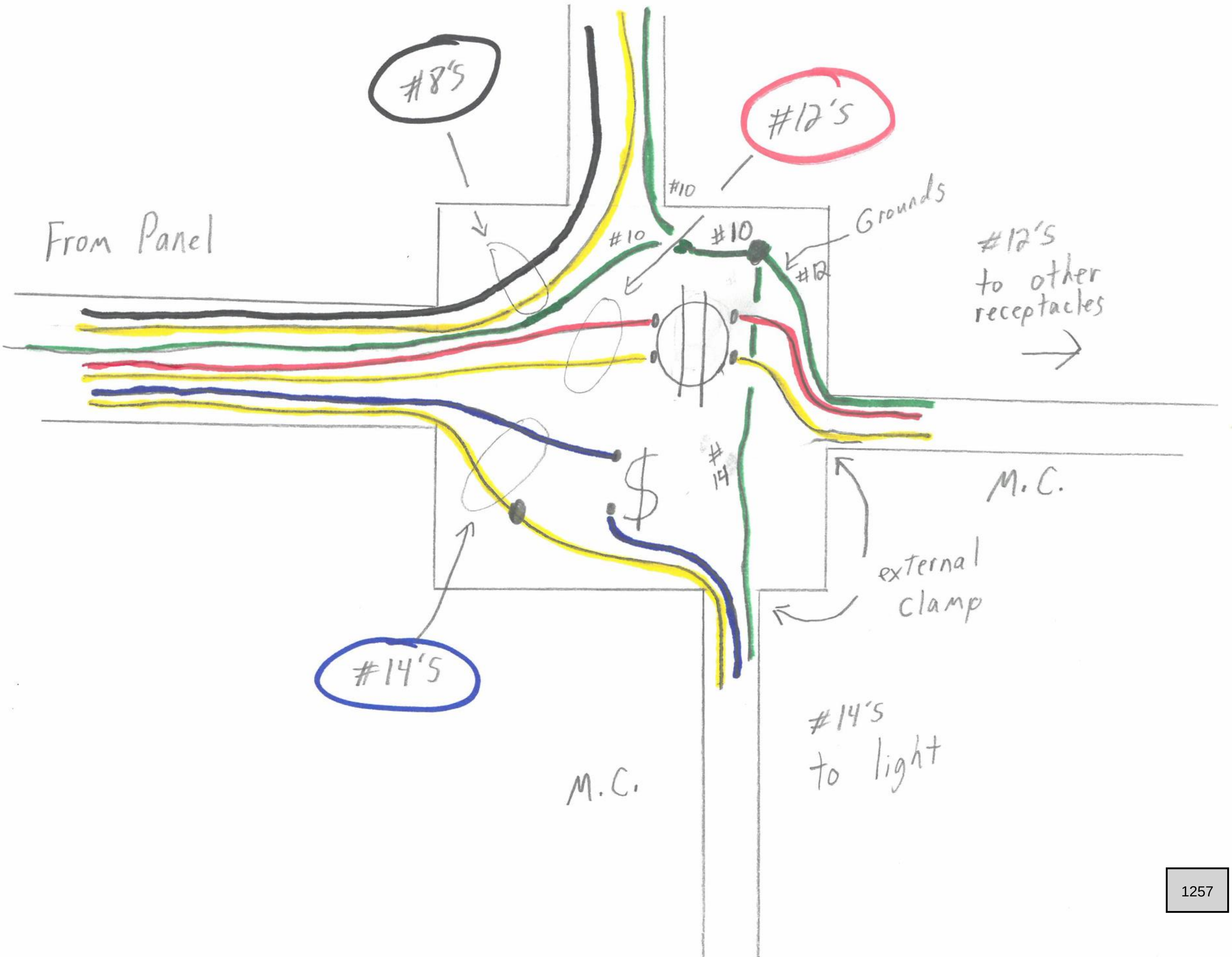
- How many #12 can fit into a 3x2x2 device box?
- How many #8 can fit into a 4 x 2 1/8 round box?

Box fill

- How many #12 can fit into a 3x2x2 device box?
  - **4**
- How many #8 can fit into a 4 x 2 1/8 round box?
  - **7**
    - Make sure boxes match exactly.

Box Fill – 314.16 (B)

- Wires passing through count once
- Fixture wires smaller than #14 do not count
- Internal clamp – counted once no matter how many – based on largest conductor in box
  - External connectors do not count
- Support fittings – counted once no matter how many – based on largest conductor size
- Devices or equipment yoke – count twice for each one based on largest wire size going to device
- Equipment grounds – No matter how many grounds, only 1 (based on largest ground) shall be counted
  - Equipment ground calculation has been revised in 2020.

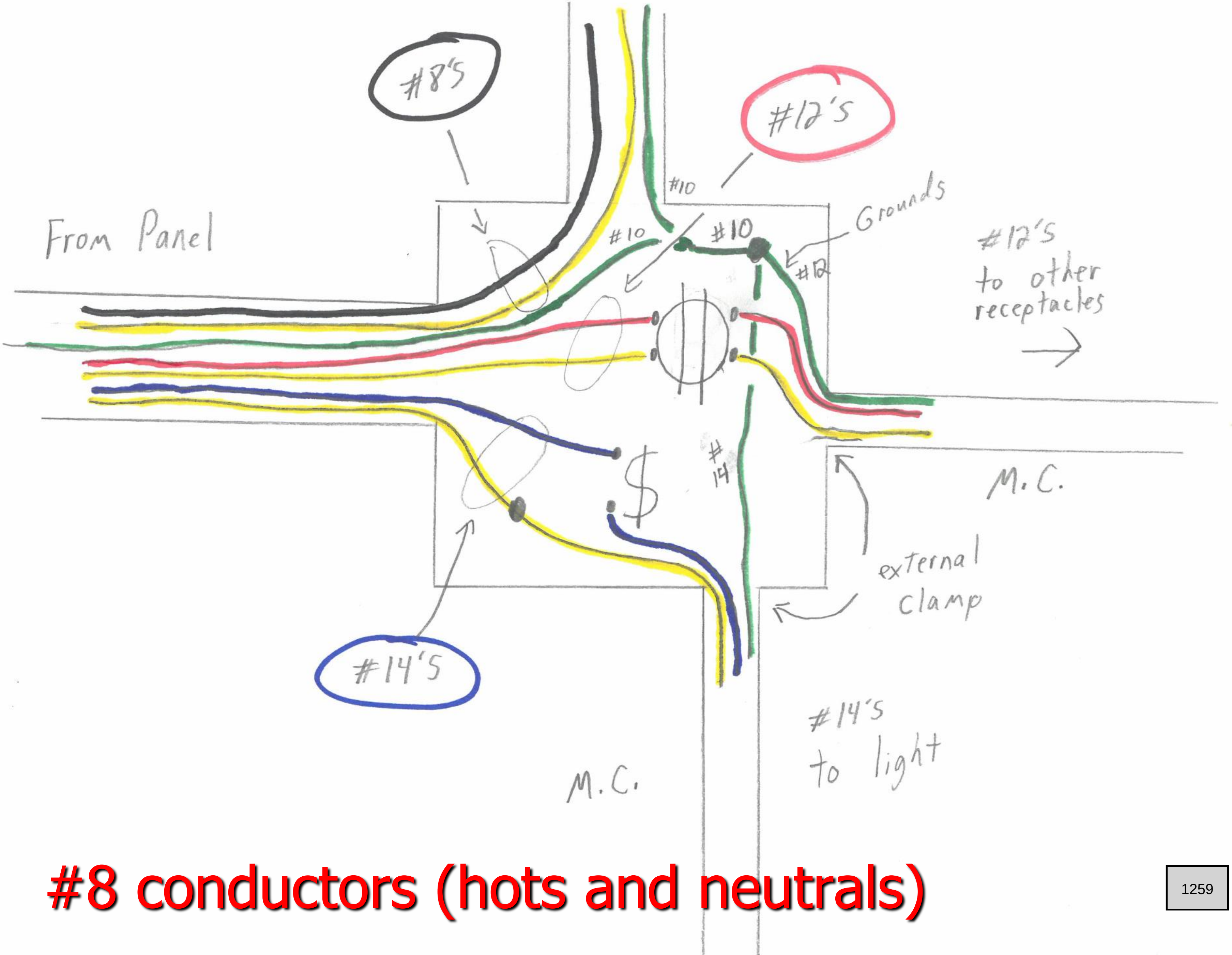

#8's
#12's
From Panel
#10
#10
#10
Grounds
#12
#12's to other receptacles
M.C.
#14
external clamp
#14's
#14's to light
M.C.

Box Fill

I have a raceway coming from a panel and terminating into a box.

In the box I have

- 2 - #8's passing straight through
- A #12 ungrounded and grounded conductor landing on a receptacle and then leaving the box to pick up other receptacles.
- A #14 ungrounded and grounded conductor enter the box. The "hot" lands on the line side of a switch. A "hot" then leaves the switch heading toward a light. The neutral is spliced and heads towards the light.
- A #10 ground enters the box. It is spliced with a #14 and #12. The #14 heads off toward the light, the #12 heads off to the other receptacles.
- The cables heading toward the other receptacle and the lights have external clamps.

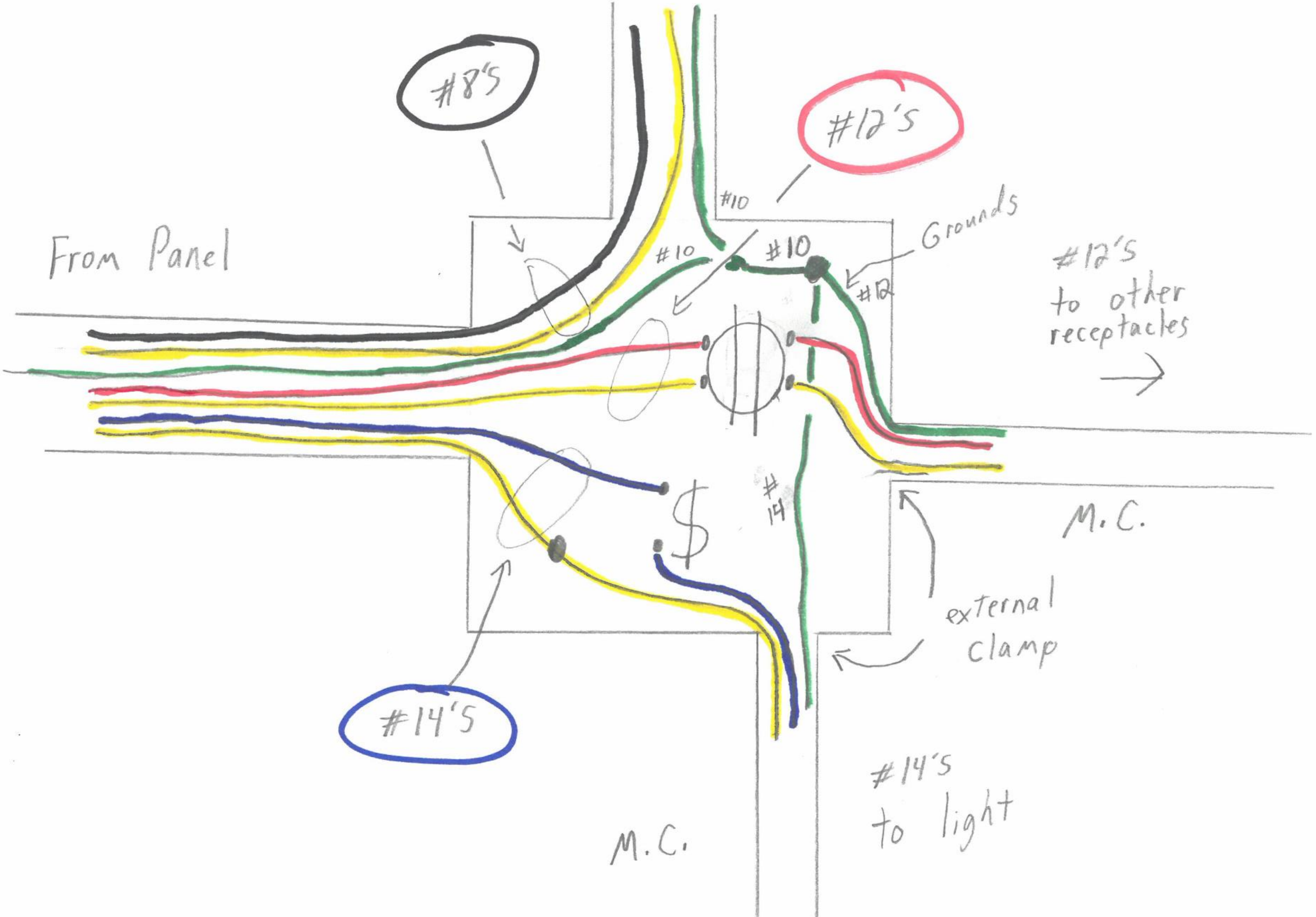


#8 conductors (hots and neutrals)

Box Fill

- 2 - #8’s pass straight through
- The volume allowance for a #8 is 3 in cubed

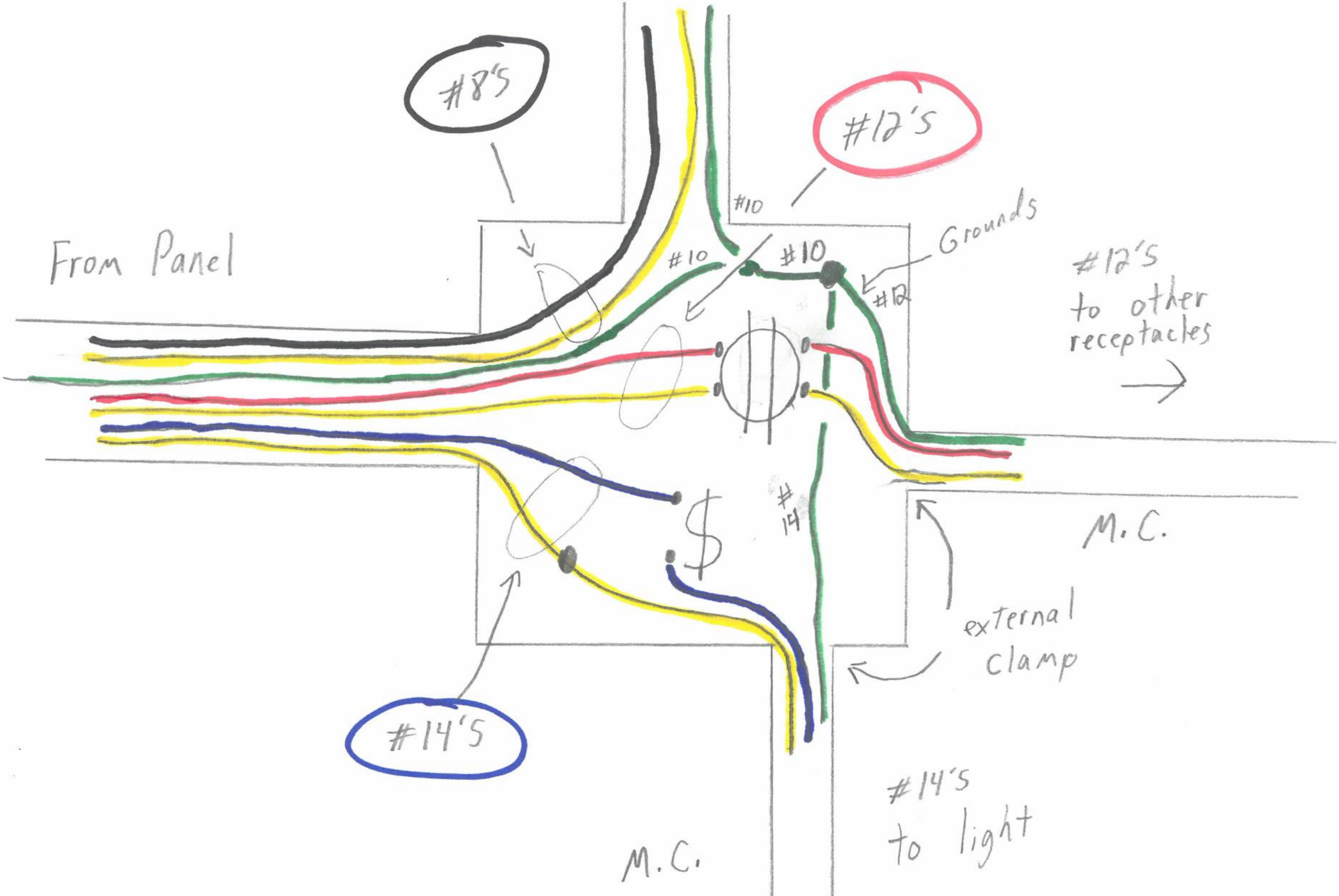
- 2 x 3 = 6
  - This is your volume of your number #8’s



#12 conductors (hots and neutrals)

Box Fill

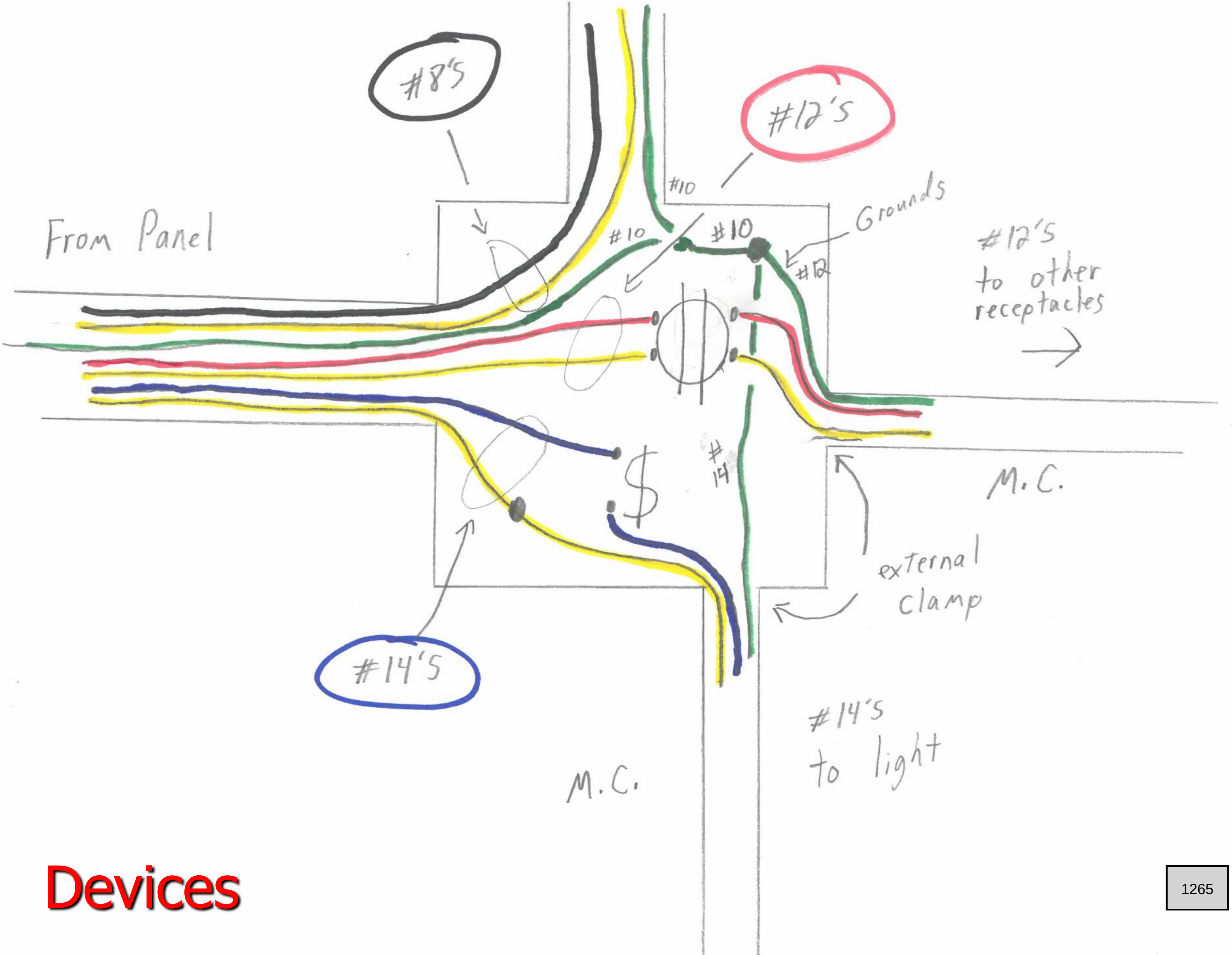
- 2 - #12’s enter the box and 2 leave the box. This is not going straight through.
- Therefore you have 4 - #12 conductors
- Each #12 has a volume of 2.25 in. cubed
  - Therefore 4 x 2.25 = 9



#14 conductors (hots and neutrals)

Box Fill

- 2 - #14’s enter the box and 2 leave the box. Since the neutral is spliced, this is not going straight through.
- You have 4 - #14 conductors
  - 4 x 2.00 = 8 inches cubed


#8's
#12's
From Panel
#10
#10
#10
Grounds
#12
#12's
to other
receptacles
#14
$
M.C.
external
clamp
#14's
#14's
to light
M.C.

Devices

Box Fill

- This takes care of your hots and neutrals.

Devices

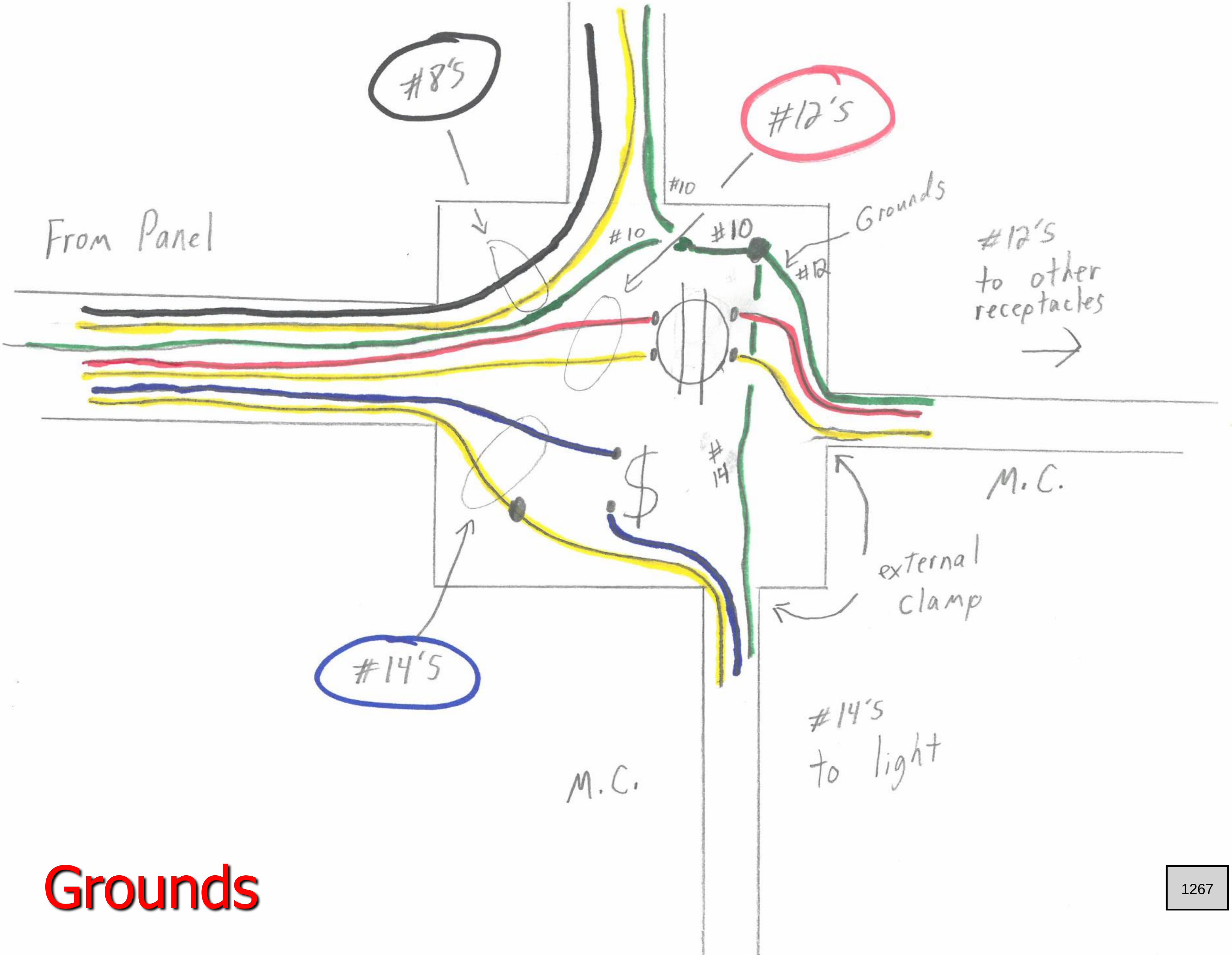
#12’s land on the receptacle

For a device, you take double the allowance of the largest conductor landed on the devices

2 x 2.25 (#12) = 4.5

#14’s land on the switch

2 x 2.00 (#14) = 4.0


#8's
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#10
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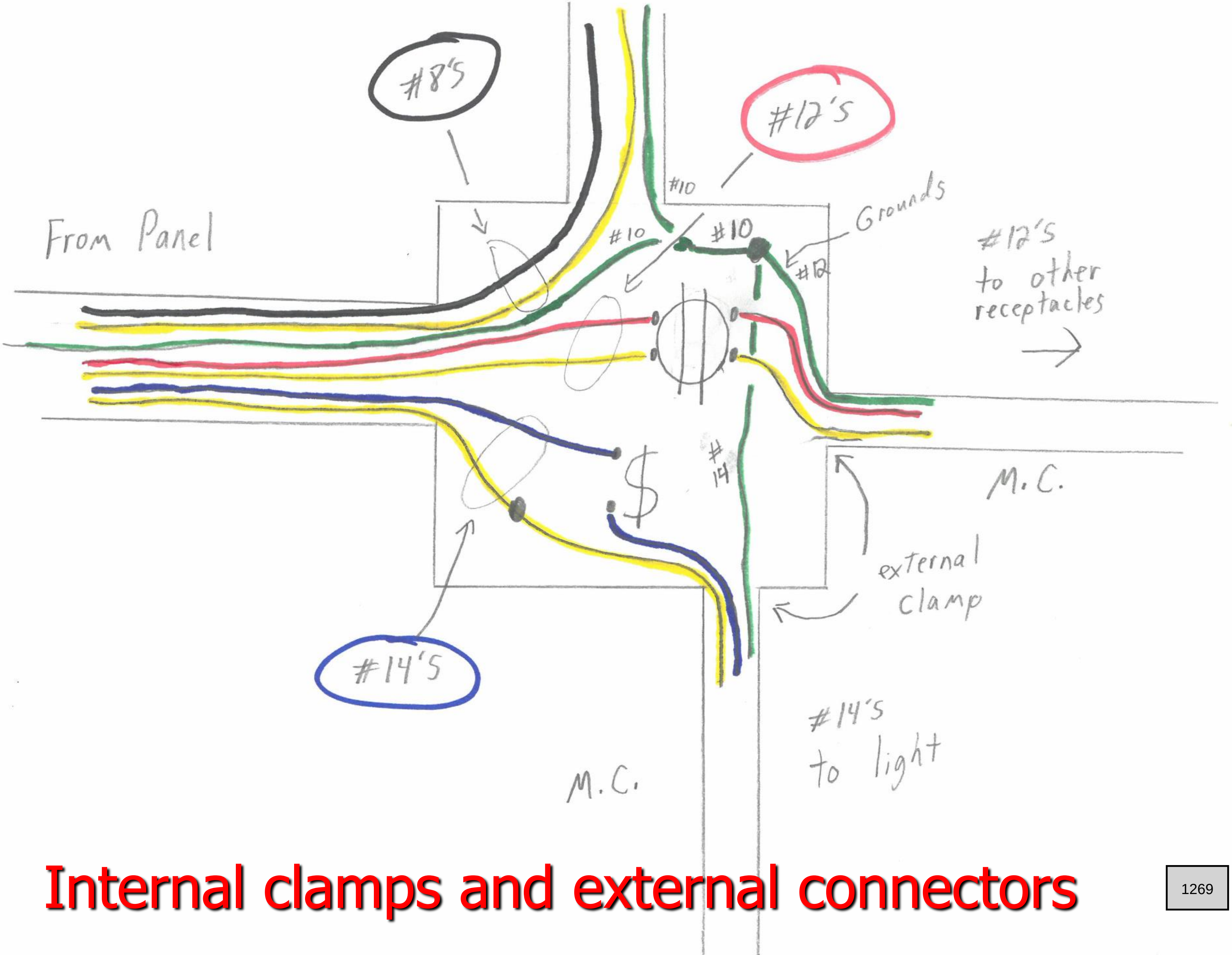
#12
From Panel
#12's
to other
receptacles
$
#14
external
clamp
M.C.
#14's
M.C.
#14's
to light

Grounds

Box Fill

- Grounds
  - You only need to take the largest size
  - There is 2 - #10’s, 1 - #12 and 1 - #14

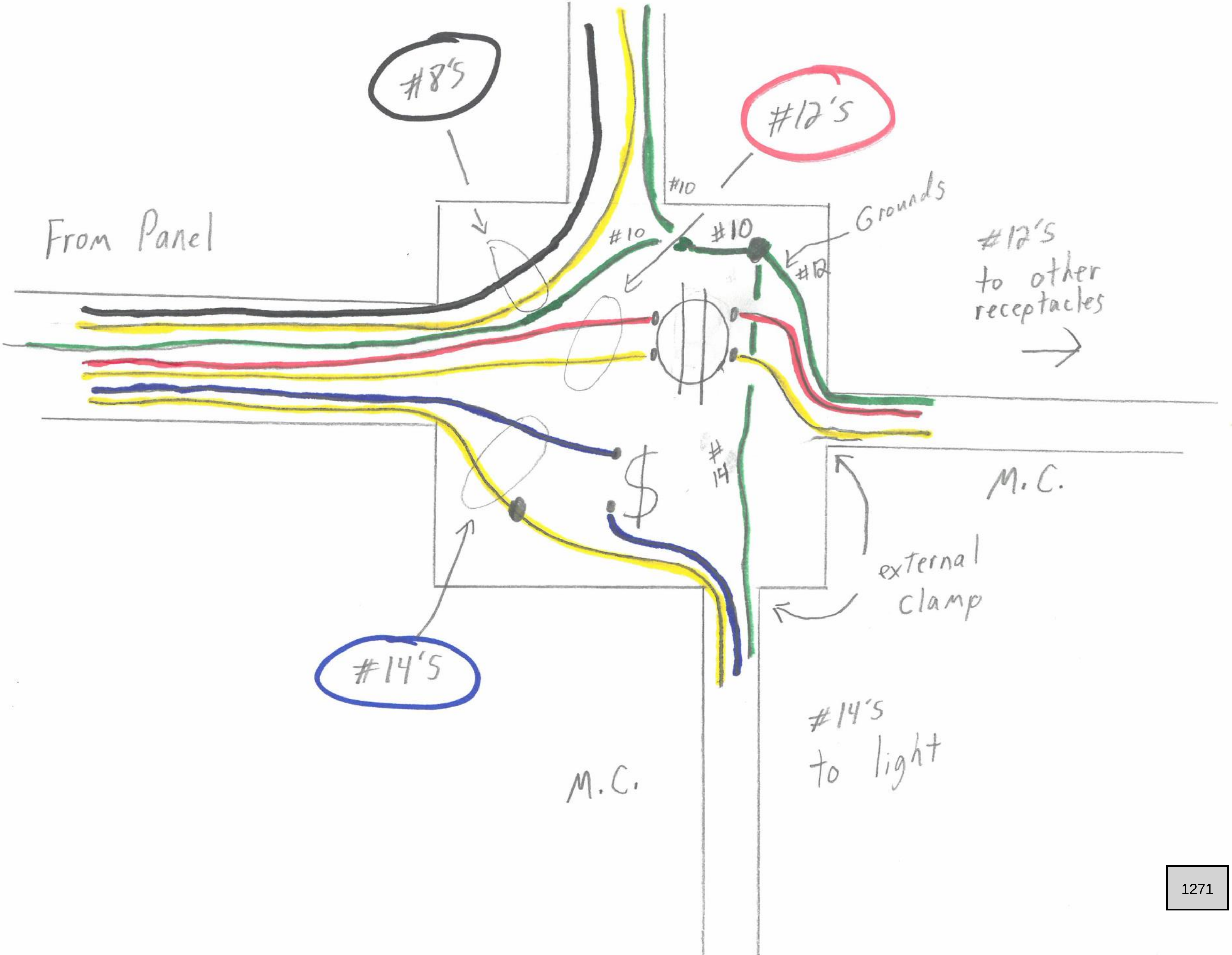
1 x 2.5 (#10) = 2.5



Internal clamps and external connectors

Box Fill

- Clamps
- You have two external clamps
  - NO ALLOWANCE REQUIRED
- Had this been internal clamps you would have taken 1 x 3.00. No matter how many internal clamps you have, take 1 x the largest conductor in the box.


#8's
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#10
#10
Grounds
#12
#12's to other receptacles
$
#14
M.C.
external clamp
#14's
M.C.
#14's to light

Box Fill

- Therefore

6 (# 8's passing through)

9 (#12's hots and neutrals on receptacle)

8 (#14's hots and neutrals on switch)

4.5 (receptacle - #12's on it)

4 (switch - #14's on it)

+ 2.5 (grounds – based on 1 - #10)

34

Box Fill

34 Cubic Inches are needed.

- You could legally have a 4 11/16 x 2 1/8 square box contain the conductors/devices.
- No 4 square is big enough – maxes at 30.3

Box fill

- What is the minimum size square box is needed for
- 4 - #14 phase conductors
- 3 - #12 phase conductors
- 2 - #10 phase conductors
- 2 - #10 equipment ground
- 2 - #12 equipment grounds
- 1 device attached to the #12
- 2 external clamps
- 2 internal clamps:

Box fill

- What is the minimum size square box is needed for
- 4 - #14 phase conductors = **4 x 2.00 = 8**
- 3 - #12 phase conductors = **3 x 2.25 = 6.75**
- 2 - #10 phase conductors = **2 x 2.50 = 5.00**
- 2 - #10 ground = **1 x 2.50 = 2.50 (only 1 needed)**
- 2 - #12 grounds = **0 (#10 ground accounted for)**
- 1 device = **2 x 2.25 = 4.50**
  - **(twice the largest conductor attached to device)**
- 2 external clamps = **0 = no allowance needed**
- 2 internal clamps = **1 x 2.50 = 2.50**

8.00 + 6.75 + 5.00 + 2.50 + 4.50 + 2.50 =**29.25**

Box fill

29.25 Cubic Inches

Go to box volume

make sure to look up correct box type (round, square, device, masonry)

4 11/16 x 1 ½" has a 29.5 allowance.

4 11/16 x 2 1/8" and 4 x 2 1/8" would be legal but would not be correct

- Pick **minimum** size needed.
- Do not pick largest box so that you are covered.

Box fill

- If box has #4 or larger, use 314.28
    - Refers to this article in 314.16
        - Straight Pulls
        - Angle or U Pulls

If conductors are pulled straight through a box, multiply the largest raceway by 8. The product will be the minimum length of the box to the opposite wall.

Box fill

Ex: A 3” conduit contains #10, #8 and #2 conductors. There is a pull box in the middle of a straight run which has the 3” conduit entering and leaving on opposite walls would require at LEAST a 24”x24” box (3” x 8) across.

Box fill

- A box will angle or U bends
- (anything not straight through)
  - Take the largest conduit on ONE side and multiply it by 6.
  - Add any additional conduits ON THE SAME SIDE to it.
  - This is the minimum dimension to the opposite wall of the box.
  - Technically must be done to all 4 sides.

Box fill

Ex: A pull box contains 1/0, #3’s and #12’s has:

1 - 2”, 3 – 1” and 2 – ¾” conduit on the left side.

1 – 2”, 3 – 1” on the bottom.

2 – 1” on the right.

Box fill

1 - 2″, 3 – 1″ and 2 – ¾″ conduit on the left side.
1 – 2″, 3 – 1″ on the bottom

2 – 1″ on the right.

- Left side:

1 – 2″ (largest size) = 2″ x 6 = 12″

12″ + 1″ + 1″ + 1″ + ¾″ + ¾″ = 16 ½″

Box fill

1 - 2″, 3 – 1″ and 2 – ¾″ conduit on the left side.
1 – 2″, 3 – 1″ on the bottom
2 – 1″ on the right.

- Bottom:

1 – 2″ (largest size) = 2″ x 6 = 12″
12″ + 1″ + 1″ + 1″ + = 15″

Box fill

1 - 2″, 3 – 1″ and 2 – ¾″ conduit on the left side.
1 – 2″, 3 – 1″ on the bottom
2 – 1″ on the right.

- Right side:

1 – 1″ (largest size) = 1″ x 6 = 6″
6″ + 1″= 7″

Box fill

- From Left side – 16 ½″ across
- From Bottom – 12″ up
- From Right side – 7″ across

- Smallest pull box would be 16 ½″.
  - If in field, would just round up.

File Attachments for Item:

ER-11 Conductor Types, Ampacities, Correction Factors (Independent Electrical Contractors)

EPE, ESI, RBO (4 hours)

Staff Notes: Received after ESIAC submission: Recommend referral to ESIAC for recommendations.

Committee Recommendation:

Box and conduit fill – derating
9/17/09
5-8 PM

5 P.M.
Box Fill

By applying 310.14, you need to know how many conductors you can legally fit in a metal or plastic box. Devices and supports can also affect your calculation

6 P.M.
Sizing conduits

By using tables 4 and 5 in the NEC you can calculate the total area of the conductors you are running as well as the allowable space inside of different types and sizes of conduits

7 P.M.
Derating ampacities

310.15 (b)(2) lessens the ampacity allowed for conductors once you have put more than 4 conductors in a raceway. We will look at common derating factors and apply them to normal construction applications.

[redacted]

APPLICATION

FOR

Continuing Education Course Approval

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

Board of Building Standards
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www.com.state.oh.us/dic/dicbbs.htm

COURSE SUBMITTER:

Course Submitter: Kevin Collins
(Contact Name)
Organization: IEC of Greater Cincinnati
(Organization/Company)
Address: 586 Kings Run Drive
(Include Room Number, Suite, etc.)
City: Cincinnati State: OH Zip: 45232
E-Mail: kcollins@iec-cincy.com
Telephone: 513-542-0400 Fax: —
Course Sponsor: IEC of Greater Cincinnati

COURSE INFORMATION:

Course Title: Conductor types, ampacities, correction factors

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

Purpose and Objective: Review article 310 of the NEC. We will discuss where different types of conductors are allowed and not allowed. We will also allowable ampacities as well as corrected ampacities based on ambient temperatures and number of conductors in a conduit.

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 ☐
Plumbing Plans Exam. ☐
Electrical Plans Exam. ☒
Mechanical Plans Exam. ☐
Building Inspector ☐
Fire Protection Inspector ☐
Mechanical Inspector ☐
Plumbing Inspector ☐
Non-Res IU Inspector ☐

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

Electrical Safety Inspectors ☒
Location of ESI Course: IEC of Greater Cincinnati Date(s) of ESI Course(s): 10/19/22

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

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

Sean Clark

901 Beechmeadow Ln. Cincinnati, Ohio 45238
(H)513/347-9054 (C)513/800-4450
sclark@ohiovalleyelectric.com

* * *

A licensed electrician with over twenty years of experience in installing, maintaining, and repairing electrical wiring, equipment, and fixtures, ensuring that work is in accordance with relevant codes, fire alarm installations, electrical control systems, and high voltage terminations. A licensed electrician with three years teaching experience in first and second year electrical.

Summary of Qualifications

- More than twenty years experience.
- Three years experience in teaching first and second year electrical.
- Thorough knowledge of electrical systems including planning additions and modifications on secondary circuits. Controls and low voltage wiring
- Able to read commercial electrical blueprints and apply NEC through the full range of commercial and industrial maintenance and construction work.
- Can use appropriate tools and diagnostic equipment to repair, install, replace, and test electrical circuits, equipment and appliances.
- Excellent ability to diagnose and repair electrical controls, industrial motor control centers, and programmable logic controllers.
- Strong desire to study and comprehend new technology.
- In-depth ability to make mathematical computations.
- Considerable ability to explain instructions and guidelines to others effectively.
- Able to assign work to employees., prioritize the work of others and organize and coordinate the work of the unit. For subs and Primes.

Professional Experience

Ohio Valley Electrical Services	2011-Present
ABC Electrical Teacher	2010-2013
Beacon Electrical Contractors	2007-2011
Ohio Valley Electrical Services	1993-2007

Electrical Superintendant/Foreman/Instructor

- First and Second year electrical instructor
- Supervision of all electrical installations of as many as 50 electricians to assure that work was done safely, efficiently, properly and within time allowed.
- Trained multiple employees in all aspects of electrical work to be able to identify an employee's strengths and weaknesses to better utilize their skills. Traced out short circuits in wiring, using test meter.
- Coordinated and implemented electrical projects within a variety of environments including plants, hospitals, schools, retail stores, public facilities, waste water treatment plants industrial buildings;

projects include both new construction and underground electrical wiring as well as renovation within existing buildings. Parking Garages and Fed Ex Ground Facilities.

- Assemble, install, test, and maintain electrical or electronic wiring, equipment, appliances, apparatus, and fixtures, using hand tools and power tools.
- Connect wires to circuit breakers, transformers, or other components.
- Construct and fabricate parts, using hand tools and specifications.
- Diagnose malfunctioning systems, apparatus, and components, using test equipment and hand tools, to locate the cause of a breakdown and correct the problem.
- Inspect electrical systems, equipment, and components to identify hazards, defects, and the need for adjustment or repair, and to ensure compliance with codes.
- Plan layout and installation of electrical wiring, equipment and fixtures, based on job specifications and local codes.
- Test electrical systems and continuity of circuits in electrical wiring, equipment, and fixtures, using testing devices such as ohmmeters, voltmeters, and oscilloscopes, to ensure compatibility and safety of system.
- Perform business management duties such as maintaining records and files, preparing reports and ordering supplies and equipment.

Education & Certifications

Master Electrician License-State of Kentucky

Journeyman Electrician's License-Hamilton, Ohio

Fire Alarm License-State of Ohio

Certified in high voltage terminations and splices

Lift, Lull, Bobcat, and Boom/scissors lift licenses

OSHA-30 card

Certified in first aid and CPR training

Certified NCCER Core Curricula Instructor

Certified NCCER Electrical Instructor

Completed 4 year apprenticeship program

1 Year Pre-apprentice school (ABC)

High School Diploma (1991)

ARCH FLASH SAFETY TRAINING

PROJECTS-SUPERVISED

$4.5mil.-MASON HIGH SCHOOL ADDITION

$250.000-3CDC-5TH RACE PARKING GARAGE

$250.000-AVONEDALE APT. COMPLEX

$100.000-MAHOGANYS AT THE BANK-

1.2mil. -PATHEON CHEMICALS

$450.000- FED EX GROUND ADDITION

$250.000-LIBERTY WAY PROJECT

$500.000-GE AT THE BANKS

$100.000 - SYCAMORE SCHOOLS/POWER/CONTROL-

$50.000 - NKU RETROFIT

$250.000- UC POWER PLANT ADDITION

$75.000 - 580BLD/ CHEMED, RETROFIT

$4.0mil - DHL- CONVEYERS/SHELL

$90.000- DOUBLE TREE AIRPORT

$2.5mil- TWIN LAKES OF MONTGOMERY

$45.000- STEINMART ANDERSON

And many small T&M jobs.

All on time and under budget

Ampacities
Article 310.15 & 16

Ampacities

- 310.15(B)(16)

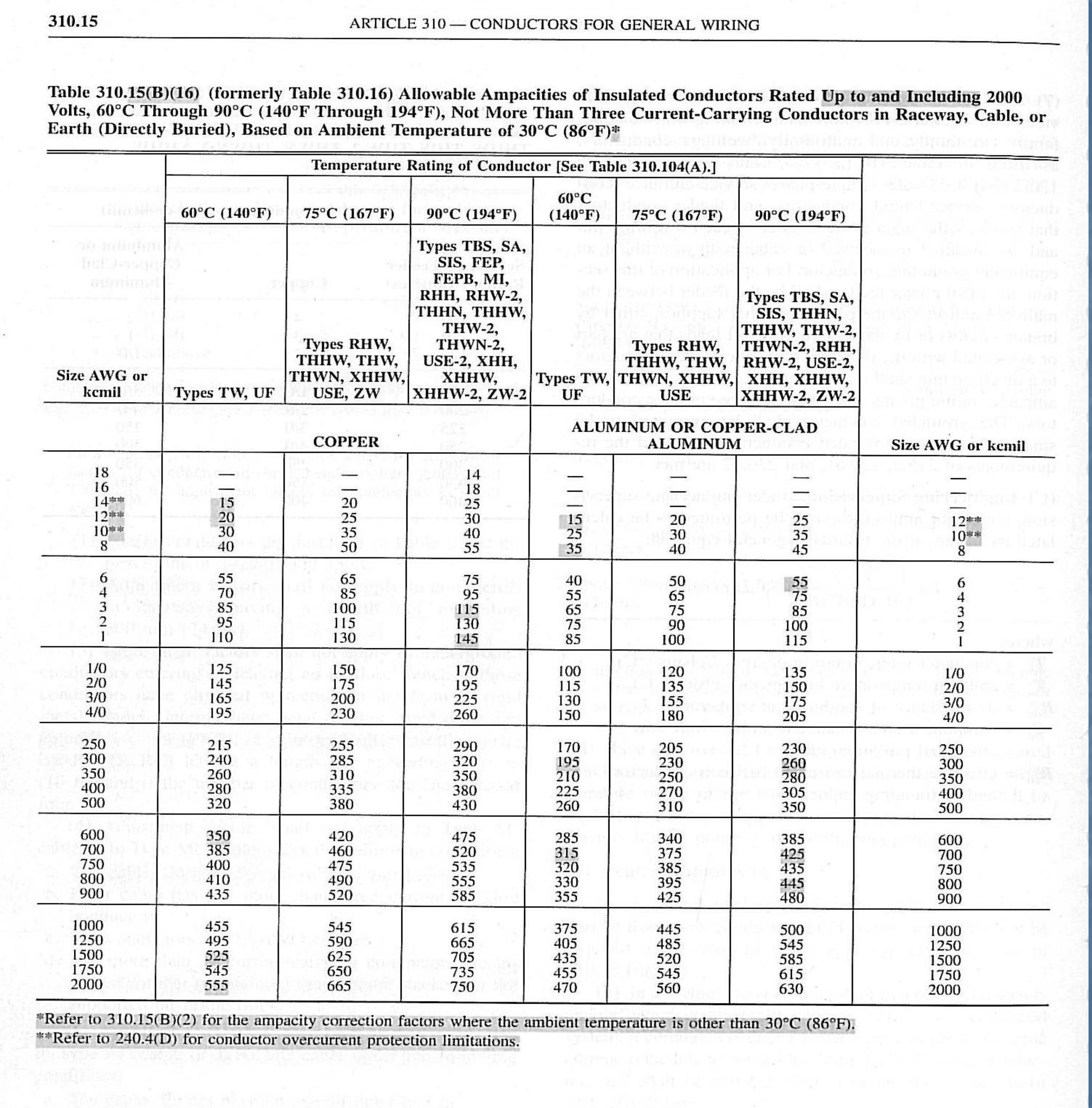


Table 310.15(B)(16) (formerly Table 310.16) Allowable Ampacities of Insulated Conductors Rated Up to and Including 2000 Volts, 60°C Through 90°C (140°F Through 194°F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)*

	Temperature Rating of Conductor [See Table 310.104(A).]						
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
Size AWG or kcmil	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			Size AWG or kcmil
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14**	15	20	25	—	—	—	—
12**	20	25	30	15	20	25	12**
10**	30	35	40	25	30	35	10**
8	40	50	55	35	40	45	8
6	55	65	75	40	50	55	6
4	70	85	95	55	65	75	4
3	85	100	115	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	145	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	195	230	260	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	350	420	475	285	340	385	600
700	385	460	520	315	375	425	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	445	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	525	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	555	665	750	470	560	630	2000

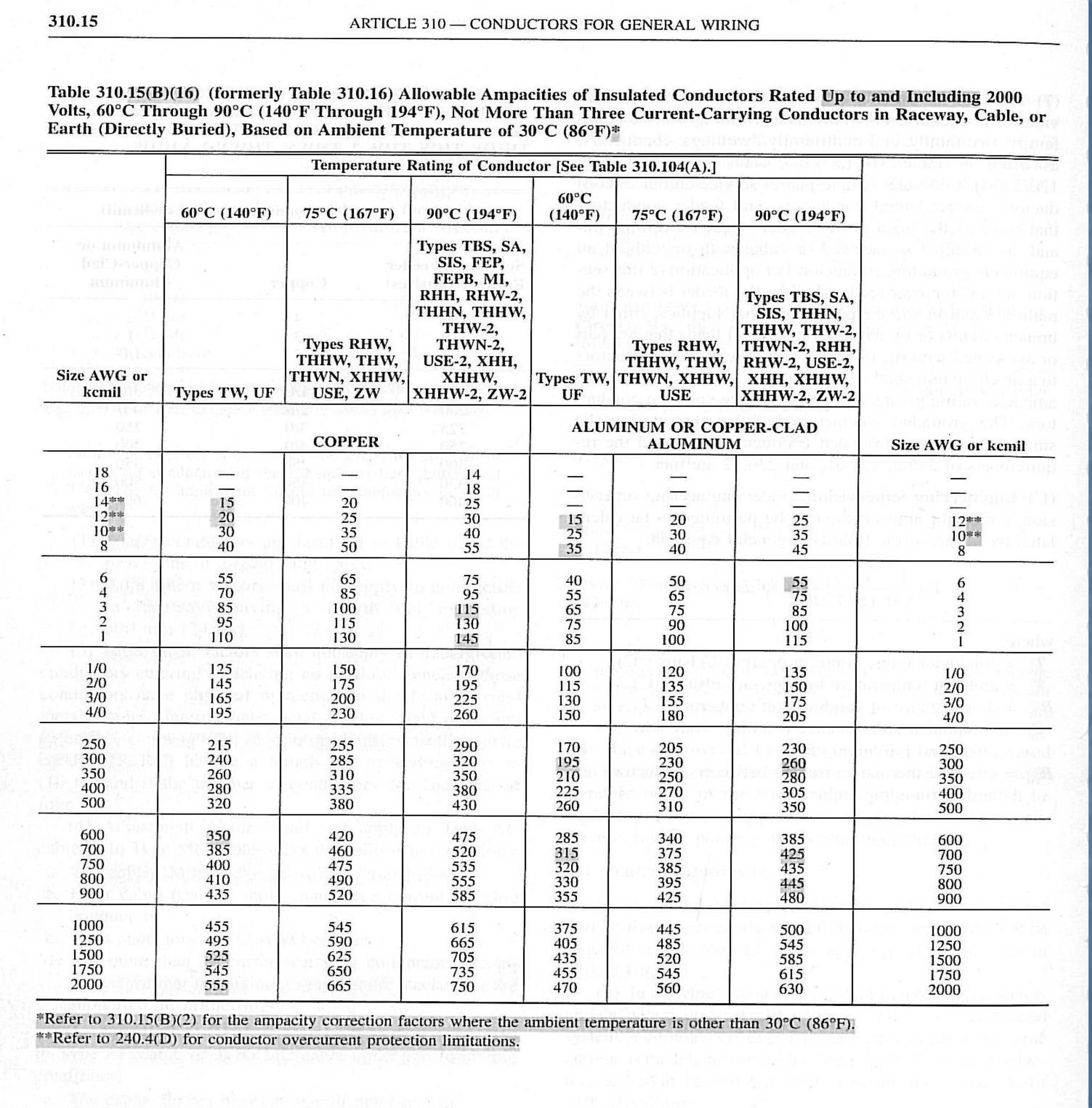
*Refer to 310.15(B)(2) for the ampacity correction factors where the ambient temperature is other than 30°C (86°F).

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

Ampacities

- How many amps is Al THW-2 #4 good for?
  - Go to right half of the chart (Aluminum conductors)
  - Find THW – 2 in the categories at the top
    - Use the 90 degree C column
  - Find #4 on the far right side
  - Find where that column and the #4 row cross.

  - 75 amps



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	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
Size AWG or kcmil	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			Size AWG or kcmil
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14**	15	20	25	—	—	—	—
12**	20	25	30	15	20	25	12**
10**	30	35	40	25	30	35	10**
8	40	50	55	35	40	45	8
6	55	65	75	40	50	55	6
4	70	85	95	55	65	75	4
3	85	100	115	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	145	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
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350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	350	420	475	285	340	385	600
700	385	460	520	315	375	425	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	445	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	525	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	555	665	750	470	560	630	2000

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

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

Ampacities

- Copper vs. Aluminum
- Use wire insulations
- DON'T WORRY ABOUT LUG RATING

How many amps are each of the following good for:

- 3/0 RHW AL
- #3 UF Cu
- 4/0 RHW-2 Cu

Ampacities

- Copper vs. Aluminum
- Use wire insulations
- DON'T WORRY ABOUT LUG RATING

How many amps are each of the following good for

- 3/0 RHW AL – **155**
- #3 UF Cu - **85**
- 4/0 RHW-2 Cu - **260**

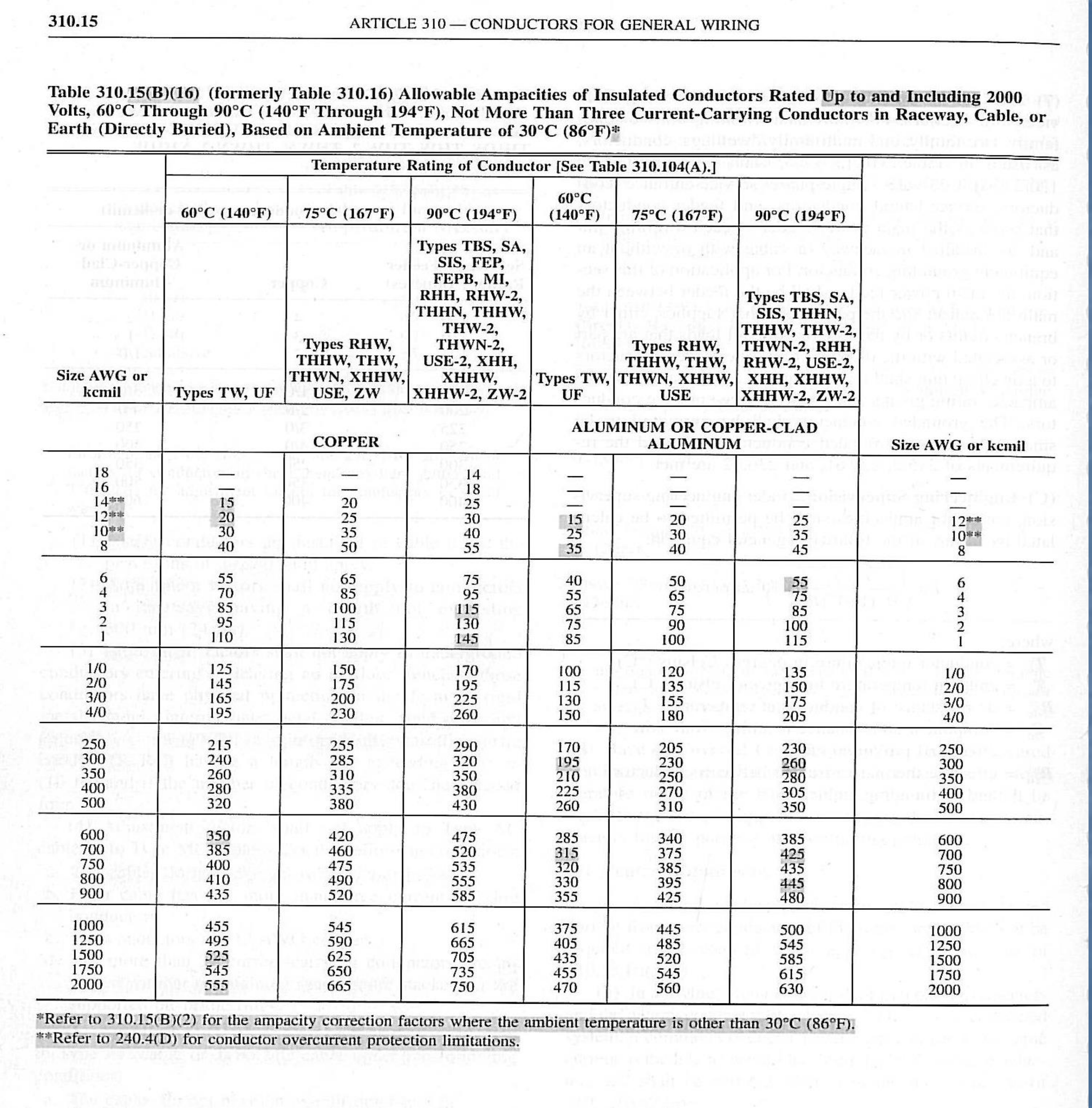

Table 310.15(B)(16) (formerly Table 310.16) Allowable Ampacities of Insulated Conductors Rated Up to and Including 2000 Volts, 60°C Through 90°C (140°F Through 194°F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)*

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Size AWG or kcmil	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			Size AWG or kcmil
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14**	15	20	25	—	—	—	—
12**	20	25	30	15	20	25	12**
10**	30	35	40	25	30	35	10**
8	40	50	55	35	40	45	8
6	55	65	75	40	50	55	6
4	70	85	95	55	65	75	4
3	85	100	115	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	145	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	195	230	260	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	350	420	475	285	340	385	600
700	385	460	520	315	375	425	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	445	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	525	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	555	665	750	470	560	630	2000

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

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

Ambient temperature – 310.15(B)(2)(a)

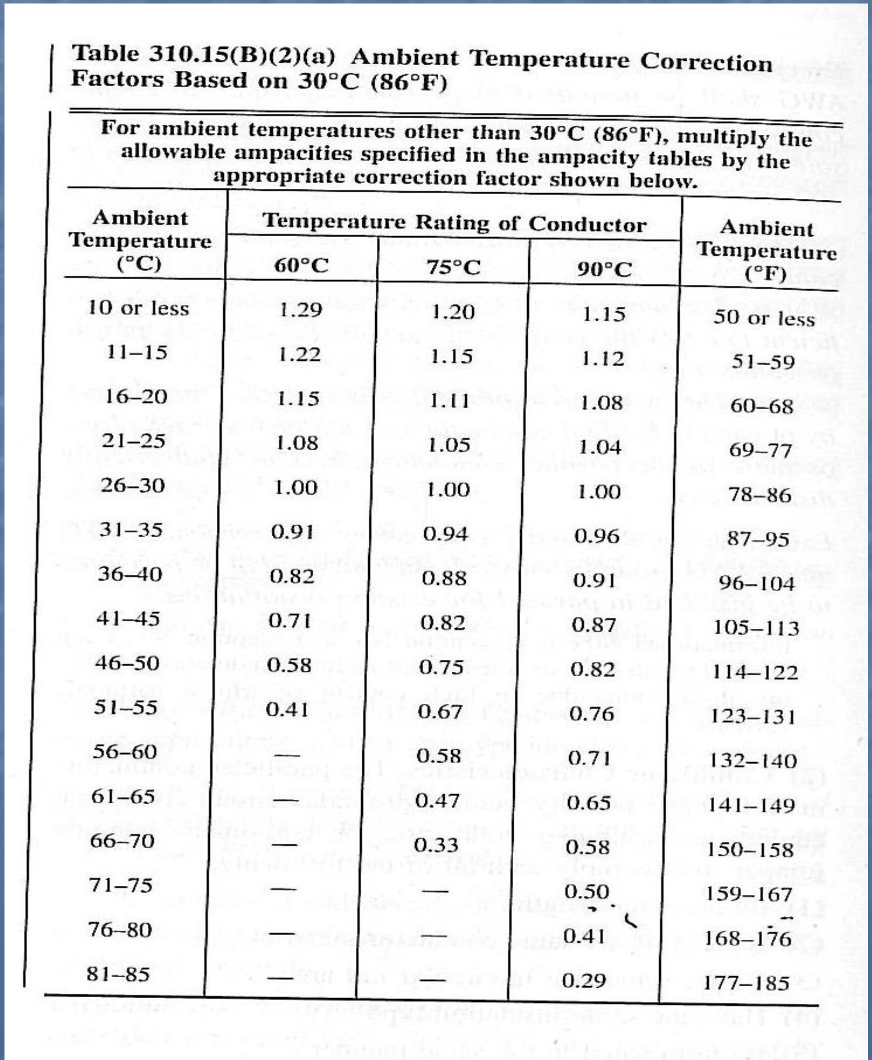


Table 310.15(B)(2)(a) Ambient Temperature Correction Factors Based on 30°C (86°F)

For ambient temperatures other than 30°C (86°F), multiply the allowable ampacities specified in the ampacity tables by the appropriate correction factor shown below.

Ambient Temperature (°C)	Temperature Rating of Conductor			Ambient Temperature (°F)
	60°C	75°C	90°C	
10 or less	1.29	1.20	1.15	50 or less
11–15	1.22	1.15	1.12	51–59
16–20	1.15	1.11	1.08	60–68
21–25	1.08	1.05	1.04	69–77
26–30	1.00	1.00	1.00	78–86
31–35	0.91	0.94	0.96	87–95
36–40	0.82	0.88	0.91	96–104
41–45	0.71	0.82	0.87	105–113
46–50	0.58	0.75	0.82	114–122
51–55	0.41	0.67	0.76	123–131
56–60	—	0.58	0.71	132–140
61–65	—	0.47	0.65	141–149
66–70	—	0.33	0.58	150–158
71–75	—	—	0.50	159–167
76–80	—	—	0.41	168–176
81–85	—	—	0.29	177–185

Ambient temperature

- Outside temperature, this is different than temperature rating of wire
- Celsius on left – Fahrenheit on right
    - Make sure to answer in correct temperature
- Ex: Use the same example we had before
- Al THW-2 #4 in 77 degree C ambient temperature
    - Take your initial amps that you found (75 amps)
    - Apply the ambient temperature factor (.41)
        - It will be in the same column as the initial amp finding
        - Find the ambient temperature on the edge of the chart
        - Could be left side (C) or right side (F)
    - Multiply the amps by the ambient temperature correction factor
- 75 x .41 = 30.75 amps

Ambient temperature

- Determine the ampere rating for each of the following conductors:

- 3/0 RHW Al in 42 C ambient temperature
- #3 UF Cu in 90 F ambient temperature
- 4/0 RHW-2 Cu in 75 F ambient temperature

Ambient temperature

Determine the ampere rating for each of the following conductors

- 3/0 RHW Al in 42 C ambient temperature
  - **127.1 amps – correction factor of .82**
- #3 UF Cu in 90 F ambient temperature
  - **77.35 amps – correction factor of .91**
- 4/0 RHW-2 Cu in 75 F ambient temperature
  - **270.4 amps – correction factor of 1.04**

You can exceed the rating of 310.15(B)(16)

Adjustment factors - derating

- 310.15(B)(3)(a)

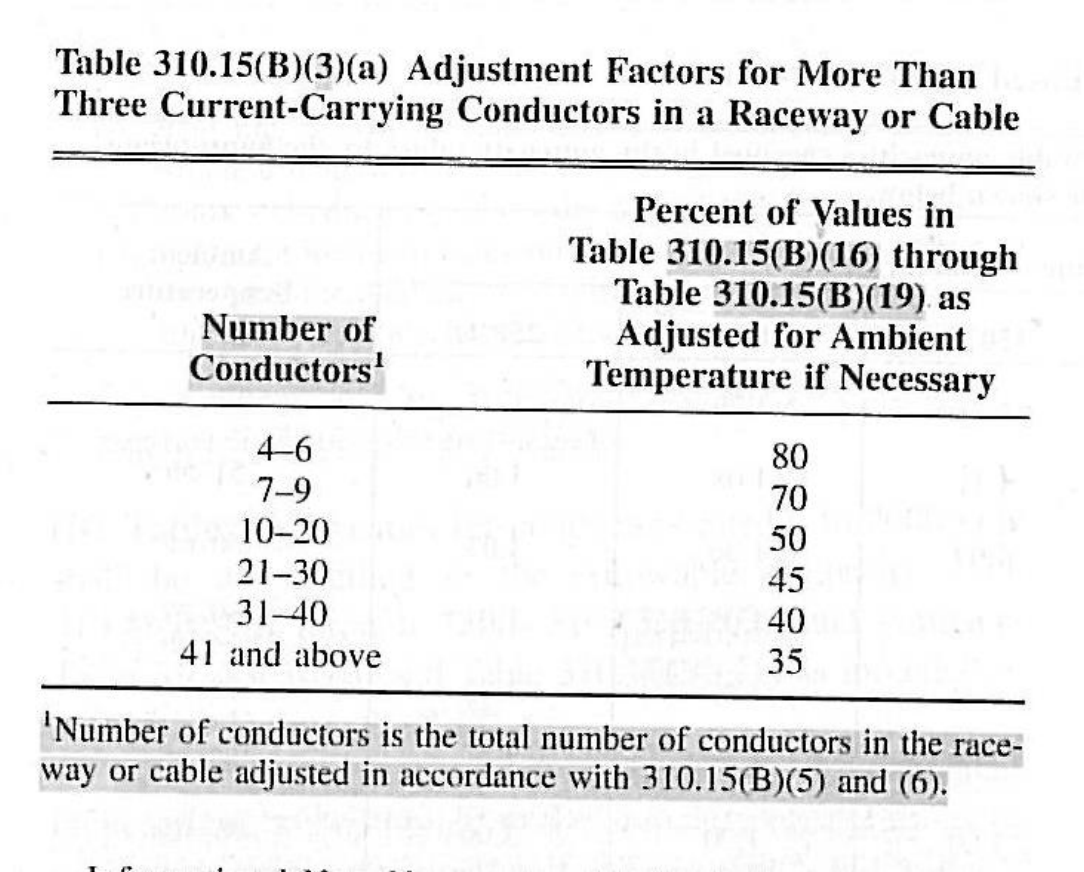


Table 310.15(B)(3)(a) Adjustment Factors for More Than Three Current-Carrying Conductors in a Raceway or Cable

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

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

Adjustment factors - derating

- Based on number of **current carrying** conductors
- HAS NOTHING TO DO WITH TYPE OR SIZE OF CONDUIT
  - 4 - #18 conductors in 6" Rigid would still be derated

- Ex: Use the same wire as before.
- What is the ampacity of 11 - Al THW-2 #4
- Take initial ampacity (75 amps)
- Use 310.15 (B)(3)(c) to apply the correction factor
- 10 – 20 has a factor of 50% (.5)
- 75 x .5 = 37.5 = **38 Amps**

Adjustment factors - derating

Determine the ampere rating for each of the following conductors:

- 5 - 3/0 RHW Al
- 21 - #3 UF Cu
- 8 - 4/0 RHW-2 Cu

Adjustment factors - derating

- Determine the ampere rating for each of the following conductors

- 5 - 3/0 RHW Al
  - **124 amps – derate at 80%**

- 21 - #3 UF Cu
  - **38.25 amps – derate at 45%**
    - Have to round down to 38 amps – decimal below .5

- 8 - 4/0 RHW-2 Cu
  - **182 amps – derate at 70%**

Combining factors for derating

- If taking into account ambient temperature and correction factor (derating) you must apply BOTH not the greatest of the two.
- Ex: 11 - Al THW-2 #4 in 77 degree C ambient temperature
    - 75 amps (off 310.15(B)(16))
    - .41 (ambient temp)
    - .5 (derating chart, 310.15 (B)(3)(a)
- 75 x .41 x .5 = 15.375 = 15 amps
- Each conductor is only good for 15 amps

Combining factors for derating

- Determine the ampere rating for each of the following conductors:
  - 5 - 3/0 RHW Al in 42 C ambient temperature
  - 21 - #3 UF Cu in 90 F ambient temperature
  - 8 - 4/0 RHW-2 Cu in 75 F ambient temperature

Combining factors

- Determine the ampere rating for each of the following conductors

- 5 - 3/0 RHW Al in 42 C ambient temperature
  - 155 x .82 x .8 = 101.68 = **102 amps**
- 21 - #3 UF Cu in 90 F ambient temperature
  - 85 x .91 x .45 = 34.8075 = **35 amps**
- 8 - 4/0 RHW-2 Cu in 75 F ambient temperature
  - 260 x 1.04 x .7 = 189.28 = **189 amps**

Dwelling Service Chart
310.15(B)(7)

- 83% Rule
  - Only for dwelling purposes
  - 100 amps through 400 amps
  - Must feed entire load
  - Single phase or single phase from a 3 phase system

Rephrased – Same Values

- 83% Rule
- Take rating of service and multiply by .83 (83%)
- Ex. 200 amp service
  - 200 x .83 = 166

- Refer to 310.15(B)(16) – Main Ampacity Chart
- Find conductors rated for at least 166 amps
  - Unless noted, use 75 degree column and copper

Dwelling Service Chart 310.15(B)(7) – page 800

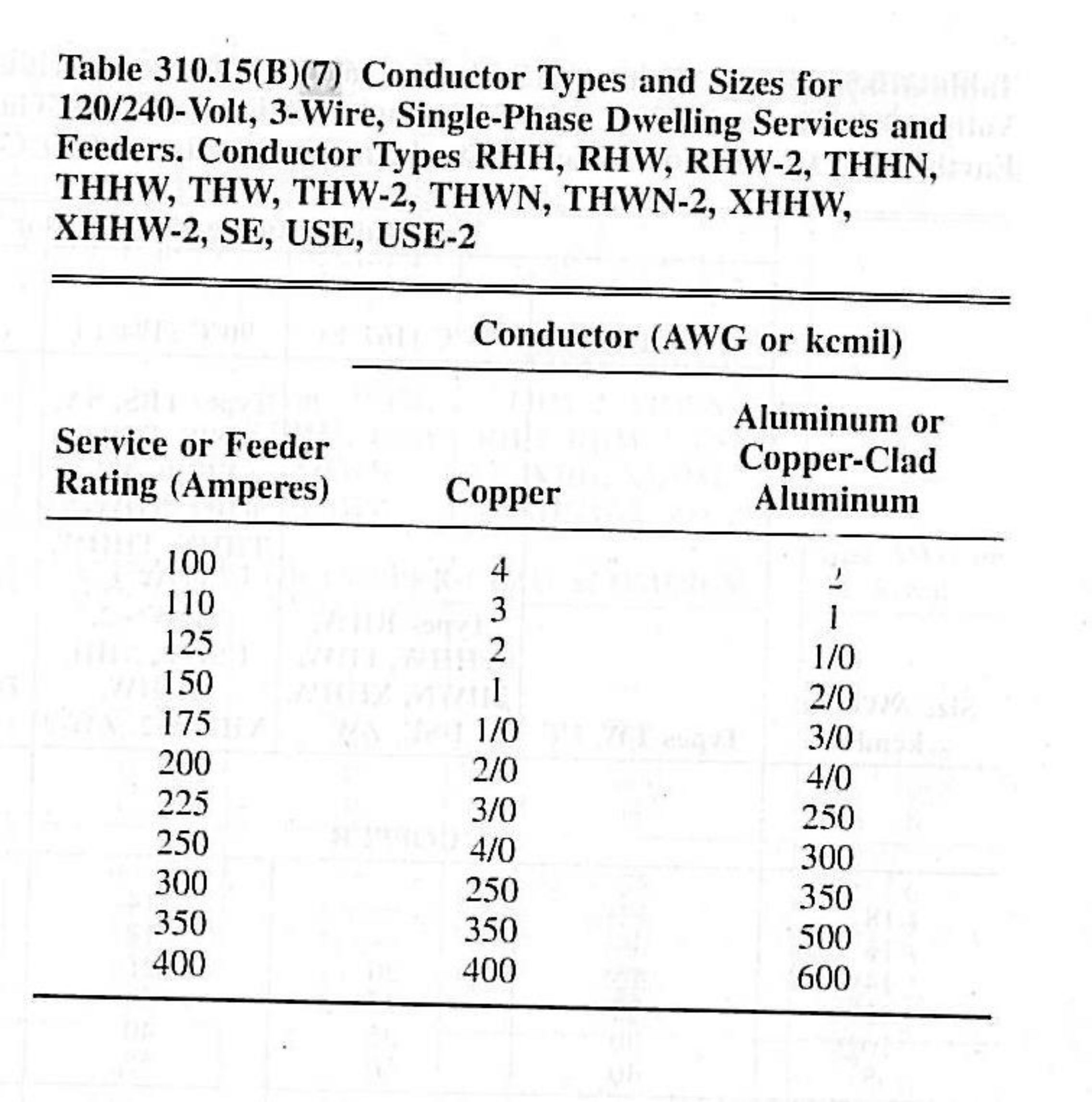


Table 310.15(B)(7) Conductor Types and Sizes for 120/240-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders. Conductor Types RHH, RHW, RHW-2, THHN, THHW, THW, THW-2, THWN, THWN-2, XHHW, XHHW-2, SE, USE, USE-2

	Conductor (AWG or kcmil)	
Service or Feeder Rating (Amperes)	Copper	Aluminum or Copper-Clad Aluminum
100	4	2
110	3	1
125	2	1/0
150	1	2/0
175	1/0	3/0
200	2/0	4/0
225	3/0	250
250	4/0	300
300	250	350
350	350	500
400	400	600

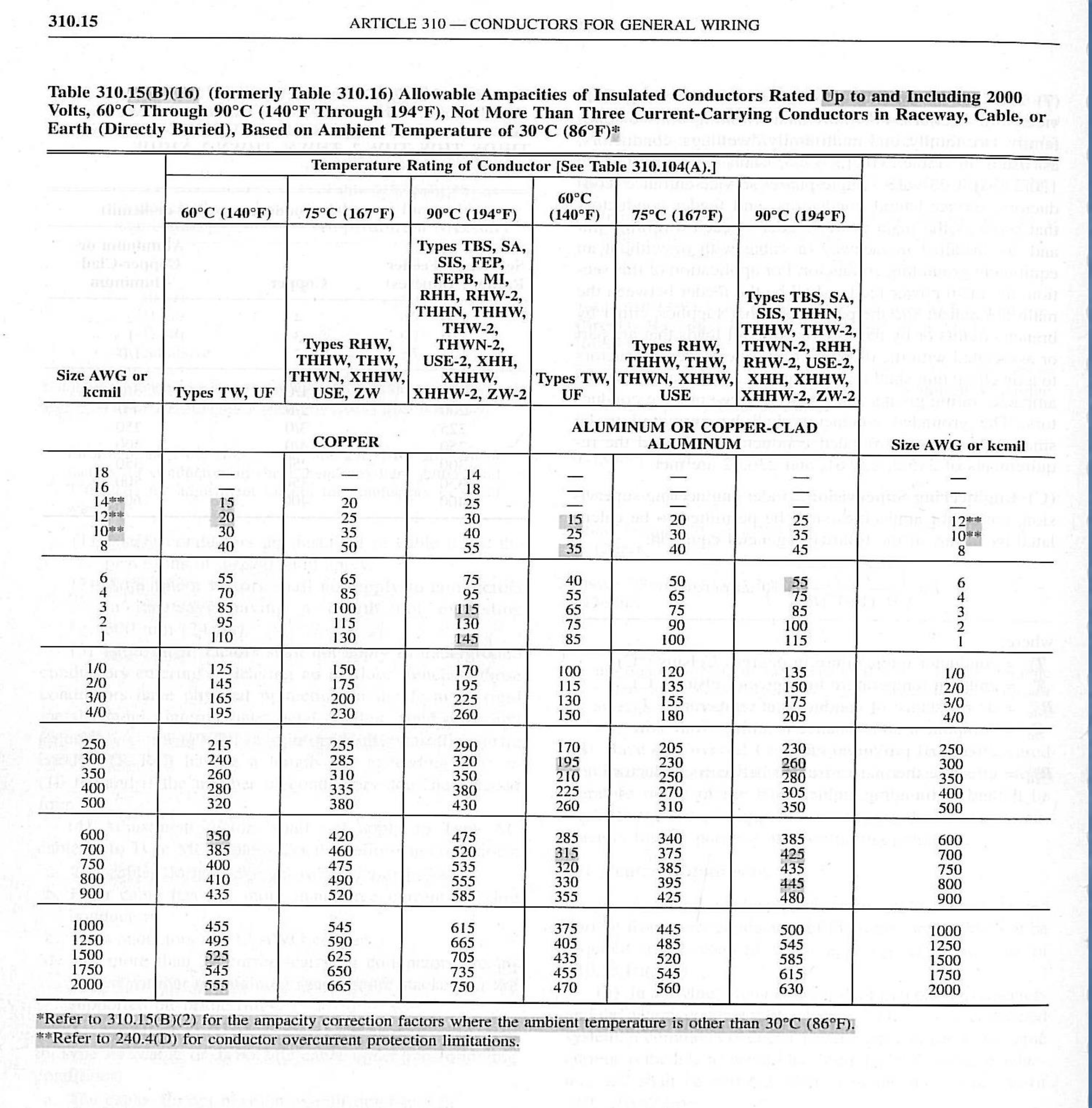


Table 310.15(B)(16) (formerly Table 310.16) Allowable Ampacities of Insulated Conductors Rated Up to and Including 2000 Volts, 60°C Through 90°C (140°F Through 194°F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)*

	Temperature Rating of Conductor [See Table 310.104(A).]						
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
Size AWG or kcmil	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			Size AWG or kcmil
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14**	15	20	25	—	—	—	—
12**	20	25	30	15	20	25	12**
10**	30	35	40	25	30	35	10**
8	40	50	55	35	40	45	8
6	55	65	75	40	50	55	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	145	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	195	230	260	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	350	420	475	285	340	385	600
700	385	460	520	315	375	425	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	445	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	525	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	555	665	750	470	560	630	2000

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

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

Dwelling Service

What size copper conductors are needed for a 150 amp residential single phase service?

Dwelling Service

What size copper conductors are needed for a 150 amp residential single phase service?

150 x .83 = 124.5 amps

#1 is good for 130 amps

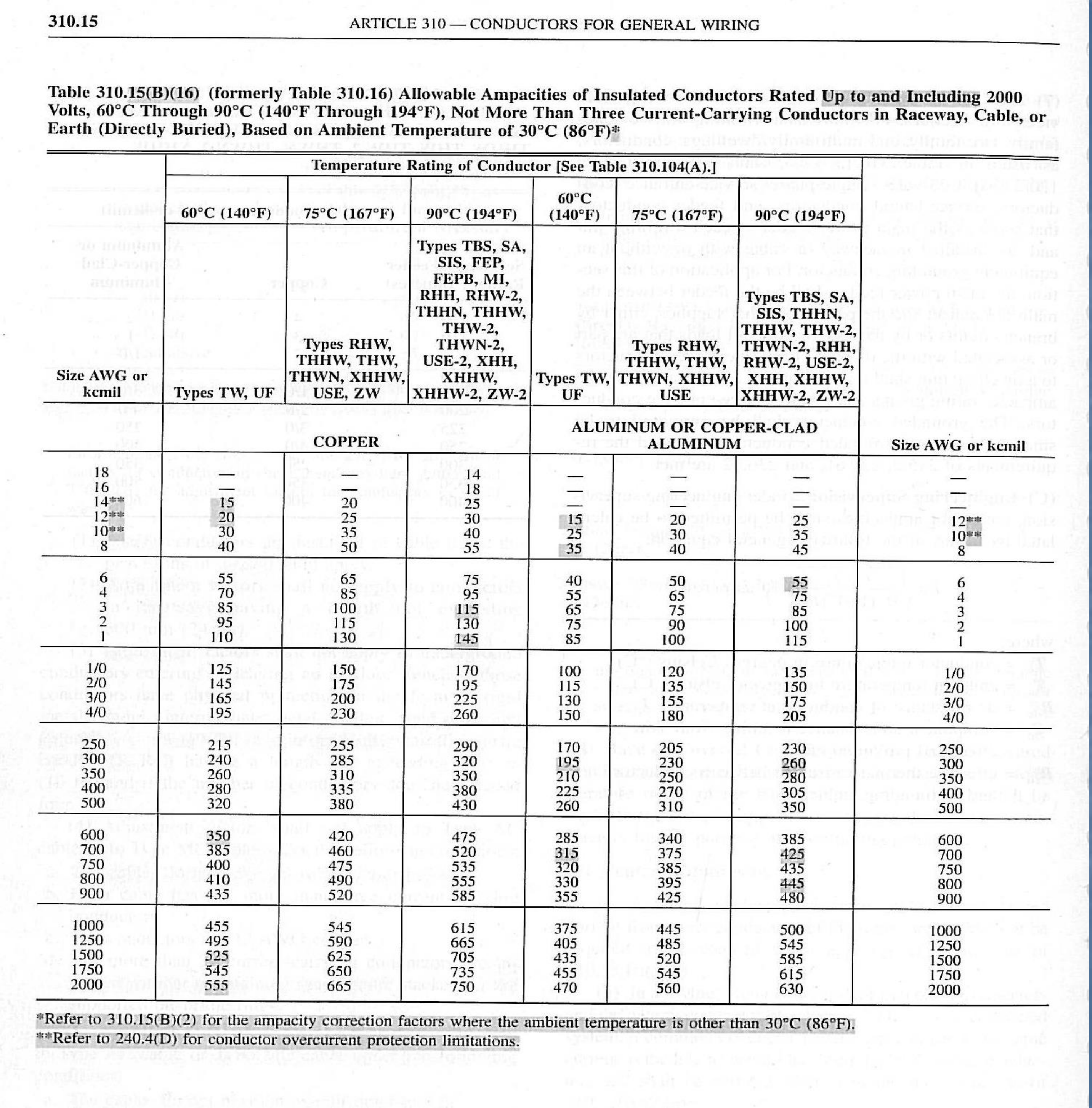


Table 310.15(B)(16) (formerly Table 310.16) Allowable Ampacities of Insulated Conductors Rated Up to and Including 2000 Volts, 60°C Through 90°C (140°F Through 194°F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)*

Size AWG or kcmil	Temperature Rating of Conductor [See Table 310.104(A).]						
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			Size AWG or kcmil
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14**	15	20	25	—	—	—	—
12**	20	25	30	15	20	25	12**
10**	30	35	40	25	30	35	10**
8	40	50	55	35	40	45	8
6	55	65	75	40	50	55	6
4	70	85	95	55	65	75	4
3	85	100	115	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	145	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	195	230	260	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	350	420	475	285	340	385	600
700	385	460	520	315	375	425	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	445	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	525	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	555	665	750	470	560	630	2000

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

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

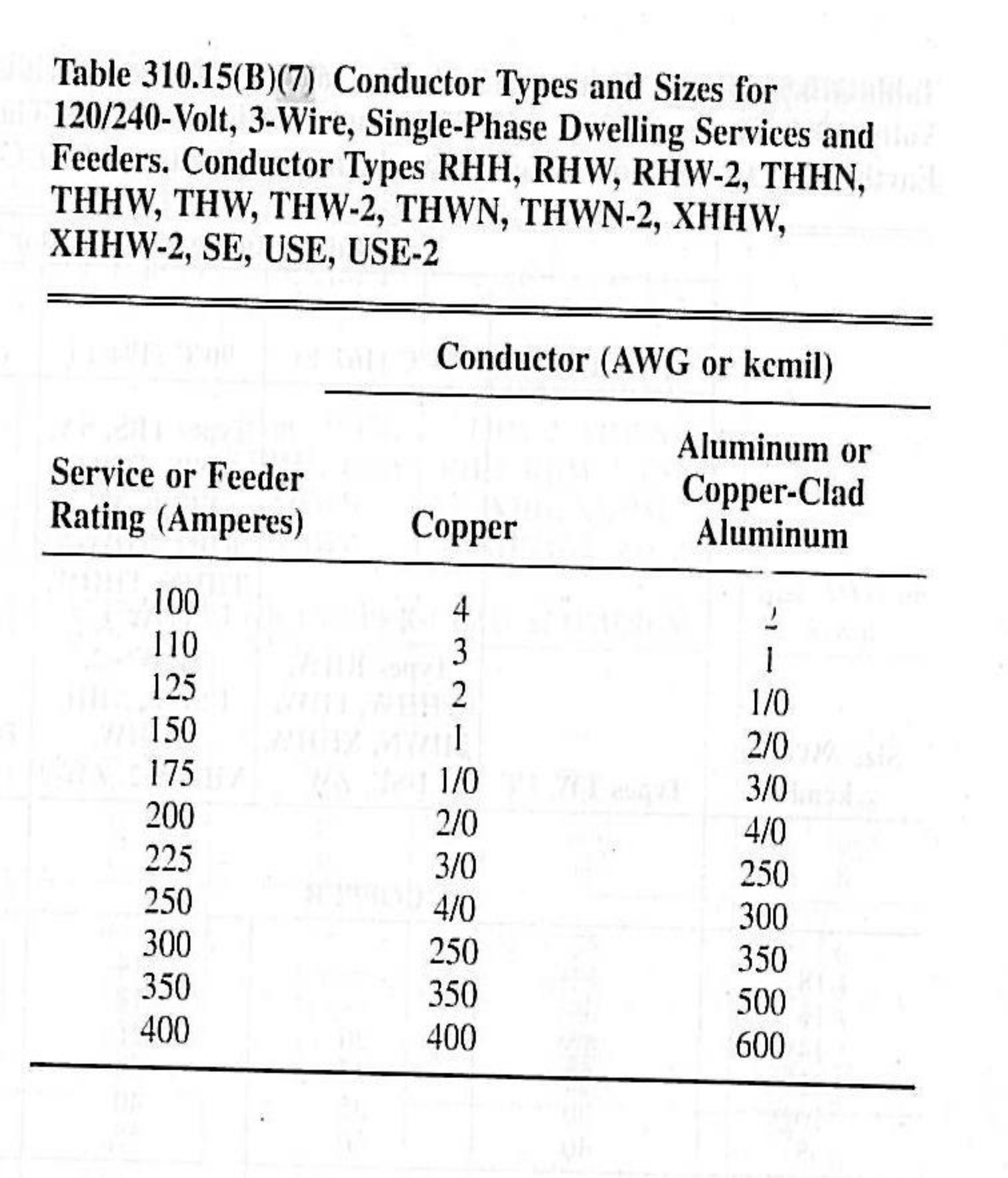


Table 310.15(B)(7) Conductor Types and Sizes for 120/240-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders. Conductor Types RHH, RHW, RHW-2, THHN, THHW, THW, THW-2, THWN, THWN-2, XHHW, XHHW-2, SE, USE, USE-2

Service or Feeder Rating (Amperes)	Conductor (AWG or kcmil) Copper	Conductor (AWG or kcmil) Aluminum or Copper-Clad Aluminum
100	4	2
110	3	1
125	2	1/0
150	1	2/0
175	1/0	3/0
200	2/0	4/0
225	3/0	250
250	4/0	300
300	250	350
350	350	500
400	400	600

Ampacities

- 310.15(B)(16) vs. 310.15 (B)(7)
  - 310.15 (B)(7) is for 120/240, 3 wire, single phase dwelling services and feeders
    - Ex. Houses, apartments
    - Feeders is a bit deceptive
  - Notice the difference in ampacities!
    - 200 amp Dwelling feeder is permitted to be 4/0 AL
    - On 310.16 if you needed 200 amps on Al wire, you would need 250 kcmil
- Only refer to 310.15 (B)(7) when all stipulations are giver

Conductor Properties

- 310.4 (A)
  - Gives trade name and type letter
  - Maximum operating temperature
    - Conductors may have different operating temperatures in different environments
      - See type ZW
  - Insulation
  - Outer covering

Conductor Properties

- 310.4 (A)
- Which conductor is good for switchboard and switchgear wiring only?

- A. ZW
- B. SA

C. MTW

D. TBS

Conductor Properties

- 310.4 (A)
- Which conductor is good for switchboard and switchgear wiring only?

A. ZW	C. MTW
B. SA	**D. TBS**

File Attachments for Item:

ER-12 Dwelling Circuit Requirements (Independent Electrical Contractors)

EPE, ESI, RBO (4 hours)

Staff Notes: Received after ESIAC submission: Recommend referral to ESIAC for recommendations.

Committee Recommendation:

Dwelling requirements

Required receptacles

- 6 foot rule – no point along the wall may be more than 6 feet from a receptacle
- 2 foot walls – the minimum size wall that is required to have receptacles
- Kitchen countertops – no point along these walls can be more than 2 feet away from a receptacle
- Appliance receptacles – at least one within 6 feet.
- Bathrooms – one per bathroom required
- Outside – receptacles are required at the front and back of the house
- Hallways – 10 foot or more require receptacles
- Garages with power – at least one required

Services

- Minimum size
- Location

Lighting

- Switched outlets required

Clearances

- Underground burial depths
- Overhead conductor minimum heights

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: Kevin Collins (Contact Name)

Organization: IEC of Greater Cincinnati (Organization/Company)

Address: 586 Kings Run Drive (Include Room Number, Suite, etc.)

City: Cincinnati State: OH Zip: 45232

E-Mail: kcollins@iec-cincy.com

Telephone: 513-542-0400 Fax: —

Course Sponsor: IEC of Greater Cincinnati

COURSE INFORMATION:

Course Title: Dwelling Circuit Requirements

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

Purpose and Objective: Review article 210 of the NEC. We will discuss receptacle & switch location requirements in a dwelling as well as required circuitry in a dwelling

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 ☐
Plumbing Plans Exam. ☐
Electrical Plans Exam. ☒
Mechanical Plans Exam. ☐
Building Inspector ☐
Fire Protection Inspector ☐
Mechanical Inspector ☐
Plumbing Inspector ☐
Non-Res IU Inspector ☐

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

Electrical Safety Inspectors ☒
Location of ESI Course: IEC of Greater Cincinnati Date(s) of ESI Course(s): 10/12/22

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

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

Sean Clark

901 Beechmeadow Ln. Cincinnati, Ohio 45238
(H)513/347-9054 (C)513/800-4450
sclark@ohiovalleyelectric.com

••••••••••••••••••••••••••••

A licensed electrician with over twenty years of experience in installing, maintaining, and repairing electrical wiring, equipment, and fixtures, ensuring that work is in accordance with relevant codes, fire alarm installations, electrical control systems, and high voltage terminations. A licensed electrician with three years teaching experience in first and second year electrical.

Summary of Qualifications

- More than twenty years experience.
- Three years experience in teaching first and second year electrical.
- Thorough knowledge of electrical systems including planning additions and modifications on secondary circuits. Controls and low voltage wiring
- Able to read commercial electrical blueprints and apply NEC through the full range of commercial and industrial maintenance and construction work.
- Can use appropriate tools and diagnostic equipment to repair, install, replace, and test electrical circuits, equipment and appliances.
- Excellent ability to diagnose and repair electrical controls, industrial motor control centers, and programmable logic controllers.
- Strong desire to study and comprehend new technology.
- In-depth ability to make mathematical computations.
- Considerable ability to explain instructions and guidelines to others effectively.
- Able to assign work to employees., prioritize the work of others and organize and coordinate the work of the unit. For subs and Primes.

Professional Experience

Ohio Valley Electrical Services	2011-Present
ABC Electrical Teacher	2010-2013
Beacon Electrical Contractors	2007-2011
Ohio Valley Electrical Services	1993-2007

Electrical Superintendant/Foreman/Instructor

- First and Second year electrical instructor
- Supervision of all electrical installations of as many as 50 electricians to assure that work was done safely, efficiently, properly and within time allowed.
- Trained multiple employees in all aspects of electrical work to be able to identify an employee's strengths and weaknesses to better utilize their skills. Traced out short circuits in wiring, using test meter.
- Coordinated and implemented electrical projects within a variety of environments including plants, hospitals, schools, retail stores, public facilities, waste water treatment plants industrial buildings;

projects include both new construction and underground electrical wiring as well as renovation within existing buildings. Parking Garages and Fed Ex Ground Facilities.

- Assemble, install, test, and maintain electrical or electronic wiring, equipment, appliances, apparatus, and fixtures, using hand tools and power tools.
- Connect wires to circuit breakers, transformers, or other components.
- Construct and fabricate parts, using hand tools and specifications.
- Diagnose malfunctioning systems, apparatus, and components, using test equipment and hand tools, to locate the cause of a breakdown and correct the problem.
- Inspect electrical systems, equipment, and components to identify hazards, defects, and the need for adjustment or repair, and to ensure compliance with codes.
- Plan layout and installation of electrical wiring, equipment and fixtures, based on job specifications and local codes.
- Test electrical systems and continuity of circuits in electrical wiring, equipment, and fixtures, using testing devices such as ohmmeters, voltmeters, and oscilloscopes, to ensure compatibility and safety of system.
- Perform business management duties such as maintaining records and files, preparing reports and ordering supplies and equipment.

Education & Certifications

Master Electrician License-State of Kentucky

Journeyman Electrician's License-Hamilton, Ohio

Fire Alarm License-State of Ohio

Certified in high voltage terminations and splices

Lift, Lull, Bobcat, and Boom/scissors lift licenses

OSHA-30 card

Certified in first aid and CPR training

Certified NCCER Core Curricula Instructor

Certified NCCER Electrical Instructor

Completed 4 year apprenticeship program

1 Year Pre-apprentice school (ABC)

High School Diploma (1991)

ARCH FLASH SAFETY TRAINING

PROJECTS-SUPERVISED

$4.5mil.-MASON HIGH SCHOOL ADDITION

$250.000-3CDC-5TH RACE PARKING GARAGE

$250.000-AVONEDALE APT. COMPLEX

$100.000-MAHOGANYS AT THE BANK-

1.2mil. -PATHEON CHEMICALS

$450.000- FED EX GROUND ADDITION

$250.000-LIBERTY WAY PROJECT

$500.000-GE AT THE BANKS

$100.000 - SYCAMORE SCHOOLS/POWER/CONTROL-

$50.000 - NKU RETROFIT

$250.000- UC POWER PLANT ADDITION

$75.000 - 580BLD/ CHEMED, RETROFIT

$4.0mil - DHL- CONVEYERS/SHELL

$90.000- DOUBLE TREE AIRPORT

$2.5mil- TWIN LAKES OF MONTGOMERY

$45.000- STEINMART ANDERSON

And many small T&M jobs.

All on time and under budget

Required receptacles

- Kitchens (wall space), family rooms, dining rooms, parlor, bedroom, recreation room, etc.
  - 6 foot rule
  - 2 foot or wider wall sections
    - sections broken by doors, fireplaces, etc
  - Fixed door panels apply
  - Railings apply
    - Floor receptacles - less than 18” off the wall
    - Wall receptacles – less than 5 ½’ above the floor

210.52(A)(2) WALL SPACE

(2) Wall Space. As used in this section, a wall space shall include the following:

(1) Any space 600 mm (2 ft) or more in width (including space measured around corners) and unbroken along the floor line by doorways and similar openings, fireplaces, and fixed cabinets that do not have countertops or similar work surfaces

(2) The space occupied by fixed panels in walls, excluding sliding panels

(3) The space afforded by fixed room dividers, such as free-standing bar-type counters or railings

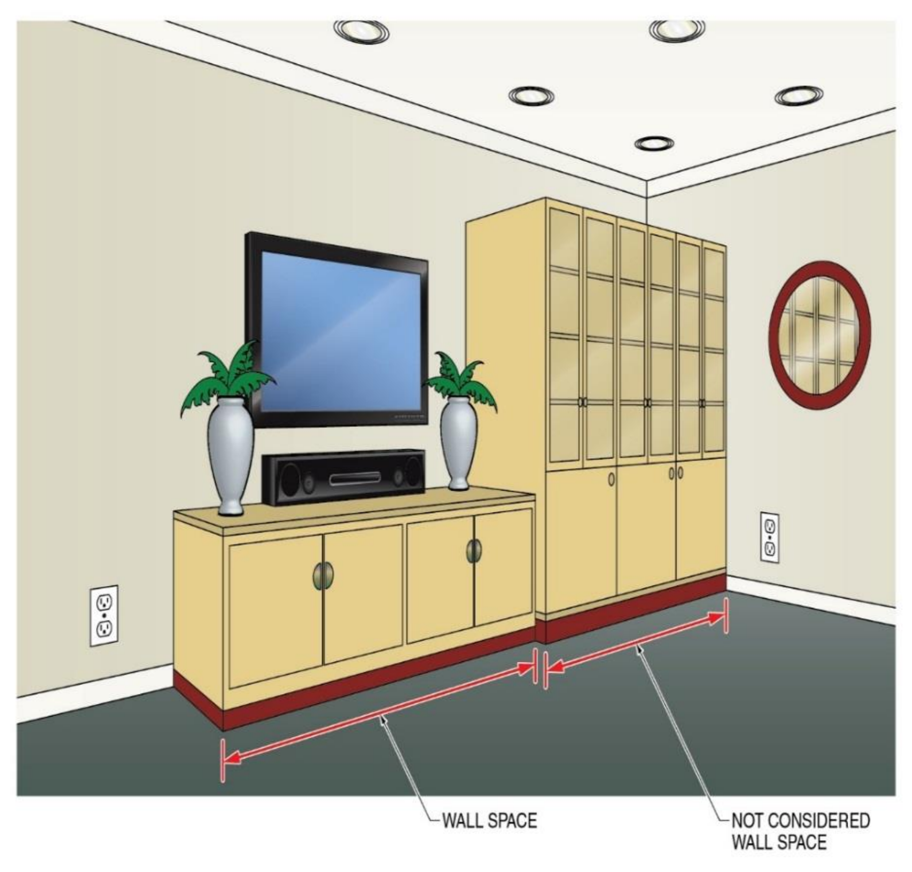
210.52(A)(2)(1) RECEPTACLE WALL SPACE

Changes have been made to clarify that countertops must be included when calculating wall space.

Kitchen type cabinets, bar area countertops, and home office counters are all considered wall space.

Key term is "fixed cabinets".

At rough-in inspection, inspector should verify blueprints to see where cabinets are located to clarify areas that are not considered wall space.



Required receptacles

- Do not count as part of required receptacles
  - Part of a luminaire or appliance
  - Controlled by a wall switch
    - Unless half switched
  - In cabinets or cupboards

Required receptacles

- Kitchens countertops
  - 2′ rule
    - Spaces are broken by sinks, ranges, etc.
    - Does not apply if sink is:
      - Straight sink is more than 12″ off back wall
      - Corner sink is more than 18″ off back wall
  - Any space wider than 12″
  - Must be 20″ or less above countertop

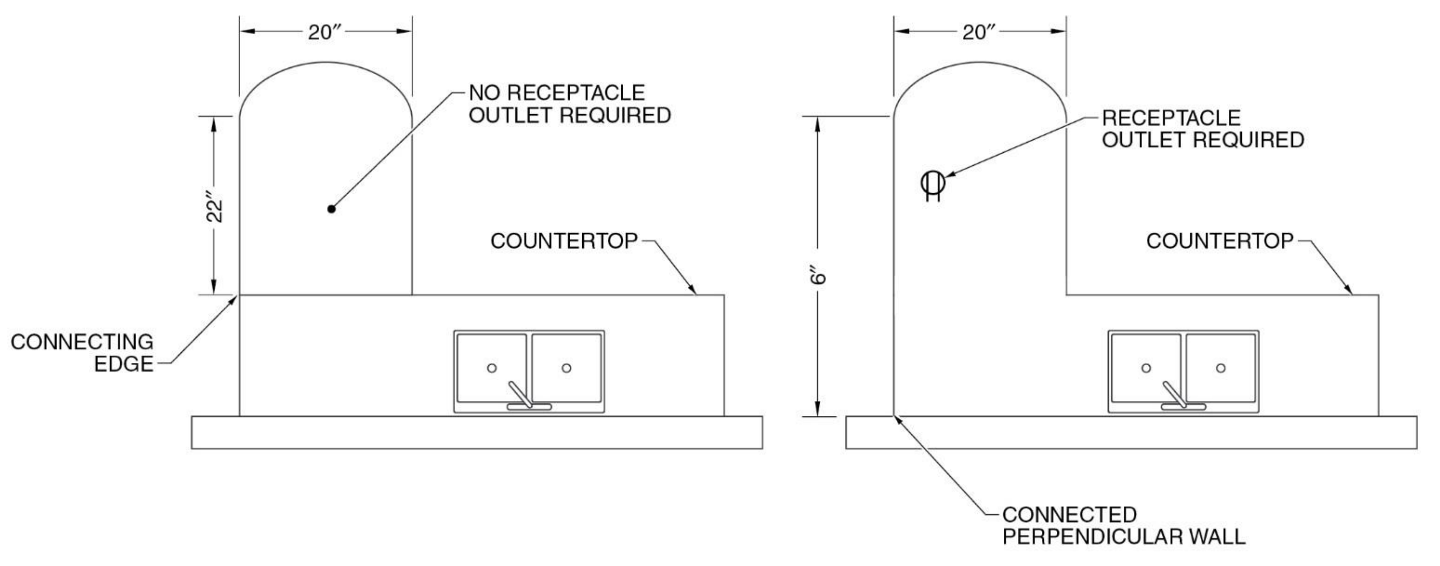
Required receptacles

- Islands
    - At least one if greater than 24” and 12”
    - Can count as two separate spaces is broken by sink, range, etc.
        - Not considered broken if more than 12” of counter behind.
- Peninsula
    - At least one if greater than 24” and 12”
        - Measured from wall
    - Same rules as islands

210.52(C)(3) PENINSULAR COUNTERTOP SPACES

(3) Peninsular Countertop Spaces. At least one receptacle outlet shall be installed at each peninsular countertop long dimension space with a long dimension of 600 mm (24 in.) or greater and a short dimension of 300 mm (12 in.) or greater. A peninsular countertop is measured from the connected perpendicular wall.

210.52(C)(3) PENINSULAR COUNTERTOP SPACES



2014 NEC
Peninsular countertop long dimension is measured from the “connecting edge”

2017 NEC
Peninsular countertop long dimension is measured from the “connected perpendicular wall”

Required receptacles

- Kitchens
  - For physically impaired or flat counter (no backsplash)
    - Can be located below counter if less than 12”
      - Doesn’t apply if counter extends 6 or more inches over base

  - Kitchen counter receptacles can not face up
    - Not permitted anywhere

Required receptacles

- Appliance receptacles within 6′ of appliance
  - Laundry equipment
  - Refrigerator

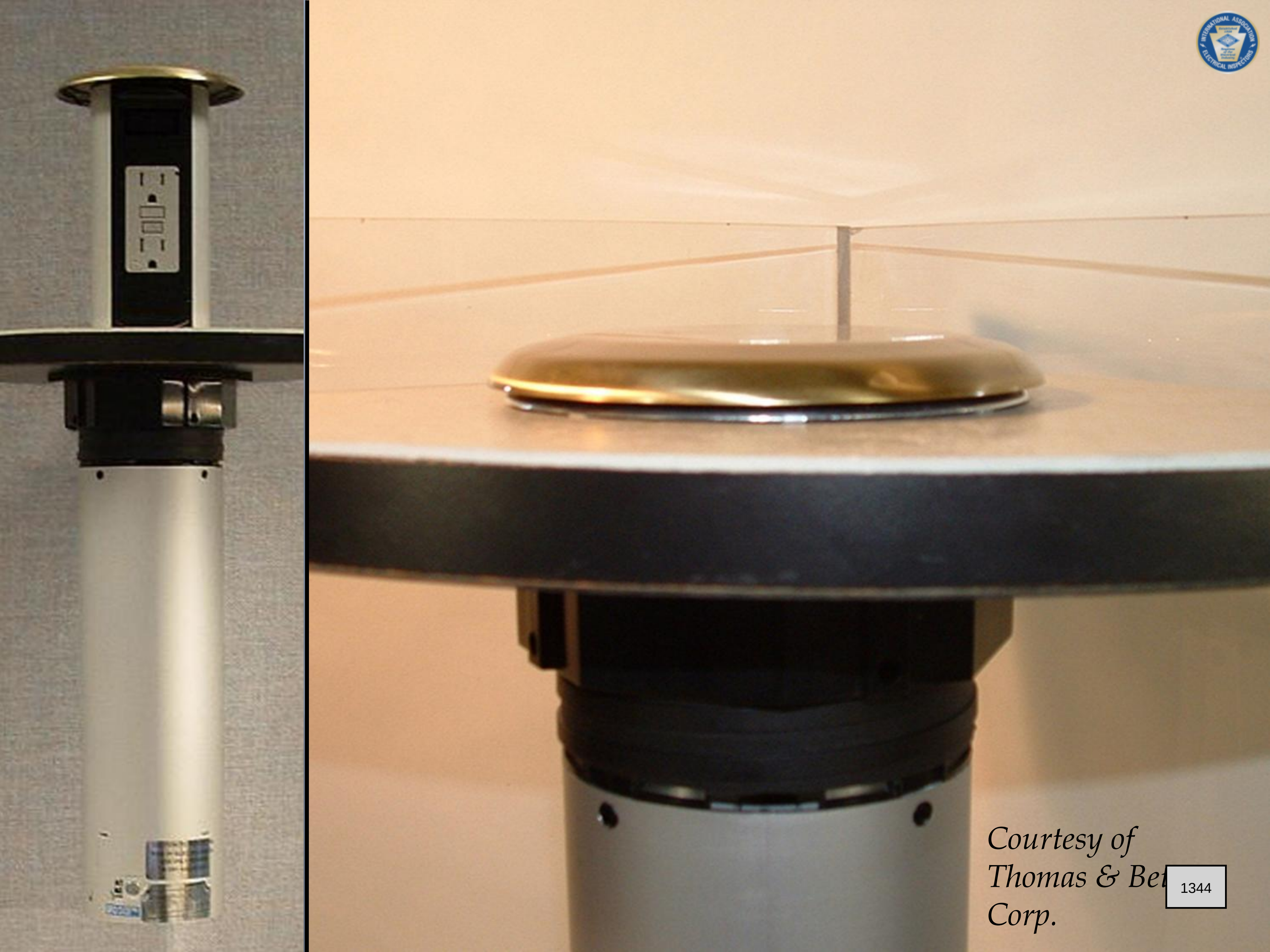
- At least one receptacle in laundry

- Bathrooms
  - At least one – within 3′ of outer edge of each basin
  - Can be located not less than 12″ below counter.
  - Listed receptacles may be used (pop up)

210.52(C)(5) and 210.52(D)

- Dwelling Unit Receptacle Outlet Locations:
  - Listed receptacle outlet assemblies are now permitted to be installed on or in kitchen and bathroom countertops to serve as the required countertop receptacles
  - Receptacle outlets must be located on, or above the countertop
  - Applies to countertops in bathrooms, kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units
  - Receptacles shall not be installed in a face-up position in countertops or similar work surfaces *[406.5(E)]*

Courtesy of
Thomas & Betts Corp.



Courtesy of Thomas & Bet
Corp.

Required receptacles

- Outdoors
  - One in front and back
    - Not more than 6 1/2′ above grade
    - All covers in use covers
    - Extra Duty
      - Clear “bubble” covers no longer allowed
- Balconies, Decks, Porches
  - One required if
    - Accessible from inside the dwelling
    - Any size, 20 square foot reference removed in 2011
  - If required, it must be
    - Accessible from the balcony
    - Less than 6 ½′ above surface

Required receptacles

- HVAC equipment
    - Within 25′ of HVAC or refrigeration equipment

- Receptacles can perform double duty

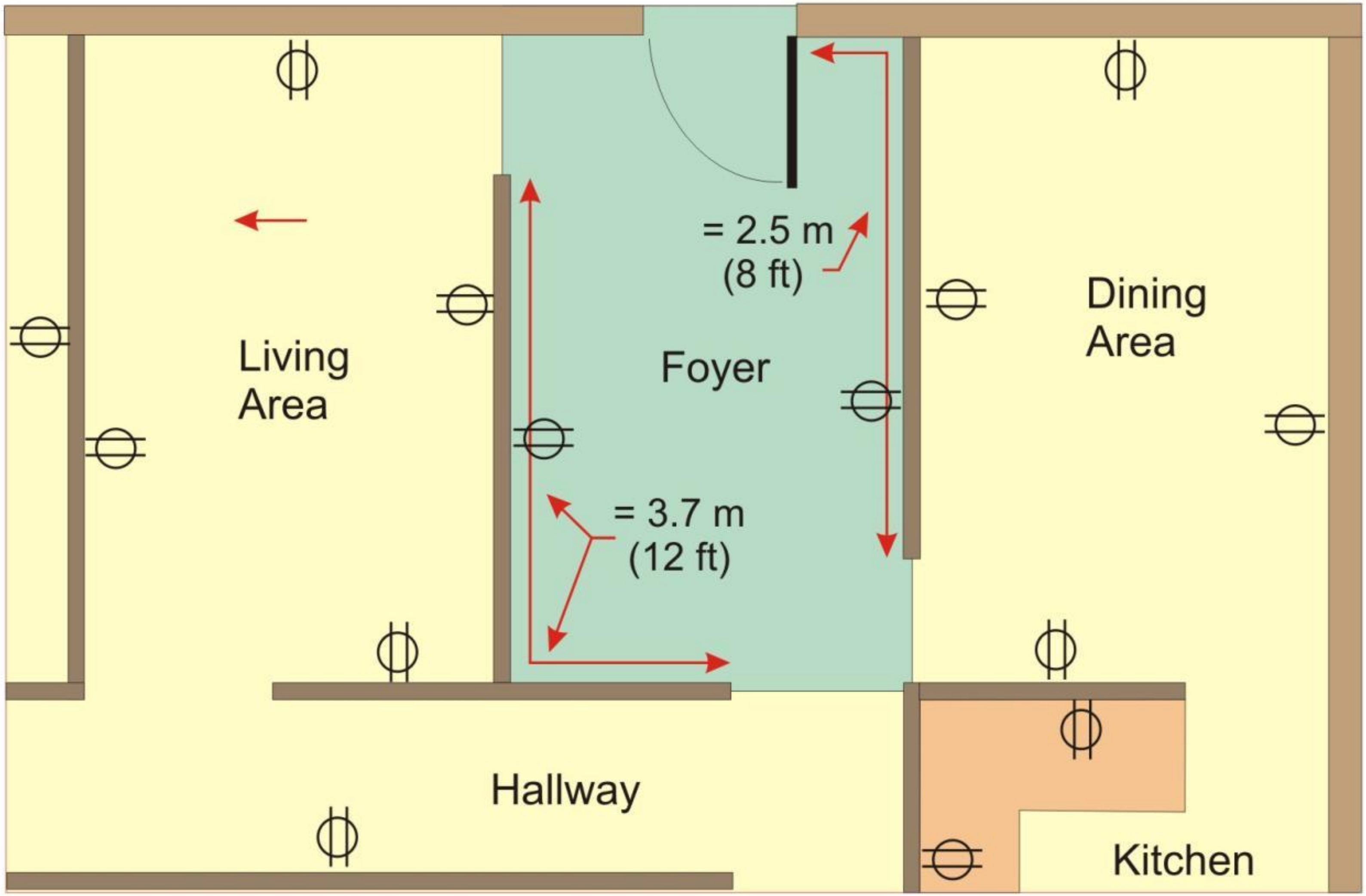
- Receptacles must be readily accessible from grade level

Required receptacles

- Hallways
  - Need only one if hallway is 10′ or longer
  - Passing through a door constitutes new area

- Foyers
  - Need at least one in each wall space 3 feet or wider
    - Does not fall under the 6 foot rule
  - Applies if foyer is 60 or more square feet

210.52(I) Foyers



Foyers that are not part of a hallway having an area that is greater than 5.6 m^2 (60 ft^2) are required to have a receptacle(s) located in each wall space 900 mm (3 ft) or more in width

Required receptacles

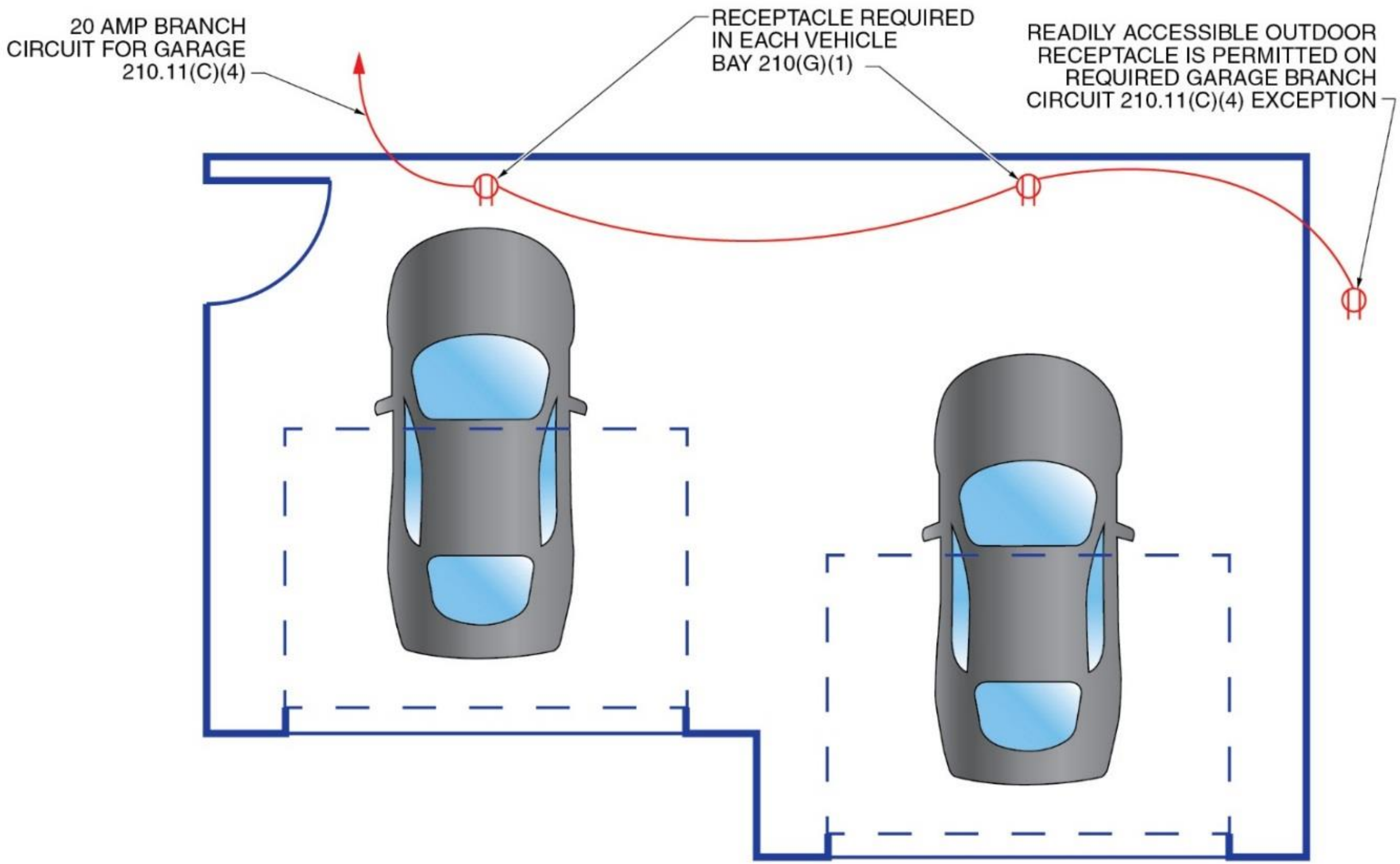
- Garage
  - Receptacles for specific equipment do not count towards required receptacles.
    - Central Vac , Garage door
  - Circuit must be dedicated in garage – 210.52 (G)(1)
    - Same rule applies for detached garage – if it has power
    - Separate circuit for attached and detached?
  - One receptacle for each car space - 210.52 (G)(1)
  - Vehicle charging circuit must be dedicated – 210.17
    - Only if installed.

210.52(G)(1) VEHICLE BAY OUTLETS

(G) Basements, Garages, and Accessory Buildings. For one- and two-family dwellings, at least one receptacle outlet shall be installed in the areas specified in 210.52(G) (1) through (3). These receptacles required for specific equipment.

(1) Garages. In each attached garage and in each detached garage with electric power, at least one receptacle outlet shall be installed in each vehicle bay and not more than 1.7 m (5-1/2 ft) above the floor.

210.11(C)(4) AND 210.52(G)(1)

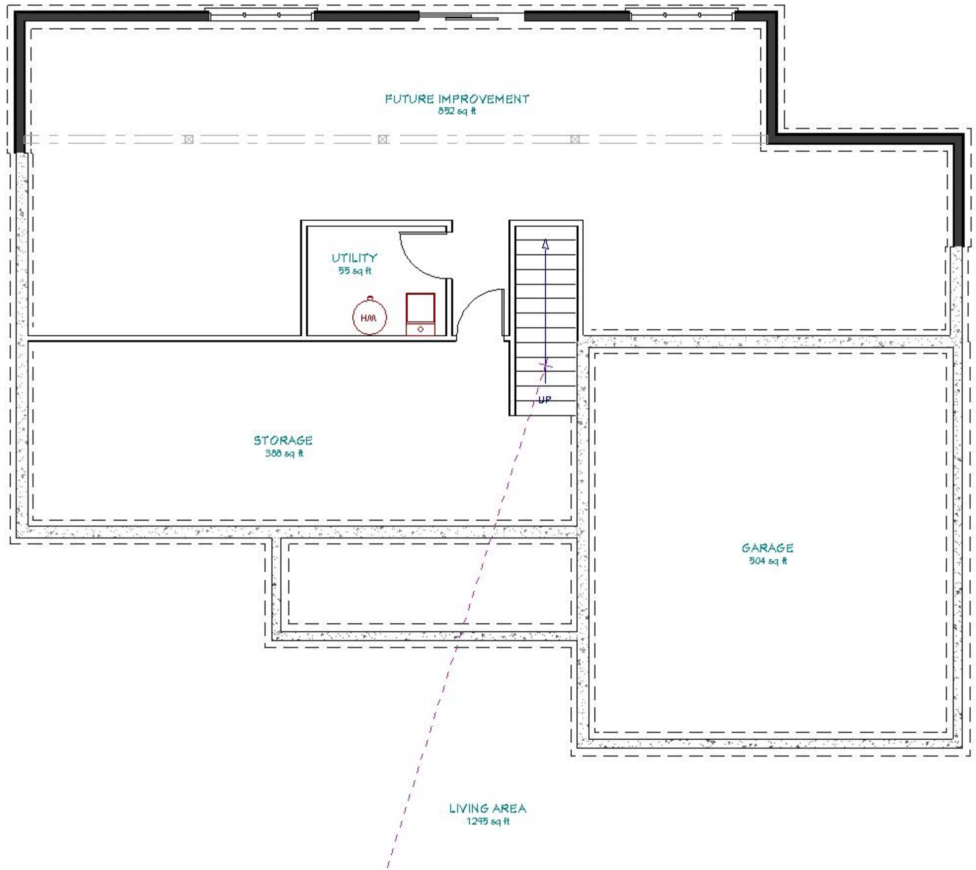


LiftMaster

Required receptacles

- Basement
  - One receptacle needed in addition to receptacle required for specific equipment
    - Central Vac , Sump pump

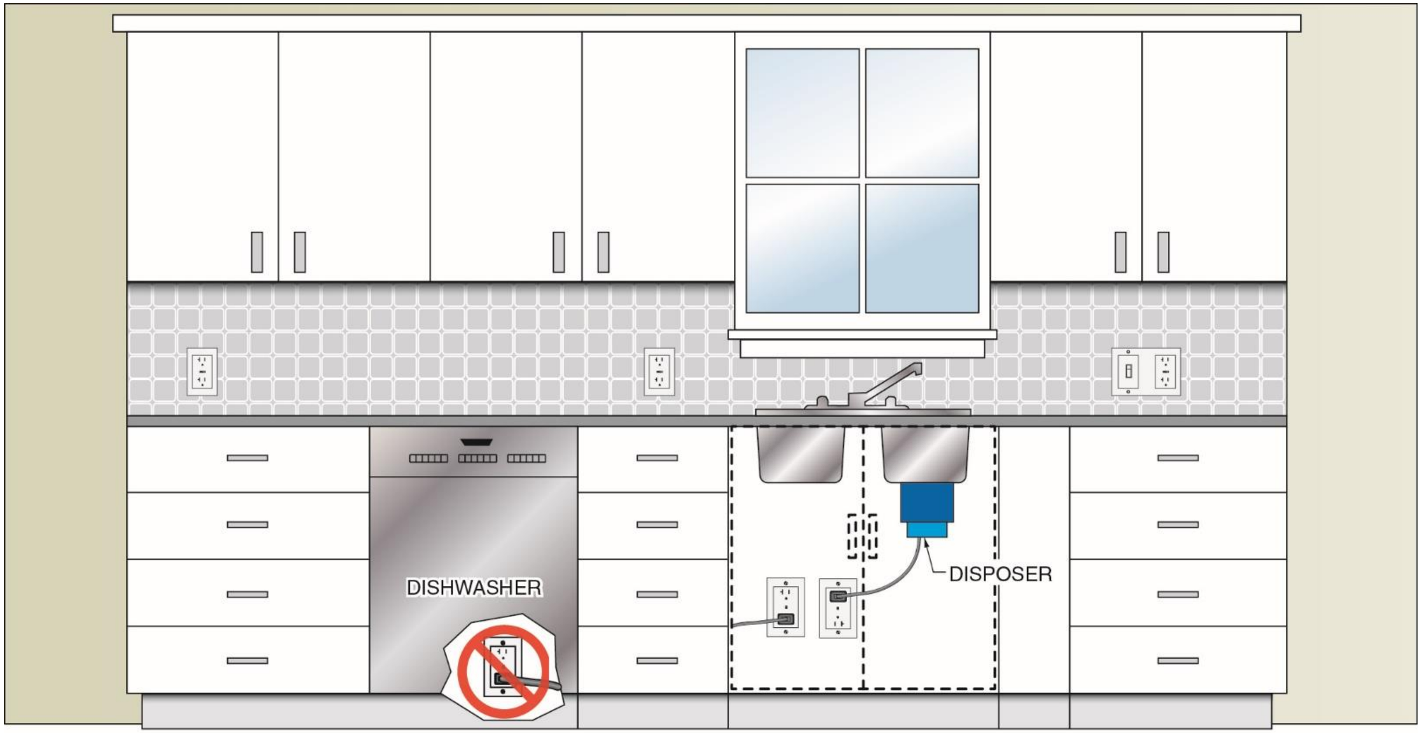
  - Each separate section is required to have a receptacle
    - Storage room
    - Partially finished basement


FUTURE IMPROVEMENT
852 sq ft
UTILITY
55 sq ft
HW
UP
STORAGE
388 sq ft
GARAGE
504 sq ft
LIVING AREA
1295 sq ft

422.16(B)(2) BUILT-IN DISHWASHERS

- Built-in Dishwashers that are cord-and-plug-connected are now required to have receptacle outlet located in space adjacent to the space occupied by the dishwasher.
- Length of dishwasher cord was increased from 4 ft to 6.5 ft, “measured from the face of the attachment plug to the plane of the rear of the appliance”.
- Trash compactor cord is still required to be between 3 and 4 ft.
- Trash compactor receptacle is required to be located in adjacent space as well.

422.16(B)(2) BUILT-IN DISHWASHERS



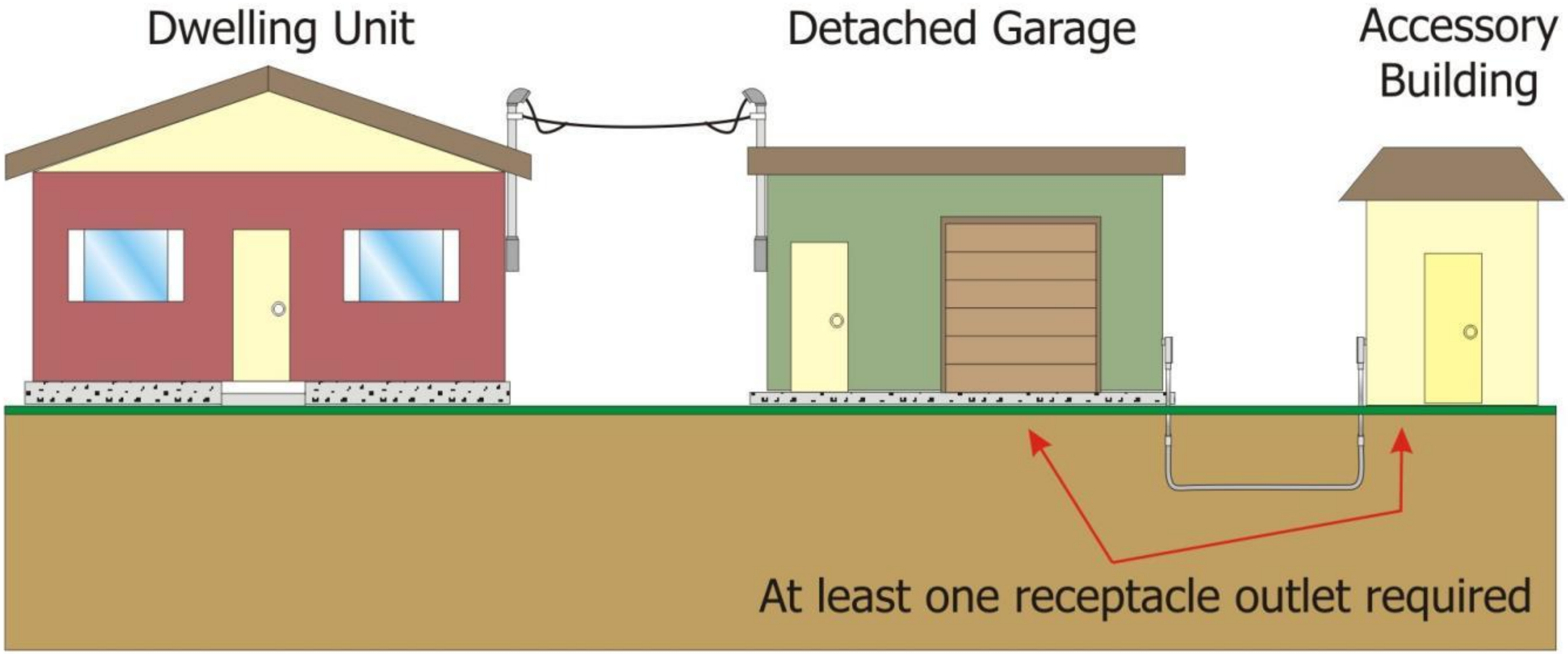
Receptacle outlet for cord-and-plug connected built-in dishwasher required to be located in the space adjacent to the space containing the dishwasher only with the length of a cord for a built-in dishwasher lengthened from 1.2 m (4 ft) to 2.0 m (6-1/2 ft)

Required receptacles

- Accessory Building(s) – (detached garage, shed, etc.)
  - Not required to run electric to any of these buildings
  - If you do run electric power, you must install a receptacle
    - Can’t do lighting only

- Only 1 branch circuit allowed to be run to building
  - Multi-wire branch circuit counts as one circuit.
  - If more circuits are needed, run feeder to subpanel.

210.52(G) Accessory Buildings with Power



210.52(G) - Basements, Garages, and Accessory Buildings

At least one 125-volt, 15- and 20-ampere receptacle outlet, in addition to those for specific equipment, shall be installed in each basement, in each attached garage, and in each detached garage or accessory building with electric power

GFCI Receptacles

- Required
  - Dwelling Units – 15 and 20 amp, 120 volt
    - Bathrooms
    - Garages-*
    - Outdoors
    - Crawl spaces
    - Unfinished basements *
    - Kitchens – where the recepts are installed to serve countertops
    - Boathouses
    - Accessory buildings with floor at or below grade not intended as habitable (storage, work areas)
  - *Do not need if used for fire alarm and/or burglar alarm systems
  - **Must be READILY ACCESSIBLE**

210.8 Ground-Fault Circuit-Interrupters

- All GFCIs for personnel must be installed in a readily accessible location
- This applies to 210.8(A), (B), and (C)

GFCI Receptacles

- Required
- Dwelling Units – 15 and 20 amp, 120 volt

  - **Within 6 feet of bathtub or shower stall**
    - Eliminated loop hole

  - **All sinks – took out kitchen sink reference**
    - Could affect disposals, microwave and fridge

  - **Laundry areas**
    - Define "area"

  - **Dishwashers – 210.8(D)**

210.8 MEASUREMENTS FOR GFCI PROTECTION

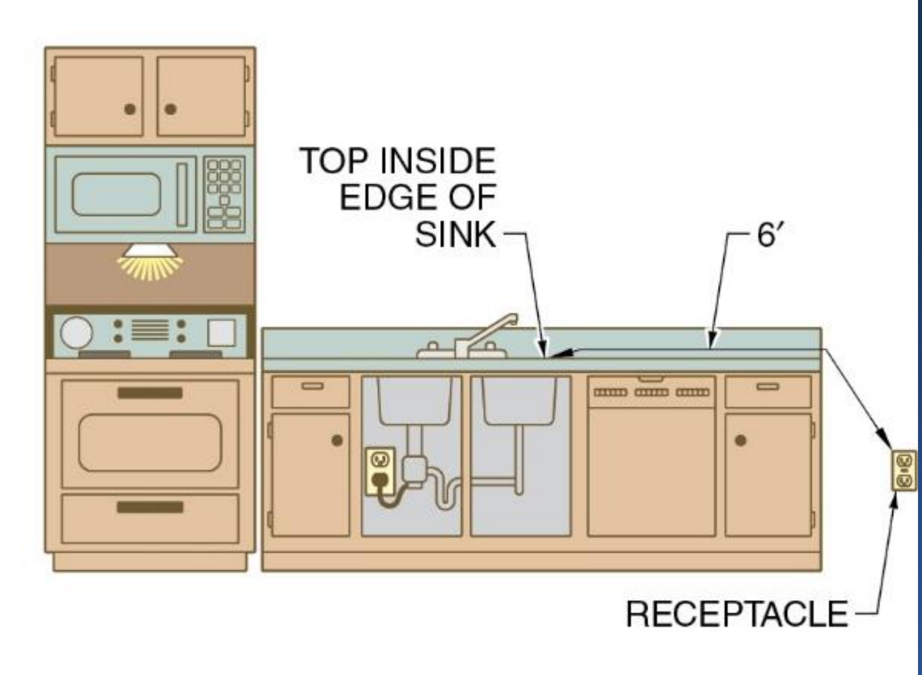
210.8 Ground-Fault Circuit-Interrupter Protection for Personnel. Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through (E). The ground-fault circuit interrupter shall be installed in a readily accessible location.

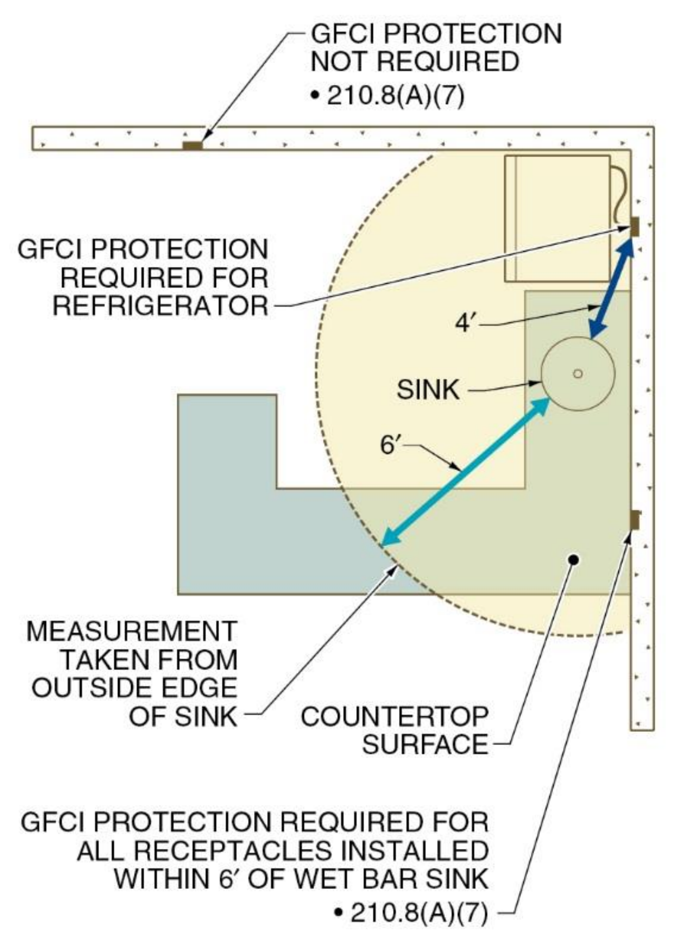
Informational Note No. 1: See 215.9 for ground-fault circuit-interrupter protection for personnel on feeders.

Informational Note No. 2: See 422.5(A) for GFCI requirements for appliances.

For the purposes of this section, when determining distance from receptacles the distance shall be measured as the shortest path the cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or window.

210.8 MEASUREMENTS FOR GFCI PROTECTION





210.8(A)(7) GFCI PROTECTION AT SINKS

(A) Dwellings …

(7) Sinks — where receptacles are installed within 1.8 m (6 ft) from the *top inside* edge of the bowl of the sink……

(B) Other than Dwelling Units….

(5) Sinks — where receptacles are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink….

Inside edge of sink

SECTION 210.8(E) GFCI PROTECTION FOR CRAWL SPACE LIGHTING OUTLETS

N **(E) Crawl Space Lighting Outlets.** GFCI protection shall be provided for lighting outlets not exceeding 120 volts installed in crawl spaces.

Applies to **ALL crawl spaces**, BOTH dwelling unit and non-dwelling units alike!

Arc Fault Receptacles

- Dwelling units – 15 and 20 amp, 120 volt
  - 210.12 (A)
  - Pretty much every place that doesn’t require GFCI

- Locations that don’t require arc fault protection
  - Bathroom
  - Outside
  - Unfinished basement
  - Garage

Arc Fault Receptacles

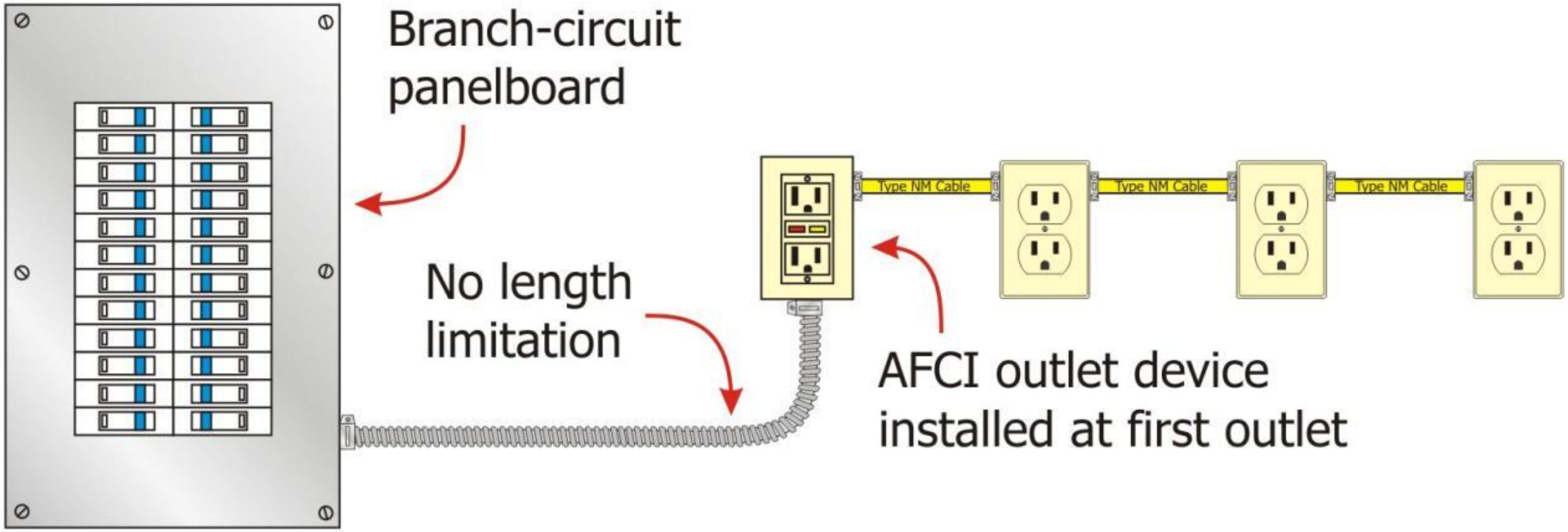
- Dwelling units – 15 and 20 amp, 120 volt
    - 210.12 (A)

- Verbiage includes the word “devices”
    - Could affect garage lighting, outdoor lighting

    - Can bypass breaker and use first outlet box if metal box and fed by metal raceway or cable.

210.12(A) Ex. No. 1 Outlet Type AFCI

Main rule at 210.12(A) requires AFCI combination-type protection installed to provide protection of the entire branch circuit



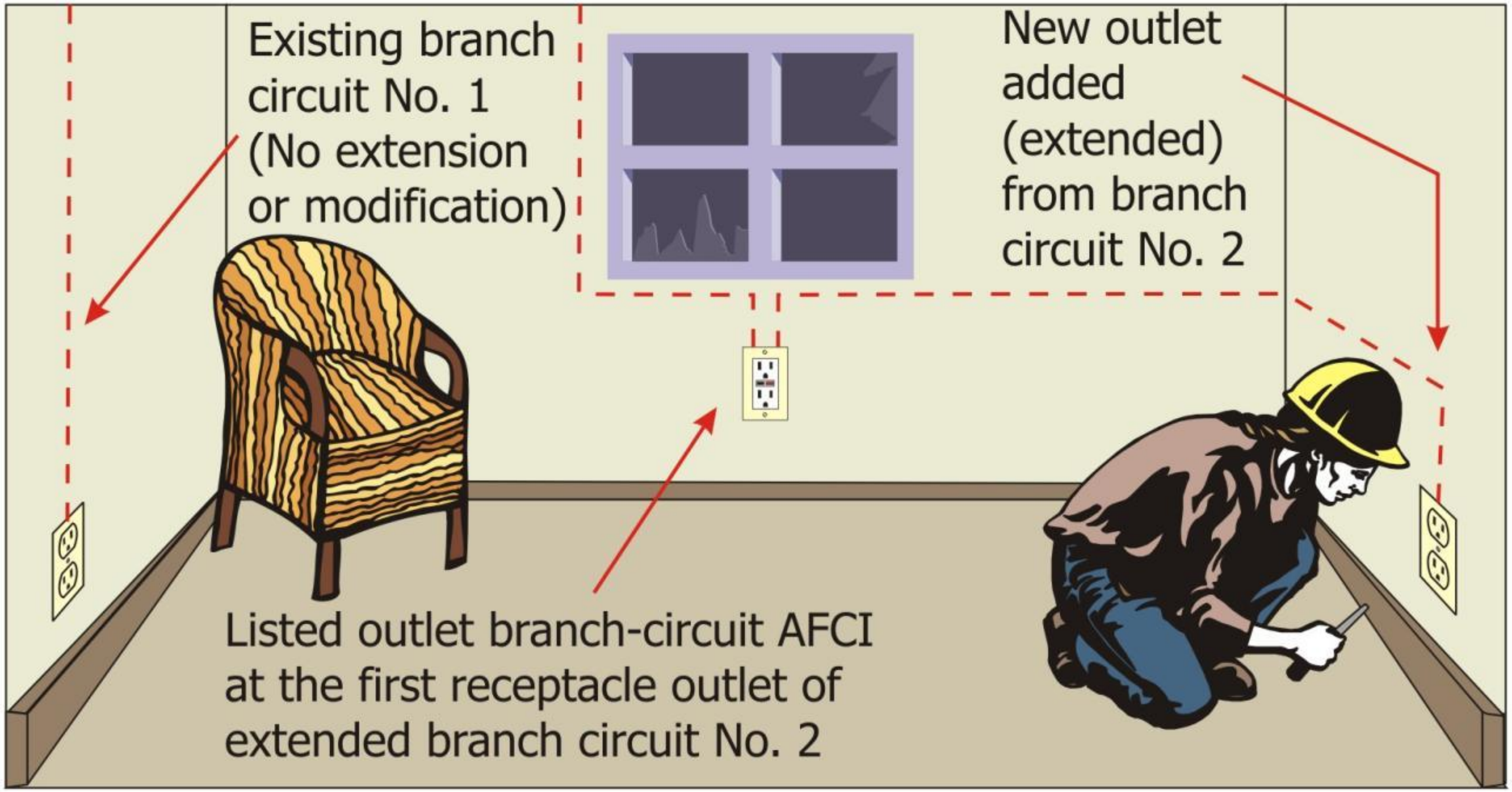
Branch-circuit panelboard

No length limitation

AFCI outlet device installed at first outlet

Ex. No. 1: If RMC, IMC, EMT, Type MC or steel armored Type AC cables meeting the requirements of 250.118 and metal outlet and junction boxes are installed for the portion of the branch circuit between the branch-circuit overcurrent device and the first outlet, it shall be permitted to install a outlet branch-circuit Type AFCI at the first outlet to provide protection for the remaining portion of the branch circuit.

210.12(B) AFCI - Extensions or Modifications



In any of the areas specified in 210.12(A), where branch-circuit wiring is modified, replaced or extended, the branch circuit shall be protected by:

(1) A listed combination AFCI located at the origin of the branch circuit, or

(2) A listed outlet branch-circuit AFCI located at the first receptacle outlet of the existing branch circuit

406.4(D)(4), EX. NO. 1 AND EX. NO. 2
AFCI FOR REPLACEMENT OF EXISTING RECEPTACLES

- Four exceptions were added to this section which covers replacement of receptacles in areas that 210.12(A) and (B) now requires to have AFCI protection.
  - AFCI is not required when replacing a non-grounding receptacle and no ground exists.
  - AFCI is not required when there is not equipment ground.
  - A listed combination type arc-fault circuit-interrupter circuit breaker is not commercially available.
  - GFCI/AFCI dual function receptacles are not commercially available.
- Exception to 210.12(B) permits existing branch circuit conductors to be modified or extended up to 1.8 m (6 ft) without AFCI protection where no additional outlets or devices are installed

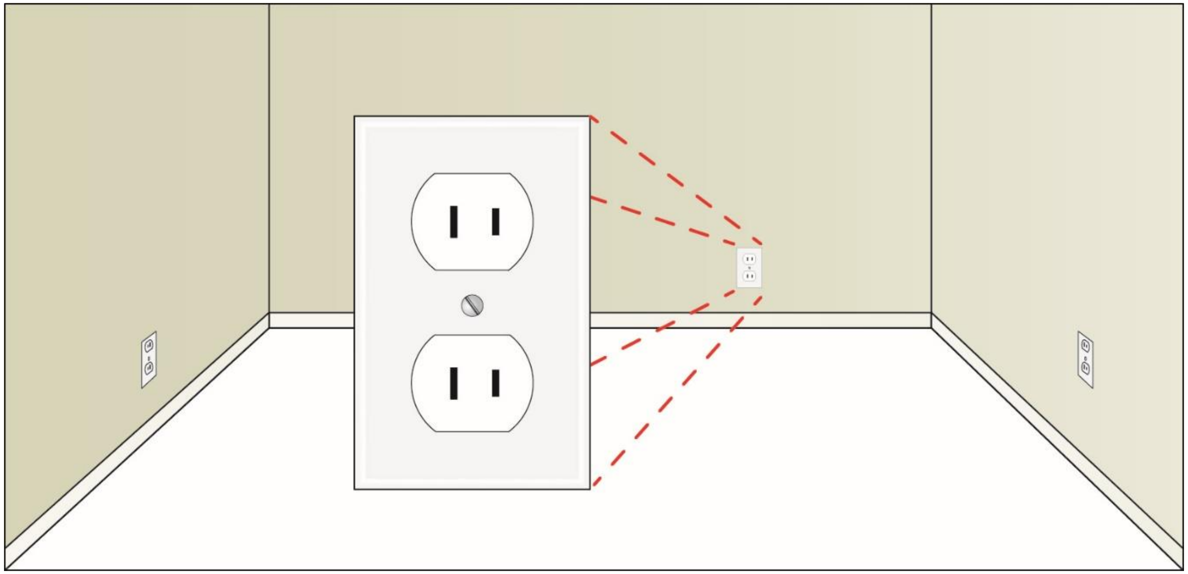
406.4(D)(4), EX. NO. 1 AND EX. NO. 2
AFCI FOR REPLACEMENT OF EXISTING RECEPTACLES

- Arc Fault replaces are not necessary if the Exception to 210.12(B) applies.

- This exception permits existing branch circuit conductors to be modified or extended up to 1.8 m (6 ft) without AFCI protection where no additional outlets or devices are installed.

406.4(D)(4) REPLACEMENT RECEPTACLES (AFCI)

Where a receptacle outlet is located in any areas specified in 210.12(A) or (B), a replacement receptacle at this outlet must be AFCI protected



Ex. No. 1: AFCI protection not required where all of the following apply:

(1) Replacement complies with 406.4(D)(2)(b) *(two-wire system-GFCI)*

(2) Impracticable to provide an EGC as provided by 250.130(C)

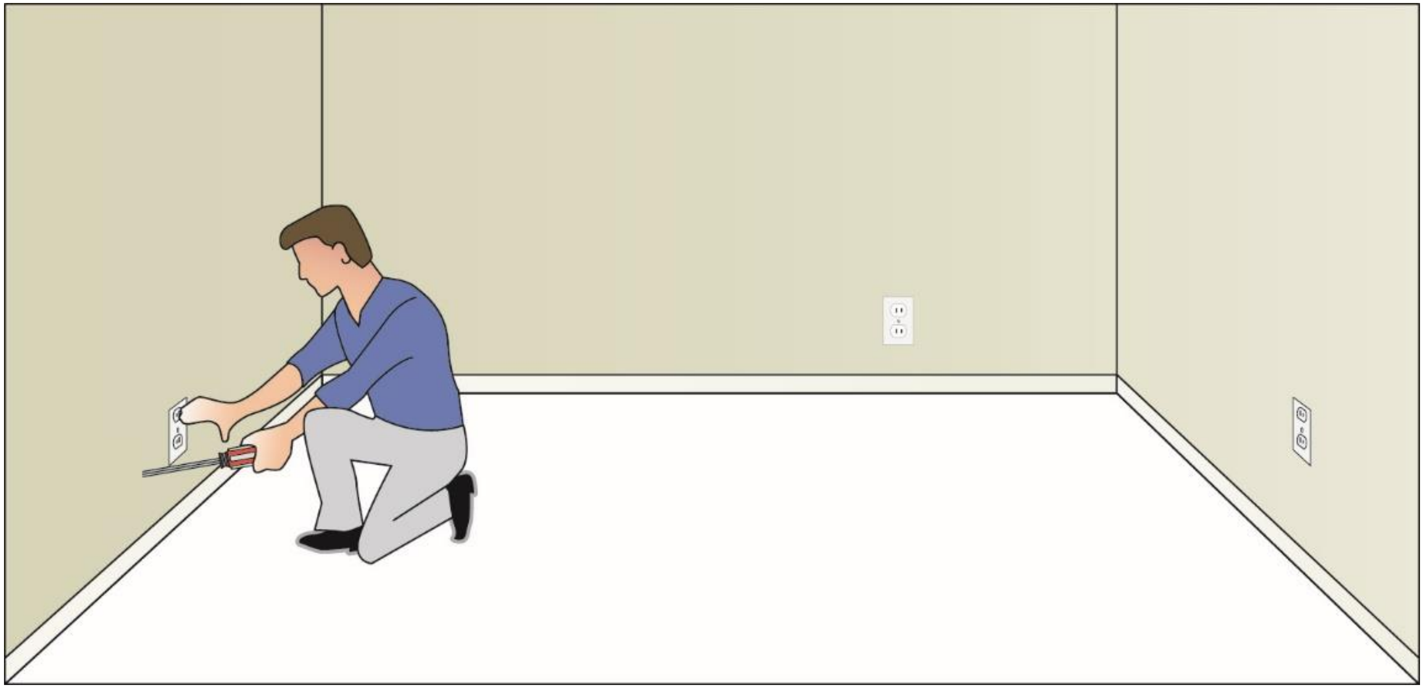
(3) Listed combination type AFCI circuit breaker not commercially available

(4) GCFI/AFCI dual function receptacles not commercially available

Ex. No. 2: Exception at 210.12(B) shall not apply to replacement of receptac

406.4(D)(4) REPLACEMENT RECEPTACLES (AFCI)

Where a receptacle outlet is located in any areas specified in 210.12(A) or (B), a replacement receptacle at this outlet must be AFCI protected



Ex. No. 2: Exception at 210.12(B) shall not apply to replacement of receptacles

[210.12(B), Ex.: AFCI protection not required where the extension of the existing conductors is not more than 1.8 m (6 ft.) and does not include any additional outlets or devices]

Required switches

- At least one wall switch controlled lighting outlet in each habitable room
  - Outlet is not the same as a receptacle
    - Overhead light
    - Wall sconce
  - Sensors are allowed if manual override available
- It may be a receptacle instead of a lighting outlet (overhead light) except for
  - Kitchen
  - Bathroom
  - Garage

Required switches

- Hallways – at least one switch
- Storage or equipment spaces
  - Attics, under floor spaces, utility rooms, basements
  - At least one switch
    - Switch near point of entry
    - Lighting outlet near equipment needing servicing
- Stairs
  - One at each level if there are 6 or more risers
  - One at each level if it is an entryway
- Exterior of exterior doors with grade level access
  - Coach lights
  - Does not include a vehicle door (garage door)

Required switches

- 2011 required a neutral to be in most switch boxes
  - Hoped to reduce having ground used as conductor

- Rules loosened up a little in 2014
  - Neutral not needed if:
    - Switch does not serve a habitable room or bathroom
      - Hallway
      - Closets
    - Multiple switching (3 ways and 4 ways)
      - Only need where switch location covers the area
    - Integral switches
      - Door jam switch
- Also kept other exceptions:
  - Raceways
  - Access to switch box at later time

404.2(C) GROUNDED CONDUCTOR AT SW. LOCATIONS

(C) Switches Controlling Lighting Loads. The grounded circuit conductor for the controlled lighting circuit shall be installed at the location where switches control lighting loads that are supplied by a grounded general-purpose branch circuit serving bathrooms, hallways, stairways, or rooms suitable for human habitation or occupancy as defined in the applicable building code. Where multiple switch locations control the same lighting load such that the entire floor area of the room or space is visible from the single or combined switch locations, the grounded circuit conductor shall only be required at one location.

404.2(C) Grounded Conductor at Switch Locations

A grounded conductor is generally required to be installed and connected to the switching device at locations where switches control lighting loads that are supplied by a grounded general purpose-branch circuit.

Grounded conductor is generally NOT required at the following locations:

Lighting controlled by automatic means

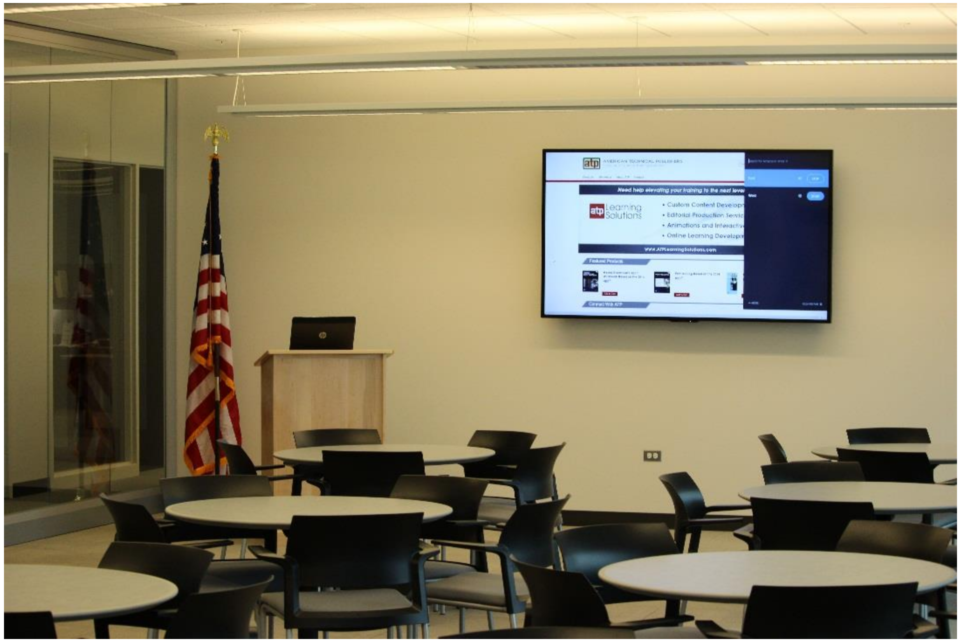
Where a switch controls a receptacle load

Switch for non-habitation type room or occupancies as defined by applicable building codes

404.2(C) GROUNDED CONDUCTOR AT SWITCH LOCATIONS

A grounded conductor is generally required to be installed and connected to the switching device at locations where switches control lighting loads that are supplied by a grounded general-purpose branch circuit

Grounded is generally **NOT** required at the following locations:



Where multiple switch locations control the same lighting load such that the entire floor area of the room or space is visible from the single or combined switch locations, the grounded circuit conductor shall only be required at one location

404.2(C) SWITCHES CONTROLLING LIGHTING LOADS

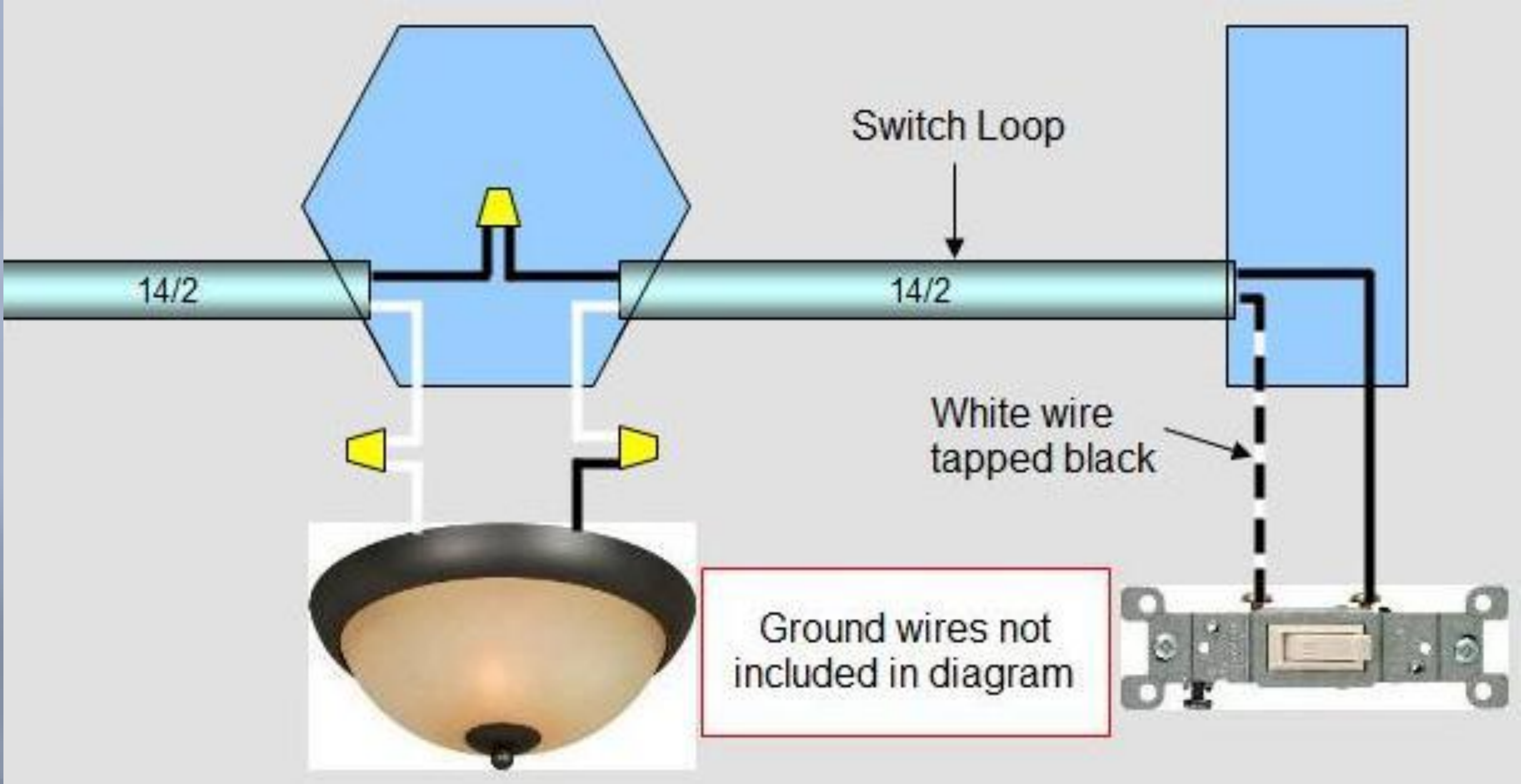
- All electronic lighting control switches are required to be listed. As of Jan. 1, 2020, electronic lighting control switches (with exceptions) will not be permitted to introduce current on the equipment-grounding conductor during normal operation.

- Manufacturers will only make devices that place current on the equipment-grounding conductor during normal operation for replacement/retrofit.

- New exception places limits to electronic switches to the following levels.
  - Branch circuit (5)
  - Or feeder (25)

Required switches

- Switch loops required to be:
  - Down on white
  - Back on black
- Must phase white conductor with phase color
  - Tape
  - Paint
  - Marker
- Not as relevant with neutral requirements

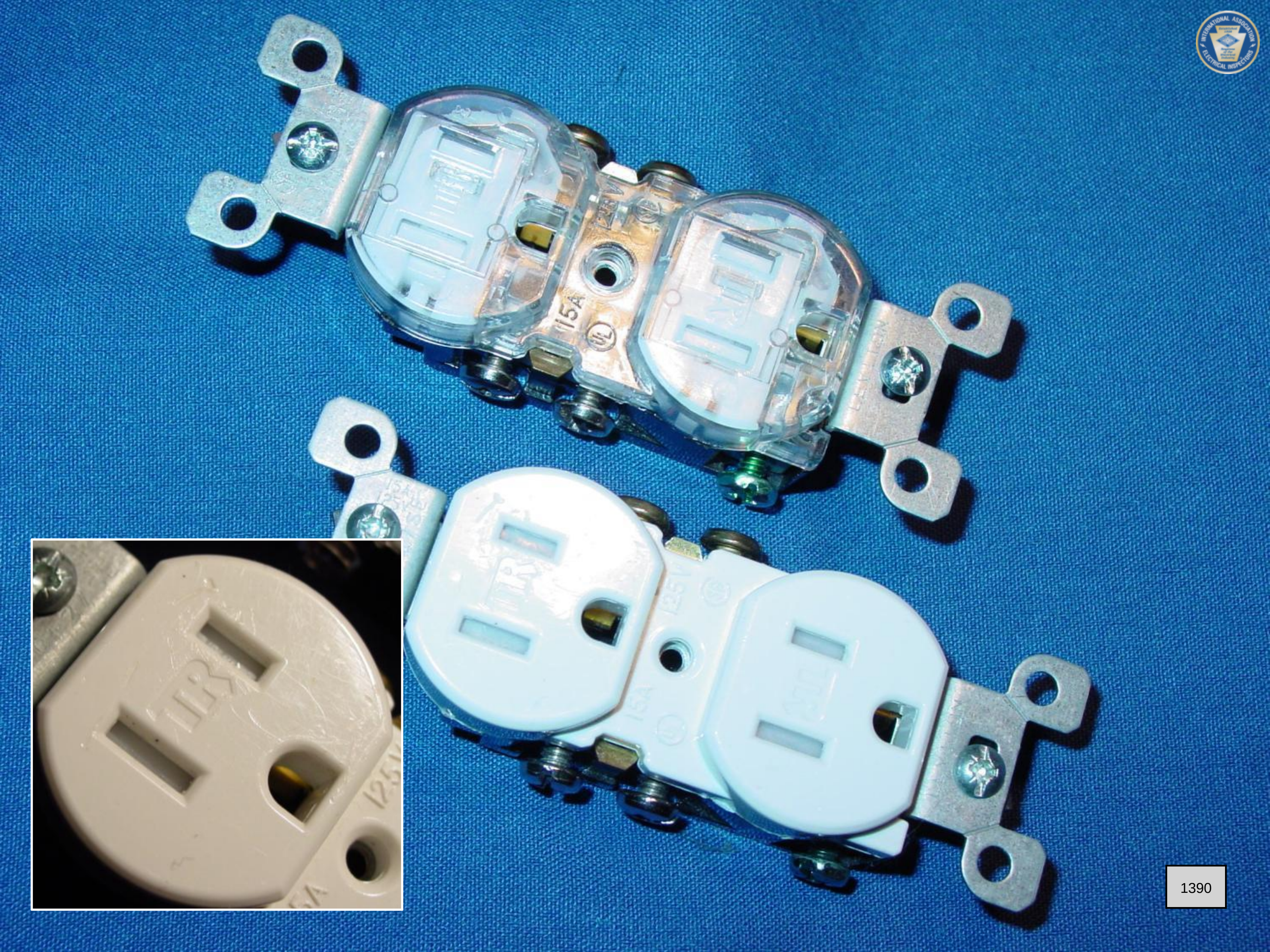

Switch Loop
14/2
14/2
White wire tapped black
Ground wires not included in diagram

Devices- General

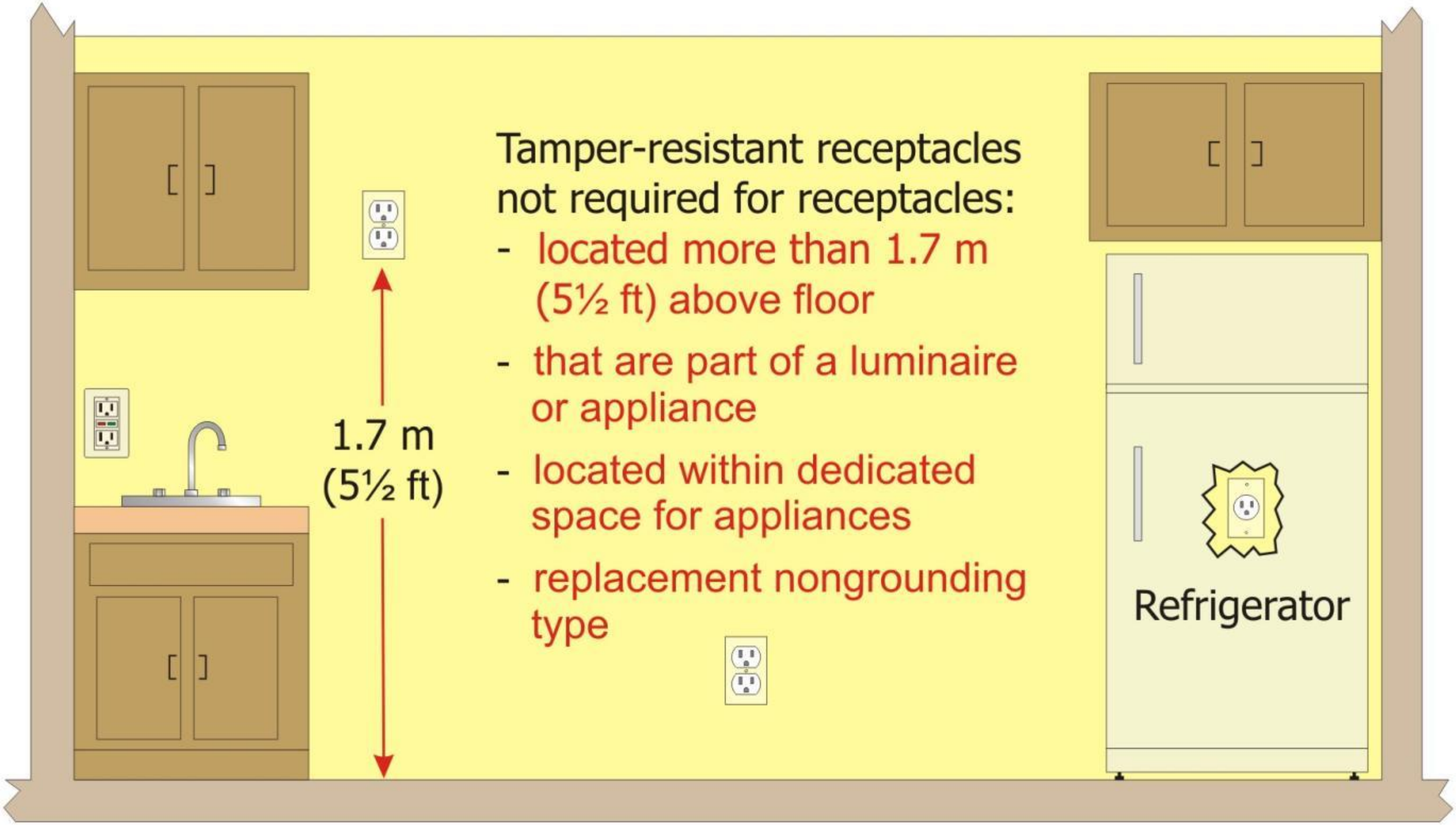
- Tamper resistant receptacles
  - Required for all 120 volt, 15 and 20 amp receptacles
    - Not required 5 ½ feet off the floor and below or dedicated for appliance.
- Weather resistant receptacles
  - Required for all outdoor receptacles
- **Extra Duty Covers**
  - Must be used in all wet locations
  - Can not be old gasket type
- CO/ALR
  - Listed for both copper and aluminum wire

Replacement receptacles must be brought up to code regarding tamper and weather resistant. There is also provisions for bringing the circuit up to arc fault standards.


EXTRA DUTY
LIFT
OPEN


15A
125V
TR
15A
125V
TR

406.12 Tamper-Resistant Receptacles



Tamper-resistant receptacles not required for receptacles:

- located more than 1.7 m (5½ ft) above floor
- that are part of a luminaire or appliance
- located within dedicated space for appliances
- replacement nongrounding type

In all areas specified in 210.52, all nonlocking type 125-volt, 15- and 20-ampere receptacles required to be listed tamper-resistant receptacles

406.4(D)(4) Receptacle Replacement (AFCI)

Existing outlet to be replaced

Arc-fault circuit-interrupter protection is required for replacement receptacle outlets where a receptacle outlet is supplied by a branch circuit that requires AFCI protection elsewhere in the *Code* *(effective date January 1, 2014)*

Replacement receptacle outlet can be protected by a listed outlet branch circuit type AFCI receptacle or a listed combination type AFCI circuit break

406.4(D)(5) Receptacle Replacement Tamper-Resistant Receptacles

Listed tamper-resistant receptacles are required for replacement receptacle outlets where a receptacle outlet is required to be tamper-resistant elsewhere in the *Code*

See 406.12, 406.13, and 406.14 for tamper-resistant receptacle requireme

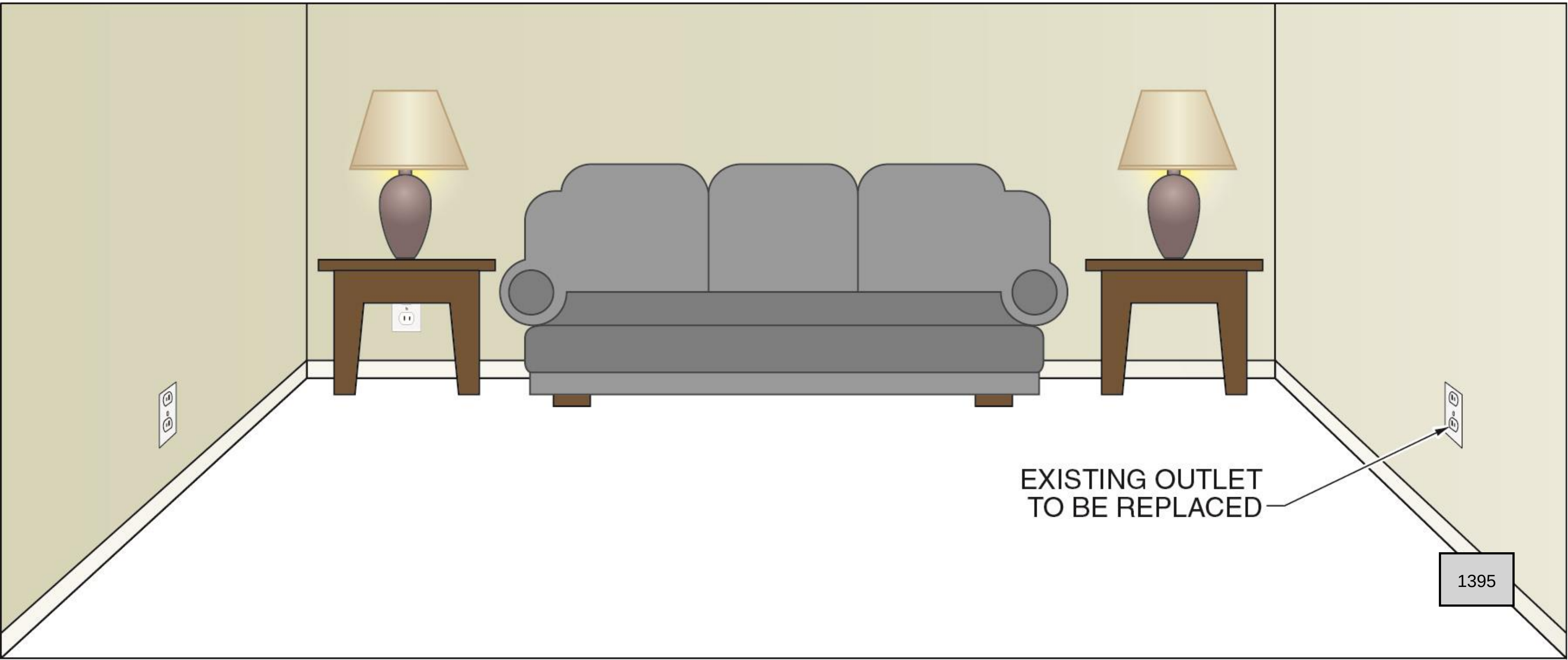
TAMPER-RESISTANT RECEPTACLES FOR REPLACEMENTS

- Tamper-resistant receptacles are presently not manufactured in a nongrounding type, two-prong receptacle

- Therefore, when replacing receptacles, tamper-resistant receptacles are required for all replacements in those areas required by the code unless a non-grounding receptacle is replaced with another non-grounding receptacle type.

406.4(D)(5) REPLACEMENT WITH TAMPER RESISTANT

(5) Tamper-Resistant Receptacles. Listed tamper-resistant receptacles shall be provided where replacements are made at receptacle outlets that are required to be tamper-resistant elsewhere in this Code, except where a non-grounding receptacle is replaced with another non-grounding receptacle.



406.4(D)(6) Receptacle Replacement Weather-Resistant Receptacles

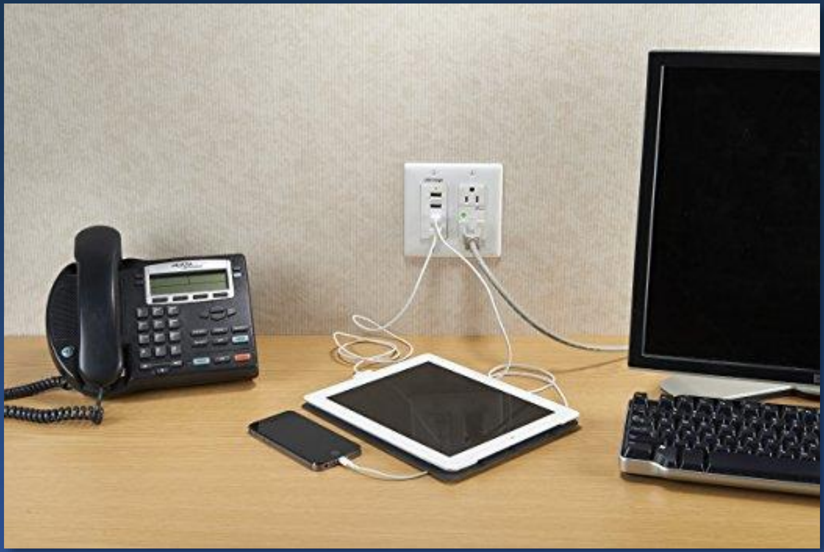
Listed weather-resistant receptacles are required for replacement receptacle outlets where a receptacle outlet is required to be weather-resistant elsewhere in the *Code*

See 406.9(A) and 406.9(B) for weather-resistant receptacle requirements

406.3(F) RECEPTACLE WITH USB CHARGER

- New Text has been added to clarify the when USB Charging ports are integral to a 125-volt, 15- or 20- amp receptacle the Class 2 circuitry necessary for the USB charging is integral to the receptacle.
- Receptacle shall be listed.
- Certain Class 2 power supplies and output connector(s) are intended to be secured and directly connected to a duplex receptacle. This is not permitted according to the new text.

RECEPTACLE WITH USB CHARGER



406.6(D) RECEPTACLE FACEPLATE (COVER PLATES) WITH INTEGRAL NIGHT LIGHT AND/OR USB CHARGER

- New requirements were added pertaining to receptacle faceplates with integral night lights and/or USB chargers
- These faceplates must be listed and constructed such that the night light and/or Class 2 circuitry is “integral with the flush device cover plate”
- Plug-in night light/covers that is not “integral with the flush device cover plate,” but simply designed to be plugged directly into a receptacle outlet presents a problem
- The ease in removing these night light-type covers from the receptacle outlet increases its safety hazard

406.6(D) Receptacle Faceplate (Cover Plates) with Integral Night Light and/or USB Charger.

A flush device cover plate that additionally provides a night light and/or Class 2 output connector(s) shall be listed and constructed such that the night light and/or Class 2 circuitry is integral with the flush device cover plate.

SnapPower

Required lighting

- Lighting fixtures
  - Bathtub and shower
    - No part of fixture shall be located within
      - 8′ vertically from top of bathtub rim or shower thresh hold
      - 3′ horizontally from edge of fixture
    - If located within this zone, must be marked for damp/wet location (can light, weatherproof trim)

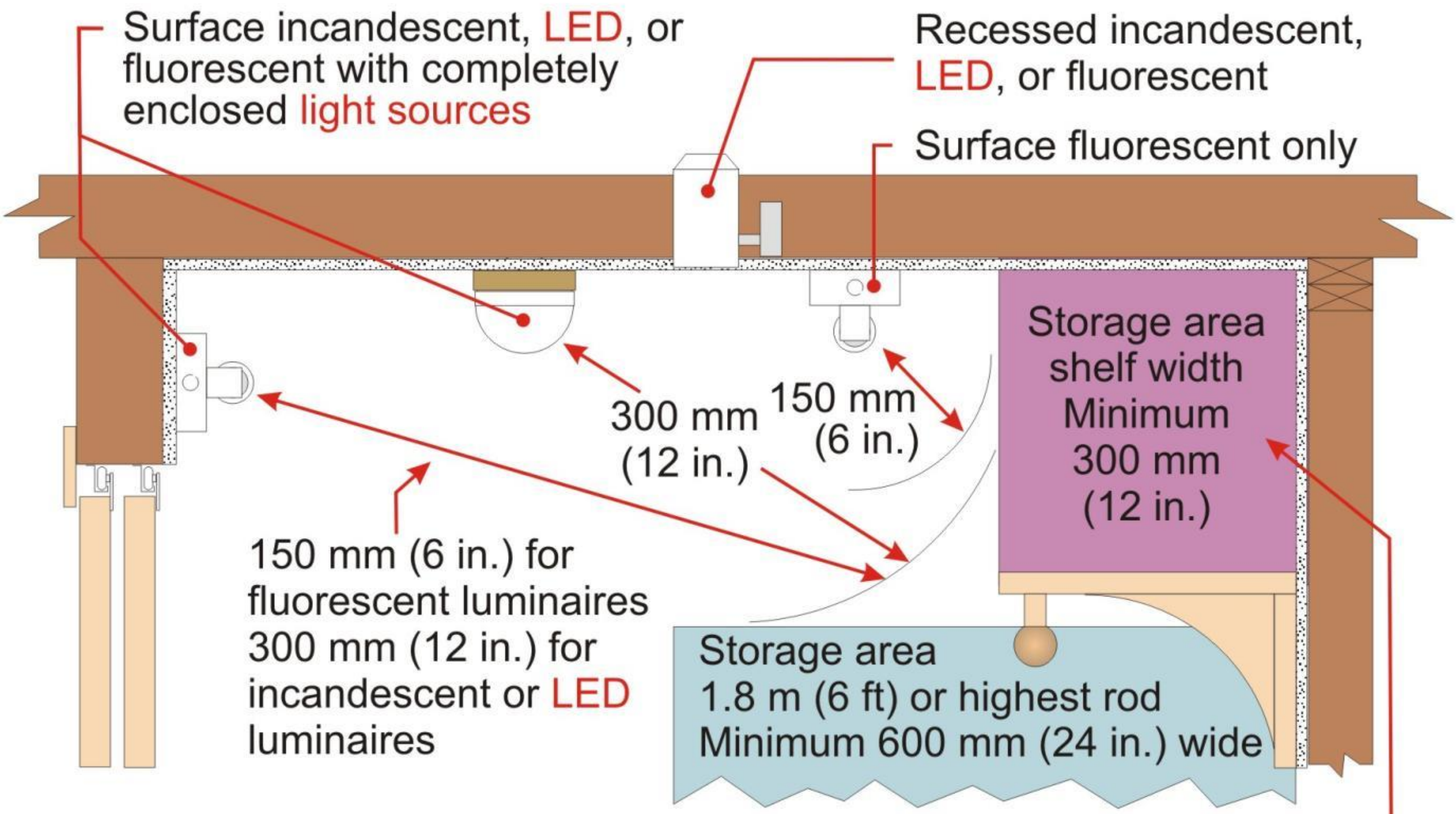
Required lighting

- Clothes closets
  - Open lamps not allowed

- Zone extends from edge of shelf to ceiling
  - 12” clearance for surface mounted incandescent lamp completely enclosed
  - 6” clearance for surface mount fluorescent, or recessed light.
  - LED lights allowed if completely enclosed or listed for closets

- White can – 3” from insulation,
- Metal can – insulation can come in contact

410.16 Luminaires in Clothes Closets



Surface incandescent, LED, or fluorescent with completely enclosed light sources

Recessed incandescent, LED, or fluorescent

Surface fluorescent only

300 mm (12 in.)

150 mm (6 in.)

Storage area shelf width Minimum 300 mm (12 in.)

150 mm (6 in.) for fluorescent luminaires 300 mm (12 in.) for incandescent or LED luminaires

Storage area
1.8 m (6 ft) or highest rod
Minimum 600 mm (24 in.) wide

Surface-mounted fluorescent or LED luminaires permitted to be installed within the closet storage space where identified for this use

Revisions were added to 410.16 to clearly permit surface-mounted LED luminaires in clothes closets

Disconnecting Means

- Needed for appliances/motors
  - In sight and within 50′
- Common disconnects
  - Furnace Central Vac
  - Dishwasher AC unit
  - Oven Dryer
- Can be switch or receptacle
- AC unit does not have to be fused – if breaker is correct

- MUST SIMULTANEOUS DISCONNECT ALL PHASE CONDUCTORS OF AN APPLIANCE

Pools/Hot tubs/Jacuzzis

- Dwelling Pools
  - At least one receptacle located between 6′-20′ from inside edge of pool shall be provided
  - Located 6′6″ or less above grade level
  - Must be GFCI protected

  - Pool pump must be GFCI protected
    - 120 or 240 volt

  - Must have insulated ground throughout circuit for light fixtures

  - Receptacle for hydro massage tub must be within one foot of the opening of the access panel with its face in direct view.

Pools/Hot tubs/Jacuzzis

- Dwelling hot tub
  - Receptacle required between 6 and 10 feet
  - Must be GFCI protected
  - Power to hot tub must be GFCI protected

- Lighting outlets, paddle fans, etc.
  - If not GFCI protected
  - Located at least 12 feet above maximum water level

  - If GFCI protected
  - Located at least 7 foot 6 above maximum water level

- Specialty fixtures may be allowed lower clearance if GFCI protected.

Smoke Detectors

- Must have one on each floor
- If placed on ceiling, keep off wall by at least 12”
- If placed on wall, mount between 4” and 12” of ceiling

- Every bedroom and common hallway is required to have one

- Must be interconnected (3 wire)

- Do not place near kitchen, bathroom, garage, utility room unless it is rated for it. Could use rate of rise or heat detector instead
- Do not put near register vents or ceiling fans.

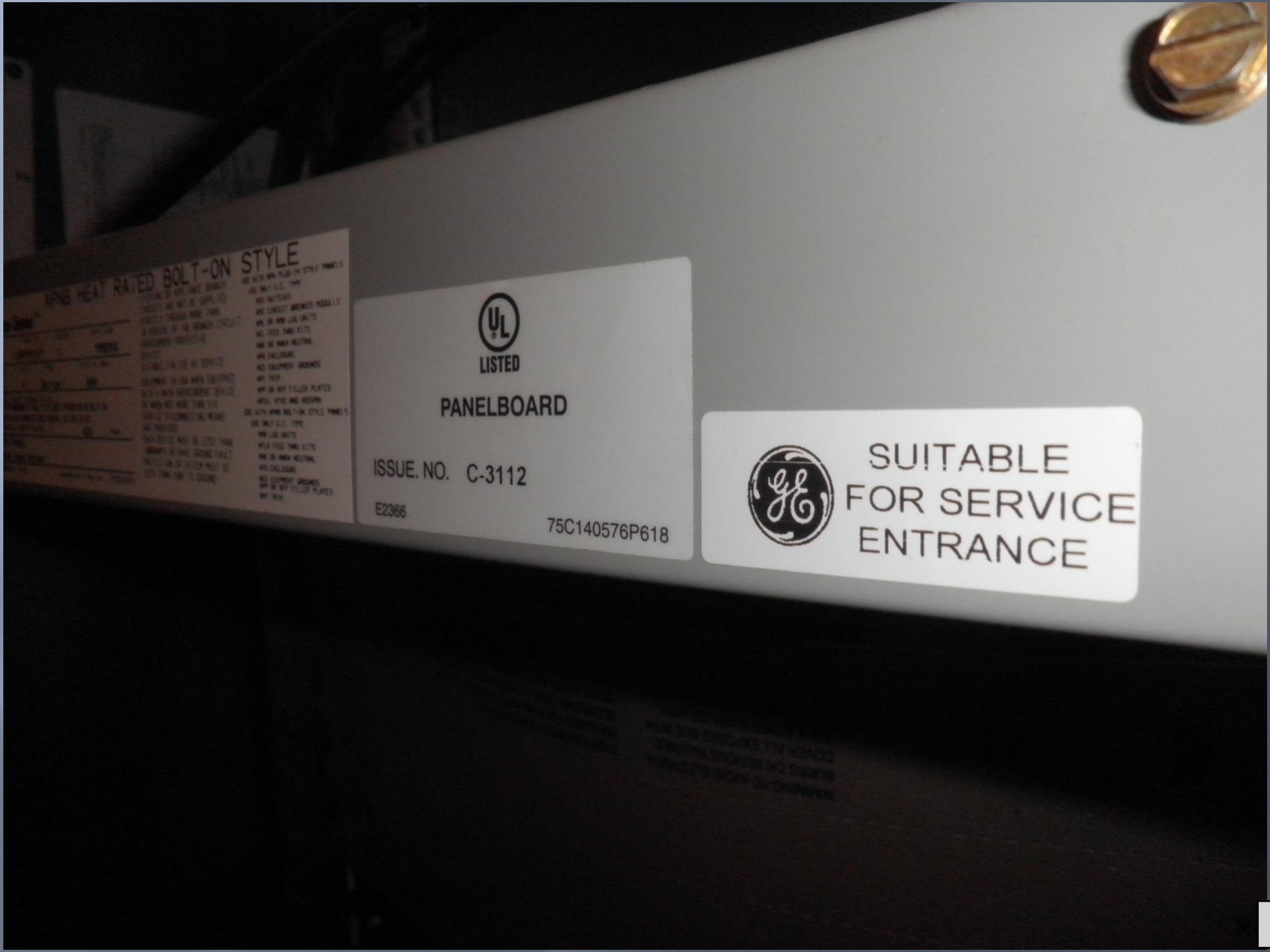
2017 RESIDENTIAL N.E.C. REQUIREMENTS

Services - general

- 230.2 – Only one service per building
  - Several exceptions – unlikely to apply to dwellings
    - Too large
    - Different voltages
    - Different rate schedules

Services - general

- Must be suitable for service entrance equipment
- Bonding ground and neutral
  - Only one time
- Main breaker must be secured in place
  - Wording is back fed devices – 408.36(D)
- Height of main breaker 6′7″ to top – 404.8(A)


HEAT RATED BOLT-ON STYLE
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ENTRANCE

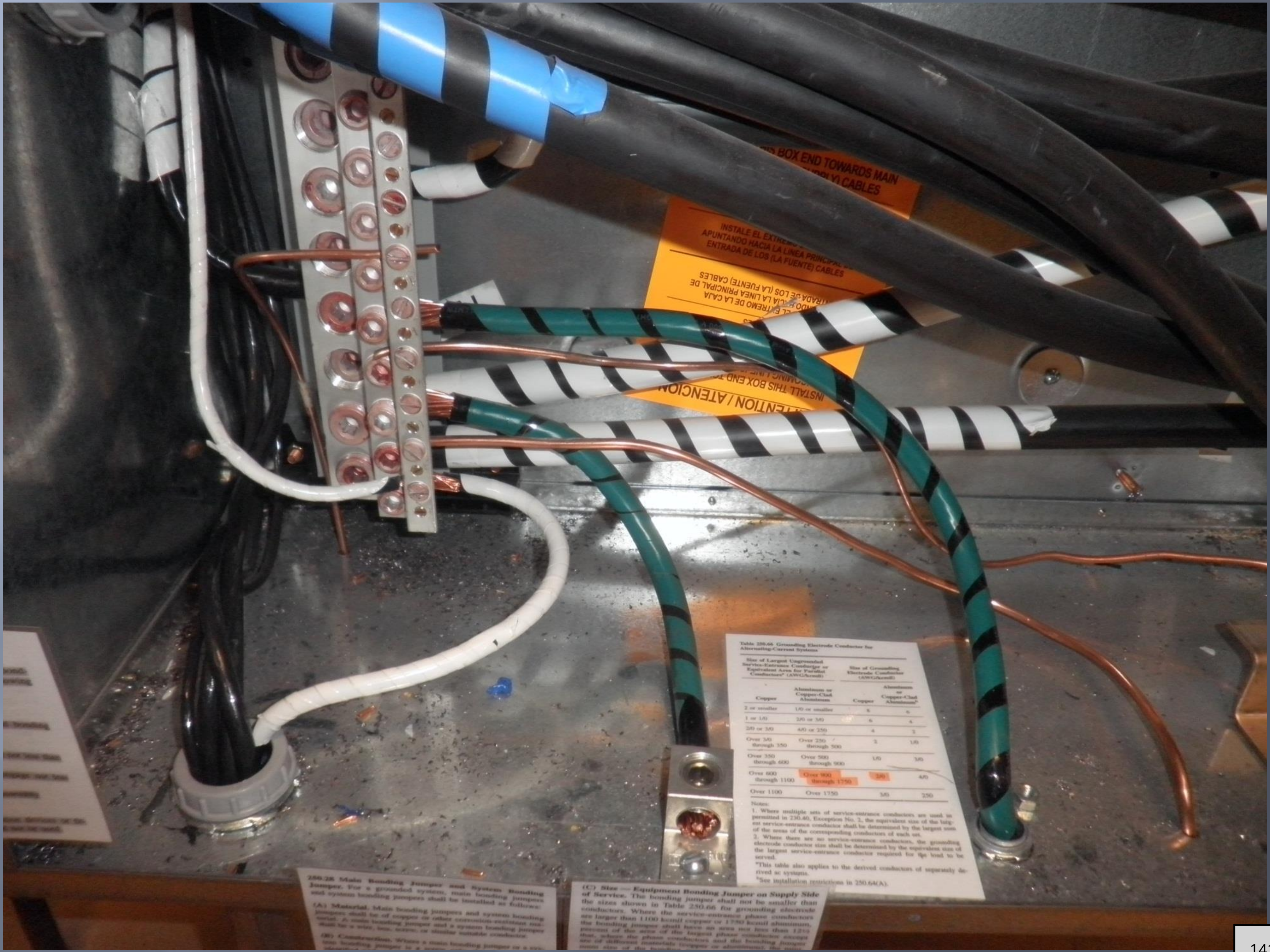


Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

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

Notes:

1. Where multiple sets of service-entrance conductors are used as permitted in 230.40, Exception No. 2, the equivalent size of the largest service-entrance conductor shall be determined by the largest sum of the areas of the corresponding conductors of each set.
2. Where there are no service-entrance conductors, the grounding electrode conductor size shall be determined by the equivalent size of the largest service-entrance conductor required for the load to be served.

^a This table also applies to the derived conductors of separately derived ac systems.

^b See installation restrictions in 250.64(A).

250.28 Main Bonding Jumper and System Bonding Jumper. For a grounded system, main bonding jumpers and system bonding jumpers shall be installed as follows:

(A) Material. Main bonding jumpers and system bonding jumpers shall be of copper or other corrosion-resistant material. A main bonding jumper and a system bonding jumper shall be a wire, bus, screw, or similar suitable conductor.

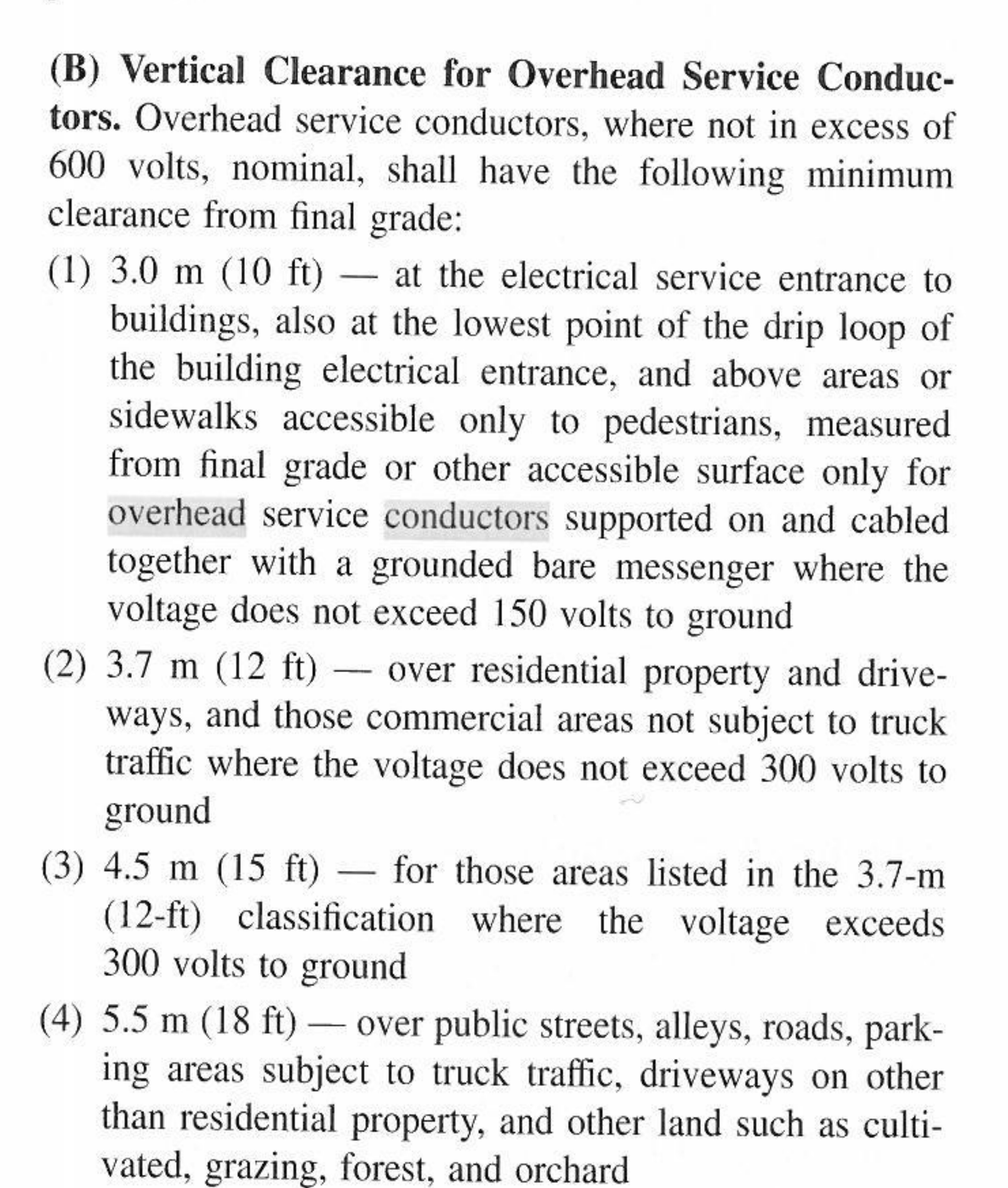
(B) Construction. Where a main bonding jumper or a

(C) Size — Equipment Bonding Jumper on Supply Side of Service. The bonding jumper shall not be smaller than the sizes shown in Table 250.66 for grounding electrode conductors. Where the service-entrance phase conductors are larger than 1100 kcmil copper or 1750 kcmil aluminum, the bonding jumper shall have an area not less than 12½ percent of the area of the largest phase conductor except that, where the phase conductors and the bonding jumper are of different materials (copper or aluminum), the


COPPER

Services - Clearances

- 230.24 (B) Vertical Clearance
- Voltages are one phase to ground
  - 10 feet
    - Pedestrian only, 150 volts to ground
  - 12 feet
    - Not subject to truck traffic, 300 volts to ground
  - 15 feet
    - Same as 12, over 300 volts to ground
  - 18 feet
    - Over public streets, subject to truck traffic
  - 24 ½ feet
    - Over railroad tracks



(B) Vertical Clearance for Overhead Service Conductors. Overhead service conductors, where not in excess of 600 volts, nominal, shall have the following minimum clearance from final grade:

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

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

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

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

Services - Clearances

- 230.9 – Clearances on buildings
  - Open conductors – 3 feet from attainable locations
    - Exception – above a window
  - Vertical Clearance – platforms, etc.
  - Roofs
    - 8 feet – normal roofs – maintained for 3 feet in all directions
      - Exception 1 – pedestrian traffic (patio, etc.)
        - Then normal clearances
      - Exception 2 - only 3 feet needed
        - Less than 300 volts
        - 4/12 slope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Services – Conductor Installation

- 230.50 (1) – Underground protection against physical damage when emerging from grade
    - Rigid metal, IMC, Schedule **80** PVC, EMT

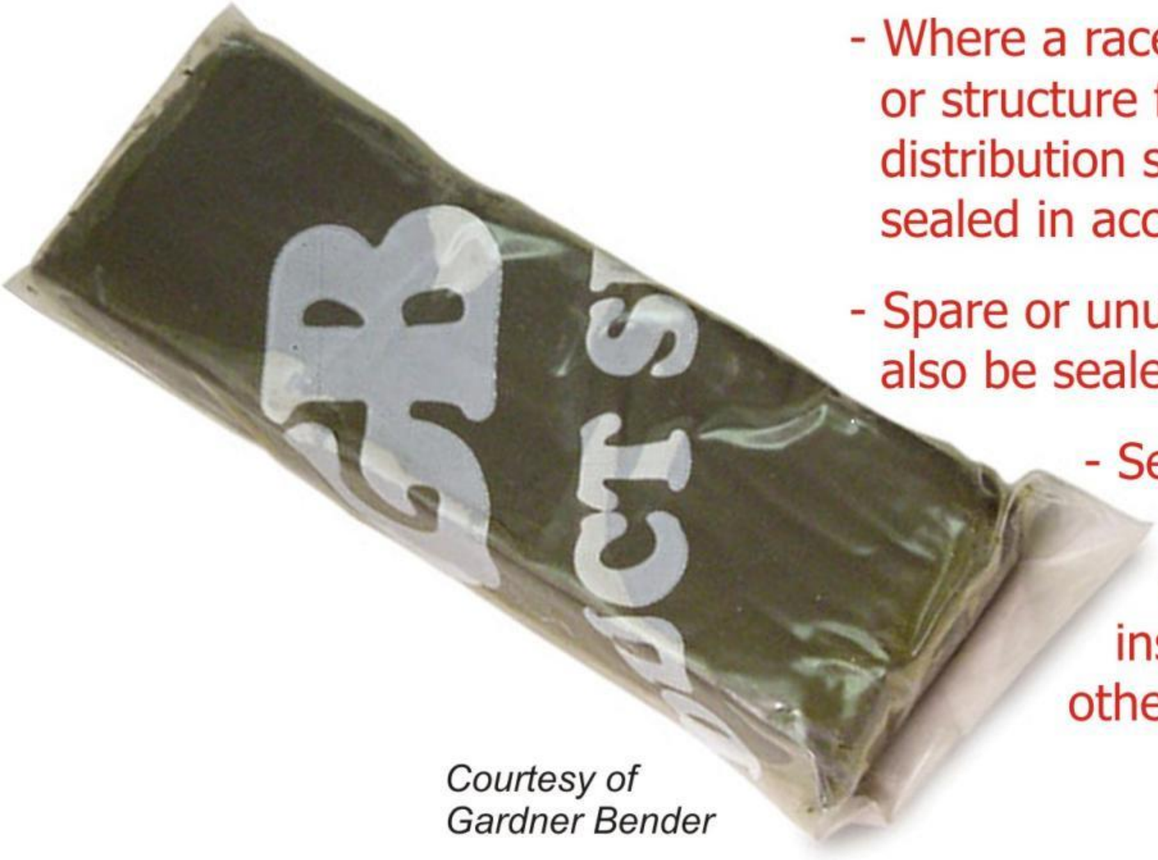
Services - Underground

- 300.5 Underground Installations
    - (D)(1) Emerging from grade
        - 8 feet above
        - 18 inches below
    - (D)(3) Service conductors
        - If not in concrete and buried 18 inches or more
            - Warning ribbon – 12 inches above conductors
    - (F) Backfill – clean
    - (J) Earth Movement – "S" loops

If conduit enters building from outside, it must be sealed

225.27 Raceway Seal

A raceway seal is required at outside underground branch circuit and feeder raceways entering a building



Courtesy of
Gardner Bender

- Where a raceway enters a building or structure from an underground distribution system, it shall be sealed in accordance with 300.5(G)
- Spare or unused raceways shall also be sealed
- Sealants shall be identified for use with the cable insulation, shield or other components

Services – Conductor Installation

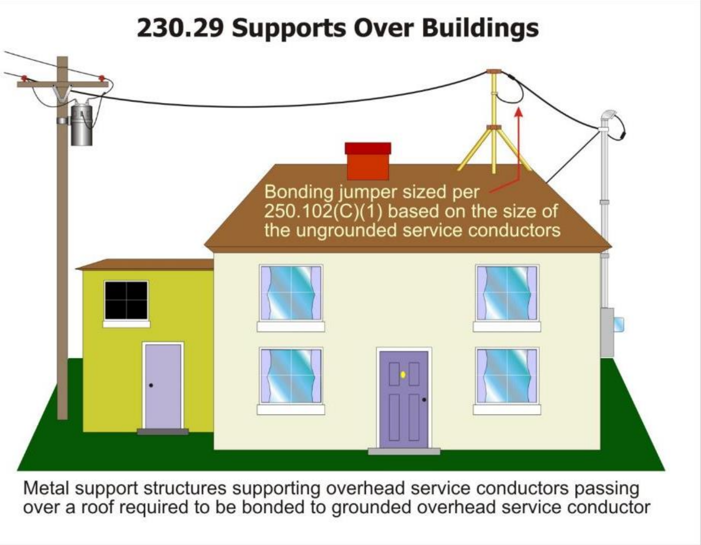
- Overhead conductors
- 230.51 (A) – mounting supports
  - 12” from “ends”
  - 30” intervals
- 230.54 (C)
  - Service heads above point of attachment
  - If impracticable – has to be less than 2 feet
- 230.54 (F)
  - Drip loops – Duke requires 3’ minimum
  - Neutral needs to be bare – Duke requirement

Services – Conductor Installation

- 225.17 (A) Mast Support –
- Hubs must be identified for use with service equipment.
- Can’t attach conductors to a mast above a coupling if no support above it (floating coupling)
- Same in section 230 (services)

230.29 OVERHEAD SERVICE CONDUCTORS—SUPPORTS OVER BUILDINGS

230.29 Supports over Buildings. Service conductors passing over a roof shall be securely supported by substantial structures. For a grounded system, where the substantial structure is metal, it shall be bonded by means of a bonding jumper and listed connector to the grounded overhead service conductor. Where practicable, such supports shall be independent of the building.



Metal support structures supporting overhead service conductors passing over a roof required to be bonded to grounded overhead service conductor

www.ieci.org

Service – size & metering

- 230.79 (C) – 100 amp for one family dwelling
- 230.79 (D) – 60 amp – others

- Meter must be placed outside unless approved by Duke
- Meter height 4 ½′ – 5 ½′ to center - Duke

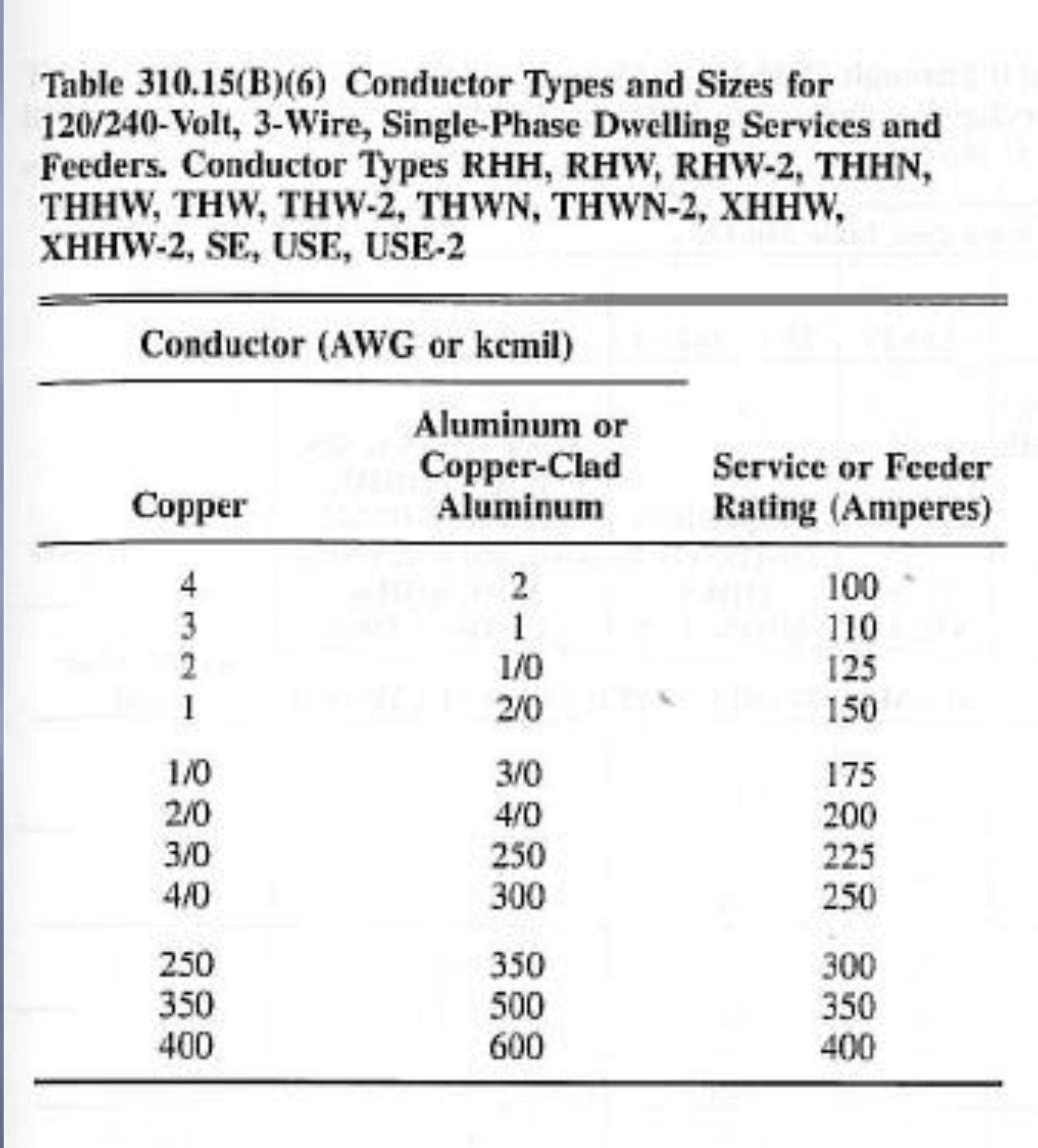


Table 310.15(B)(6) Conductor Types and Sizes for 120/240-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders. Conductor Types RHH, RHW, RHW-2, THHN, THHW, THW, THW-2, THWN, THWN-2, XHHW, XHHW-2, SE, USE, USE-2

Conductor (AWG or kcmil)		
Copper	Aluminum or Copper-Clad Aluminum	Service or Feeder Rating (Amperes)
4	2	100
3	1	110
2	1/0	125
1	2/0	150
1/0	3/0	175
2/0	4/0	200
3/0	250	225
4/0	300	250
250	350	300
350	500	350
400	600	400

310.15(B)(7) DWELLING UNIT SERVICES AND FEEDERS

- After many cycles of debate, the provisions for sizing dwelling unit service (and main power feeder) was expanded to allow for 208Y/120-volt single-phase systems.
- Keep in mind this is only for the single-phase component of a three phase 208/120 volt system.
- Many users liked the simplified residential dwelling ampacity table and this was added back to the Annex D7. (Previous Table 310.15(B)(7) in 2014).
- Explanatory language added to address the permitted application of correction or adjustment factors required by 310.15(B)(2)(a) (Temperature Correction Factors) or 310.15(B)(3)(a) (More Than Three Current-Carrying Conductors) applied to the ampacity associated with the temperature rating of the conductors
- New informational note added with direction to 240.6(A) for service ratings based on standard ampacity ratings for application of 310.15(B)(7)

310.15(B)(7)

(7) ~~120/240-Volt,~~ Single-Phase Dwelling Services and Feeders.

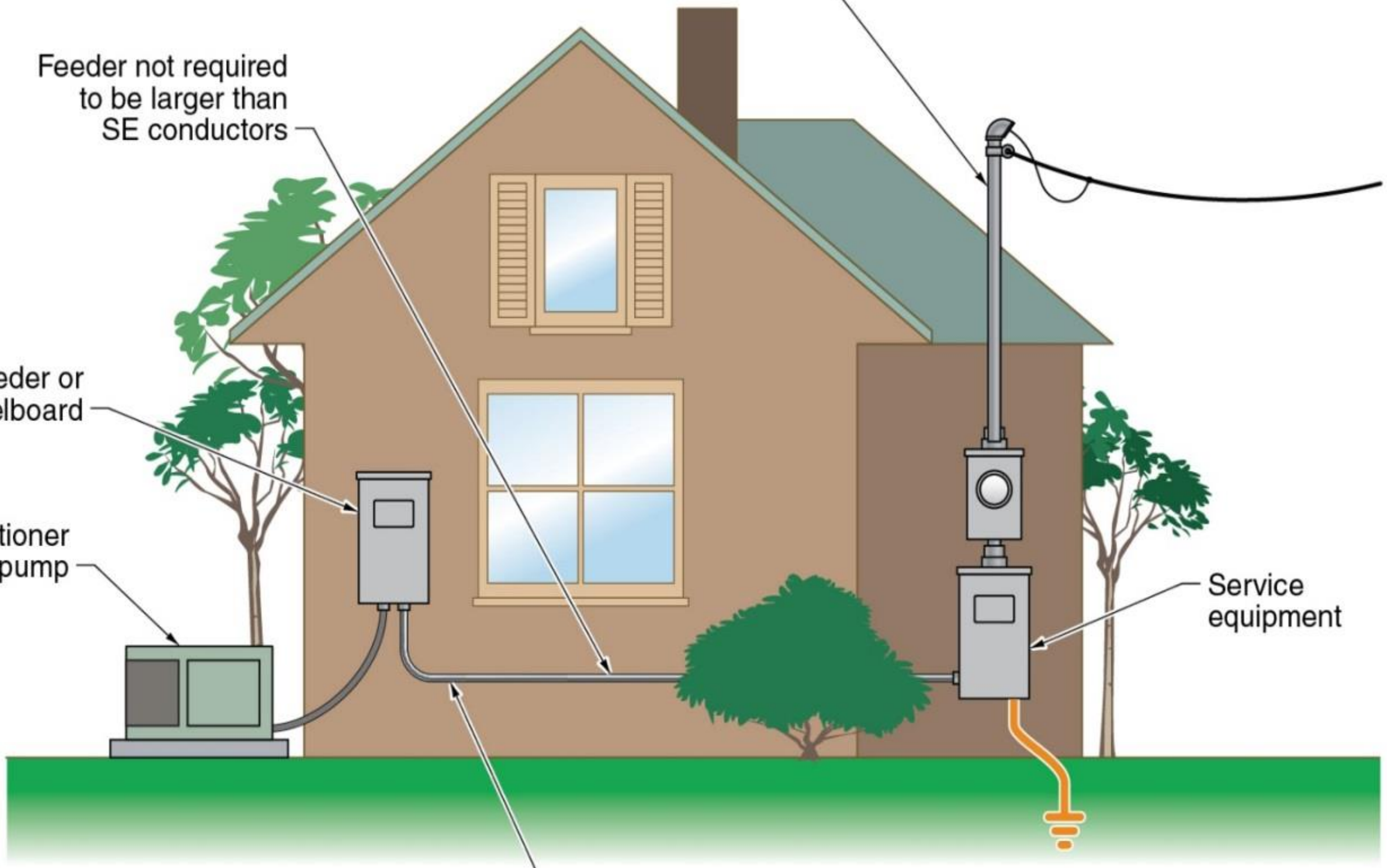
For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, service and feeder conductors supplied by a single-phase, 120/240-volt system shall be permitted to be sized in accordance with 310.15(B)(7)(1) through (4).

Single-phase feeders from a 208Y/120 volt system shall be permitted to use 310.15(B)(7)(1) through (4).

For a service rated 100 through 400 ~~A~~ amperes, the service conductors supplying the entire load associated with a one-family dwelling, or the service conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling, shall be permitted to have an ampacity not less than 83 percent of the service rating…

Continued on next slide…

310.15(B)(7) Dwelling Unit Services and Feeders



83 percent reduction from 310.15(B)(7) can be applied to standard service ampacity rating from 240.6(D) using ampacity from Table 310.15(B)(16)

Feeder not required to be larger than SE conductors

Feeder or subpanelboard

Air-conditioner or heat pump

Service equipment

2017 *NEC* - 310.15(B)(7) - Will apply to 120/240-volt and 208Y/120-volt single-phase dwelling services and main feeder

Services – Disconnecting Means

- 230.70 (1) – Readily accessible location
  - Nearest point of entrance
  - No six foot rule
    - Service conductor protection
      - Not necessarily panel
  - Don’t put in:
  - Bathrooms
  - 240.24(F)
    - Vicinity of easily ignitable material – clothes closets
    - Located above steps

Services – Disconnecting Means

- 230.70 (1) – Readily accessible location
  - Working clearance
    - 3 feet depth – 120/240 volt – 110.26
    - Equipment may not extend 6" beyond the front
      - Be careful of trough
      - Meters are exempt
    - Width – panel width or 30"
      - Can infringe upon other panel space
    - Headroom – 6'6" or ceiling (whichever is greater)
      - Existing dwellings (service changes) exempt from 6'6" if panel is 200 amps or less
    - Door opens 90 degrees


SIEMENS

408.3(A)(2) BARRIERS AT SERVICE PANELBOARDS

- New requirement to provide barrier in all service panelboards such that no uninsulated, ungrounded service busbar or service terminal be exposed to inadvertent contact by persons
- Helps with arc-flash concern and lowers incident energy if energized work performed on load side of main.
- Requirement came from Canadian Electrical Code.
- An exception was also added eliminating the barriers at panelboards installed to comply with the requirements of 408.36, Ex. No. 1, 2, and 3
- Exceptions to 408.36 address the “six means of disconnect” rules and the old “split-bus” panelboards that could be present

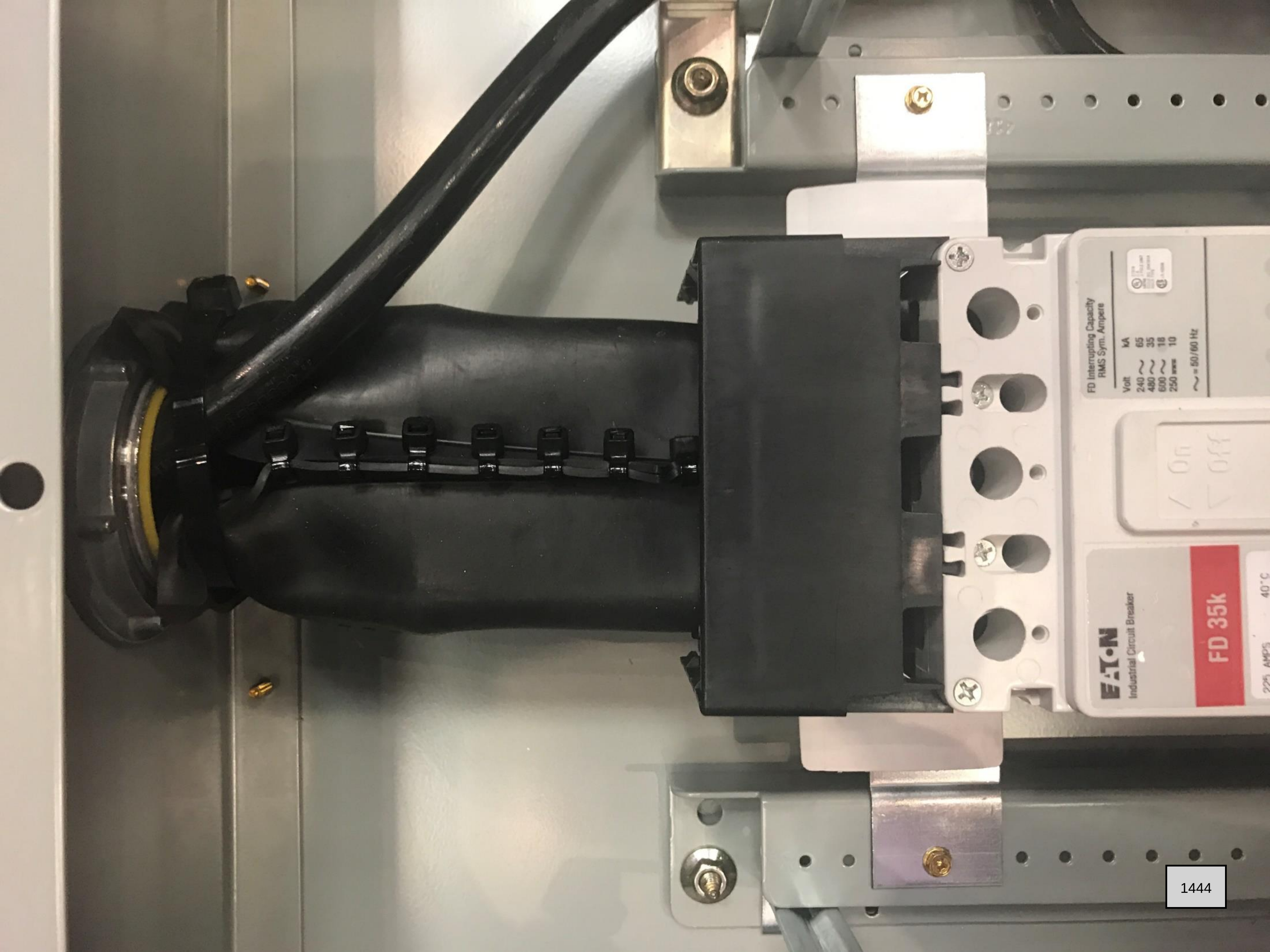
408.3(A)(2) BARRIERS AT SERVICE PANELBOARDS

Barriers required in all service panelboards, switchboards, and switchgear such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations

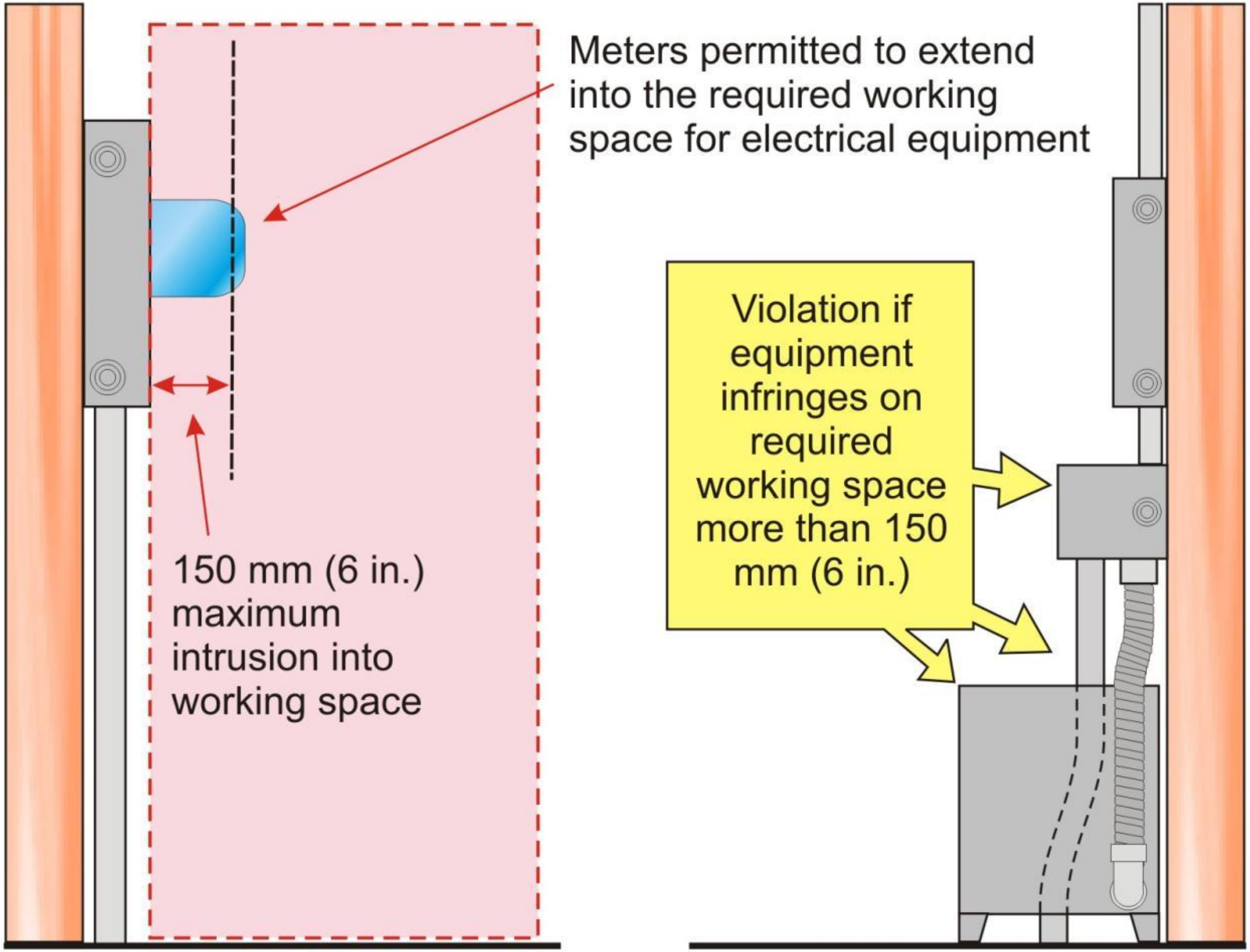
Schneider Electric

Exception: *This requirement shall not apply to service panelboards with provisions for more than one service disconnect within a single enclosure as permitted in 408.36, Exceptions No. 1, 2, and 3*


CAUTION


EATON
Industrial Circuit Breaker
FD 35k
FD Interrupting Capacity
RMS Sym. Ampere
Volt kA
240 ~ 65
480 ~ 35
600 ~ 18
250 ⎓ 10
~ = 50/60 Hz
On
Off
40°C
225 AMPS

110.26(A)(3), Ex. No. 2 Height of Working Space



Meters permitted to extend into the required working space for electrical equipment

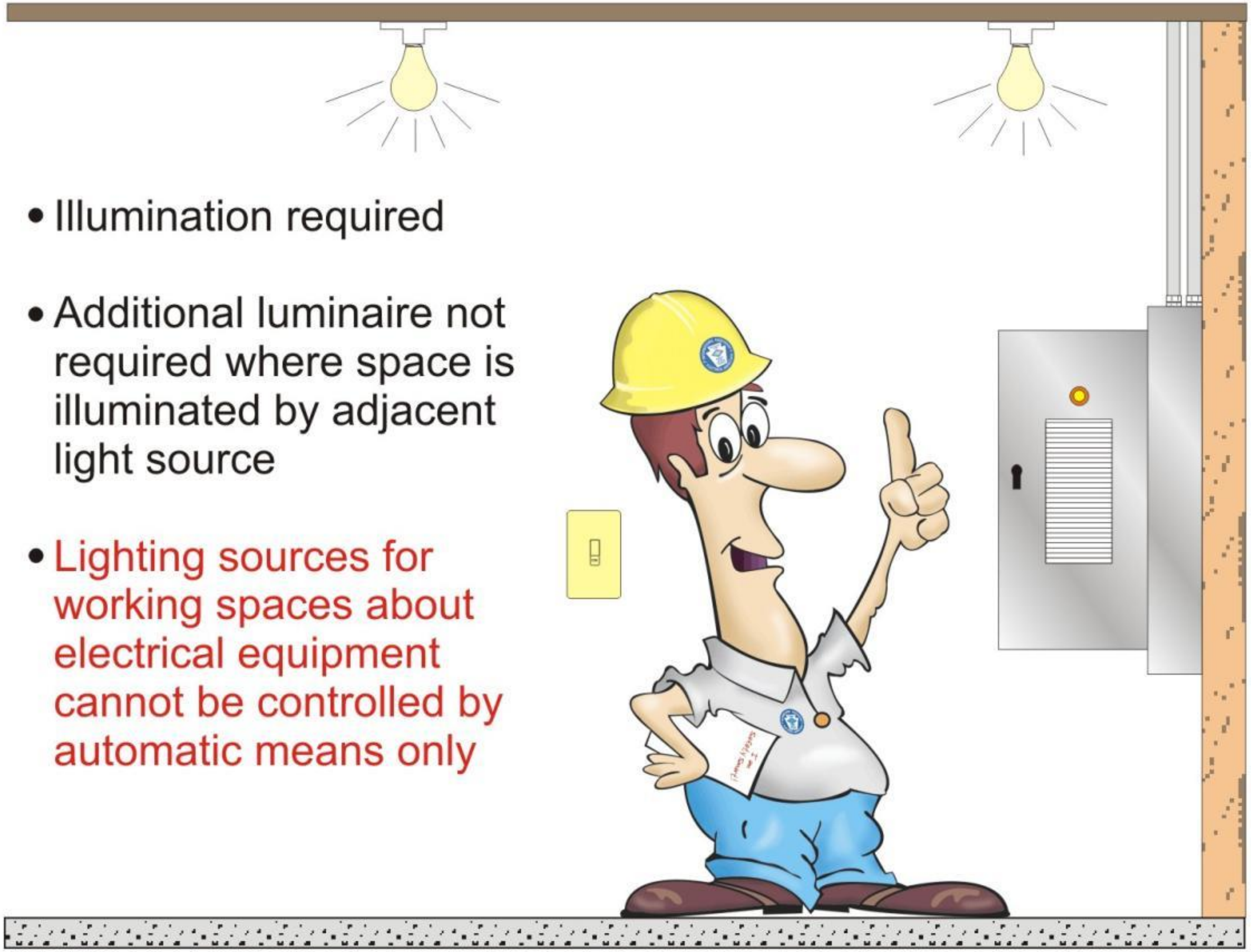
150 mm (6 in.) maximum intrusion into working space

Violation if equipment infringes on required working space more than 150 mm (6 in.)

Services – Disconnecting Means

- 230.70 (1) – Readily accessible location
    - Illumination – must be lit
    - No automatic devices unless able to be overridden
    - Dedicated equipment space
        - 6 feet above equipment
        - Also applies outdoors
        - Up – On, Down – Off – 404.7

110.26(D) Illumination About Electrical Equipment



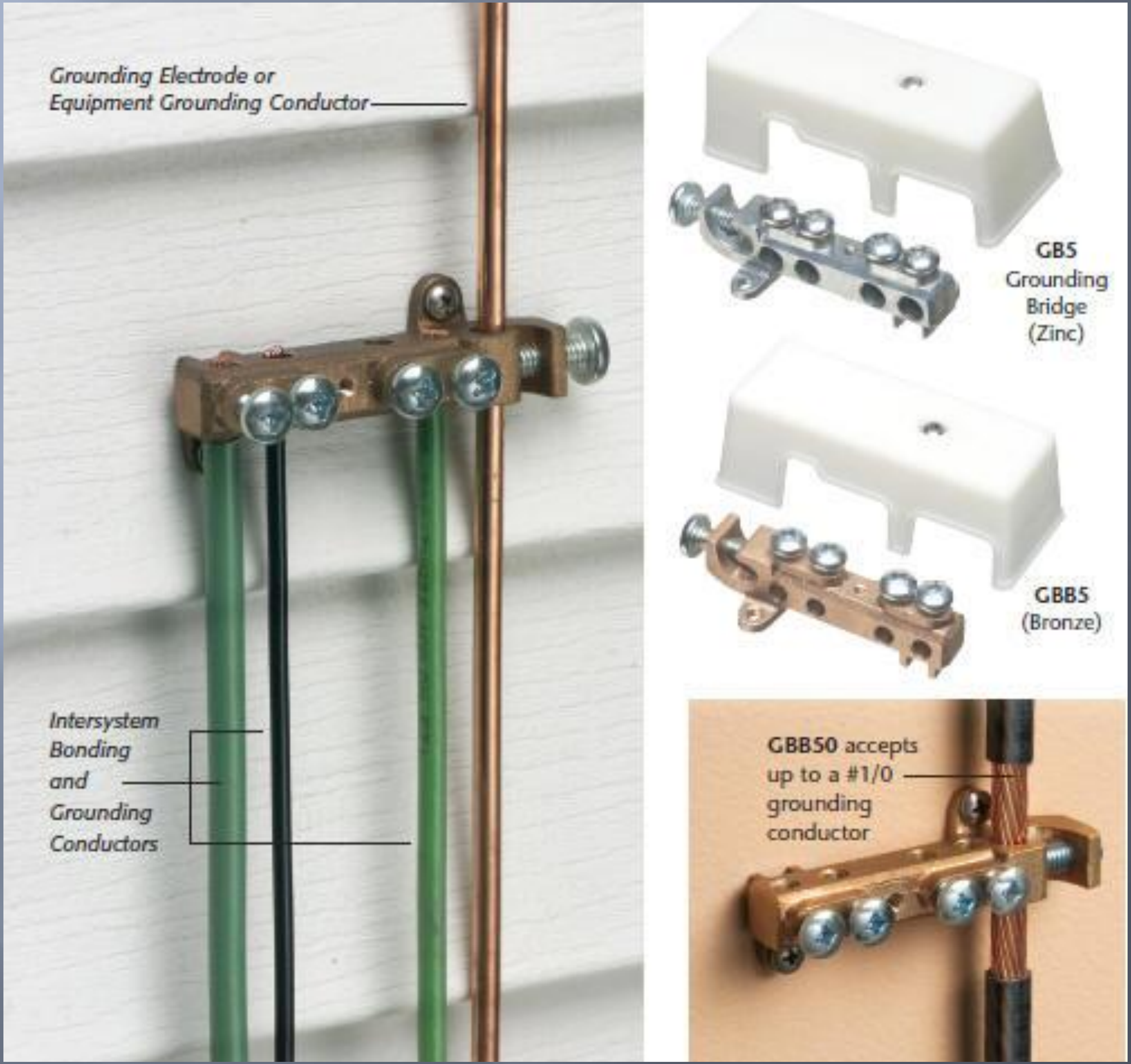
- Illumination required
- Additional luminaire not required where space is illuminated by adjacent light source
- Lighting sources for working spaces about electrical equipment cannot be controlled by automatic means only

Illumination shall be provided for all working spaces about service equipment, switchboards, panelboards, or motor control centers installed indoors

Service – Panel

- 230.71
  - Six switch rule
  - Intersystem bonding
  - Marking of circuits – not arbitrary
  - Handle ties required on shared neutral
    - Red and black conductor in cable must have common trip.
  - Tie wrap neutral with circuit conductors
    - Not needed if you can tell in panel
      - same cable, distinct size, etc.


SIEMENS
KOHLER
POWER SYSTEMS


Grounding Electrode or
Equipment Grounding Conductor
Intersystem Bonding and Grounding Conductors
GB5
Grounding Bridge
(Zinc)
GBB5
(Bronze)
GBB50 accepts up to a #1/0 grounding conductor

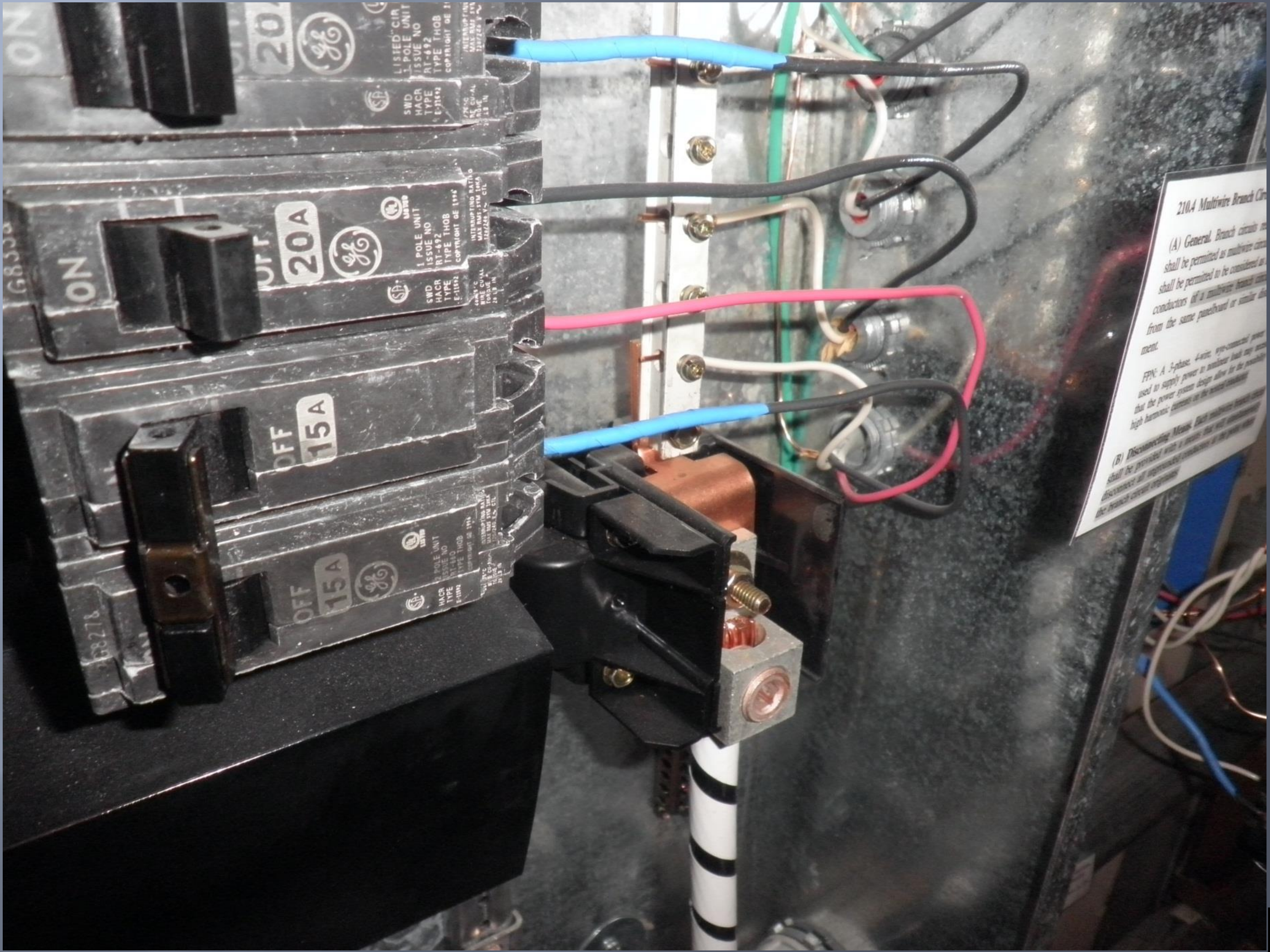

ON
20A
OFF
20A
OFF
15A
OFF
15A
210.4 Multiwire Branch Cir
(A) General. Branch circuits
shall be permitted as multiwire circ
shall be permitted to be considered as
conductors of a multiwire branch circ
from the same panelboard or similar di
ment.
FPN: A 3-phase, 4-wire, wye-connected power
used to supply power to nonlinear loads may
that the power system design allow for the possibilit
high harmonic currents on the neutral conductor
(B) Disconnecting Means.


Table 310.15(B)(2)(a) Adjustment Factors for More Than
Three Current-Carrying Conductors in a Raceway or Cable
Number of
Carrying
Conductors
Percent of Values in Tables
310.16 through 310.19 as
Adjusted for Ambient
Temperature if Necessary
4–6
7–9
10–20
21–30
31–40
41 and above
80
50
45
40
35
FPN No. 1: See Annex B, Table B.310.11, for adjustment
factors for more than three current-carrying conductors in a
raceway or cable with load diversity.
Multiple Circuits. Where a single equipment ground-
conductor is run with multiple circuits in the same
raceway, cable, or cable tray, it shall be sized for the largest
overcurrent device protecting conductors in the raceway,
cable, or cable tray. Equipment grounding conductors in-
stalled in cable trays shall meet the minimum requirements
NYLON OR THWN FT1 NON-ANCE 90C --- RoHS 27MAR2008 08:15

Grounding – 250.52

- Metal Frames of buildings
- Concrete Encased Electrodes - footer
  - 20 feet / #4
  - Listed connector
- Rod and Pipe
  - Supplemental - #6
  - You probably don’t need it.
    - Only if metal underground water pipe
    - Only if no other means available
- Other Local metal underground systems
- **Do not ground metal underground gas piping systems**

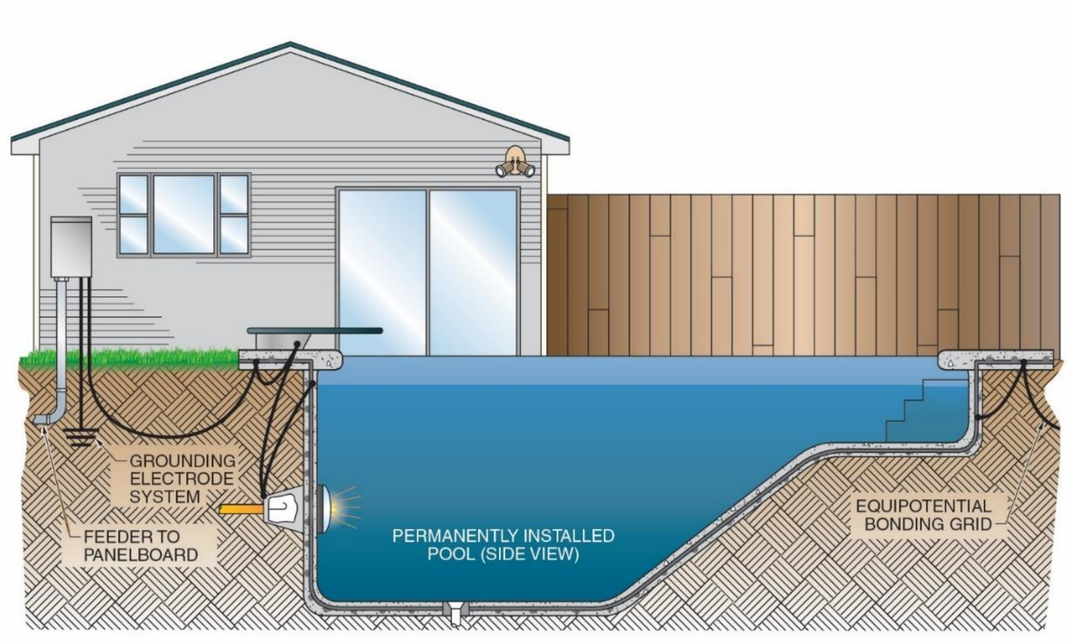
250.52(B)(3) SWIMMING POOLS NOT PERMITTED FOR USE AS GROUNDING ELECTRODES

- Third item added to the list of objects that are prohibited from being used as a grounding electrode at 250.52(B) (cont.)
- Items that shall not be used as a grounding electrode include:
  - Underground gas piping systems
  - An aluminum electrode
  - Structures and structural reinforcing steel of an in-ground swimming pool

250.52(B)(3) SWIMMING POOLS NOT PERMITTED FOR USE AS GROUNDING ELECTRODES

The provisions of 680.26 for equipotential bonding are to reduce voltage gradients *(difference of voltage potential between two conducting objects),* not to establish a grounding electrode system for a building or structure

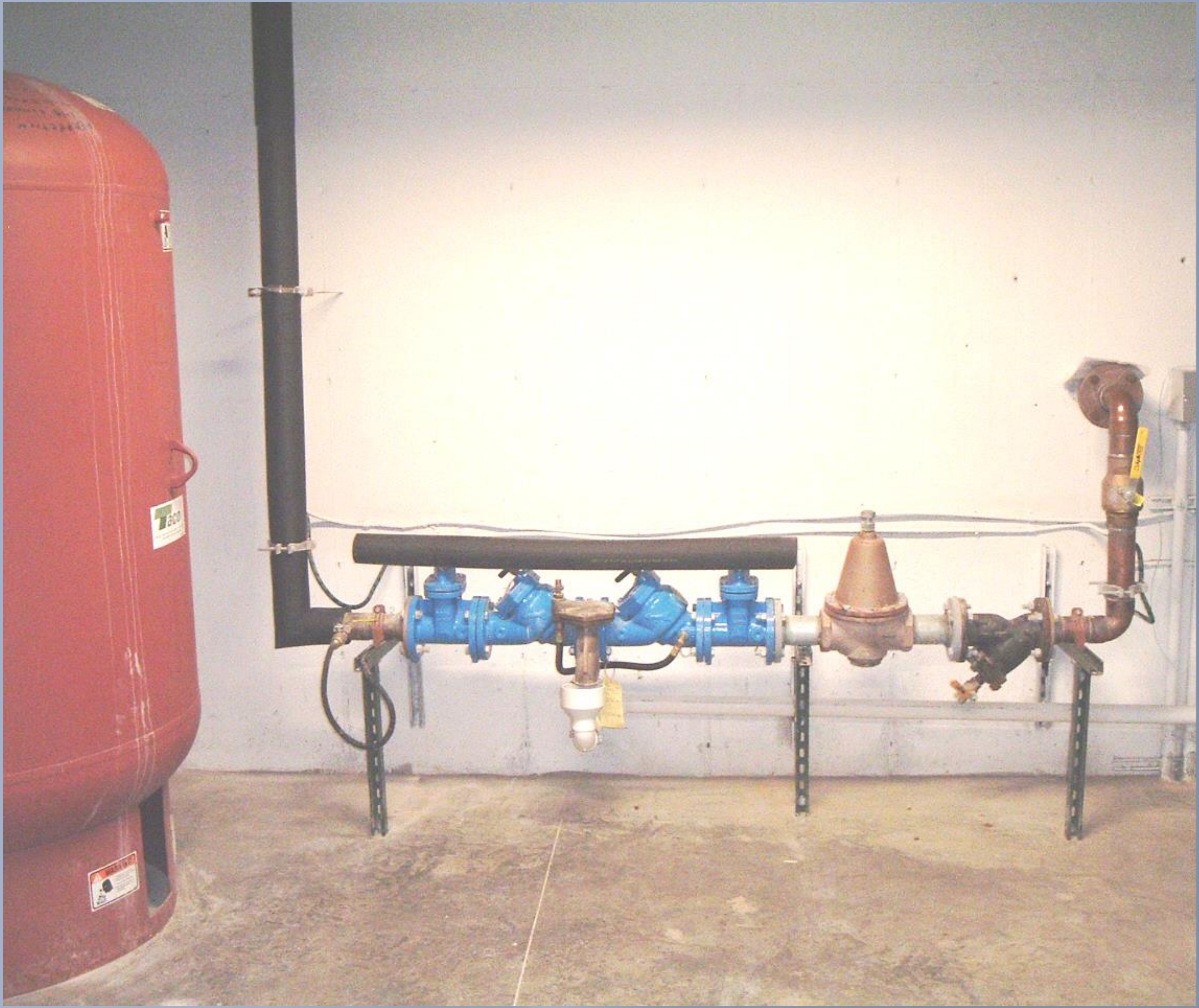
The structures and structural reinforcing steel of an in-ground swimming pool as described in 680.26(B)(1) and (B)(2) are prohibited from being used as a grounding electrode




PERI

Grounding - sizing

- 250.66
- Grounding electrode conductor (water pipe)
  - Contact with earth for at least 10 feet
  - Hit within 5 feet of entrance
  - Jump the meter
- Based on largest ungrounded conductor, not ampacity
- Typical – if pulling normal conductors
- 100 amp - #2 Al conductor - #8 Cu ground
- 150 amp – 2/0 Al conductor - #6 Cu ground
- 200 amp – 4/0 Al conductor - #4 Cu ground


Taco

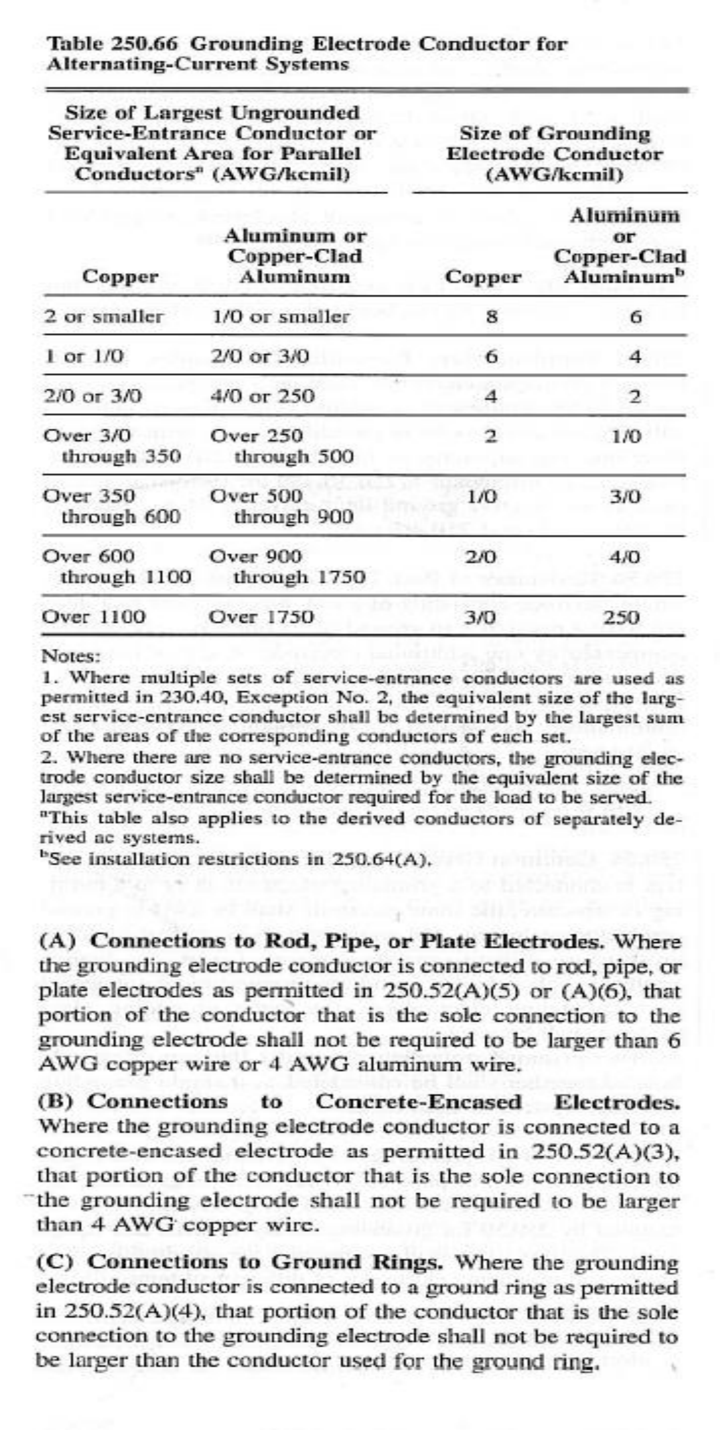


Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

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

Notes:

1. Where multiple sets of service-entrance conductors are used as permitted in 230.40, Exception No. 2, the equivalent size of the largest service-entrance conductor shall be determined by the largest sum of the areas of the corresponding conductors of each set.

2. Where there are no service-entrance conductors, the grounding electrode conductor size shall be determined by the equivalent size of the largest service-entrance conductor required for the load to be served.

[a] This table also applies to the derived conductors of separately derived ac systems.

[b] See installation restrictions in 250.64(A).

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

(B) Connections to Concrete-Encased Electrodes. Where the grounding electrode conductor is connected to a concrete-encased electrode as permitted in 250.52(A)(3), that portion of the conductor that is the sole connection to the grounding electrode shall not be required to be larger than 4 AWG copper wire.

(C) Connections to Ground Rings. Where the grounding electrode conductor is connected to a ground ring as permitted in 250.52(A)(4), that portion of the conductor that is the sole connection to the grounding electrode shall not be required to be larger than the conductor used for the ground ring.

Cables - Underground

- 300.5 Underground Installations
  - (B) Wet locations – Contains Letter W
  - (C) Under a building – raceway

  If conduit enters building from outside, it must be sealed

- Can’t run Romex in conduit to enclosure
  - Sleeve OK
  - Must have a connector

TABLE 300.5 MINIMUM COVER REQUIREMENTS

- Low voltage lighting is at voltage levels at 50 volts or below which is less a safety hazard.

- Conflicts is resolved between manufacture instructions that in many cases allows for a reduced wiring depth on the secondary of a transformer than what is required in Table 300.5.

- Added new footnotes to Table 300.5 allowing reduced depths for listed low-voltage lighting system and for pool and spa lighting when included as part of a listed low-voltage lighting system.

Table 300.5 Minimum Cover Requirements, 0 to 1000 Volts, Nominal, Burial in Millimeters (Inches)

Location of Wiring Method or Circuit	Type of Wiring Method or Circuit									
	Column 1 Direct Burial Cables or Conductors		Column 2 Rigid Metal Conduit or Intermediate Metal Conduit		Column 3 Nonmetallic Raceways Listed for Direct Burial Without Concrete Encasement or Other Approved Raceways		Column 4 Residential Branch Circuits Rated 120 Volts or Less with GFCI Protection and Maximum Overcurrent Protection of 20 Amperes		Column 5 Circuits for Control of Irrigation and Landscape Lighting Limited to Not More than 30 volts and Installed with Type UF or in Other Identified Cable or Raceway	
	mm	in	mm	in	mm	in	mm	in	mm	in
All locations not specified below	600	24	150	6	450	18	300	12	150[a, b]	6[a, b]
In trench below 50 mm (2 in.) thick concrete or equivalent	150	18	150	6	300	12	150	6	150	6
Under a building	0	0	0	0	0	0	0	0	0	0
Under minimum of 102 mm (4 in) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 152 mm (6 in) beyond the underground installation.	450	18	100	4	100	4	150 100	6 4	150 100	6 4
Under streets, highways, roads, alleys, driveways, and parking lots	600	24	600	24	600	24	600	24	600	24
One- and two-family dwelling driveways and outdoor parking areas, and used only for dwelling related purposes	450	18	450	18	450	18	300	12	450	18
In or under airport runways, including adjacent areas where trespassing prohibited	450	18	450	18	450	18	300	12	450	18

[a] A lesser depth shall be permitted where specifed in the installation instructions of a listed low-voltage lighting system.

[b] A depth of 150 mm (6 in.) shall be permitted for pool, spa, and fountain lighting, installed in a nonmetallic raceway, limited to not more than 30 volts where part of a listed low-voltage lighting system.

Cables - General

300.4 – Bored Holes

  1 ¼" from edge

  1/16" protector plate – also notched studs

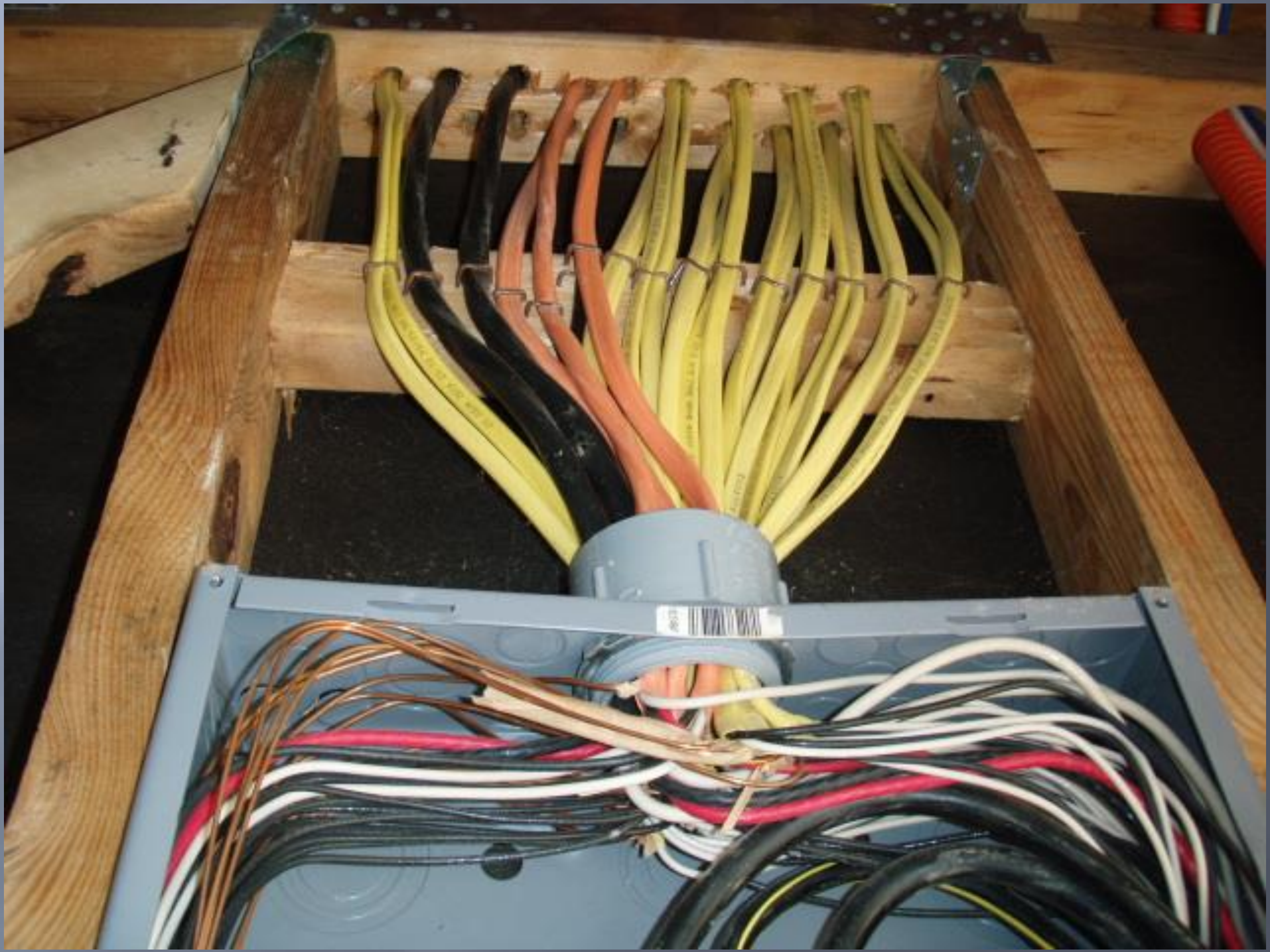
300.4 – NM through metal framing members

  must have grommets completely around

300.22 (B) – Plenums

Bundles of cables run through holes

  derating



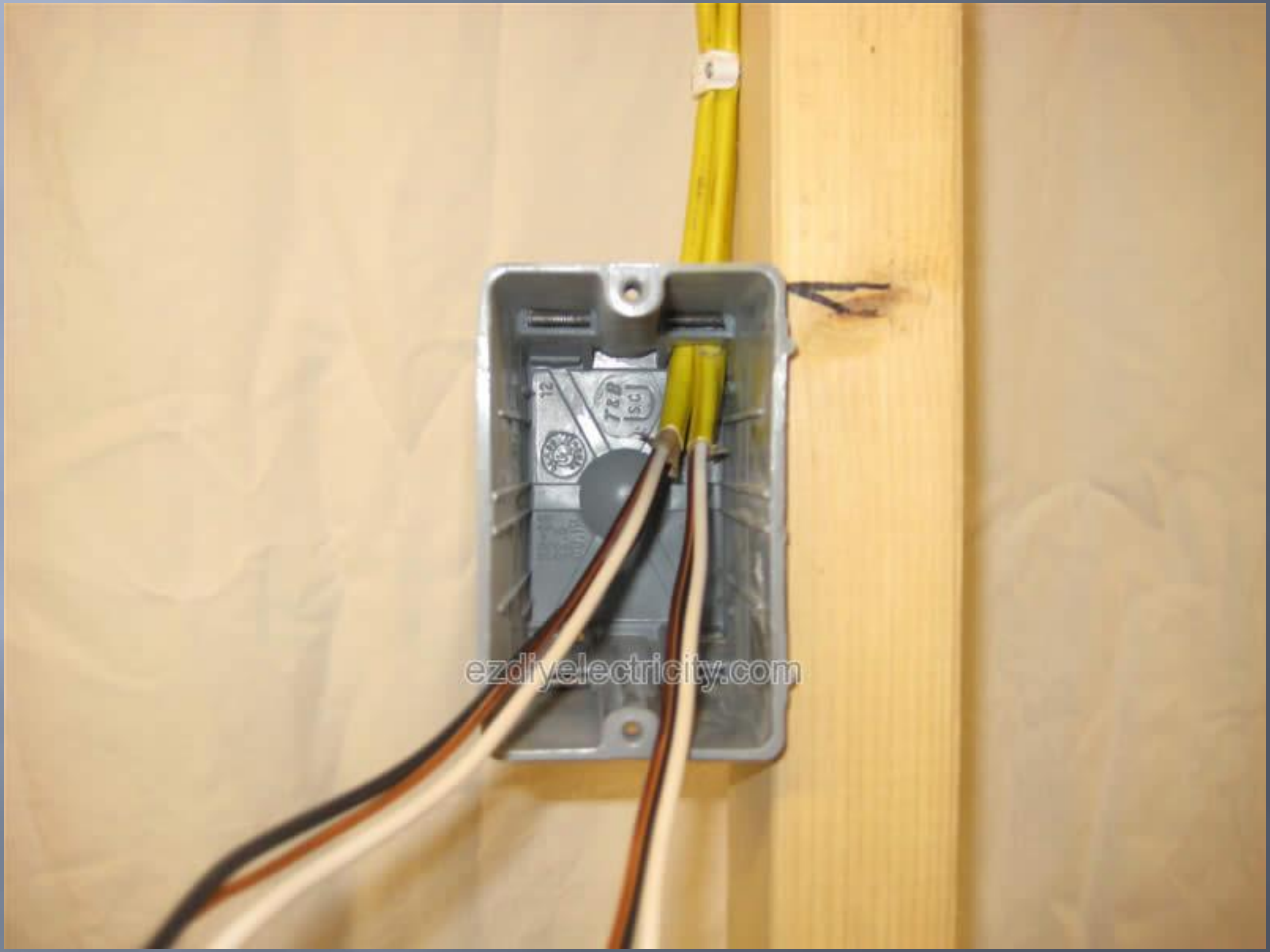
NM Cable

- 334.12 (B)(4) Uses not permitted
  - Wet or damp locations
  - Allowed to use in garages (attached and detached), accessory and storage buildings
- 334.15 (C) Unfinished basements under joists
  - Two - #6 AWG
  - Three - #8 AWG
  - Running boards or bored holes
- 334.30 Securing and supporting
  - 12"/ 4 ½'


NOT FOR PRESSURE

NM Cable Support

- 334.30 (A)
  - Horizontal Runs through Holes and Notches
- 314.17 (C) Nonmetallic boxes
  - ¼″ sheath in box
  - 8″ if cable not supported by box
- Unsupported Cables
  - Fishing
  - 4 ½′ for fixture within an accessible ceiling


12
T&B
S.C

Boxes - general

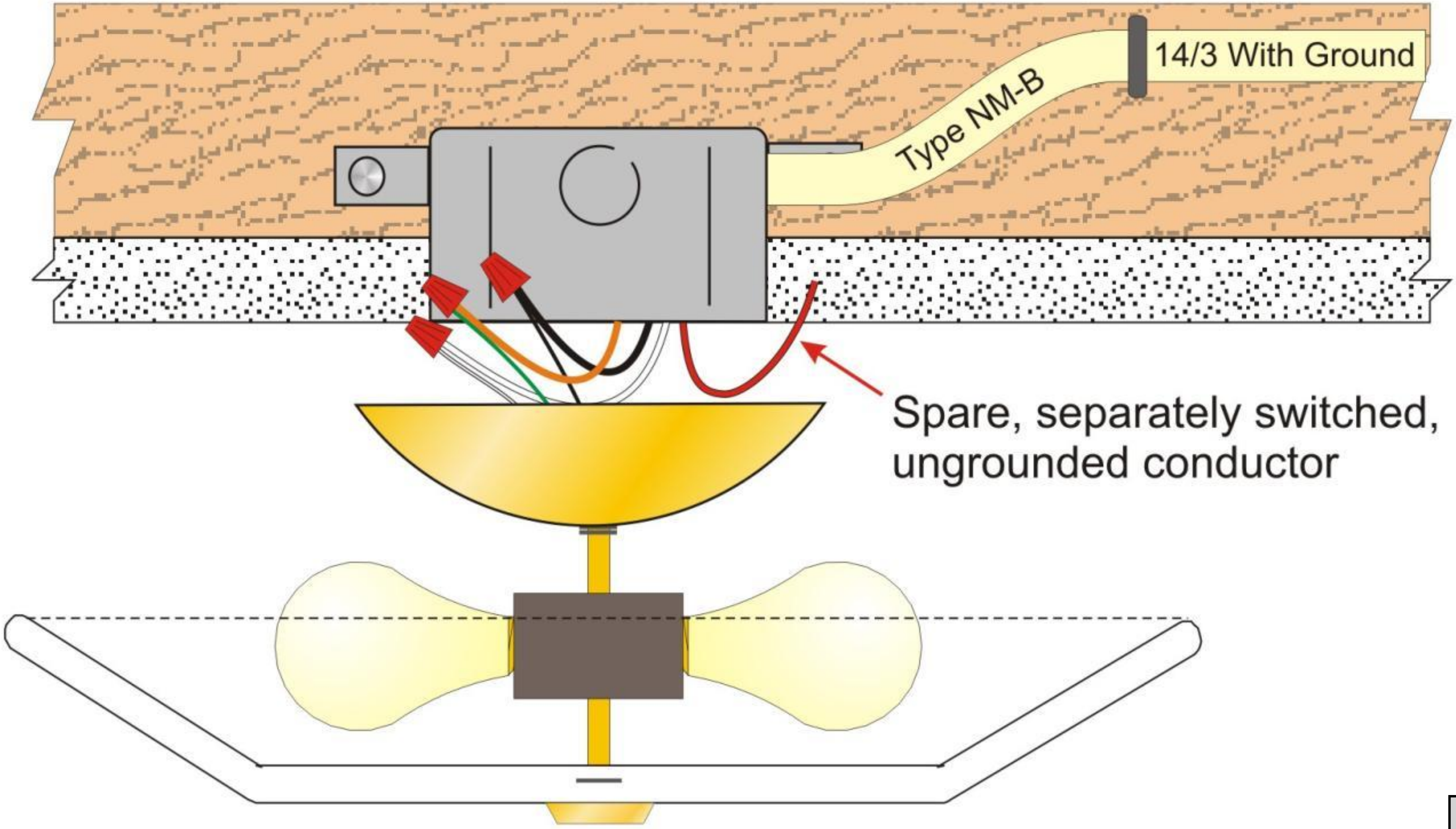
- Boxes must have backs for electrical
- Not needed but allowed for data
- Divider for double gang box
- Close all unused openings
- All boxes must have covers and be accessible
    - Doorbell transformers in basements
- Weatherproof boxes/bell boxes
    - Wet and damp locations

Boxes - fixtures

- Ceiling fan boxes must be listed
  - 70 lbs max
  - Must show max weight if above 35 lbs
  - Weight stamped inside of box - 2014
  - If running 3 wire to ceiling box it must be rated for a fan – if a fan is possible
- Vertical surface outlets (wall sconce)
  - 6 lbs. or less– can use device box
  - Not allowed for ceiling mount

314.27(C) Boxes at Ceiling Fan Outlets

At single or multi-family dwellings, spare, separately switched, ungrounded conductors at ceiling-mounted outlet boxes (in a location acceptable for a ceiling fan) require outlet box or system listed for sole support of a ceiling-suspended (paddle) fan



Spare, separately switched, ungrounded conductor

Circuits required

- Small appliance circuit – 20 amp
  - 2 for counters, can also hit dining room
  - No other receptacles
    - Not more than one kitchen is allowed
    - Definition of a kitchen
- Laundry circuit – 20 amp
  - Typically washing machine
- Bathroom circuit – 20 amp
  - All bath receptacles OR
  - All circuits in ONE bathroom
  - NOT BOTH

Circuits required

- Lighting and general purpose receptacles
  - All lighting
  - Bedroom receptacles
  - Living room/rec room/etc. receptacles
  - Hallway
  - Outdoor
  - Garage

210.11(C)(4) GARAGE BRANCH CIRCUITS

N **(4) Garage Branch Circuits.** In addition to the number of branch circuits required by other parts of this section, at least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle outlets in attached garages an in detached garages with electric power. This circuit shall have no other outlets.

Exception: This circuit shall be permitted to supply readily accessible outdoor receptacle outlets.

Circuits required

- Take square footage of house
  - Measure on the outside
  - Do not include
    - Garages
    - Open porches/decks
    - Space not adaptable for future use /crawl spaces
- Multiply by 3 (VA)
- Divide by 120 (your voltage)
- Divide by breaker size (typically 15)

Circuits required

- 2,200 square foot house with 400 square foot room addition, 600 square foot garage.
- Total of 2,600 square feet (no garage)
- 2,600 x 3 = 7,800 VA
- You need 7,800 total volt amps of lighting, general receptacles
- 7,800 VA/120 V = 65 amps
- 65 amps/15 amp breakers = 4.3
- You would have to have AT LEAST 5 – 15amp breakers for lighting, general recepts. Etc.

Circuits required

- How many general purpose receptacles are you allowed to put on a 15 amp circuit?

Circuits required

- How many general purpose receptacles are you allowed to put on a 15 amp circuit?

No Limit

File Attachments for Item:

ER-13 Grounding and Bonding (Independent Electrical Contractors)

EPE, ESI, RBO (4 hours)

Staff Notes: Received after ESIAC submission: Recommend referral to ESIAC for recommendations.

Committee Recommendation:

Grounding

Purpose of Grounding
Grounding Terminology

Different Types of grounding electrodes
- Steel
- Water Pipe
- Ground Rod
- Concrete Encased Electrodes
- Ground Ring
- Ground Plates

Sizing the grounding electrode – 250.66

Sizing the Main bonding jumper – 250.102(C)(1)
- 12 ½% rule

Sizing the equipment ground – 250.122
- Sizing the equipment ground conductor when oversizing the phase conductors.

Bonding requirements – Both on line side and load side.

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: Kevin Collins (Contact Name)
Organization: IEC of Greater Cincinnati (Organization/Company)
Address: 586 Kings Run Drive (Include Room Number, Suite, etc.)
City: Cincinnati State: OH Zip: 45232
E-Mail: kcollins@iec-cincy.com
Telephone: 513-542-0400 Fax: —
Course Sponsor: IEC of Greater Cincinnati

COURSE INFORMATION:

Course Title: Grounding + Bonding

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

Purpose and Objective: Review article 250 of the NEC. We will discuss different grounding electrodes, what are required at different structures, sizing the GEC, different types of equipment grounding conductors, how to size them, where main bonding jumpers/system bonding jumpers are required & how to size them

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 ☐
Plumbing Plans Exam. ☐
Electrical Plans Exam. ☒
Mechanical Plans Exam. ☐
Building Inspector ☐
Fire Protection Inspector ☐
Mechanical Inspector ☐
Plumbing Inspector ☐
Non-Res IU Inspector ☐

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

Electrical Safety Inspectors ☒
Location of ESI Course: IEC of Greater Cincinnati Date(s) of ESI Course(s): 3/15/23

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

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

Sean Clark

901 Beechmeadow Ln. Cincinnati, Ohio 45238
(H)513/347-9054 (C)513/800-4450
sclark@ohiovalleyelectric.com

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A licensed electrician with over twenty years of experience in installing, maintaining, and repairing electrical wiring, equipment, and fixtures, ensuring that work is in accordance with relevant codes, fire alarm installations, electrical control systems, and high voltage terminations. A licensed electrician with three years teaching experience in first and second year electrical.

Summary of Qualifications

- More than twenty years experience.
- Three years experience in teaching first and second year electrical.
- Thorough knowledge of electrical systems including planning additions and modifications on secondary circuits. Controls and low voltage wiring
- Able to read commercial electrical blueprints and apply NEC through the full range of commercial and industrial maintenance and construction work.
- Can use appropriate tools and diagnostic equipment to repair, install, replace, and test electrical circuits, equipment and appliances.
- Excellent ability to diagnose and repair electrical controls, industrial motor control centers, and programmable logic controllers.
- Strong desire to study and comprehend new technology.
- In-depth ability to make mathematical computations.
- Considerable ability to explain instructions and guidelines to others effectively.
- Able to assign work to employees., prioritize the work of others and organize and coordinate the work of the unit. For subs and Primes.

Professional Experience

Ohio Valley Electrical Services	2011-Present
ABC Electrical Teacher	2010-2013
Beacon Electrical Contractors	2007-2011
Ohio Valley Electrical Services	1993-2007

Electrical Superintendant/Foreman/Instructor

- First and Second year electrical instructor
- Supervision of all electrical installations of as many as 50 electricians to assure that work was done safely, efficiently, properly and within time allowed.
- Trained multiple employees in all aspects of electrical work to be able to identify an employee's strengths and weaknesses to better utilize their skills. Traced out short circuits in wiring, using test meter.
- Coordinated and implemented electrical projects within a variety of environments including plants, hospitals, schools, retail stores, public facilities, waste water treatment plants industrial buildings;

projects include both new construction and underground electrical wiring as well as renovation within existing buildings. Parking Garages and Fed Ex Ground Facilities.

- Assemble, install, test, and maintain electrical or electronic wiring, equipment, appliances, apparatus, and fixtures, using hand tools and power tools.
- Connect wires to circuit breakers, transformers, or other components.
- Construct and fabricate parts, using hand tools and specifications.
- Diagnose malfunctioning systems, apparatus, and components, using test equipment and hand tools, to locate the cause of a breakdown and correct the problem.
- Inspect electrical systems, equipment, and components to identify hazards, defects, and the need for adjustment or repair, and to ensure compliance with codes.
- Plan layout and installation of electrical wiring, equipment and fixtures, based on job specifications and local codes.
- Test electrical systems and continuity of circuits in electrical wiring, equipment, and fixtures, using testing devices such as ohmmeters, voltmeters, and oscilloscopes, to ensure compatibility and safety of system.
- Perform business management duties such as maintaining records and files, preparing reports and ordering supplies and equipment.

Education & Certifications

Master Electrician License-State of Kentucky

Journeyman Electrician's License-Hamilton, Ohio

Fire Alarm License-State of Ohio

Certified in high voltage terminations and splices

Lift, Lull, Bobcat, and Boom/scissors lift licenses

OSHA-30 card

Certified in first aid and CPR training

Certified NCCER Core Curricula Instructor

Certified NCCER Electrical Instructor

Completed 4 year apprenticeship program

1 Year Pre-apprentice school (ABC)

High School Diploma (1991)

ARCH FLASH SAFETY TRAINING

PROJECTS-SUPERVISED

$4.5mil.-MASON HIGH SCHOOL ADDITION

$250.000-3CDC-5TH RACE PARKING GARAGE

$250.000-AVONEDALE APT. COMPLEX

$100.000-MAHOGANYS AT THE BANK-

1.2mil. -PATHEON CHEMICALS

$450.000- FED EX GROUND ADDITION

$250.000-LIBERTY WAY PROJECT

$500.000-GE AT THE BANKS

$100.000 - SYCAMORE SCHOOLS/POWER/CONTROL-

$50.000 - NKU RETROFIT

$250.000- UC POWER PLANT ADDITION

$75.000 - 580BLD/ CHEMED, RETROFIT

$4.0mil - DHL- CONVEYERS/SHELL

$90.000- DOUBLE TREE AIRPORT

$2.5mil- TWIN LAKES OF MONTGOMERY

$45.000- STEINMART ANDERSON

And many small T&M jobs.

All on time and under budget

Grounding
Article 250

Grounding

- 250.66
- 250.102(C)(1)
- 250.122

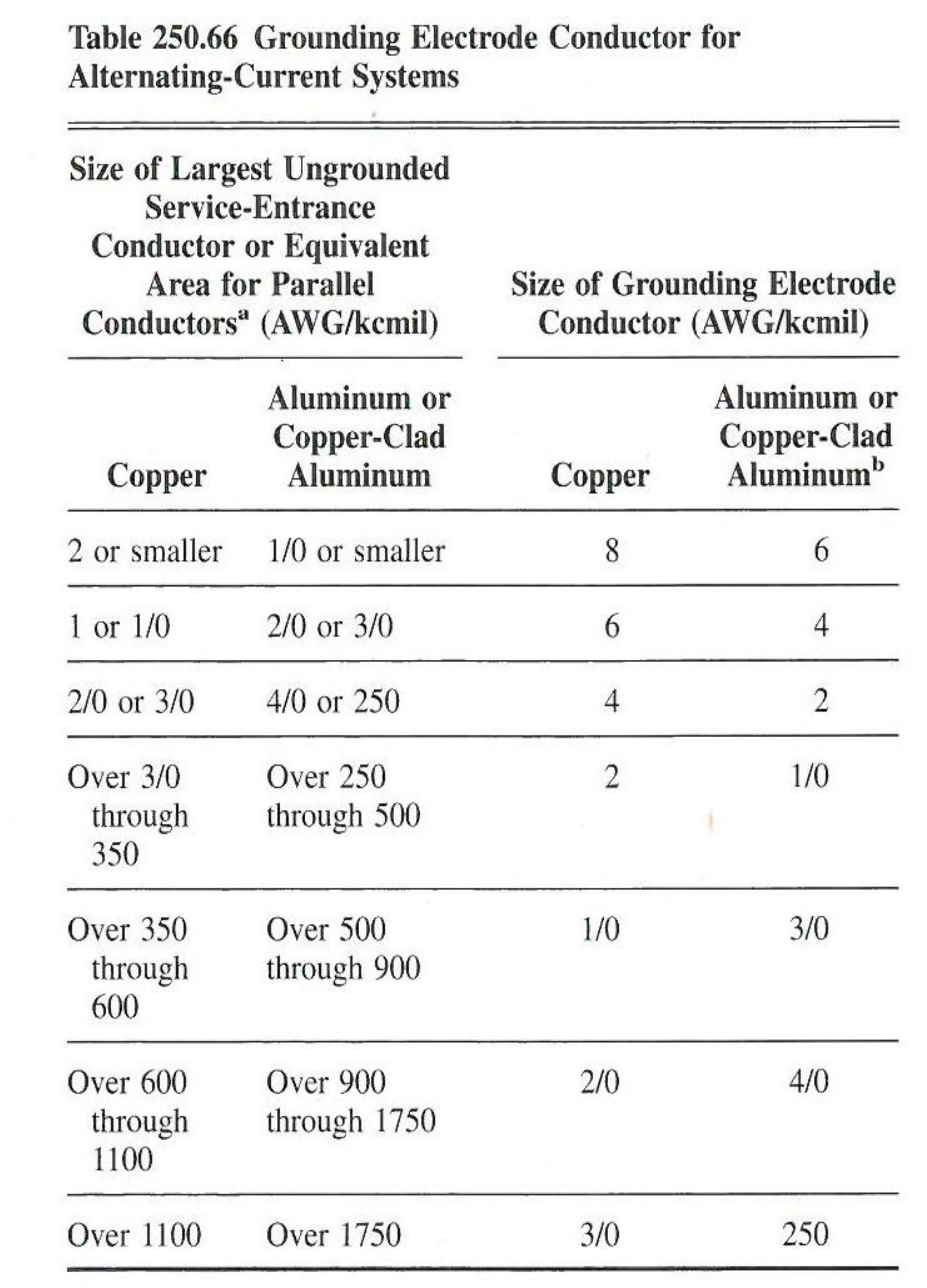


Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

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

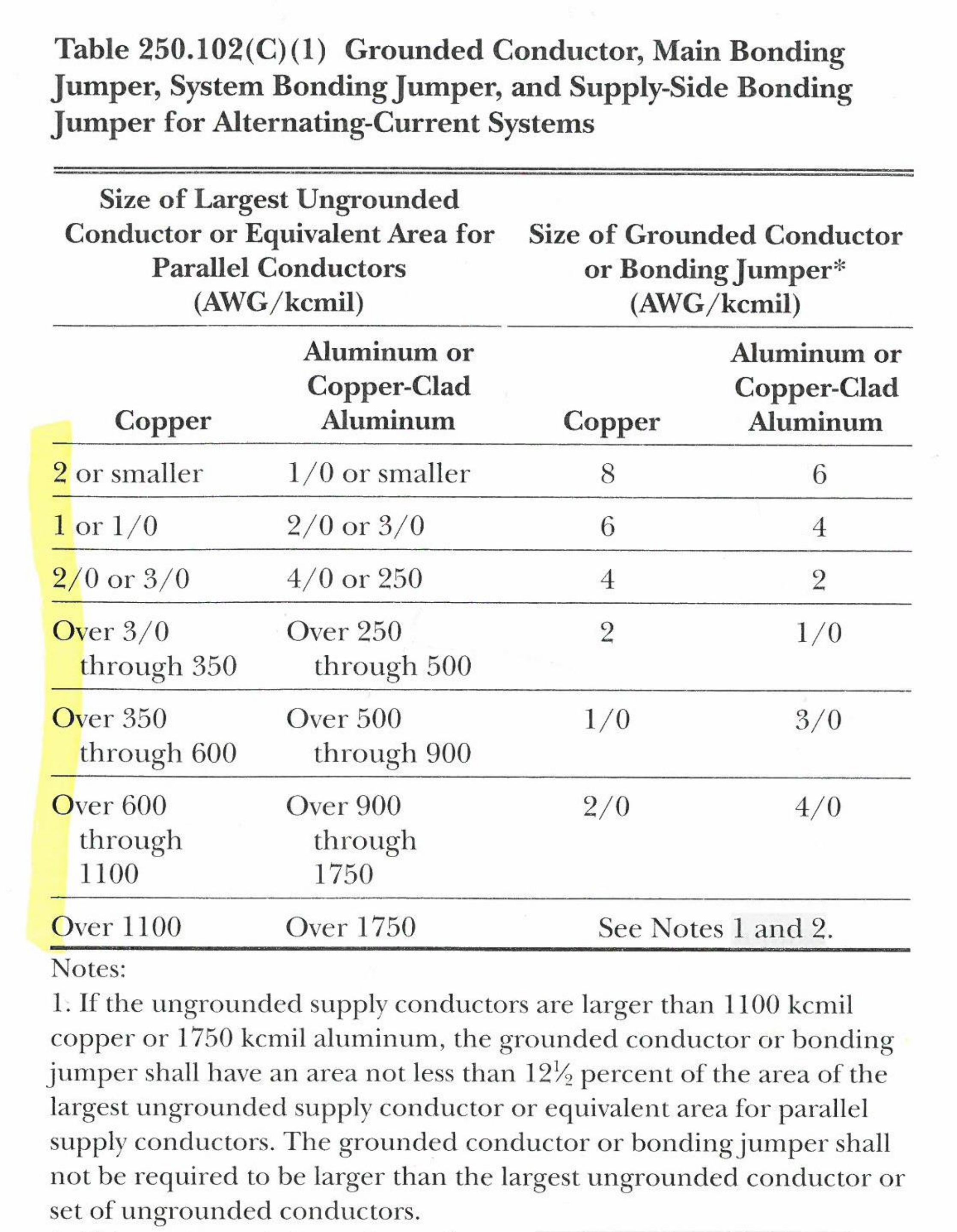


Table 250.102(C)(1) Grounded Conductor, Main Bonding Jumper, System Bonding Jumper, and Supply-Side Bonding Jumper for Alternating-Current Systems

Size of Largest Ungrounded Conductor or Equivalent Area for Parallel Conductors (AWG/kcmil)		Size of Grounded Conductor or Bonding Jumper* (AWG/kcmil)	
Copper	Aluminum or Copper-Clad Aluminum	Copper	Aluminum or Copper-Clad Aluminum
2 or smaller	1/0 or smaller	8	6
1 or 1/0	2/0 or 3/0	6	4
2/0 or 3/0	4/0 or 250	4	2
Over 3/0 through 350	Over 250 through 500	2	1/0
Over 350 through 600	Over 500 through 900	1/0	3/0
Over 600 through 1100	Over 900 through 1750	2/0	4/0
Over 1100	Over 1750	See Notes 1 and 2.	

Notes:

1. If the ungrounded supply conductors are larger than 1100 kcmil copper or 1750 kcmil aluminum, the grounded conductor or bonding jumper shall have an area not less than 12½ percent of the area of the largest ungrounded supply conductor or equivalent area for parallel supply conductors. The grounded conductor or bonding jumper shall not be required to be larger than the largest ungrounded conductor or set of ungrounded conductors.

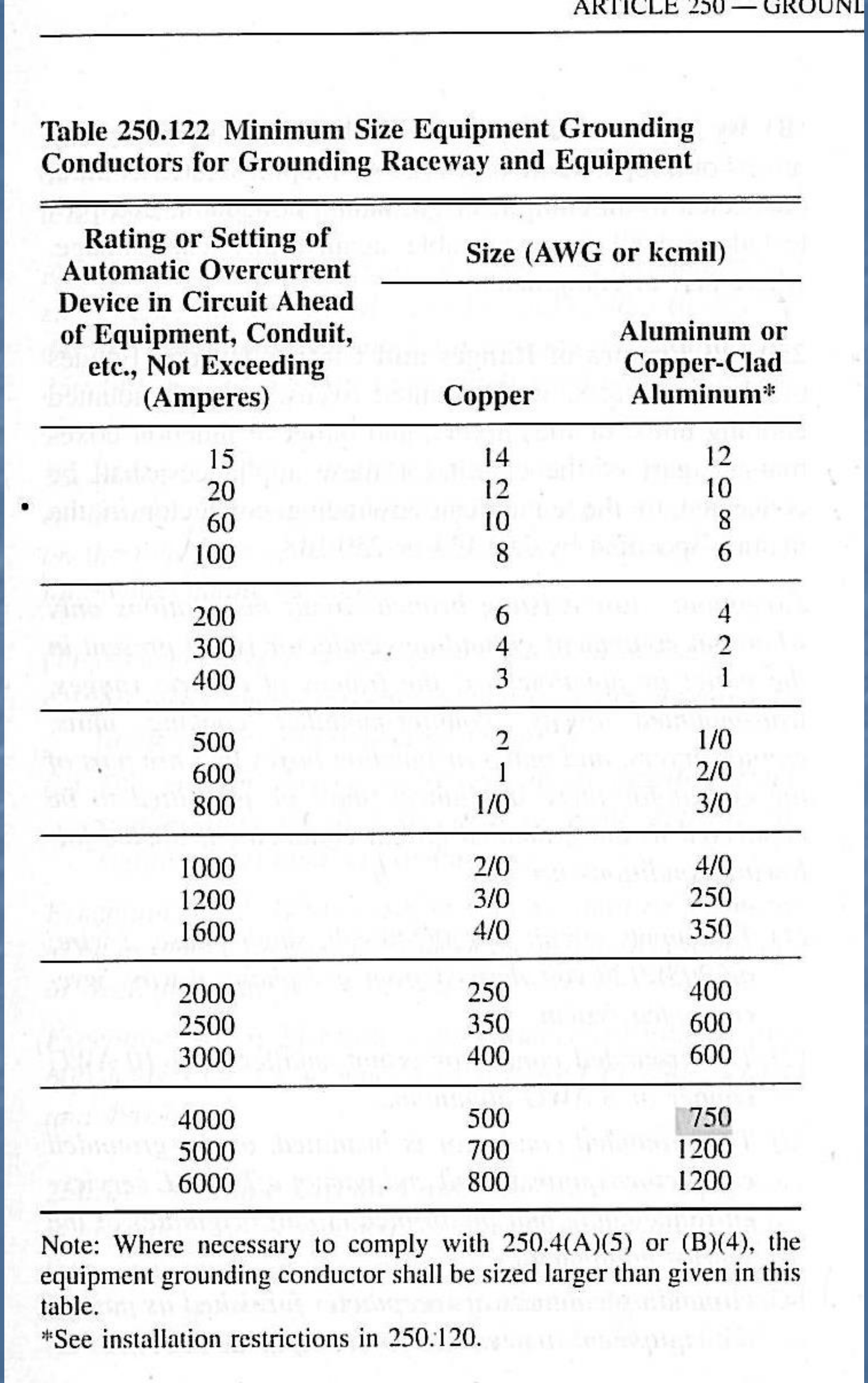


Table 250.122 Minimum Size Equipment Grounding Conductors for Grounding Raceway and Equipment

Rating or Setting of Automatic Overcurrent Device in Circuit Ahead of Equipment, Conduit, etc., Not Exceeding (Amperes)	Size (AWG or kcmil)	
	Copper	Aluminum or Copper-Clad Aluminum*
15	14	12
20	12	10
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0
800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	350
2000	250	400
2500	350	600
3000	400	600
4000	500	750
5000	700	1200
6000	800	1200

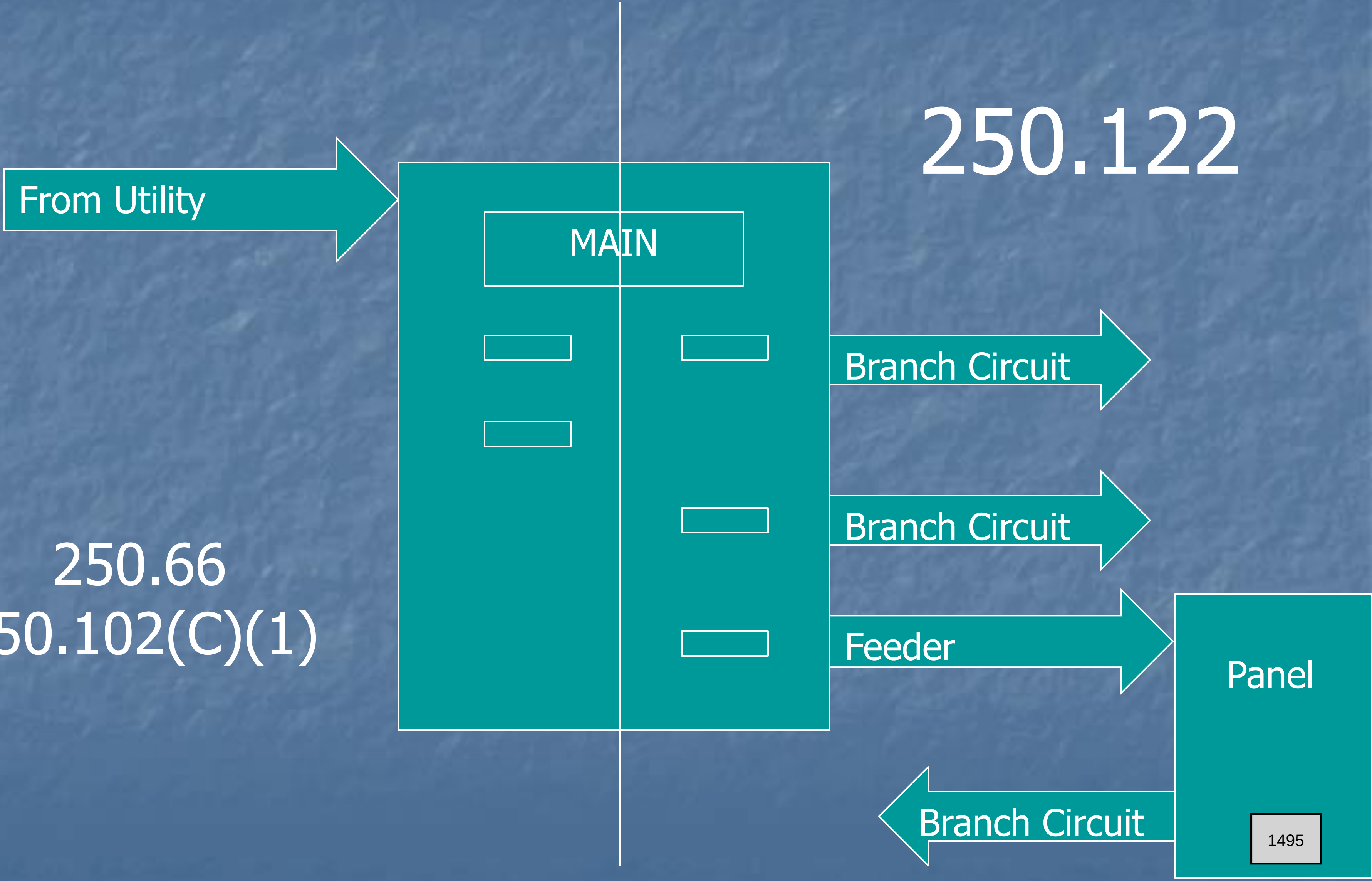
Note: Where necessary to comply with 250.4(A)(5) or (B)(4), the equipment grounding conductor shall be sized larger than given in this table.

*See installation restrictions in 250.120.

Grounding

- 250.66/250.102(C)(1) vs. 250.122
    - .66 & 102(C)(1) is before first overcurrent protection device. (SERVICE)
    - .122 based on the size of overcurrent protection device in circuit

Grounding



From Utility

MAIN

Branch Circuit

Branch Circuit

Feeder

Panel

Branch Circuit

250.122

250.66
250.102(C)(1)

Grounding electrode(s)

- Based on 250.66
- Water pipe, steel, ground rod, footer ground (concrete encased electrode), ground ring, ground plate are all grounding electrodes. All are sized off this chart.
  - Additional code articles to NOT require grounding electrode conductor to:
    - Ground rod conductor larger than 6 – 250.66 (A)
    - Concrete encased (footer) larger than 4 – 250.66 (B)
    - Ground ring larger than 2 – 250.66 (C)

Grounding electrode(s)

- Based on 250.66
- Grounding electrode conductors MAX OUT
  - 3/0 Cu or 250 Al is the largest required

- Based on size of TOTAL area of ONE phase
    - Add all of the conductors of the same phase (hots)
  - Has nothing to do with service size
  - Make sure to read chart carefully
    - 3/0, 350, 600 and 1100 appear twice
      - One row will say through
      - One row will say over

Grounding

- Example
  - I have 1 set of 3/0 Cu feeding a 200 amp service. Size the grounding electrode to the metal in-ground support structure (steel), water pipe, ground rod and the concrete encased electrode:

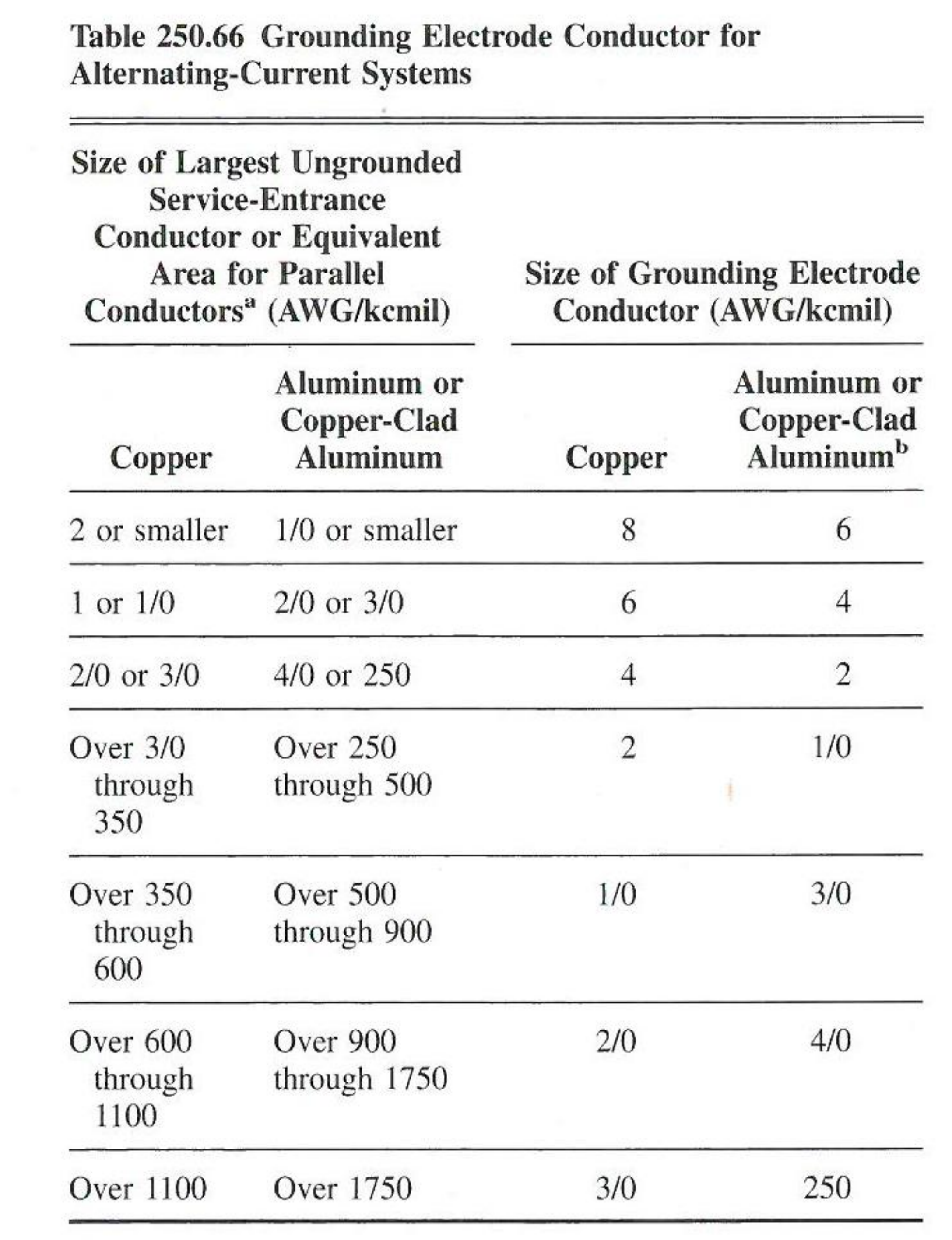


Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

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

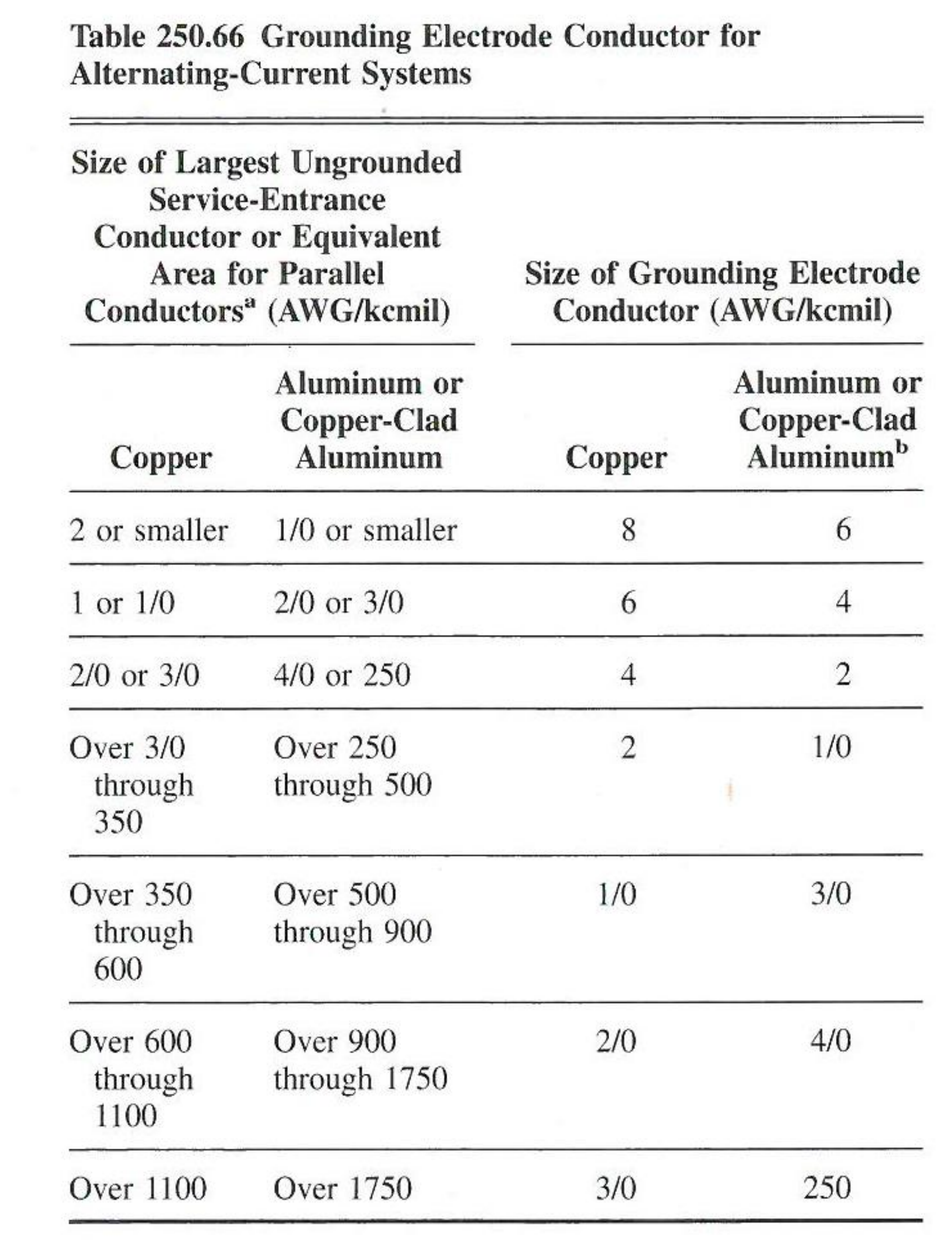
Grounding

- Example
  - I have 1 set of 3/0 Cu feeding a 200 amp service. Size the grounding electrode to the metal in-ground support structure (steel), water pipe, ground rod and the concrete encased electrode
  - Find 3/0 on 250.66 – read across
  - Water pipe - **#4 Cu or #2 Al**
  - Steel - **#4 Cu or #2 Al**
  - Ground rod **#6**, Concrete encased **#4**

MAKE SURE TO ANSWER IN CORRECT CONDUCTOR TYPE

Grounding

- Example (parallel sets)
  - I have 4 sets of 350 kcmil Cu feeding a 1200 amp service. Size the grounding electrode to the metal in-ground support structure, water pipe, ground rod and the concrete encased electrode:



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2/0 or 3/0	4/0 or 250	4	2
Over 3/0 through 350	Over 250 through 500	2	1/0
Over 350 through 600	Over 500 through 900	1/0	3/0
Over 600 through 1100	Over 900 through 1750	2/0	4/0
Over 1100	Over 1750	3/0	250

Grounding

- Example (parallel sets)
  - I have 4 sets of 350 kcmil Cu feeding a 1200 amp service. Size the grounding electrode to the metal in-ground support stucture, water pipe, ground rod and the concrete encased electrode
  - 4 x 350,000 = 1,400,000 or 1,400 kcmil
  - 1,400 kcmil exceeds 250.66
  - Water pipe – **3/0 Cu or 250 kcmil Al**
  - Steel – **3/0 Cu or 250 kcmil Al**
  - Rod - **#6**, Concrete encased - **#4**

Grounding

- Example
  - I have 2 sets of 250 kcmil Cu feeding a 500 amp service. Size the grounding electrode to the metal in-ground support stucture, water pipe, ground rod and the concrete encased electrode:

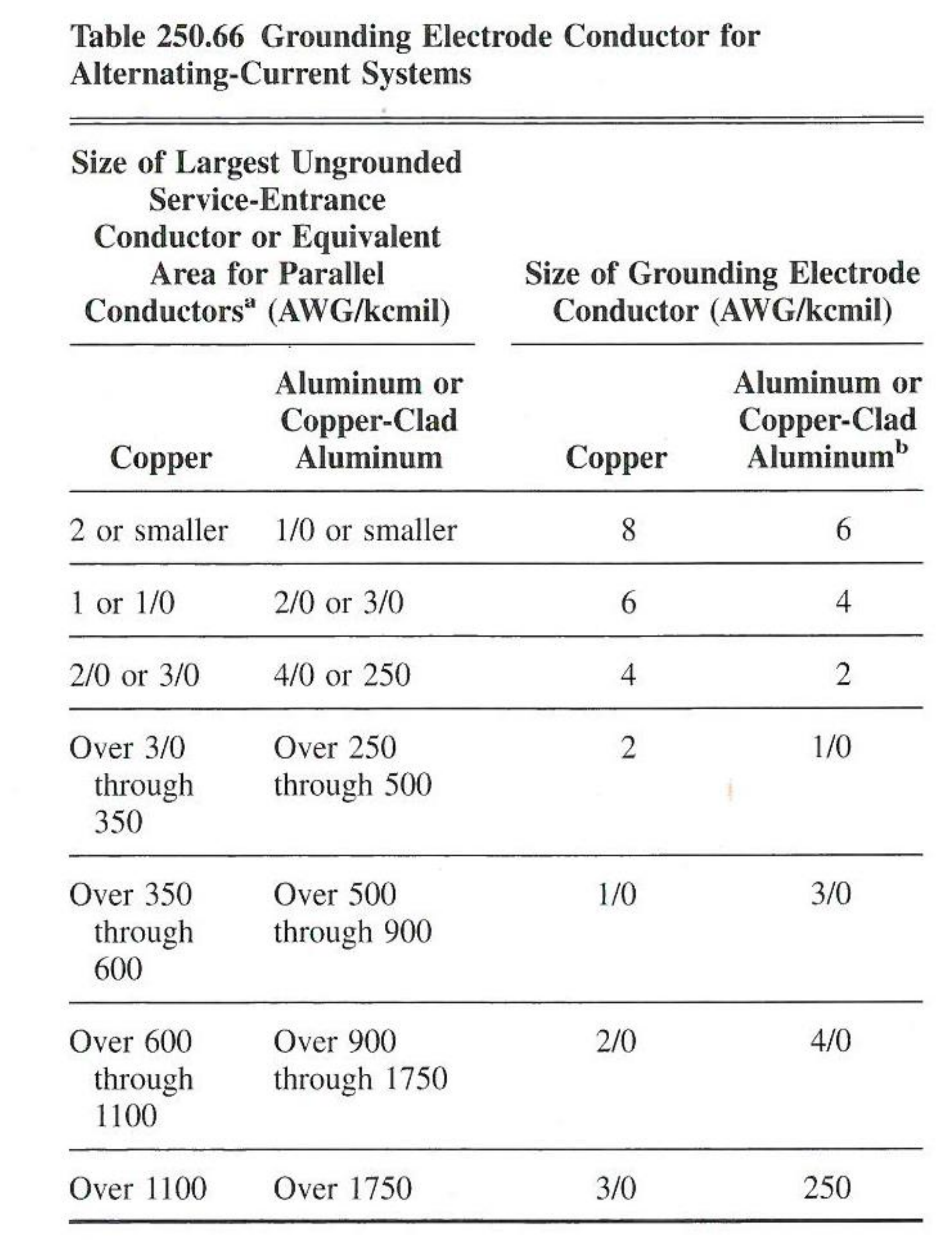

Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems

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

Grounding

- Example
  - I have 2 sets of 250 kcmil Cu feeding a 500 amp service. Size the grounding electrode to the metal in-ground support stucture, water pipe, ground rod and the concrete encased electrode
  - 2 x 250,000 = 500,000 or 500 kcmil
  - Water pipe – **1/0 Cu or 3/0 kcmil Al**
  - Steel – **1/0 Cu or 3/0 kcmil Al**
  - Rod - **#6**, Concrete encased - **#4**

Grounding

- Main bonding jumper (MBJ)
  - New chart – 250.102(C)(1) – almost same as 250.66
  - Bonds the grounded conductor (neutral) to the grounding conductor (ground)
    - Only done once per service
    - Also transformers/treat like a new service
  - Size the same as grounding electrode
    - Only difference is it does not max out
    - Read directly off chart until you are over 1100 kcmil Cu or 250 Al.

Grounding electrode conductor and MBJ will be the same size unless conductors exceed 250.66.

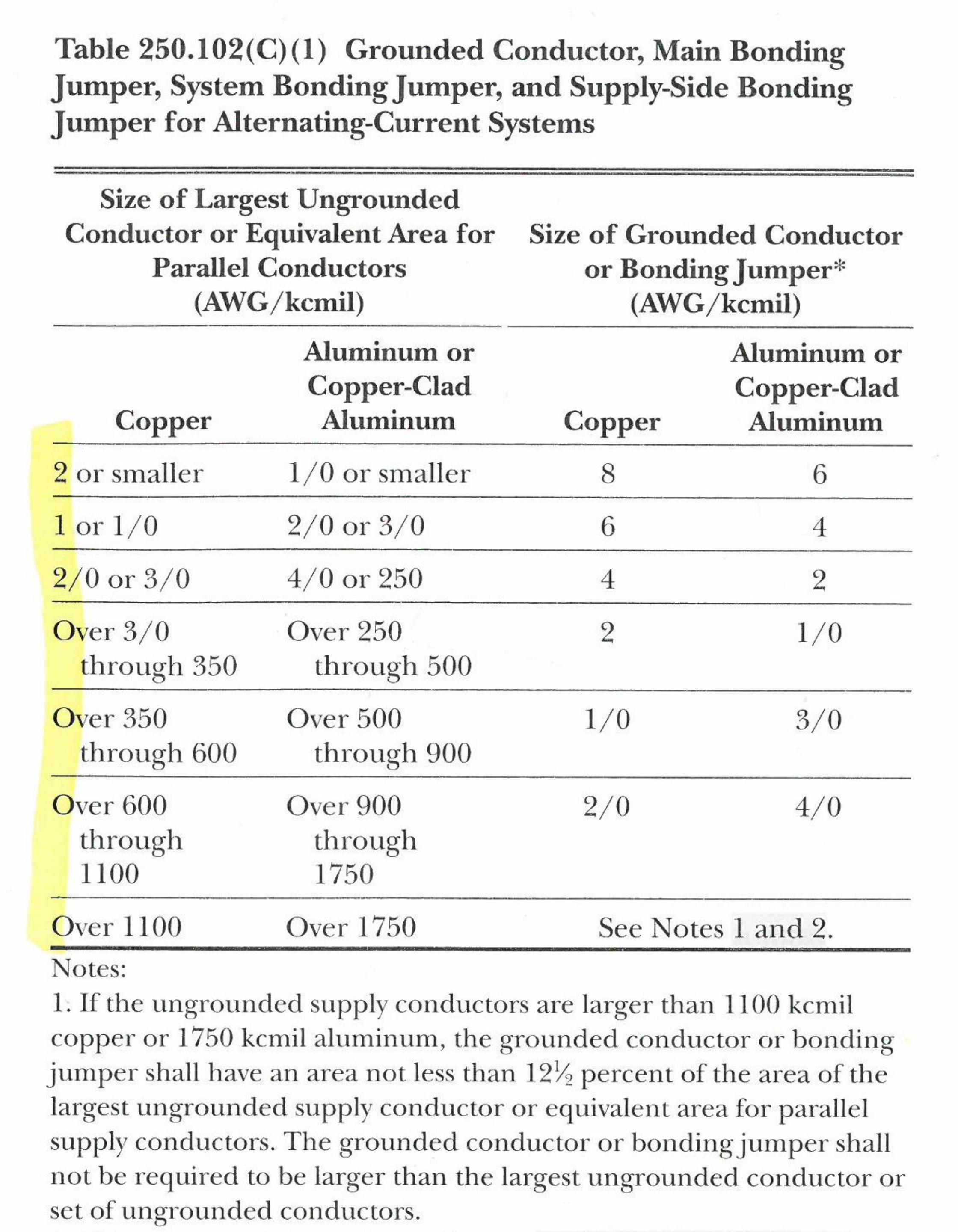

Table 250.102(C)(1) Grounded Conductor, Main Bonding Jumper, System Bonding Jumper, and Supply-Side Bonding Jumper for Alternating-Current Systems

Size of Largest Ungrounded Conductor or Equivalent Area for Parallel Conductors (AWG/kcmil)		Size of Grounded Conductor or Bonding Jumper* (AWG/kcmil)	
Copper	Aluminum or Copper-Clad Aluminum	Copper	Aluminum or Copper-Clad Aluminum
2 or smaller	1/0 or smaller	8	6
1 or 1/0	2/0 or 3/0	6	4
2/0 or 3/0	4/0 or 250	4	2
Over 3/0 through 350	Over 250 through 500	2	1/0
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Over 600 through 1100	Over 900 through 1750	2/0	4/0
Over 1100	Over 1750	See Notes 1 and 2.	

Notes:

1. If the ungrounded supply conductors are larger than 1100 kcmil copper or 1750 kcmil aluminum, the grounded conductor or bonding jumper shall have an area not less than 12½ percent of the area of the largest ungrounded supply conductor or equivalent area for parallel supply conductors. The grounded conductor or bonding jumper shall not be required to be larger than the largest ungrounded conductor or set of ungrounded conductors.

Grounding - Main Bonding Jumper

- Once the total of a phase exceeds 250.102(C)(1) THEN use 12 ½%
- Take 12 ½% of kcmil and size it from Table 8 in back of code book

DO NOT USE 12 ½%
AUTOMATICALLY ON THE MBJ

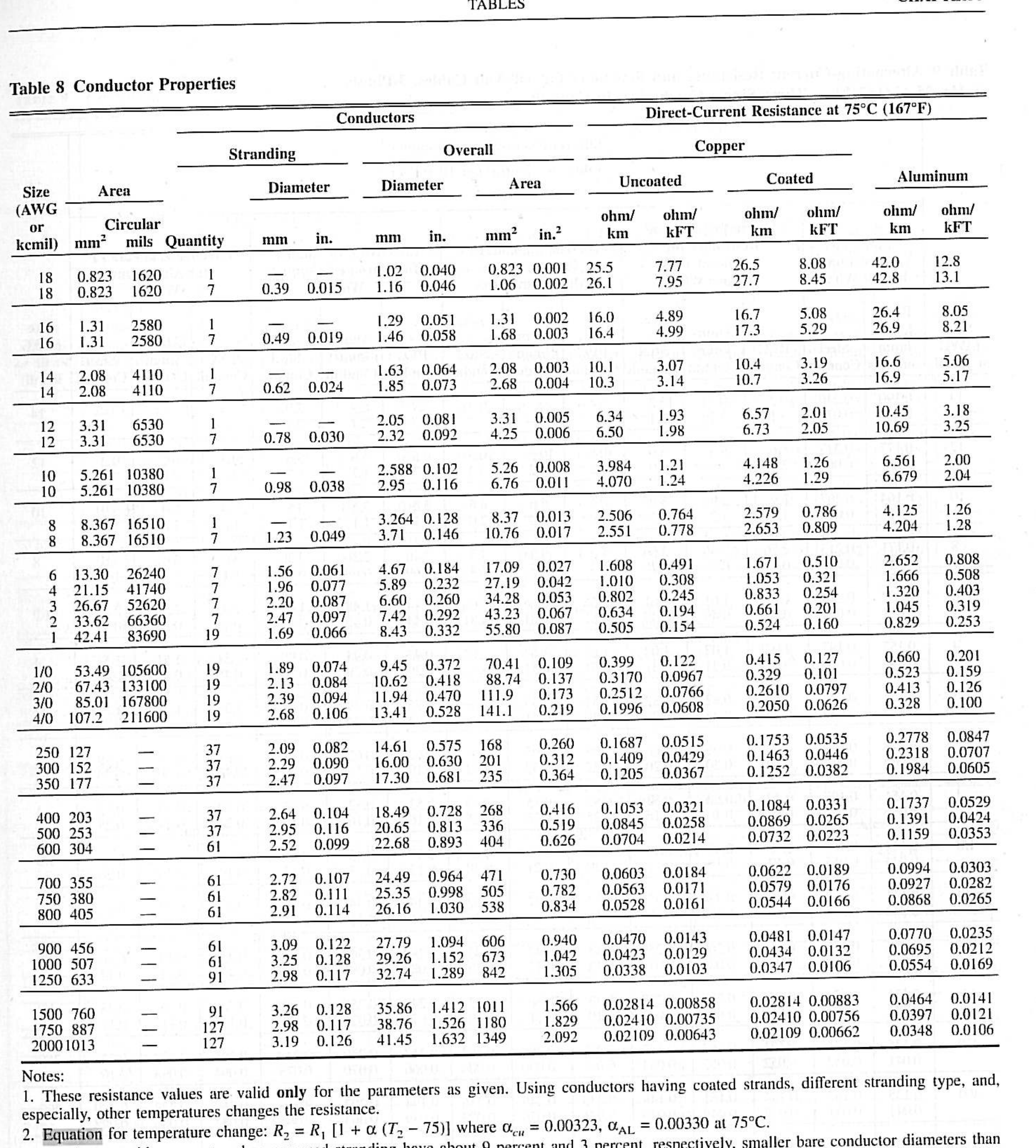


Table 8 Conductor Properties

			Conductors							Direct-Current Resistance at 75°C (167°F)					
			Stranding			Overall				Copper					
Size (AWG or kcmil)	Area			Diameter		Diameter		Area		Uncoated		Coated		Aluminum	
	mm²	Circular mils	Quantity	mm	in.	mm	in.	mm²	in.²	ohm/km	ohm/kFT	ohm/km	ohm/kFT	ohm/km	ohm/kFT
18	0.823	1620	1	—	—	1.02	0.040	0.823	0.001	25.5	7.77	26.5	8.08	42.0	12.8
18	0.823	1620	7	0.39	0.015	1.16	0.046	1.06	0.002	26.1	7.95	27.7	8.45	42.8	13.1
16	1.31	2580	1	—	—	1.29	0.051	1.31	0.002	16.0	4.89	16.7	5.08	26.4	8.05
16	1.31	2580	7	0.49	0.019	1.46	0.058	1.68	0.003	16.4	4.99	17.3	5.29	26.9	8.21
14	2.08	4110	1	—	—	1.63	0.064	2.08	0.003	10.1	3.07	10.4	3.19	16.6	5.06
14	2.08	4110	7	0.62	0.024	1.85	0.073	2.68	0.004	10.3	3.14	10.7	3.26	16.9	5.17
12	3.31	6530	1	—	—	2.05	0.081	3.31	0.005	6.34	1.93	6.57	2.01	10.45	3.18
12	3.31	6530	7	0.78	0.030	2.32	0.092	4.25	0.006	6.50	1.98	6.73	2.05	10.69	3.25
10	5.261	10380	1	—	—	2.588	0.102	5.26	0.008	3.984	1.21	4.148	1.26	6.561	2.00
10	5.261	10380	7	0.98	0.038	2.95	0.116	6.76	0.011	4.070	1.24	4.226	1.29	6.679	2.04
8	8.367	16510	1	—	—	3.264	0.128	8.37	0.013	2.506	0.764	2.579	0.786	4.125	1.26
8	8.367	16510	7	1.23	0.049	3.71	0.146	10.76	0.017	2.551	0.778	2.653	0.809	4.204	1.28
6	13.30	26240	7	1.56	0.061	4.67	0.184	17.09	0.027	1.608	0.491	1.671	0.510	2.652	0.808
4	21.15	41740	7	1.96	0.077	5.89	0.232	27.19	0.042	1.010	0.308	1.053	0.321	1.666	0.508
3	26.67	52620	7	2.20	0.087	6.60	0.260	34.28	0.053	0.802	0.245	0.833	0.254	1.320	0.403
2	33.62	66360	7	2.47	0.097	7.42	0.292	43.23	0.067	0.634	0.194	0.661	0.201	1.045	0.319
1	42.41	83690	19	1.69	0.066	8.43	0.332	55.80	0.087	0.505	0.154	0.524	0.160	0.829	0.253
1/0	53.49	105600	19	1.89	0.074	9.45	0.372	70.41	0.109	0.399	0.122	0.415	0.127	0.660	0.201
2/0	67.43	133100	19	2.13	0.084	10.62	0.418	88.74	0.137	0.3170	0.0967	0.329	0.101	0.523	0.159
3/0	85.01	167800	19	2.39	0.094	11.94	0.470	111.9	0.173	0.2512	0.0766	0.2610	0.0797	0.413	0.126
4/0	107.2	211600	19	2.68	0.106	13.41	0.528	141.1	0.219	0.1996	0.0608	0.2050	0.0626	0.328	0.100
250	127	—	37	2.09	0.082	14.61	0.575	168	0.260	0.1687	0.0515	0.1753	0.0535	0.2778	0.0847
300	152	—	37	2.29	0.090	16.00	0.630	201	0.312	0.1409	0.0429	0.1463	0.0446	0.2318	0.0707
350	177	—	37	2.47	0.097	17.30	0.681	235	0.364	0.1205	0.0367	0.1252	0.0382	0.1984	0.0605
400	203	—	37	2.64	0.104	18.49	0.728	268	0.416	0.1053	0.0321	0.1084	0.0331	0.1737	0.0529
500	253	—	37	2.95	0.116	20.65	0.813	336	0.519	0.0845	0.0258	0.0869	0.0265	0.1391	0.0424
600	304	—	61	2.52	0.099	22.68	0.893	404	0.626	0.0704	0.0214	0.0732	0.0223	0.1159	0.0353
700	355	—	61	2.72	0.107	24.49	0.964	471	0.730	0.0603	0.0184	0.0622	0.0189	0.0994	0.0303
750	380	—	61	2.82	0.111	25.35	0.998	505	0.782	0.0563	0.0171	0.0579	0.0176	0.0927	0.0282
800	405	—	61	2.91	0.114	26.16	1.030	538	0.834	0.0528	0.0161	0.0544	0.0166	0.0868	0.0265
900	456	—	61	3.09	0.122	27.79	1.094	606	0.940	0.0470	0.0143	0.0481	0.0147	0.0770	0.0235
1000	507	—	61	3.25	0.128	29.26	1.152	673	1.042	0.0423	0.0129	0.0434	0.0132	0.0695	0.0212
1250	633	—	91	2.98	0.117	32.74	1.289	842	1.305	0.0338	0.0103	0.0347	0.0106	0.0554	0.0169
1500	760	—	91	3.26	0.128	35.86	1.412	1011	1.566	0.02814	0.00858	0.02814	0.00883	0.0464	0.0141
1750	887	—	127	2.98	0.117	38.76	1.526	1180	1.829	0.02410	0.00735	0.02410	0.00756	0.0397	0.0121
2000	1013	—	127	3.19	0.126	41.45	1.632	1349	2.092	0.02109	0.00643	0.02109	0.00662	0.0348	0.0106

Notes:

1. These resistance values are valid **only** for the parameters as given. Using conductors having coated strands, different stranding type, and, especially, other temperatures changes the resistance.
2. Equation for temperature change: $R_2 = R_1\ [1 + \alpha\ (T_2 - 75)]$ where $\alpha_{cu} = 0.00323$, $\alpha_{AL} = 0.00330$ at 75°C.

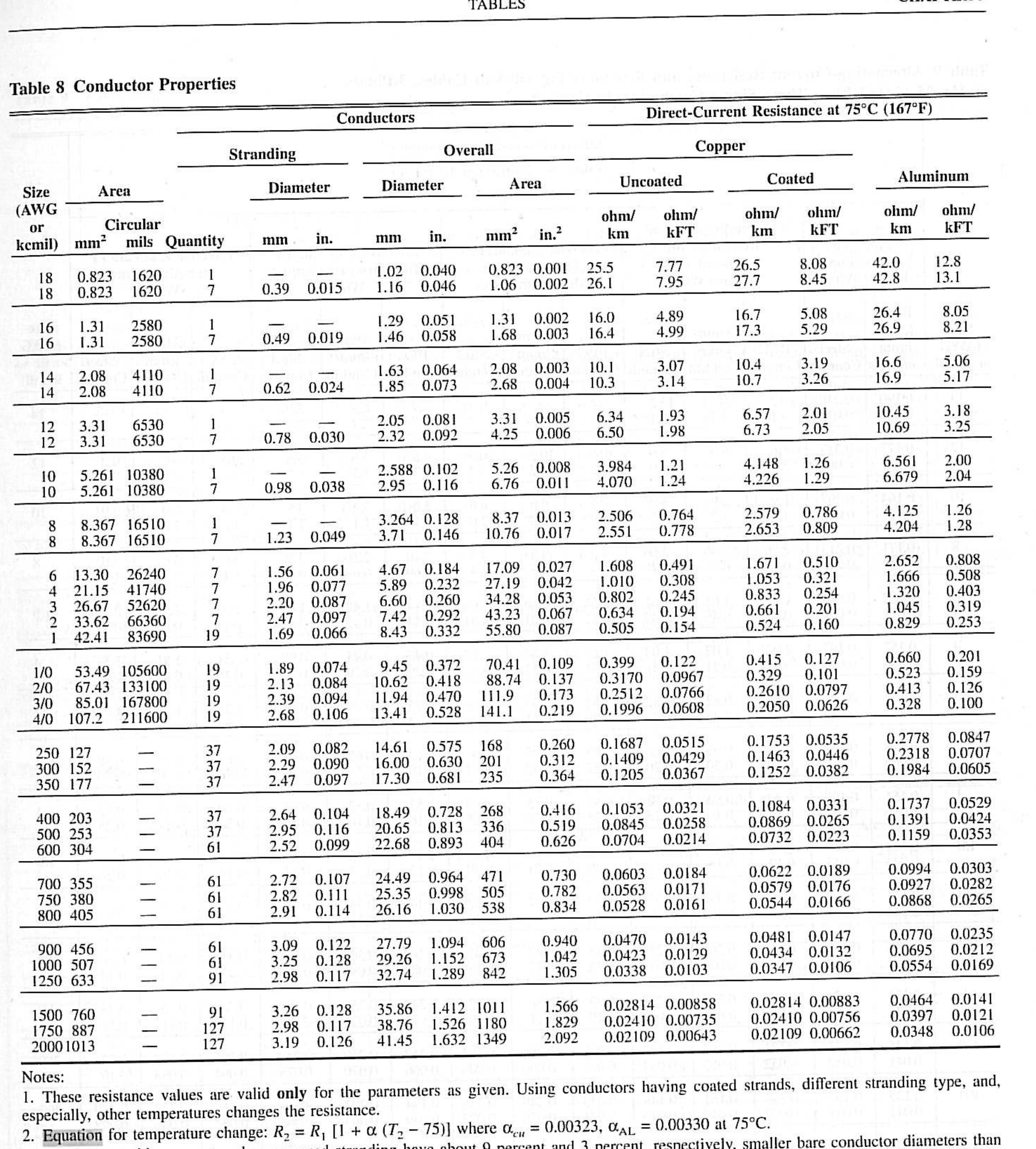
stranding have about 9 percent and 3 percent, respectively, smaller bare conductor diameters than

Grounding – Main Bonding Jumper

- Example
  - I have 4 sets of 350MCM Cu feeding a 1200 amp service. Size the Cu main bonding jumper.

Grounding – Main Bonding Jumper

- Example
  - I have 4 sets of 350 kcmil Cu feeding a 1200 amp service. Size the main bonding jumper.
  - 4 x 350,000 = 1,400,000 or 1,400 kcmil
  - 1400 kcmil exceeds chart
  - 1,400,000 x .125 (12 ½%) = 175,000.
  - The main bonding jumper must be AT LEAST 175,000 circular mills



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	Area		Stranding			Overall				Copper				Aluminum	
				Diameter		Diameter		Area		Uncoated		Coated			
	mm²	Circular mils	Quantity	mm	in.	mm	in.	mm²	in.²	ohm/km	ohm/kFT	ohm/km	ohm/kFT	ohm/km	ohm/kFT
18	0.823	1620	1	—	—	1.02	0.040	0.823	0.001	25.5	7.77	26.5	8.08	42.0	12.8
18	0.823	1620	7	0.39	0.015	1.16	0.046	1.06	0.002	26.1	7.95	27.7	8.45	42.8	13.1
16	1.31	2580	1	—	—	1.29	0.051	1.31	0.002	16.0	4.89	16.7	5.08	26.4	8.05
16	1.31	2580	7	0.49	0.019	1.46	0.058	1.68	0.003	16.4	4.99	17.3	5.29	26.9	8.21
14	2.08	4110	1	—	—	1.63	0.064	2.08	0.003	10.1	3.07	10.4	3.19	16.6	5.06
14	2.08	4110	7	0.62	0.024	1.85	0.073	2.68	0.004	10.3	3.14	10.7	3.26	16.9	5.17
12	3.31	6530	1	—	—	2.05	0.081	3.31	0.005	6.34	1.93	6.57	2.01	10.45	3.18
12	3.31	6530	7	0.78	0.030	2.32	0.092	4.25	0.006	6.50	1.98	6.73	2.05	10.69	3.25
10	5.261	10380	1	—	—	2.588	0.102	5.26	0.008	3.984	1.21	4.148	1.26	6.561	2.00
10	5.261	10380	7	0.98	0.038	2.95	0.116	6.76	0.011	4.070	1.24	4.226	1.29	6.679	2.04
8	8.367	16510	1	—	—	3.264	0.128	8.37	0.013	2.506	0.764	2.579	0.786	4.125	1.26
8	8.367	16510	7	1.23	0.049	3.71	0.146	10.76	0.017	2.551	0.778	2.653	0.809	4.204	1.28
6	13.30	26240	7	1.56	0.061	4.67	0.184	17.09	0.027	1.608	0.491	1.671	0.510	2.652	0.808
4	21.15	41740	7	1.96	0.077	5.89	0.232	27.19	0.042	1.010	0.308	1.053	0.321	1.666	0.508
3	26.67	52620	7	2.20	0.087	6.60	0.260	34.28	0.053	0.802	0.245	0.833	0.254	1.320	0.403
2	33.62	66360	7	2.47	0.097	7.42	0.292	43.23	0.067	0.634	0.194	0.661	0.201	1.045	0.319
1	42.41	83690	19	1.69	0.066	8.43	0.332	55.80	0.087	0.505	0.154	0.524	0.160	0.829	0.253
1/0	53.49	105600	19	1.89	0.074	9.45	0.372	70.41	0.109	0.399	0.122	0.415	0.127	0.660	0.201
2/0	67.43	133100	19	2.13	0.084	10.62	0.418	88.74	0.137	0.3170	0.0967	0.329	0.101	0.523	0.159
3/0	85.01	167800	19	2.39	0.094	11.94	0.470	111.9	0.173	0.2512	0.0766	0.2610	0.0797	0.413	0.126
4/0	107.2	211600	19	2.68	0.106	13.41	0.528	141.1	0.219	0.1996	0.0608	0.2050	0.0626	0.328	0.100
250	127	—	37	2.09	0.082	14.61	0.575	168	0.260	0.1687	0.0515	0.1753	0.0535	0.2778	0.0847
300	152	—	37	2.29	0.090	16.00	0.630	201	0.312	0.1409	0.0429	0.1463	0.0446	0.2318	0.0707
350	177	—	37	2.47	0.097	17.30	0.681	235	0.364	0.1205	0.0367	0.1252	0.0382	0.1984	0.0605
400	203	—	37	2.64	0.104	18.49	0.728	268	0.416	0.1053	0.0321	0.1084	0.0331	0.1737	0.0529
500	253	—	37	2.95	0.116	20.65	0.813	336	0.519	0.0845	0.0258	0.0869	0.0265	0.1391	0.0424
600	304	—	61	2.52	0.099	22.68	0.893	404	0.626	0.0704	0.0214	0.0732	0.0223	0.1159	0.0353
700	355	—	61	2.72	0.107	24.49	0.964	471	0.730	0.0603	0.0184	0.0622	0.0189	0.0994	0.0303
750	380	—	61	2.82	0.111	25.35	0.998	505	0.782	0.0563	0.0171	0.0579	0.0176	0.0927	0.0282
800	405	—	61	2.91	0.114	26.16	1.030	538	0.834	0.0528	0.0161	0.0544	0.0166	0.0868	0.0265
900	456	—	61	3.09	0.122	27.79	1.094	606	0.940	0.0470	0.0143	0.0481	0.0147	0.0770	0.0235
1000	507	—	61	3.25	0.128	29.26	1.152	673	1.042	0.0423	0.0129	0.0434	0.0132	0.0695	0.0212
1250	633	—	91	2.98	0.117	32.74	1.289	842	1.305	0.0338	0.0103	0.0347	0.0106	0.0554	0.0169
1500	760	—	91	3.26	0.128	35.86	1.412	1011	1.566	0.02814	0.00858	0.02814	0.00883	0.0464	0.0141
1750	887	—	127	2.98	0.117	38.76	1.526	1180	1.829	0.02410	0.00735	0.02410	0.00756	0.0397	0.0121
2000	1013	—	127	3.19	0.126	41.45	1.632	1349	2.092	0.02109	0.00643	0.02109	0.00662	0.0348	0.0106

Notes:

1. These resistance values are valid **only** for the parameters as given. Using conductors having coated strands, different stranding type, and, especially, other temperatures changes the resistance.
2. Equation for temperature change: $R_2 = R_1\ [1 + \alpha\ (T_2 - 75)]$ where $\alpha_{cu} = 0.00323$, $\alpha_{AL} = 0.00330$ at 75°C.

stranding have about 9 percent and 3 percent, respectively, smaller bare conductor diameters than

Grounding – Main Bonding Jumper

- Refer to Table 8 conductor properties
  - 3/0 is 167,800 circular mills
  - 4/0 is 211,600 circular mills
    - Parallel 4/0 - sizing
- 4/0 Cu is the size of the main bonding jumper.
- You can not round this number up no matter how close it is.
- Conductors 250 kcmil and larger are already labeled in circular mill
  - Ex. If you needed 311,000 kcmil, you would need 350MCM.

Grounding – Main Bonding Jumper

- Example
  - I have 2 sets of 350MCM Cu feeding a 600 amp service. Size the Cu main bonding jumper:

Grounding – Main Bonding Jumper

- Example
  - I have 2 sets of 350 kcmil Cu feeding a 600 amp service. Size the main bonding jumper.
  - 2 x 350,000 = 700,000 or 700 kcmil
  - 700 kcmil does not exceed the chart
- The main bonding jumper is:
  - 2/0 Cu or 4/0 Al

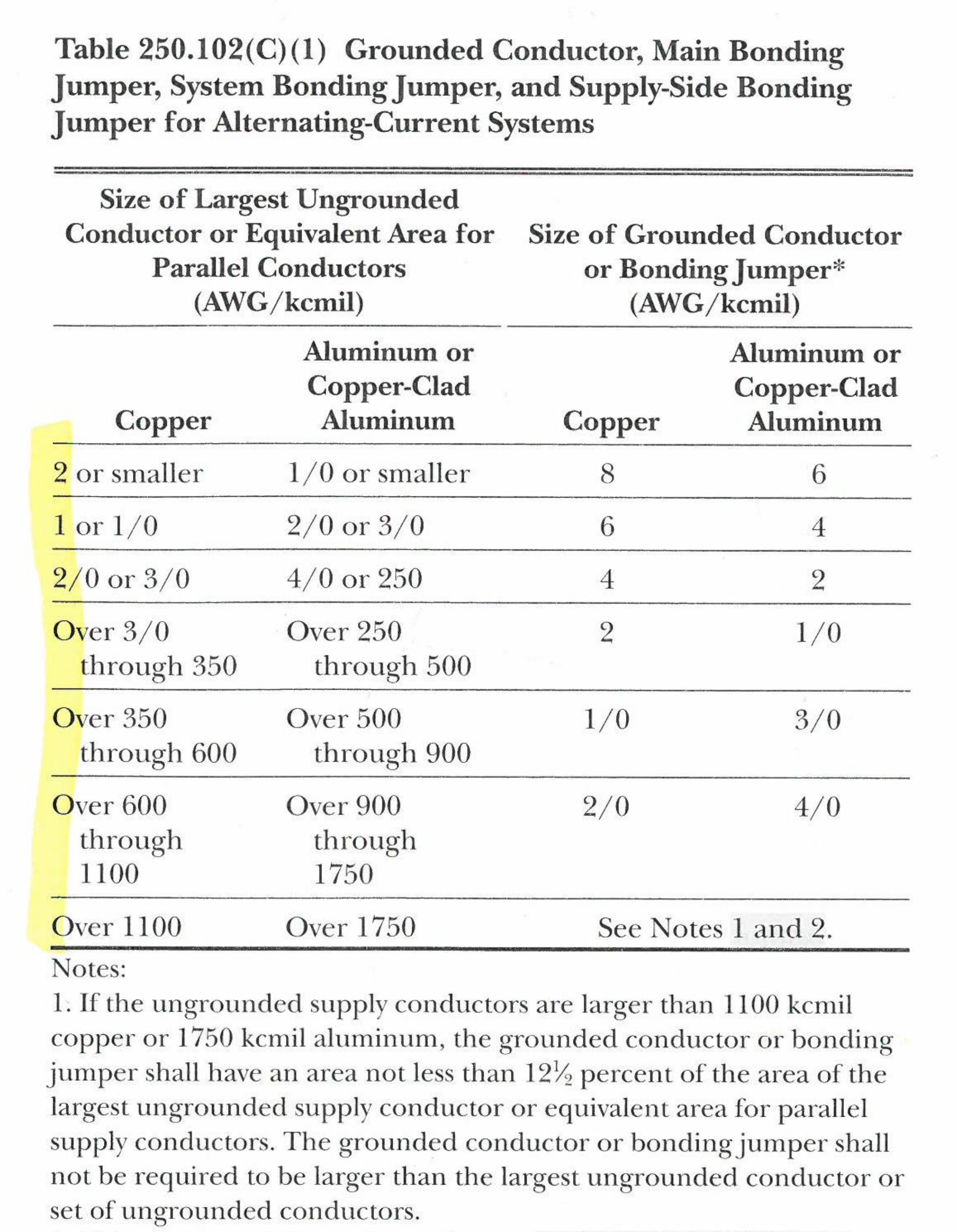


Table 250.102(C)(1) Grounded Conductor, Main Bonding Jumper, System Bonding Jumper, and Supply-Side Bonding Jumper for Alternating-Current Systems

Size of Largest Ungrounded Conductor or Equivalent Area for Parallel Conductors (AWG/kcmil)		Size of Grounded Conductor or Bonding Jumper* (AWG/kcmil)	
Copper	Aluminum or Copper-Clad Aluminum	Copper	Aluminum or Copper-Clad Aluminum
2 or smaller	1/0 or smaller	8	6
1 or 1/0	2/0 or 3/0	6	4
2/0 or 3/0	4/0 or 250	4	2
Over 3/0 through 350	Over 250 through 500	2	1/0
Over 350 through 600	Over 500 through 900	1/0	3/0
Over 600 through 1100	Over 900 through 1750	2/0	4/0
Over 1100	Over 1750	See Notes 1 and 2.	

Notes:

1. If the ungrounded supply conductors are larger than 1100 kcmil copper or 1750 kcmil aluminum, the grounded conductor or bonding jumper shall have an area not less than 12½ percent of the area of the largest ungrounded supply conductor or equivalent area for parallel supply conductors. The grounded conductor or bonding jumper shall not be required to be larger than the largest ungrounded conductor or set of ungrounded conductors.

Grounding

- 250.122 – Equipment grounding conductor
  - Based on the size of overcurrent protection device in circuit

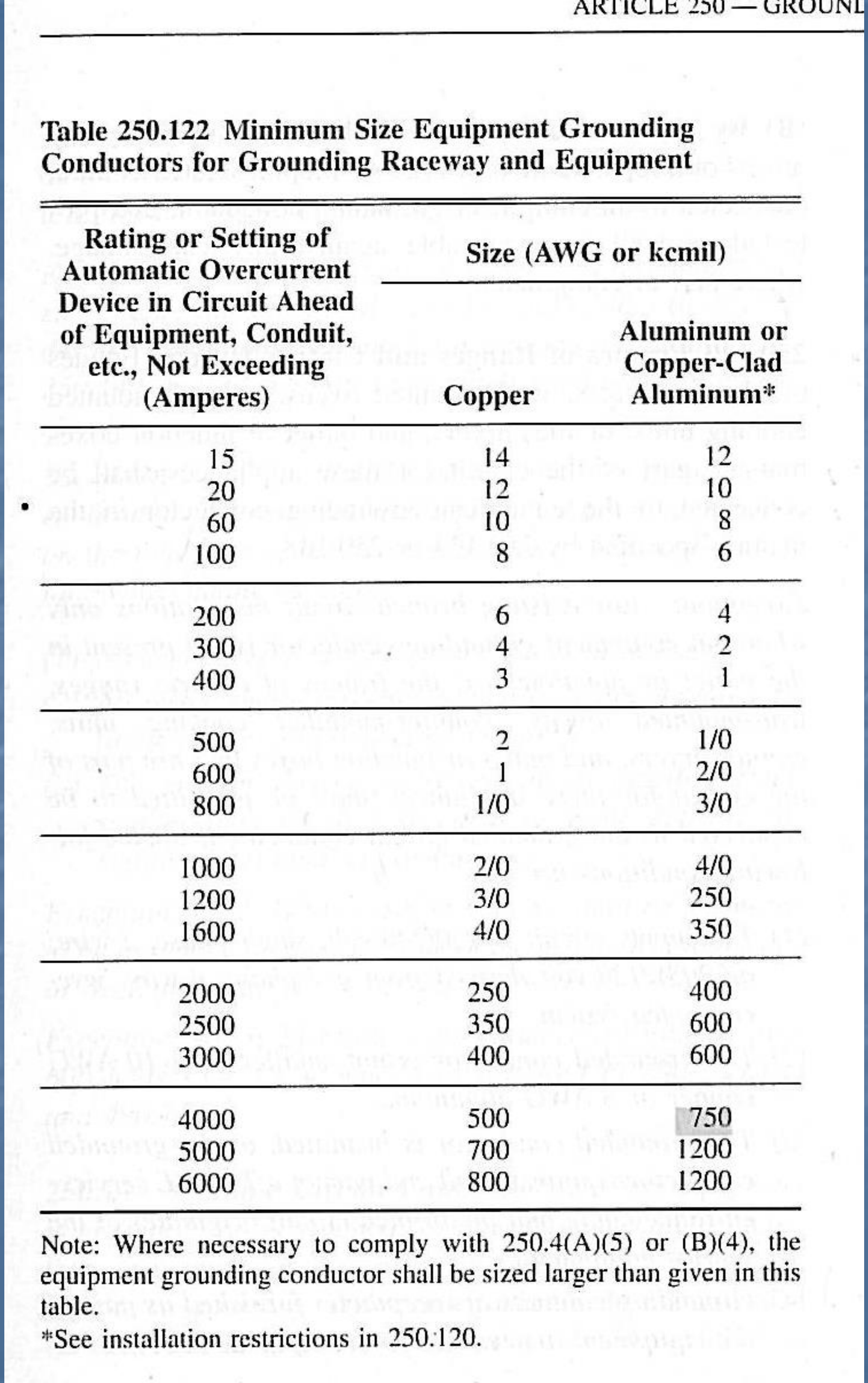


Table 250.122 Minimum Size Equipment Grounding Conductors for Grounding Raceway and Equipment

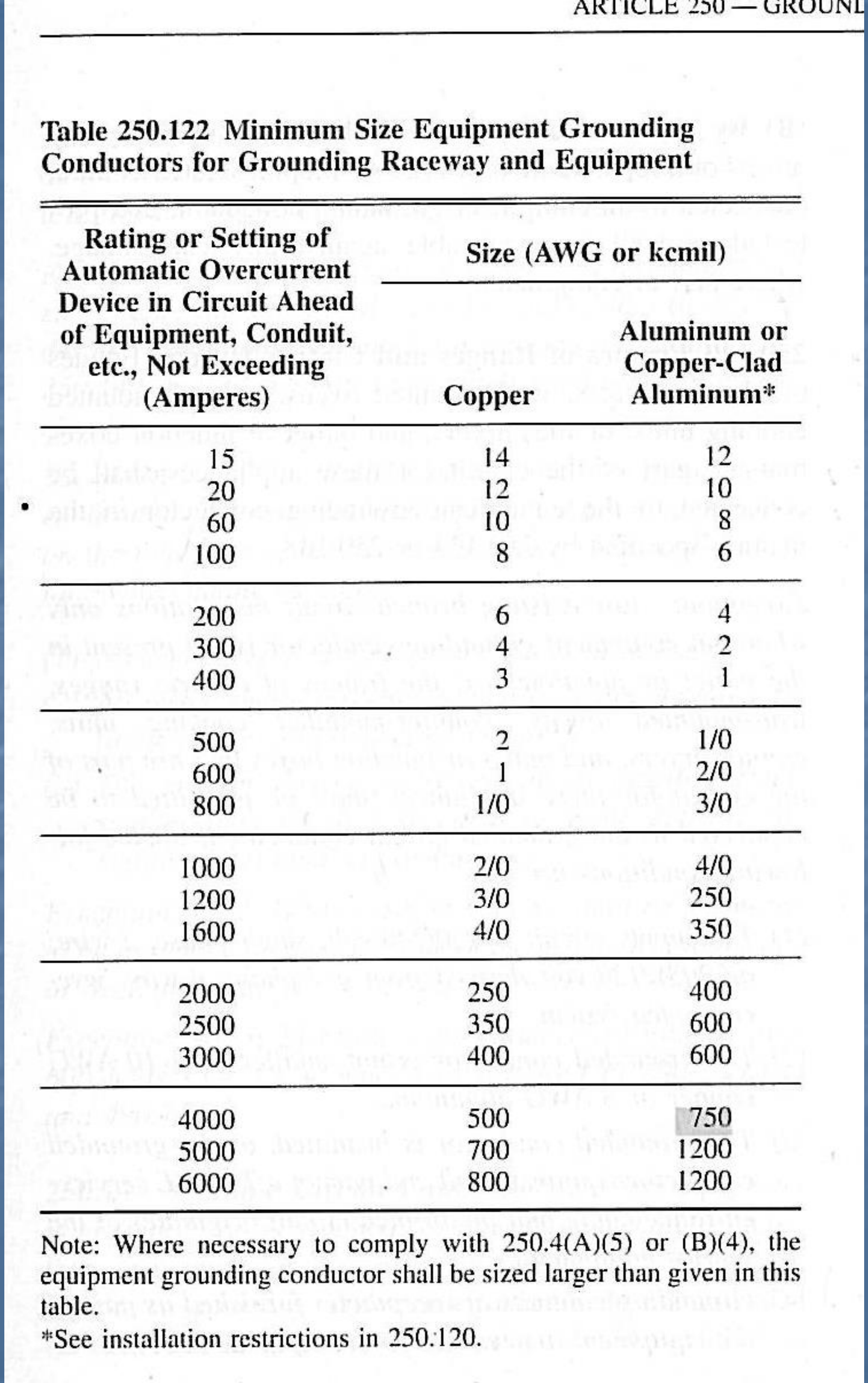
Rating or Setting of Automatic Overcurrent Device in Circuit Ahead of Equipment, Conduit, etc., Not Exceeding (Amperes)	Size (AWG or kcmil)	
	Copper	Aluminum or Copper-Clad Aluminum*
15	14	12
20	12	10
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0
800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	350
2000	250	400
2500	350	600
3000	400	600
4000	500	750
5000	700	1200
6000	800	1200

Note: Where necessary to comply with 250.4(A)(5) or (B)(4), the equipment grounding conductor shall be sized larger than given in this table.

*See installation restrictions in 250.120.

Grounding

- 250.122
  - Must go up if in between sizes
  - What size Cu is the equipment grounding conductor on a 60 amp circuit?
  - What size Cu is the equipment grounding conductor on a 90 amp circuit?



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Rating or Setting of Automatic Overcurrent Device in Circuit Ahead of Equipment, Conduit, etc., Not Exceeding (Amperes)	Size (AWG or kcmil)	
	Copper	Aluminum or Copper-Clad Aluminum*
15	14	12
20	12	10
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0
800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	350
2000	250	400
2500	350	600
3000	400	600
4000	500	750
5000	700	1200
6000	800	1200

Note: Where necessary to comply with 250.4(A)(5) or (B)(4), the equipment grounding conductor shall be sized larger than given in this table.

*See installation restrictions in 250.120.

Grounding

- 250.122
  - Must go up if in between sizes
  - What size Cu is the equipment grounding conductor on a 60 amp circuit? - **#10 Cu**
  - What size Cu is the equipment grounding conductor on a 90 amp circuit? - **#8 Cu**

Grounding

- 250.122
  - If you have multiple circuits in a raceway, you base it on the largest overcurrent device
  - Only one equipment ground needed in a raceway
    - Unless you have an isolated ground also.
  - If you oversize phase conductors due to voltage drop, you also need to oversize ground proportionally
    - This will not be on the exam

Grounding

- 250.122
  - What size Cu is the equipment grounding conductor in a raceway that contains:
  - 2 – 40 amp circuits
  - 1 – 30 amp circuit
  - 3 – 20 amp circuits

Grounding

- 250.122
  - What size Cu is the equipment grounding conductor in a raceway that contains:
  - 2 – 40 amp circuits
  - 1 – 30 amp circuit
  - 3 – 20 amp circuits

- #10 – based on a 40 amp circuit

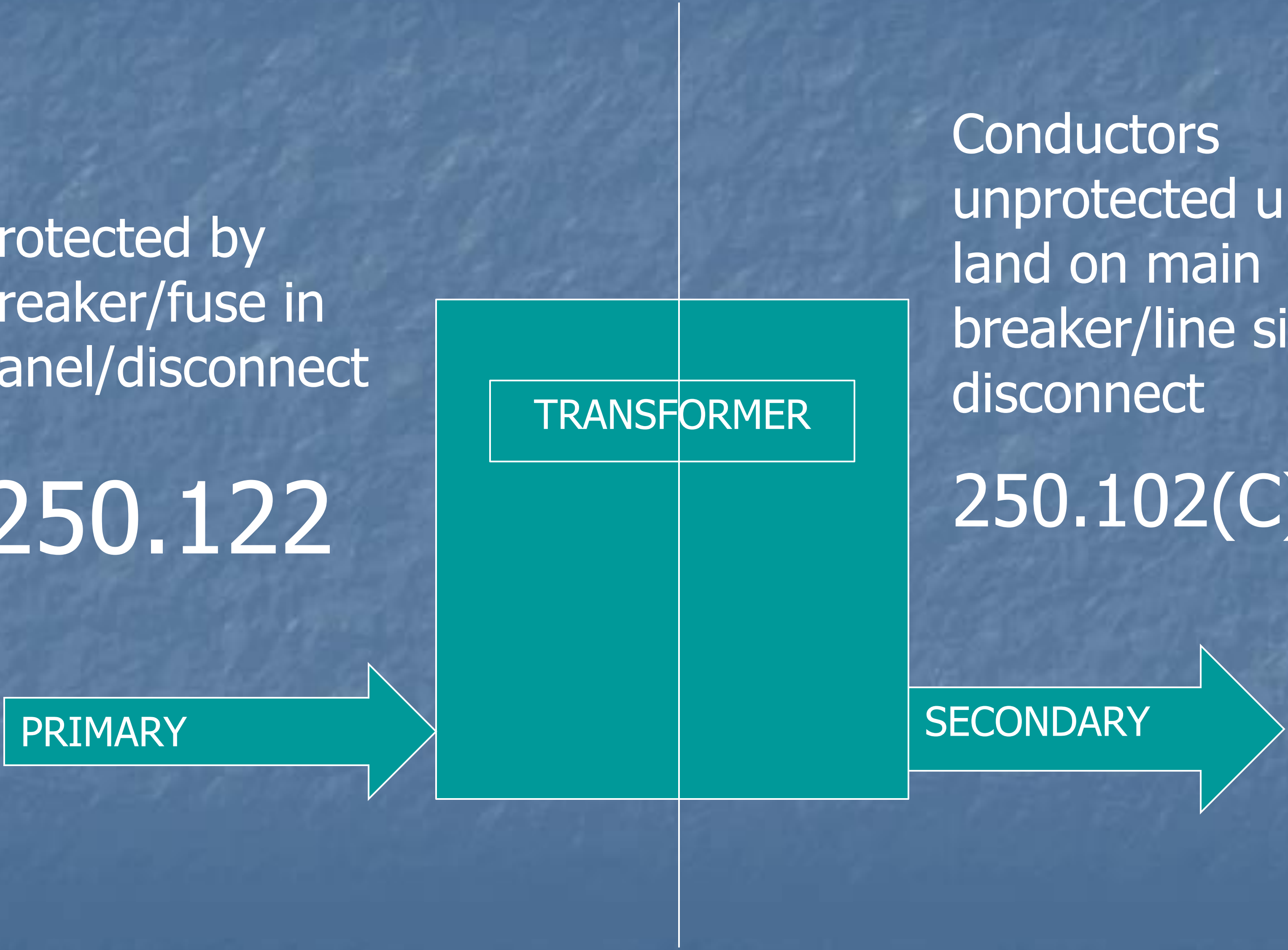
Grounding

Protected by breaker/fuse in panel/disconnect

250.122

Conductors unprotected until they land on main breaker/line side of disconnect

250.102(C)(1)



File Attachments for Item:

ER-14 Voltage Drop (Independent Electrical Contractors)

EPE, ESI, RBO (4 hours)

Staff Notes: Received after ESIAC submission: Recommend referral to ESIAC for recommendations.

Committee Recommendation:

Voltage Drop

This course will go over the calculations to ensure that you do not exceed the 3% or 5% voltage drop per NEC 210.19 A for both single phase and three phase circuits.

Conductor type, length, voltage, conductor size and ampacity all are factors when deciding how to properly run circuits.

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: Kevin Collins (Contact Name)
Organization: IEC of Greater Cincinnati (Organization/Company)
Address: 586 Kings Run Drive (Include Room Number, Suite, etc.)
City: Cincinnati State: OH Zip: 45232
E-Mail: kcollins@iec-cincy.com
Telephone: 513-542-0400 Fax: —
Course Sponsor: IEC of Greater Cincinnati

COURSE INFORMATION:

Course Title: Voltage drop
New Course Submittal: ☒ Update Course: ☐ Prior Approval Number:
Purpose and Objective: We will calculate the voltages at a load based on conductor size, conductor material, distance from panel, ampacity of the load and the voltage system that it is fed from.

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 ☐
Plumbing Plans Exam. ☐
Electrical Plans Exam. ☒
Mechanical Plans Exam. ☐
Building Inspector ☐
Fire Protection Inspector ☐
Mechanical Inspector ☐
Plumbing Inspector ☐
Non-Res IU Inspector ☐

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

Electrical Safety Inspectors ☒
Location of ESI Course: IEC of Greater Cincinnati Date(s) of ESI Course(s): 10/26/22

SUBMITTAL CHECKLIST: **Make Sure** all of the Following Information is **Submitted**:

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

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

Voltage Drop

- Write down the formula

$$Vd = \frac{2\,K\,I\,L}{CMA}$$

K= 12 for Cu*, 19 for Al*,

I = amperage,

L = length (one way)

Voltage Drop

- $$L = \frac{CMA\ x\ Vd}{2\ K\ I}$$

$$CMA = \frac{2\ K\ I\ L}{Vd}$$

If 3 phase, replace "2" with "1.73" (square root of 3)

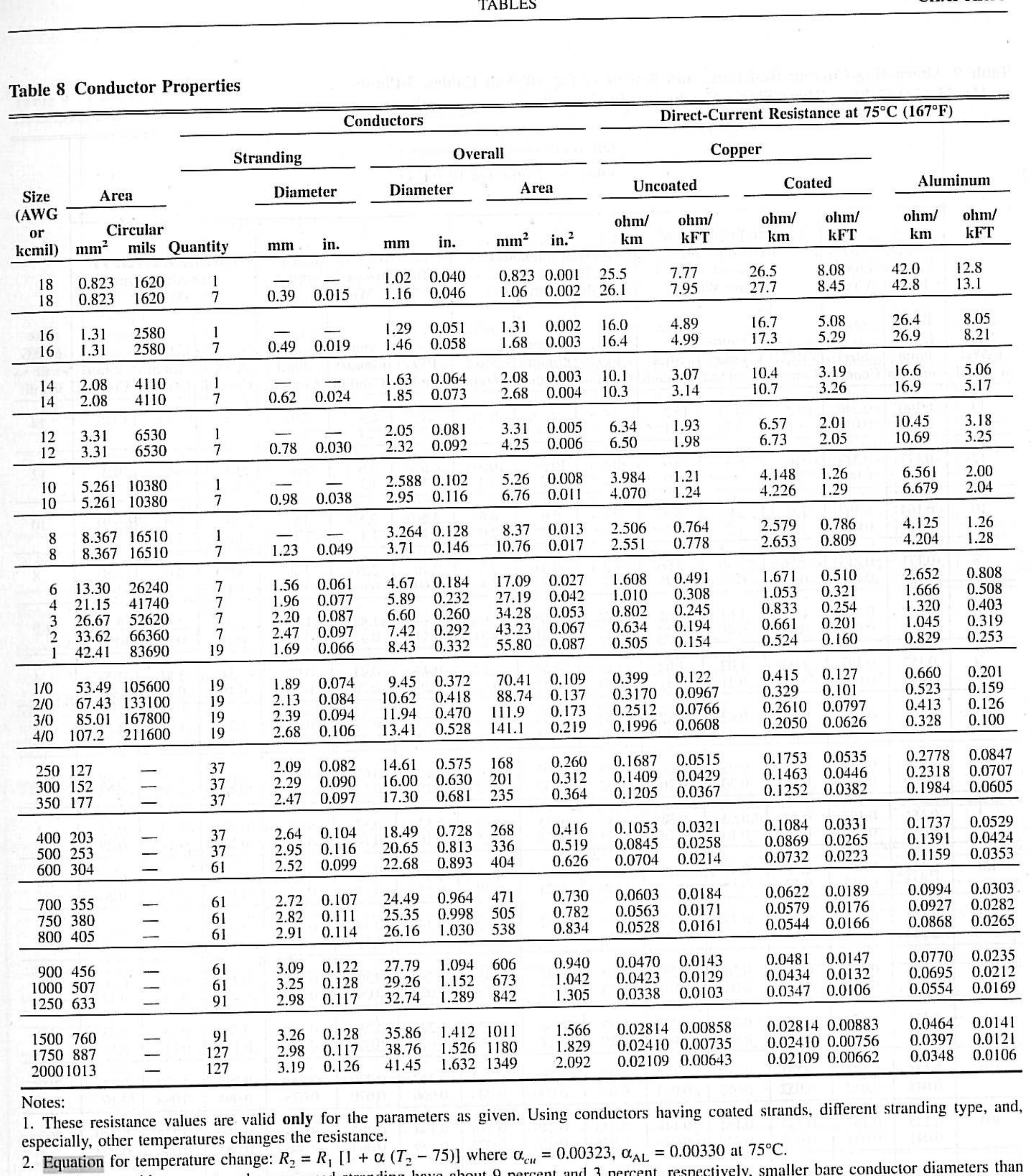


Table 8 Conductor Properties

Size (AWG or kcmil)	Area mm²	Area Circular mils	Stranding Quantity	Stranding Diameter mm	Stranding Diameter in.	Overall Diameter mm	Overall Diameter in.	Overall Area mm²	Overall Area in.²	Copper Uncoated ohm/km	Copper Uncoated ohm/kFT	Copper Coated ohm/km	Copper Coated ohm/kFT	Aluminum ohm/km	Aluminum ohm/kFT
18	0.823	1620	1	—	—	1.02	0.040	0.823	0.001	25.5	7.77	26.5	8.08	42.0	12.8
18	0.823	1620	7	0.39	0.015	1.16	0.046	1.06	0.002	26.1	7.95	27.7	8.45	42.8	13.1
16	1.31	2580	1	—	—	1.29	0.051	1.31	0.002	16.0	4.89	16.7	5.08	26.4	8.05
16	1.31	2580	7	0.49	0.019	1.46	0.058	1.68	0.003	16.4	4.99	17.3	5.29	26.9	8.21
14	2.08	4110	1	—	—	1.63	0.064	2.08	0.003	10.1	3.07	10.4	3.19	16.6	5.06
14	2.08	4110	7	0.62	0.024	1.85	0.073	2.68	0.004	10.3	3.14	10.7	3.26	16.9	5.17
12	3.31	6530	1	—	—	2.05	0.081	3.31	0.005	6.34	1.93	6.57	2.01	10.45	3.18
12	3.31	6530	7	0.78	0.030	2.32	0.092	4.25	0.006	6.50	1.98	6.73	2.05	10.69	3.25
10	5.261	10380	1	—	—	2.588	0.102	5.26	0.008	3.984	1.21	4.148	1.26	6.561	2.00
10	5.261	10380	7	0.98	0.038	2.95	0.116	6.76	0.011	4.070	1.24	4.226	1.29	6.679	2.04
8	8.367	16510	1	—	—	3.264	0.128	8.37	0.013	2.506	0.764	2.579	0.786	4.125	1.26
8	8.367	16510	7	1.23	0.049	3.71	0.146	10.76	0.017	2.551	0.778	2.653	0.809	4.204	1.28
6	13.30	26240	7	1.56	0.061	4.67	0.184	17.09	0.027	1.608	0.491	1.671	0.510	2.652	0.808
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700	355	—	61	2.72	0.107	24.49	0.964	471	0.730	0.0603	0.0184	0.0622	0.0189	0.0994	0.0303
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900	456	—	61	3.09	0.122	27.79	1.094	606	0.940	0.0470	0.0143	0.0481	0.0147	0.0770	0.0235
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2. Equation for temperature change: $R_2 = R_1\ [1 + \alpha\ (T_2 - 75)]$ where $\alpha_{cu} = 0.00323$, $\alpha_{AL} = 0.00330$ at 75°C.
3. have about 9 percent and 3 percent, respectively, smaller bare conductor diameters than

Voltage Drop

- I have a 120 V circuit that pulls 4 amps. The conductors are #6 copper and the load is 300 feet away. What is my voltage drop?

Voltage Drop

I have a 120 V circuit that pulls 4 amps. The conductors are #6 copper and the load is 300 feet away. What is my voltage drop?

2 x 12 x 4 x 300 / 26,240 (Table 8)

= 28,800 / 26,240

= **1.09**

This circuit will lose 1.1 volts

Voltage Drop

I have a 120 V circuit that pulls 9 amps. The conductors are #8 Al and the load is 450 feet away. What is my voltage drop?

Voltage Drop

I have a 120 V circuit that pulls 9 amps. The conductors are #8 Al and the load is 450 feet away. What is my voltage drop?

2 x 19 x 9 x 450 / 16,510 =

= 153,900 / 16,510

= **9.32 volts**

Voltage Drop

- Feeders and branch circuits should be sized to maintain a maximum total voltage drop not to exceed 5% to the farthest outlet see **(215.2(A)(1)Informational note 2)**
    - 5% service to furthest point
    - 3% branch circuit panel to furthest point
- .03 x 120 = ***3.6*** is the max volts you can legally drop on a 120 V circuit
- .03 x 480 = 14.4 is the max volts you can legally drop on a 480 V circuit

Voltage Drop

I have a 120 V circuit that pulls 4 amps. The conductors are #6 copper and the load is 300 feet away. What is my voltage drop?

2 x 12 x 4 x 300 / 26,240 (Table 8)

= 28,800 / 26,240

= 1.09

This circuit will lose 1.1 volts

This would be a legal installation

Voltage Drop

I have a 120 V circuit that pulls 9 amps. The conductors are #8 Al and the load is 450 feet away. What is my voltage drop?

2 x 19 x 9 x 450 / 16,510 =

= 153,000 / 16,510

= 9.32 volts

Not allowed by code

Voltage Drop

- Question can be phrased differently:
- What is the maximum distance I can run #2 Cu on 120 V circuit that pulls 11 amps?

Voltage Drop

- What is the maximum distance I can run #2 Cu on 120 V circuit that pulls 11 amps?
- 120 x .03 = 3.6. This is the maximum volts that I can lose and still be legal.

$$L = \frac{66{,}360\ x\ 3.6}{2\ x\ 12\ x\ 11}$$

$$L = \frac{238{,}896}{264}$$

L = 904.9 feet

Voltage Drop

- What is the maximum distance I can run #10 Cu on 120 V circuit that pulls 8 amps?

Voltage Drop

- What is the maximum distance I can run #10 Cu on 120 V circuit that pulls 8 amps?

$$L = \frac{10{,}380\ x\ 3.6}{2\ x\ 12\ x\ 8}$$

$$L = \frac{37{,}368}{192}$$

L = 194.6

Voltage Drop

- What size copper conductors do you need for a 120 volt, 53 amp load that is 250 feet away? **K= 14**

Voltage Drop

- What size copper conductors do you need for a 120 volt, 53 amp load that is 250 feet away? **K= 14**

$$CMA = \frac{2\ x\ 14\ x\ 53\ x\ 250}{3.6}$$

$$CMA = \frac{371,000}{3.6}$$

$$CMA = \mathbf{103{,}555\ (1/0)}$$

Sean Clark

901 Beechmeadow Ln. Cincinnati, Ohio 45238
(H)513/347-9054 (C)513/800-4450
sclark@ohiovalleyelectric.com

* * *

A licensed electrician with over twenty years of experience in installing, maintaining, and repairing electrical wiring, equipment, and fixtures, ensuring that work is in accordance with relevant codes, fire alarm installations, electrical control systems, and high voltage terminations. A licensed electrician with three years teaching experience in first and second year electrical.

Summary of Qualifications

- More than twenty years experience.
- Three years experience in teaching first and second year electrical.
- Thorough knowledge of electrical systems including planning additions and modifications on secondary circuits. Controls and low voltage wiring
- Able to read commercial electrical blueprints and apply NEC through the full range of commercial and industrial maintenance and construction work.
- Can use appropriate tools and diagnostic equipment to repair, install, replace, and test electrical circuits, equipment and appliances.
- Excellent ability to diagnose and repair electrical controls, industrial motor control centers, and programmable logic controllers.
- Strong desire to study and comprehend new technology.
- In-depth ability to make mathematical computations.
- Considerable ability to explain instructions and guidelines to others effectively.
- Able to assign work to employees., prioritize the work of others and organize and coordinate the work of the unit. For subs and Primes.

Professional Experience

Ohio Valley Electrical Services	2011-Present
ABC Electrical Teacher	2010-2013
Beacon Electrical Contractors	2007-2011
Ohio Valley Electrical Services	1993-2007

Electrical Superintendant/Foreman/Instructor

- First and Second year electrical instructor
- Supervision of all electrical installations of as many as 50 electricians to assure that work was done safely, efficiently, properly and within time allowed.
- Trained multiple employees in all aspects of electrical work to be able to identify an employee's strengths and weaknesses to better utilize their skills. Traced out short circuits in wiring, using test meter.
- Coordinated and implemented electrical projects within a variety of environments including plants, hospitals, schools, retail stores, public facilities, waste water treatment plants industrial buildings;

projects include both new construction and underground electrical wiring as well as renovation within existing buildings. Parking Garages and Fed Ex Ground Facilities.

- Assemble, install, test, and maintain electrical or electronic wiring, equipment, appliances, apparatus, and fixtures, using hand tools and power tools.
- Connect wires to circuit breakers, transformers, or other components.
- Construct and fabricate parts, using hand tools and specifications.
- Diagnose malfunctioning systems, apparatus, and components, using test equipment and hand tools, to locate the cause of a breakdown and correct the problem.
- Inspect electrical systems, equipment, and components to identify hazards, defects, and the need for adjustment or repair, and to ensure compliance with codes.
- Plan layout and installation of electrical wiring, equipment and fixtures, based on job specifications and local codes.
- Test electrical systems and continuity of circuits in electrical wiring, equipment, and fixtures, using testing devices such as ohmmeters, voltmeters, and oscilloscopes, to ensure compatibility and safety of system.
- Perform business management duties such as maintaining records and files, preparing reports and ordering supplies and equipment.

Education & Certifications

Master Electrician License-State of Kentucky

Journeyman Electrician's License-Hamilton, Ohio

Fire Alarm License-State of Ohio

Certified in high voltage terminations and splices

Lift, Lull, Bobcat, and Boom/scissors lift licenses

OSHA-30 card

Certified in first aid and CPR training

Certified NCCER Core Curricula Instructor

Certified NCCER Electrical Instructor

Completed 4 year apprenticeship program

1 Year Pre-apprentice school (ABC)

High School Diploma (1991)

ARCH FLASH SAFETY TRAINING

PROJECTS-SUPERVISED

$4.5mil.-MASON HIGH SCHOOL ADDITION
$250.000-3CDC-5TH RACE PARKING GARAGE
$250.000-AVONEDALE APT. COMPLEX
$100.000-MAHOGANYS AT THE BANK-
1.2mil. -PATHEON CHEMICALS
$450.000- FED EX GROUND ADDITION
$250.000-LIBERTY WAY PROJECT
$500.000-GE AT THE BANKS
$100.000 - SYCAMORE SCHOOLS/POWER/CONTROL-
$50.000 - NKU RETROFIT
$250.000- UC POWER PLANT ADDITION
$75.000 - 580BLD/ CHEMED, RETROFIT
$4.0mil - DHL- CONVEYERS/SHELL
$90.000- DOUBLE TREE AIRPORT
$2.5mil- TWIN LAKES OF MONTGOMERY
$45.000- STEINMART ANDERSON
And many small T&M jobs.
All on time and under budget

File Attachments for Item:

OB-1 Education credit for recruitment/outreach activities

Chris Parmelee, BO for Lakewood Ohio, attending to discuss outreach activities he has performed.

Sample reporting form for discussion.

Ohio | Department of Commerce
Mike DeWine, Governor
Jon Husted, Lt. Governor
Sheryl Maxfield, Director

Building Department Personnel
Community Outreach Record

Name:____________________

BBS ID:_____________

Date	Organization	Activity	Hours

I certify that this is a true and correct statement of outreach activities I have personally completed during the last renewal period, ____________________________(dates)

____
Signature

Certified Personnel may receive up to 15 hours credit each renewal period for performing community outreach activities which increase the visibility of the OBC and RCO, their building departments, and the code administration profession.

Qualifying outreach activities include:

Career Fairs
School and Career Center appearances
Apprenticeship Program talks
Construction Industry Groups
Community Fair/Festival Booth
Department Open House

Other activities not listed here may qualify: contact BBS at 614-644-2613 BBS@com.ohio.gov

File Attachments for Item:

EC-1 Substantial Damage Determinations (Ohio Building Officials Association)

All certifications (4 hours)

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: James E. Decker, Jr.

Course Submitter: James E. Decker, Jr.
(Contact Name)
Organization: Ohio Building Officials Association
(Organization/Company)
Address: PO Box 1506
(Include Room Number, Suite, etc.)
City: Columbus State: OH Zip: 43216
E-Mail: jedjrpe@gmail.com; jdecker@safebuilt.com
Telephone: 440-476-1400 Fax:
Course Sponsor: James E. Decker, Jr.

COURSE INFORMATION:

Course Title: Substantial Damage Determinations

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

Purpose and Objective: The purpose of the course is to train individuals on the procedures for performing substantial damage determinations for structures located in a special flood hazard area who have received damage due to flood, wind, fire, etc. The objective is to prepare a list of individuals who are willing to deploy throughout Ohio to assist local floodplain administrators in performing substantial damage determinations. The course outline will include an overview of the requirements of the RCO and OBC with respect to floods, training in utilizing a damage assessment triage form and the requirements for employer acknowledgment to participate in the Damage Assessment Response Team (DART)

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

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

Program Applicable for the Following Participants:

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

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

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

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

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

Substantial Damage Assessment Training

PILOT COURSE

OHIO BUILDING OFFICIALS ASSOCIATION
OBOA

OHIO EMERGENCY MANAGEMENT AGENCY

Purpose

1) Introduce community officials to requirements for assessing damage to structural development in mapped flood hazard areas
2) Explain use of ODNR's Substantial Damage Assessment Guidance for Community Officials & Field Guide Document
3) Explain generalized procedures for assessing damage to structures
4) Explain process for requesting post-disaster assistance

Background

- Communities that participate in the National Flood Insurance Program (NFIP) are required to **ADOPT**, **ADMINISTER**, & **ENFORCE** floodplain management regulations through a permitting process
- This permitting process is intended to ensure that new & substantially improved development proposed in mapped flood hazard areas is constructed in compliance with these floodplain management regulations
- Effective & proper administration of locally adopted regulations is a requirement of NFIP-participation
  - Communities that do not effectively & properly administer their floodplain management regulations can face probation or suspension from the program

Acronyms, Terms, & Phrases

Acronym	Expansion
DRT	Disaster Response Team
EMAC	Emergency Management Assistance Compact
ESF	Emergency Support Function
ICC	Increased Cost of Compliance *OR* International Code Council
IMAC	Intrastate Mutual Aid Compact
JFO	Joint Field Office
MOU	Memorandum of Understanding
OBOA	Ohio Building Officials Association
SEOC	State Emergency Operations Center
SD	Substantial Damage
SDA	Substantial Damage Assessment
SI	Substantial Improvement

NFIP Requirements

- When a building in the mapped flood hazard area is **affected** by any damaging event (flood, fire, wind, tornado, etc…), the building must be assessed to determine if it has been substantially damaged
    - If the structure has been substantially damaged, it must be brought into compliance with current floodplain management standards.

Substantial Damage (SD)

- Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50% of the market value of the structure before the damage occurred.

Substantial Improvement (SI)

- Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure before the “start of construction” of the improvement. This term includes structures that have incurred “substantial damage,” regardless of the actual repair work performed. The term does not, however, include either:
  1) Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official & which are the minimum necessary to assure safe living conditions or
  2) Any alteration of a “historic structure,” provided that the alteration will not preclude the structure's continued designation as a “historic structure.”

- *The definition of substantial improvement includes structures that have incurred substantial damage. Work necessary to restore a substantially damaged building to its pre-damage condition constitutes a substantial improvement; therefore, the NFIP regulations that refer to substantial improvement also include substantial damage.*

SD Formula

IF,

$$\frac{\text{Cost of Repair to Pre-Damage Condition}}{\text{Market Value of the Building}} \geq 50\%$$

THEN, the structure is considered

SUBSTANTIALLY DAMAGED

SI Formula

IF,

$$\frac{\text{Cost of Improvement to Pre-Damage/Current Condition}}{\text{Market Value of the Building}} \geq 50\%$$

THEN, the improvement is considered

SUBSTANTIAL IMPROVEMENT

Roles & Responsibilities

- Clearly identifying & understanding ROLES & RESPONSIBILTIES will help communities respond more effectively after a damaging event.
  - Many agencies & organizations may be activated to perform various types of evaluations or inspections - depending on the size & magnitude of the disaster or damaging event.
- Damage assessment is required:
  - Post-disaster situations
  - Occurrence of damage from any source.
    - *A building is considered damaged when it has incurred flooding, been damaged by fire/wind/tornado, or any other means.*

Roles & Responsibilities

COMMUNITY

NFIP-Participating Community

- Regulate all development in mapped flood hazard areas
- Administer floodplain development permitting process
- Enforce locally adopted floodplain management regulations
  - Perform damage assessment
  - SD requirements for repair & improvement of buildings
- Assigned to Floodplain Manager*
  - Responsible for performing damage assessment & floodplain development permitting to ensure compliance with locally adopted floodplain management regulations

Roles & Responsibilities

STATE

Ohio Emergency Management Agency's (OEMA) Mitigation Branch

- Implements FEMA's hazard mitigation programs
- Assists Ohio communities with mitigation planning

Ohio Department of Natural Resources (ODNR) Floodplain Management Program (FMP)

- State NFIP Coordinating Agency for the State of Ohio
- Provide technical assistance to communities
- Monitor community floodplain management programs
- Coordinate between communities & the NFIP
- Provide training & guidance to community officials performing SD assessment (flooding or any damaging event)

Roles & Responsibilities

FEDERAL

Federal Emergency Management Agency (FEMA)

- Administers the NFIP nationally & promulgates minimum regulatory requirements
- Supports State floodplain management programs
- Provides technical assistance
- Monitors community floodplain management programs
- Produces flood hazard maps

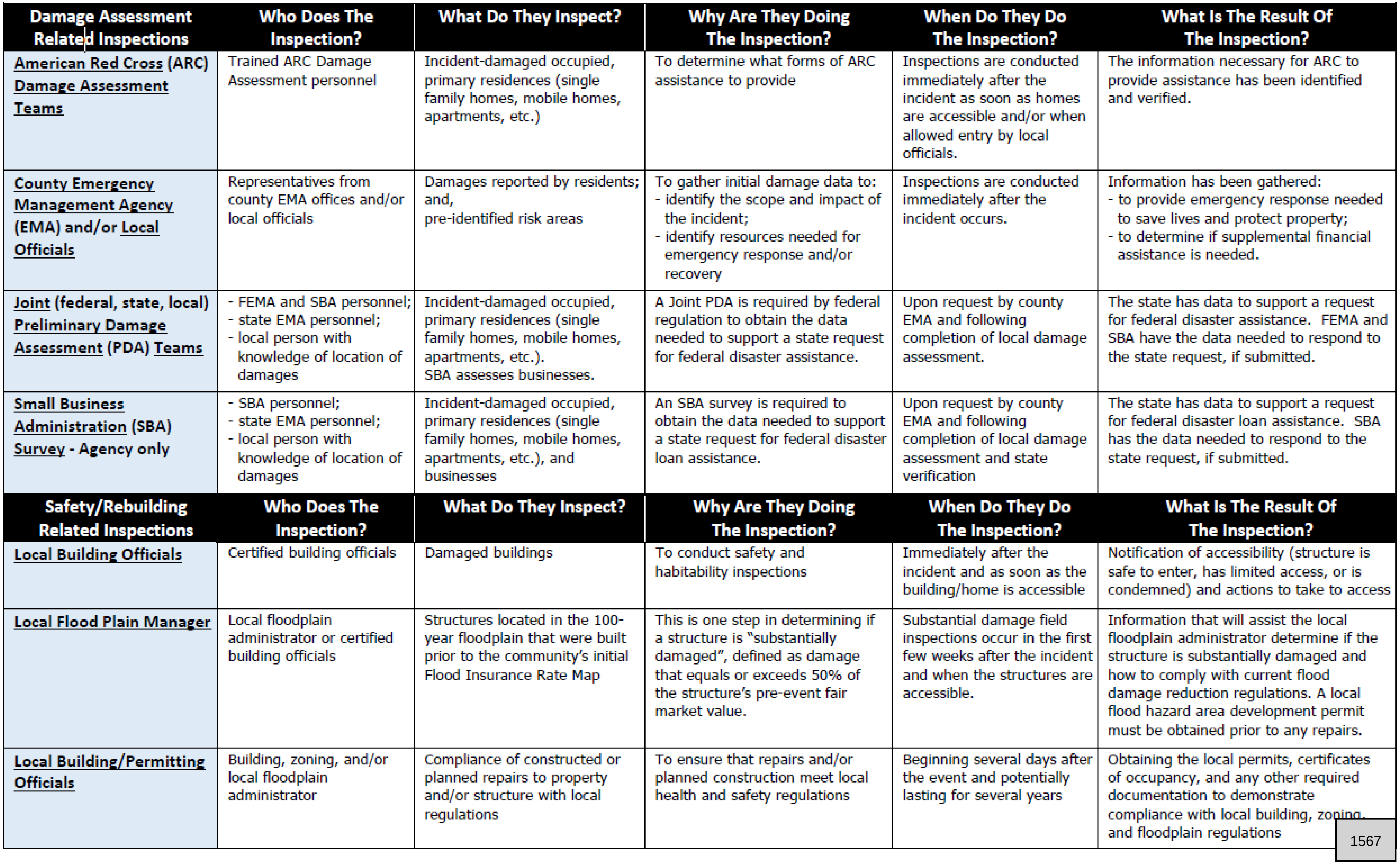
FEMA does not perform substantial damage assessment or determinations & does not notify any property owner of a damage determination.

So. Many. Different. Inspections.

- Different agencies/organizations perform post-disaster inspections for various purposes
    - **THESE “OTHER” INSPECTIONS ARE NOT SUBSTANTIAL DAMAGE ASSESSMENT INSPECTIONS**
- Communities are responsible for performing SD Inspections & Determinations after any damaging event
- Substantially damaged buildings must be brought into compliance with current local floodplain management regulations during the repair/rebuilding process.

Disaster-Related Building Inspections List

Page 1



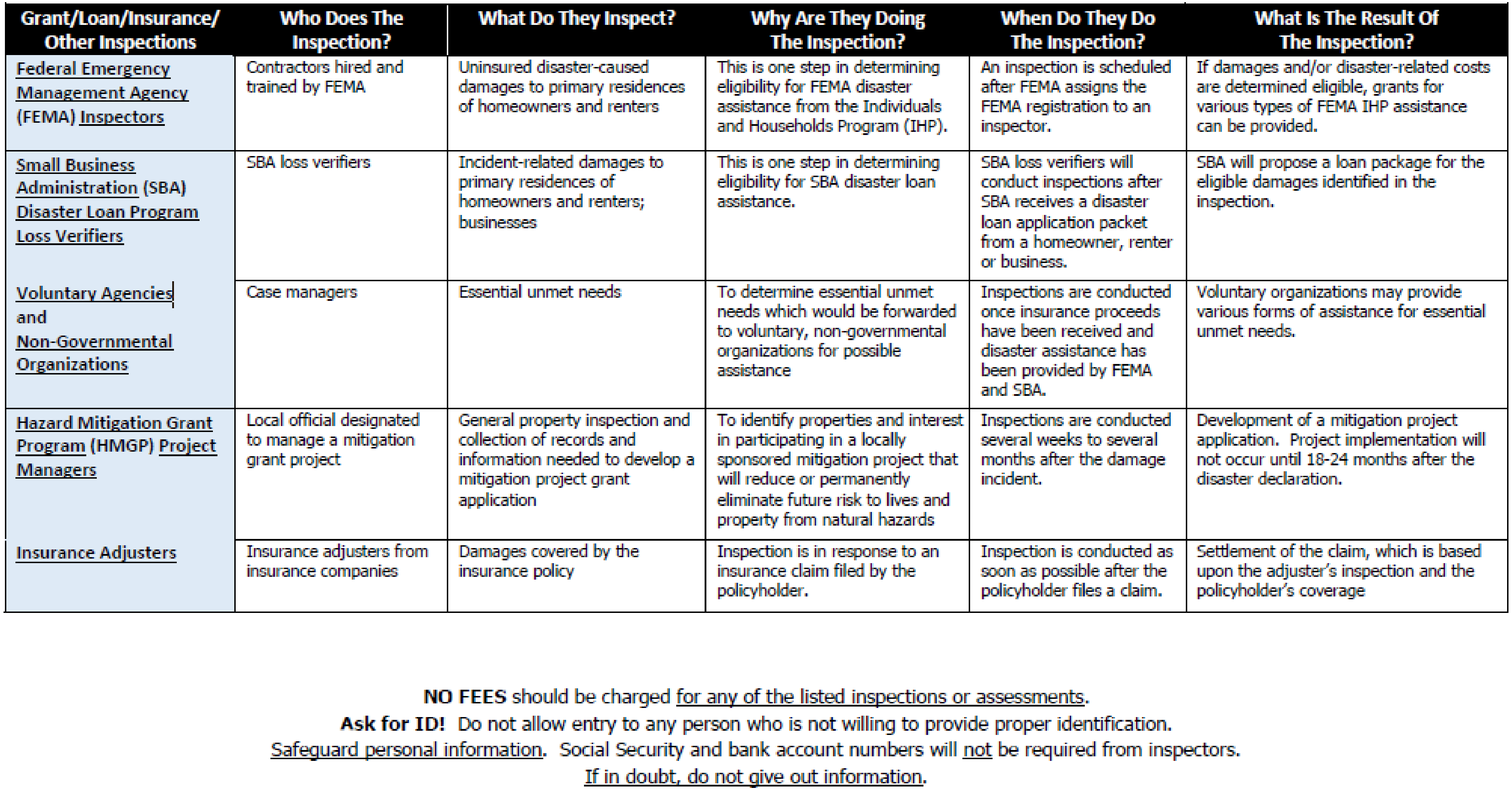
Damage Assessment Related Inspections	Who Does The Inspection?	What Do They Inspect?	Why Are They Doing The Inspection?	When Do They Do The Inspection?	What Is The Result Of The Inspection?
American Red Cross (ARC) Damage Assessment Teams	Trained ARC Damage Assessment personnel	Incident-damaged occupied, primary residences (single family homes, mobile homes, apartments, etc.)	To determine what forms of ARC assistance to provide	Inspections are conducted immediately after the incident as soon as homes are accessible and/or when allowed entry by local officials.	The information necessary for ARC to provide assistance has been identified and verified.
County Emergency Management Agency (EMA) and/or Local Officials	Representatives from county EMA offices and/or local officials	Damages reported by residents; and, pre-identified risk areas	To gather initial damage data to: - identify the scope and impact of the incident; - identify resources needed for emergency response and/or recovery	Inspections are conducted immediately after the incident occurs.	Information has been gathered: - to provide emergency response needed to save lives and protect property; - to determine if supplemental financial assistance is needed.
Joint (federal, state, local) Preliminary Damage Assessment (PDA) Teams	- FEMA and SBA personnel; - state EMA personnel; - local person with knowledge of location of damages	Incident-damaged occupied, primary residences (single family homes, mobile homes, apartments, etc.). SBA assesses businesses.	A Joint PDA is required by federal regulation to obtain the data needed to support a state request for federal disaster assistance.	Upon request by county EMA and following completion of local damage assessment.	The state has data to support a request for federal disaster assistance. FEMA and SBA have the data needed to respond to the state request, if submitted.
Small Business Administration (SBA) Survey - Agency only	- SBA personnel; - state EMA personnel; - local person with knowledge of location of damages	Incident-damaged occupied, primary residences (single family homes, mobile homes, apartments, etc.), and businesses	An SBA survey is required to obtain the data needed to support a state request for federal disaster loan assistance.	Upon request by county EMA and following completion of local damage assessment and state verification	The state has data to support a request for federal disaster loan assistance. SBA has the data needed to respond to the state request, if submitted.

Safety/Rebuilding Related Inspections	Who Does The Inspection?	What Do They Inspect?	Why Are They Doing The Inspection?	When Do They Do The Inspection?	What Is The Result Of The Inspection?
Local Building Officials	Certified building officials	Damaged buildings	To conduct safety and habitability inspections	Immediately after the incident and as soon as the building/home is accessible	Notification of accessibility (structure is safe to enter, has limited access, or is condemned) and actions to take to access
Local Flood Plain Manager	Local floodplain administrator or certified building officials	Structures located in the 100-year floodplain that were built prior to the community's initial Flood Insurance Rate Map	This is one step in determining if a structure is "substantially damaged", defined as damage that equals or exceeds 50% of the structure's pre-event fair market value.	Substantial damage field inspections occur in the first few weeks after the incident and when the structures are accessible.	Information that will assist the local floodplain administrator determine if the structure is substantially damaged and how to comply with current flood damage reduction regulations. A local flood hazard area development permit must be obtained prior to any repairs.
Local Building/Permitting Officials	Building, zoning, and/or local floodplain administrator	Compliance of constructed or planned repairs to property and/or structure with local regulations	To ensure that repairs and/or planned construction meet local health and safety regulations	Beginning several days after the event and potentially lasting for several years	Obtaining the local permits, certificates of occupancy, and any other required documentation to demonstrate compliance with local building, zoning, and floodplain regulations

Source: Ohio EMA

Disaster-Related Building Inspections List

Page 2



Grant/Loan/Insurance/ Other Inspections	Who Does The Inspection?	What Do They Inspect?	Why Are They Doing The Inspection?	When Do They Do The Inspection?	What Is The Result Of The Inspection?
Federal Emergency Management Agency (FEMA) Inspectors	Contractors hired and trained by FEMA	Uninsured disaster-caused damages to primary residences of homeowners and renters	This is one step in determining eligibility for FEMA disaster assistance from the Individuals and Households Program (IHP).	An inspection is scheduled after FEMA assigns the FEMA registration to an inspector.	If damages and/or disaster-related costs are determined eligible, grants for various types of FEMA IHP assistance can be provided.
Small Business Administration (SBA) Disaster Loan Program Loss Verifiers	SBA loss verifiers	Incident-related damages to primary residences of homeowners and renters; businesses	This is one step in determining eligibility for SBA disaster loan assistance.	SBA loss verifiers will conduct inspections after SBA receives a disaster loan application packet from a homeowner, renter or business.	SBA will propose a loan package for the eligible damages identified in the inspection.
Voluntary Agencies and Non-Governmental Organizations	Case managers	Essential unmet needs	To determine essential unmet needs which would be forwarded to voluntary, non-governmental organizations for possible assistance	Inspections are conducted once insurance proceeds have been received and disaster assistance has been provided by FEMA and SBA.	Voluntary organizations may provide various forms of assistance for essential unmet needs.
Hazard Mitigation Grant Program (HMGP) Project Managers	Local official designated to manage a mitigation grant project	General property inspection and collection of records and information needed to develop a mitigation project grant application	To identify properties and interest in participating in a locally sponsored mitigation project that will reduce or permanently eliminate future risk to lives and property from natural hazards	Inspections are conducted several weeks to several months after the damage incident.	Development of a mitigation project application. Project implementation will not occur until 18-24 months after the disaster declaration.
Insurance Adjusters	Insurance adjusters from insurance companies	Damages covered by the insurance policy	Inspection is in response to an insurance claim filed by the policyholder.	Inspection is conducted as soon as possible after the policyholder files a claim.	Settlement of the claim, which is based upon the adjuster's inspection and the policyholder's coverage

NO FEES should be charged for any of the listed inspections or assessments.
Ask for ID! Do not allow entry to any person who is not willing to provide proper identification.
Safeguard personal information. Social Security and bank account numbers will not be required from inspectors.
If in doubt, do not give out information.

Source: Ohio EMA

Four Major Actions

SDA includes:

1) Determine costs to repair damage

2) Determine pre-damage market values

3) Make substantial damage determinations, &

4) Require owners to obtain permits to bring substantially damaged buildings into compliance with floodplain management regulations

SD Assessment vs. Determination

- Floodplain Manager is responsible for performing **SUBSTANTIAL DAMAGE ASSESSMENT** & making **SUBSTANTIAL DAMAGE DETERMINATIONS**
- **Assessment**: Field inspection of the damaged building where damage & conditions are documented.
- **Determination**: Review & evaluation of information obtained from field assessment & applicant to ascertain whether the cost to repair/improve the building will equal or exceed 50% of the building's market value

Substantial Damage Assessment (SDA)

1) Identify affected areas
   - Tour SFHAs immediately - as soon as floodwaters recede.
   - Note areas where damage has occurred. For flood events, look for high water marks/mud lines on structures/objects, damaged items piled outside of homes, etc… Identify affected/damaged structures on maps, take notes & photographs (damage, high water marks, debris, etc…). High water marks should be measured in feet above grade.
2) Provide Public Notice
   - Post public notices about local floodplain management regulations/requirements to obtain floodplain development permits & issue press releases .
3) Initiate inspections of individual structures
4) Conduct inspections of all damaged structures using the Damage Assessment Worksheets or FEMA's SDE.
   - Inform property owners of local floodplain management regulations & requirements to obtain floodplain development permits.
   - Post notices on damaged structures
   - Determine whether cost to repair is SD & notify property owners.
   - Contact ODNR's Floodplain Management Program to report findings.

Substantial Damage Assessment (SDA)

5) Permitting
   - Review floodplain development permit applications for compliance with local floodplain management regulations.
6) Issue permits for compliant developments.
7) Provide Technical Assistance
   - Property owners will have many questions. Provide technical assistance, informational materials, contact information for additional resources
   - Identify opportunities to mitigate flood risk. Share information, options, & resources with property owners.

Substantial Damage Determination

Acquire the necessary data from property owners for floodplain development permitting:

- Obtain & review floodplain development permit applications to determine whether the building repairs (& possible improvements) constitute substantial damage/improvement.
- Review documented description of proposed work submitted by permit applicants to ensure that all requirements are addressed.
- Review cost estimates of the proposed work submitted by permit applicants & determine if the costs are reasonable for the proposed work to repair/restore buildings to pre-damage condition
- Determine market values of damaged buildings or review market value appraisals (if submitted by permit applicants). (Appraisals must reasonably represent the characteristics of the building & the market value of the buildings only.)
    - May use a combination of information to estimate or verify costs & market values are legitimate
- Determine if damaged buildings are substantially damaged based on cost estimates for repairs compared to the market value of the building before the damage occurred.

SD - Accepted Methods

1) Qualified Estimate

- Damage estimate is based on information obtained from local official's onsite inspection of the damaged building & their professional knowledge of damage, repair & construction costs.

2) Documentation Evaluation

- Detailed documentation provided for review by a community official to determine estimate damage.
- Includes itemized costs of materials & labor or estimates of materials & labor prepared by licensed contractors or professional construction cost estimators
- Building valuation tables (published by building code organizations & cost-estimating manuals) & tools available from professional building cost-estimating services
- Documentation developed & provided by the building owner
    - Must provide as much supporting documentation as possible (such as pricing information from lumber companies & hardware stores).
    - Estimate must include the value of labor, including the value of the owner's labor.

SD - Accepted Methods

3) FEMA's Substantial Damage Estimator (SDE)

- Free, downloadable computer software
- Can be used to estimate residential & nonresidential building damage
- Allows community officials with limited appraisal or construction backgrounds to develop reasonable estimates of structure values & structure-specific damages in accordance with the NFIP requirements
- Assessment options for residential structures (single-family homes, town or row houses, & manufactured homes) & common nonresidential structures (e.g., office buildings, strip malls, restaurants)
- May be used in conjunction with an industry-accepted, residential construction cost-estimating guide.

➢**Site inspections must be performed regardless of estimation approach used.**

➢**Flood insurance claim data cannot be used to make a SD determination.**

Triage

- Less than 40% damage = Full Compliance NOT Required
- 40% - 60% damage = Detailed Damage/Repair Data Needed
- Over 60% damage = Full Compliance Required

Damage Assessment Process

- Damage assessment must be performed immediately after any damaging event *(most often - flooding)*
- Property owners cannot repair structures until the damage has been assessed for substantial damage

1) Identify affected areas
    - Tour SFHAs immediately - as soon as floodwaters recede.
    - Note areas where damage has occurred.
        - For flood events, look for high water marks/mud lines on structures/objects, damaged items piled outside of homes, etc…
        - Identify affected/damaged structures on maps, take notes & photographs (damage, high water marks, debris, etc…) High water marks should be measured in feet above grade.

2) Provide Public Notice
    - Post public notices about local floodplain management regulations/requirements to obtain floodplain development permits & issue press releases

Damage Assessment Process

3) Initiate inspections of individual structures
   - Conduct inspections of all damaged structures using the Damage Assessment Worksheets or FEMA's SDE.
   - Inform property owners of local floodplain management regulations & requirements to obtain floodplain development permits.
   - Post notices on damaged structures
   - Determine whether cost to repair is SD & notify property owners
   - Contact ODNR's Floodplain Management Program to report findings

4) Permitting
   - Review floodplain development permit applications for compliance with local floodplain management regulations
   - Issue permits for compliant developments

5) Provide Technical Assistance
   - Property owners will have many questions. Provide technical assistance, informational materials, contact information for additional resources
   - Identify opportunities to mitigate flood risk. Share information, options, & resources with property owners.

Making SD Determinations

Local officials must:

- Notify the property owner in writing of the SD determination
    - Written notification of SD is necessary for owners of NFIP-insured buildings to file an Increased Cost of Compliance (ICC) claim to help pay to bring buildings into compliance
        - If a property owner disagrees with the SD determination, they may appeal the decision
            - Must provide supporting documentation
            - Use Appeals procedure outlined in the community's floodplain management regulations
- Maintain detailed permit files, including:
    - Copy of the flood map for the location
    - Lowest floor elevations
    - Elevations of machinery/equipment
    - Flood protection designs.
- Conduct periodic field inspections during construction to ensure that development complies with issued permits, work with the permit applicant to correct deficiencies/violations.

SD – Required Costs

Items directly associated with the building *(including but not limited to)***:**

- Materials & labor, including the estimated value of donated or discounted materials & owner or volunteer labor
- Site preparation related to the improvement or repair (e.g., foundation excavation or filling in basements)
- Demolition & construction debris disposal
- Labor & other costs associated with demolishing, moving, or altering building components to accommodate improvements, additions, & making repairs
- Costs associated with complying with any other regulations or code requirement that is triggered by the work, including costs to comply with the requirements of the Americans with Disabilities Act (ADA)
- Costs associated with elevating a structure when the proposed elevation is lower than the BFE
- Construction management & supervision
- Contractor’s overhead & profit
- Sales taxes on materials

SD – Required Costs

- Structural elements & exterior finishes, including:
  - Foundations (e.g., spread or continuous foundation footings, perimeter walls, chainwalls, pilings, columns, posts, etc.)
  - Monolithic or other types of concrete slabs
  - Bearing walls, tie beams, trusses
  - Joists, beams, subflooring, framing, ceilings
  - Interior non-bearing walls
  - Exterior finishes (e.g., brick, stucco, siding, painting, & trim)
  - Windows & exterior doors
  - Roofing, gutters, & downspouts
  - Hardware
  - Attached decks & porches
- Interior finish elements, including:
  - Floor finishes (e.g., hardwood, ceramic, vinyl, linoleum, stone, & wall-to-wall carpet over subflooring)
  - Bathroom tiling & fixtures
  - Wall finishes (e.g., drywall, paint, stucco, plaster, paneling, & marble)
  - Built-in cabinets (e.g., kitchen, utility, entertainment, storage, & bathroom)
  - Interior doors
  - Interior finish carpentry
  - Built-in bookcases & furniture
  - Hardware
  - Insulation

SD – Excluded Costs

Items <u>not</u> directly associated with the building *(including but not limited to)*:

- Clean-up & trash removal
- Costs to temporarily stabilize a building so that it is safe to enter to evaluate & identify required repairs
- Costs to obtain or prepare plans & specifications
- L& survey costs
- Permit fees & inspection fees
- Carpeting & recarpeting installed over finished flooring such as wood or tiling
- Outside improvements, including landscaping, irrigation, sidewalks, driveways, fences, yard lights, swimming pools, pool enclosures, & detached accessory structures (e.g., garages, sheds, & gazebos)
- Costs required for the minimum necessary work to correct existing violations of health, safety, & sanitary codes
- Plug-in appliances such as washing machines, dryers, & stoves

Valuation

Determining Market Value of the BUILDING

Market value refers to the price that a seller of real property can expect to receive from a buyer in a fair & open negotiation. For substantial damage determinations, only the market value of the building is evaluated (land, land improvements, & accessory structures are excluded). The market value must always be based on the condition of the structure before the damage occurred. If a structure has not been maintained & has deteriorated over time, then the pre-damage market value is the value to be used as of the date the application for a permit is submitted.

Methods that can be used to estimate market value include:

Appraisals prepared by qualified professionals licensed in the State of Ohio

Values developed for property tax assessment purposes, adjusted to approximate market value

Valuation

- Local officials are responsible for reviewing the validity of all cost estimates provided by applicants
  - Even if prepared by contractors (licensed or registered), engineers, architects, professional cost estimators, or property owners.
  - When applicants submit professional appraisals of market value, local officials should examine the documentation to verify that the appraisals reflect the specific characteristics of the buildings.
  - Local officials should also use data from damage inspections to verify that the proposed costs include all work necessary to restore the structures to pre-damage condition.

Consequences

- Substantially damaged buildings that have been are repaired/rebuilt without being brought into compliance will be subject to increased flood risk
- Incur higher flood insurance premiums
- Require the community to take enforcement action against the property owner

Additional Considerations

- Floodplain management regulations may vary across communities
  - Some communities in Ohio adopt regulations based on the minimum NFIP criteria, while others may have adopted more stringent floodplain management standards

Updated SDA Manual

- Guidance
- Procedures
- Worksheets
- Contacts
- Resources

Disasters Can Be Overwhelming

Following a disaster:

- Reduced community resources
- Additional duties
- MANY impacted buildings
- MANY permit applications to review/process

- Property owners want to repair & rebuild as quickly as possible.
- **Need to perform damage assessment as soon as floodwaters recede & access is possible so the community can begin recovery**

Why Request Assistance from the DRT?

- Local officials must decide if the need for substantial damage determinations exceeds the community's ability to perform inspections in a timely manner
  - Decision can be based upon preliminary damage information obtained from OEMA Preliminary Damage Assessments
- Post-disaster assistance can be requested from the DRT to help perform various post-disaster duties
  - DRTs can conduct MANY assessments in a short period of time
  - Volunteers from the DRT have been trained & can provide assistance to communities that do not have the resources needed to complete timely SDA
  - Completed damage assessment expedites community recovery

OHIO EMERGENCY MANAGEMENT AGENCY

DRT Services

Preliminary Damage Inspections

- Initial assessment of damage
- Assist local officials determine the event scope & means to accomplish recovery.

Substantial Damage Assessment

- Assist communities enforce regulatory standards through inspection of individual buildings & determination if the structure has/has not been "substantially damaged".

Inspections for Approval of Construction

- Assistance with post assessment activity
- Help community officials with the issuance of permits, conducting inspections of repair &/or replacement work, issuing repair orders, & issuing condemnation orders.

DRT Services

Field Inspections

- Document & survey high water marks
- Identify & map damage areas
- Collect photo documentation
- Perform “triage” on damage structures
- Onsite Disaster Trailer (provided by Geauga County)

Data Collection

- Collect building addresses & map depth-damage data
- Compile data needed for damage assessments

Permit Processing

- Complete damage assessment database & inventory
- Assist with damage assessment notifications
- Assist local staff with post-event permit processing

DRT Services

Outreach /Education

- Assist with education on post-disaster requirements
- Operate informational booths or kiosks
- Develop handouts or summary documents for citizens
- Post notices or door hangers on impacted structures

Mitigation Advice

- Provide mitigation program outreach & education
- Gather data needed for mitigation grant development

Drone Reconnaissance

- Perform safety reconnaissance for the community
- Collect aerial imagery of flood damage

Requesting Assistance – Process

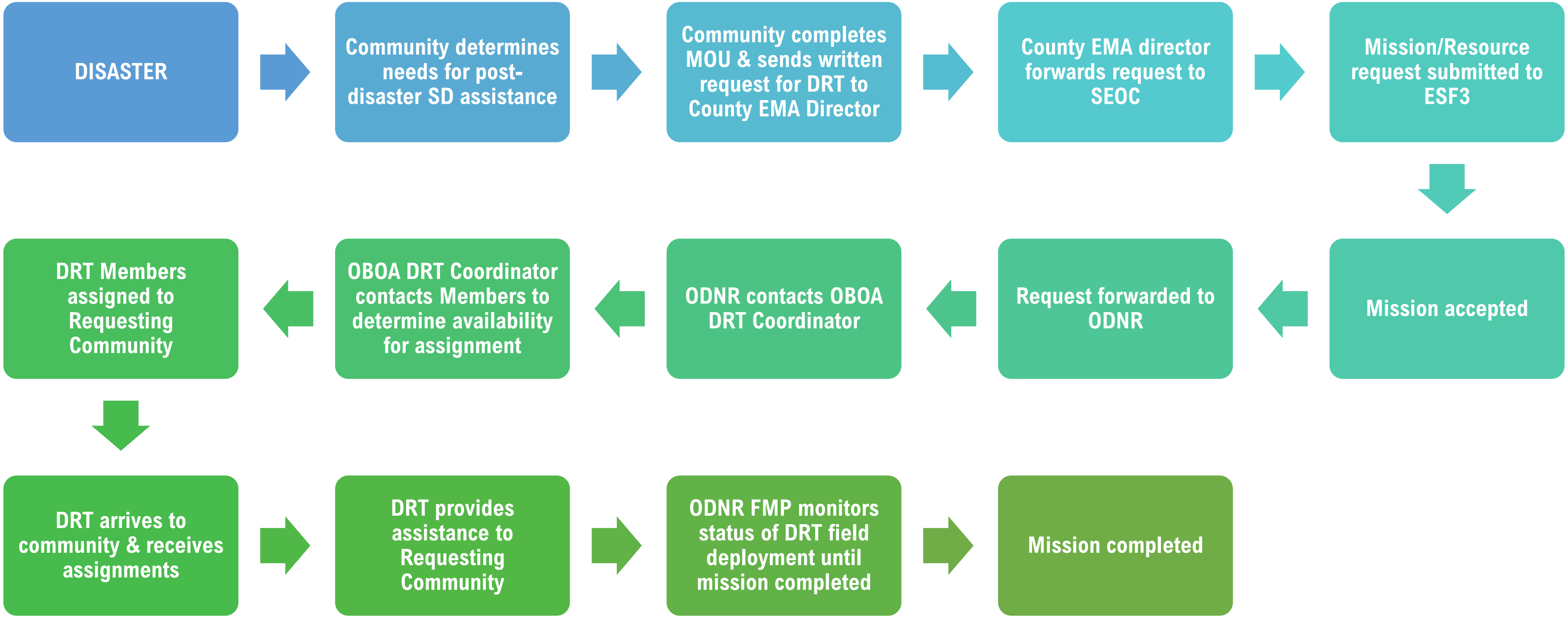
1) The Community Floodplain Administrator completes a written request for assistance with substantial damage field inspections (or other service) to the County EMA Director.
2) The County EMA Director forwards the request for assistance to the State Emergency Operations Center (SEOC), where a Mission/Resource request will be submitted to ESF-3. (ESF-3 is the Engineering & Public Works component of Ohio’s Emergency Operations Plan.)
3) The Mission will be accepted, & the request will be forwarded to the appropriate agency.

Requesting Assistance – Process

4) The designated OBOA DRT Coordinator (responsible for coordinating the substantial damage determination field inspection process) will be contacted.
5) The OBOA DRT Coordinator maintains a database of Inspectors trained to conduct SD field inspections. The OBOA DRT Coordinator will begin contacting Inspectors to determine availability for assignment. Volunteer Inspectors will be assigned to communities based on the prioritized need.
6) ODNR’s Floodplain Management Program will monitor the status of DRT field inspections/deployment until all missions have been completed.

Ohio Emergency Management Agency

Requesting Assistance Process



DISASTER

Community determines needs for post-disaster SD assistance

Community completes MOU & sends written request for DRT to County EMA Director

County EMA director forwards request to SEOC

Mission/Resource request submitted to ESF3

Mission accepted

Request forwarded to ODNR

ODNR contacts OBOA DRT Coordinator

OBOA DRT Coordinator contacts Members to determine availability for assignment

DRT Members assigned to Requesting Community

DRT arrives to community & receives assignments

DRT provides assistance to Requesting Community

ODNR FMP monitors status of DRT field deployment until mission completed

Mission completed

Requesting Assistance - Logistics

- To prepare for requesting OBOA's DRT, **Requesting Communities** should:
    - Identify potential overnight accommodations for OBOA inspectors in your community & make any arrangements necessary with lodging owners.
    - Identify vehicle fueling locations & make advance arrangements to ensure that OBOA inspectors have easy access & availability to fuel, OR
    - Have necessary information for fuel/mileage reimbursement
    - Discuss with your community financial personnel & document your community's meal reimbursement process/policy & have any needed forms ready for the OBOA inspectors

OHIO EMERGENCY MANAGEMENT

Requesting Assistance - Logistics

- Where are Inspectors being deployed?
- Prepare necessary materials, supplies, resources & information for Inspectors
    - Maps of community & affected areas
    - Damage estimation materials/tools
        - ❑ Damage Estimation Field Worksheets
    - Informational materials for distribution to property owners
        - ❑ Relevant information about available resources for residents, shelters, Joint Field Office (JFO), disaster assistance, mitigation options, local debris management, cleaning procedures, filing a flood insurance claim, public meetings, etc…
        - ❑ Contact sheets for relevant community contacts (Floodplain Manager, Building Department, Health Department, etc…)
        - ❑ Community Floodplain Development Permit Applications
- Credentialing
- Determine what Inspectors need to bring?

Requesting Assistance - Logistics

- Where are Inspectors being deployed?
  - Community?
- Prepare necessary materials, supplies, resources & information for Inspectors
  - Maps of community & affected areas
  - Damage estimation materials/tools
    - ❑ Damage Estimation Field Worksheets
- Credentialing
- Determine what Inspectors need to bring?

History - DRT

- OBOA, ODNR, OEMA worked together to develop the DRT years ago
- Lack of requests left the process outdated
- OBOA, ODNR, OEMA recognized a need to update the existing procedures & socialize the resource
  - Updated policies
  - Procedures
  - Manual
- Revised SDA guidance, forms, MOU, etc…

Joining the DRT

Attend 2 annual trainings to become an APPROVED INSPECTOR

1) SD Regulations & Procedures Course (Webinar)
    - NFIP requirements for compliance
    - Post-disaster inspection procedures

2) Field Training
    - Perform onsite damage assessment for residential/nonresidential* development

Renew Credentials annually

- Requires completion of both courses
- Renew MOU (Assisting Community)
    - MOU acknowledges Emergency Management Assistance Compact (EMAC) & Intrastate Mutual Aid Compact (IMAC)

** Not all types of nonresidential development will be addressed*

Ohio Emergency Management Agency

DRT Inspector Qualifications

1) Be knowledgeable in the building code enforcement industry by holding any certification issued by the Ohio Board of Building Standards (Building Official, Plans Examiner, Inspector, Permit Technician); holding the duties of the local floodplain administrator; or holding the duties of a local property maintenance inspector.

2) Providing signed documentation from the Inspector’s jurisdiction of a MOU between the municipality & OBOA. The MOU will contain language that provides protections to the responding Inspector following the statewide EMAC procedures & IMAC procedures.

3) Provide verification the responder has attended damage response training.

Memorandum of Understanding (MOU)

- **Communities REQUESTING ASSISTANCE & PROVIDING ASSISTANCE (i.e DRT Inspectors) must complete the MOU.**

The MOU:

- Provides a framework for OBOA/DRT members to coordinate their services & equipment with the appropriate state agencies & organizations [Ohio EMA, ODNR, OFMA, etc…] in support of statewide & local emergency management functions;
- Purpose (through joint coordination & exercise of the resources of OBOA, Federal, State, & local governments) is to enhance the statewide posture of emergency management readiness for conceivable emergencies.
- Documents details concerning working relationships, arrangements, resources to be provided, reimbursements, & negotiations for both the requesting & assisting communities.

MOU

Requesting Community

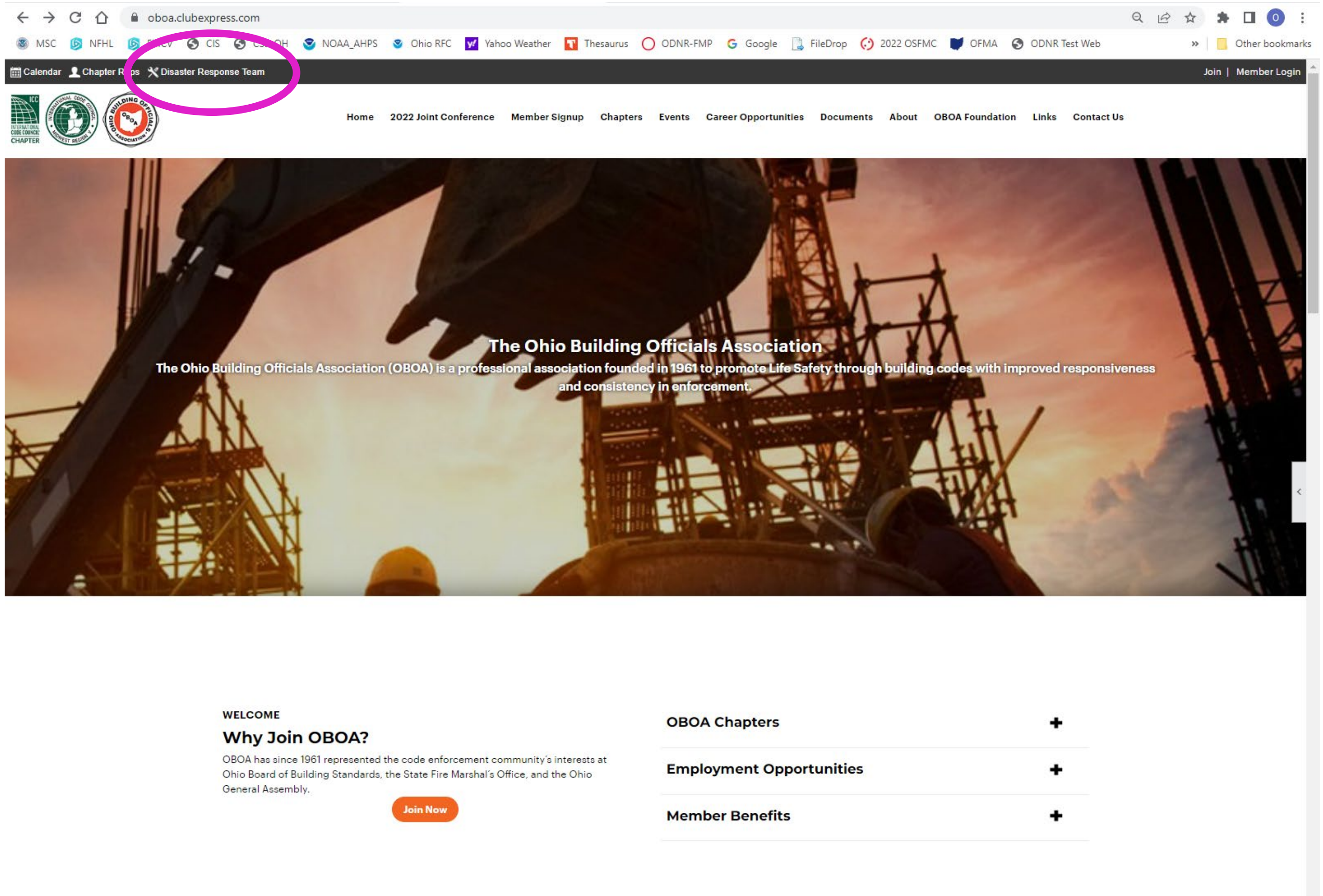
- Jurisdiction who has suffered damage from a hazard event.
- The requesting community has requested assistance in accordance with the MOU & supporting guidance.

Assisting Community

- Jurisdiction offering to provide assistance to the requesting community in accordance with this MOU, the Agreement to Provide Assistance included with this MOU & the Manual Prepared by the Committee.

Roster of Members

- Accessible at OBOA website
  - Disaster Response Team



The Ohio Building Officials Association

The Ohio Building Officials Association (OBOA) is a professional association founded in 1961 to promote Life Safety through building codes with improved responsiveness and consistency in enforcement.

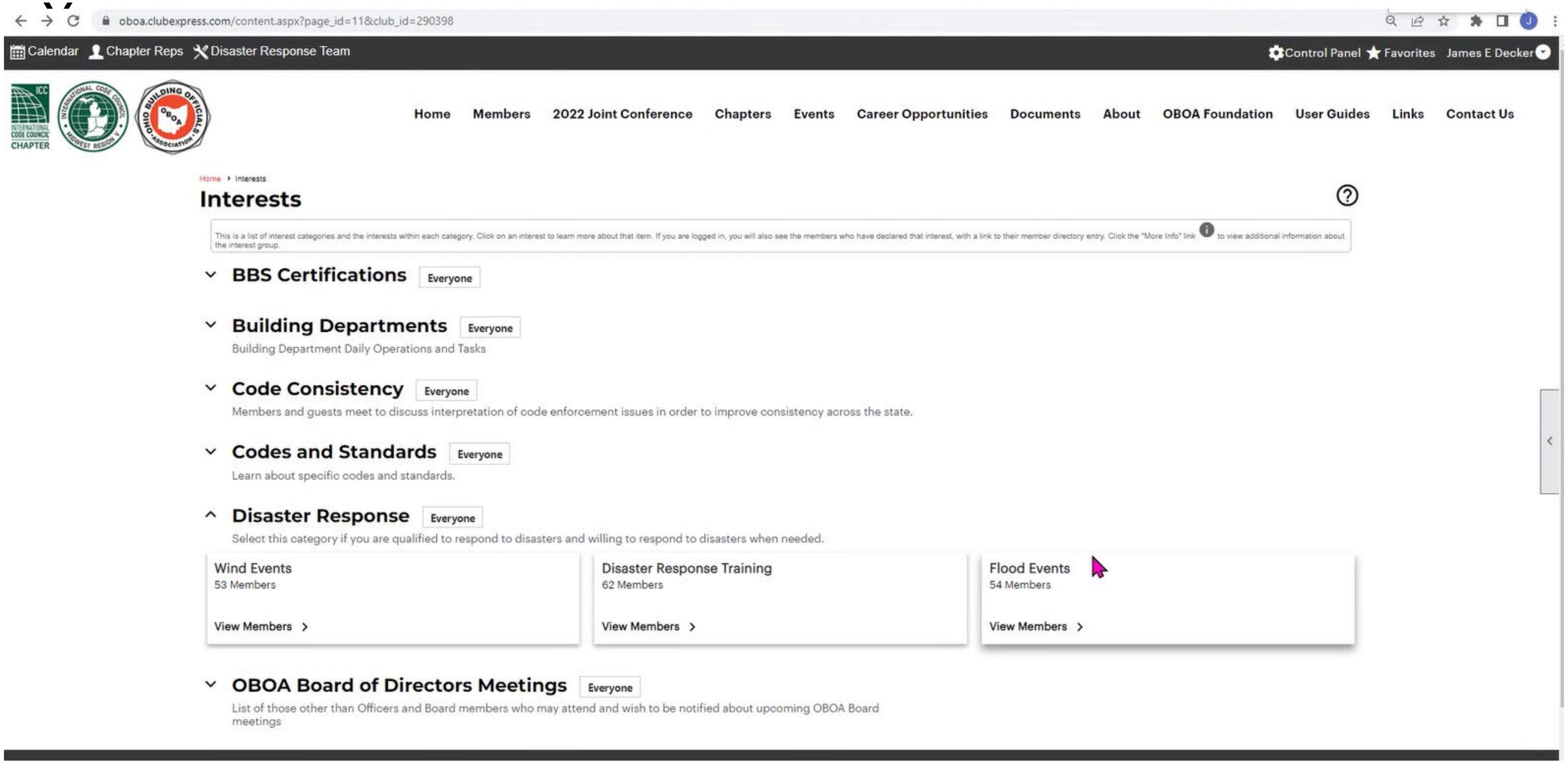
WELCOME

Why Join OBOA?

OBOA has since 1961 represented the code enforcement community's interests at Ohio Board of Building Standards, the State Fire Marshal's Office, and the Ohio General Assembly.

OHIO EMERGENCY MANAGEMENT AGENCY

Roster of Members



Interests

This is a list of interest categories and the interests within each category. Click on an interest to learn more about that item. If you are logged in, you will also see the members who have declared that interest, with a link to their member directory entry. Click the "More Info" link ⓘ to view additional information about the interest group.

BBS Certifications Everyone

Building Departments Everyone

Building Department Daily Operations and Tasks

Code Consistency Everyone

Members and guests meet to discuss interpretation of code enforcement issues in order to improve consistency across the state.

Codes and Standards Everyone

Learn about specific codes and standards.

Disaster Response Everyone

Select this category if you are qualified to respond to disasters and willing to respond to disasters when needed.

Wind Events	Disaster Response Training	Flood Events
53 Members	62 Members	54 Members
View Members ›	View Members ›	View Members ›

OBOA Board of Directors Meetings Everyone

List of those other than Officers and Board members who may attend and wish to be notified about upcoming OBOA Board meetings

DRT Participation

- Comprised of OBOA members, experienced floodplain management professionals, & ODNR Floodplain Management Program
- OBOA is a professional statewide organization composed of building code officials, whose purpose is to:
  - Foster communication & education between building officials, plans examiners, inspectors, & associated industry members
  - Promote high standards of efficiency in the administration & enforcement of building codes & the development of regulatory codes
  - Provide professional assistance & technical advice to legislative & other governmental bodies in the promulgation & administration of building codes & related regulations

DRT Participation

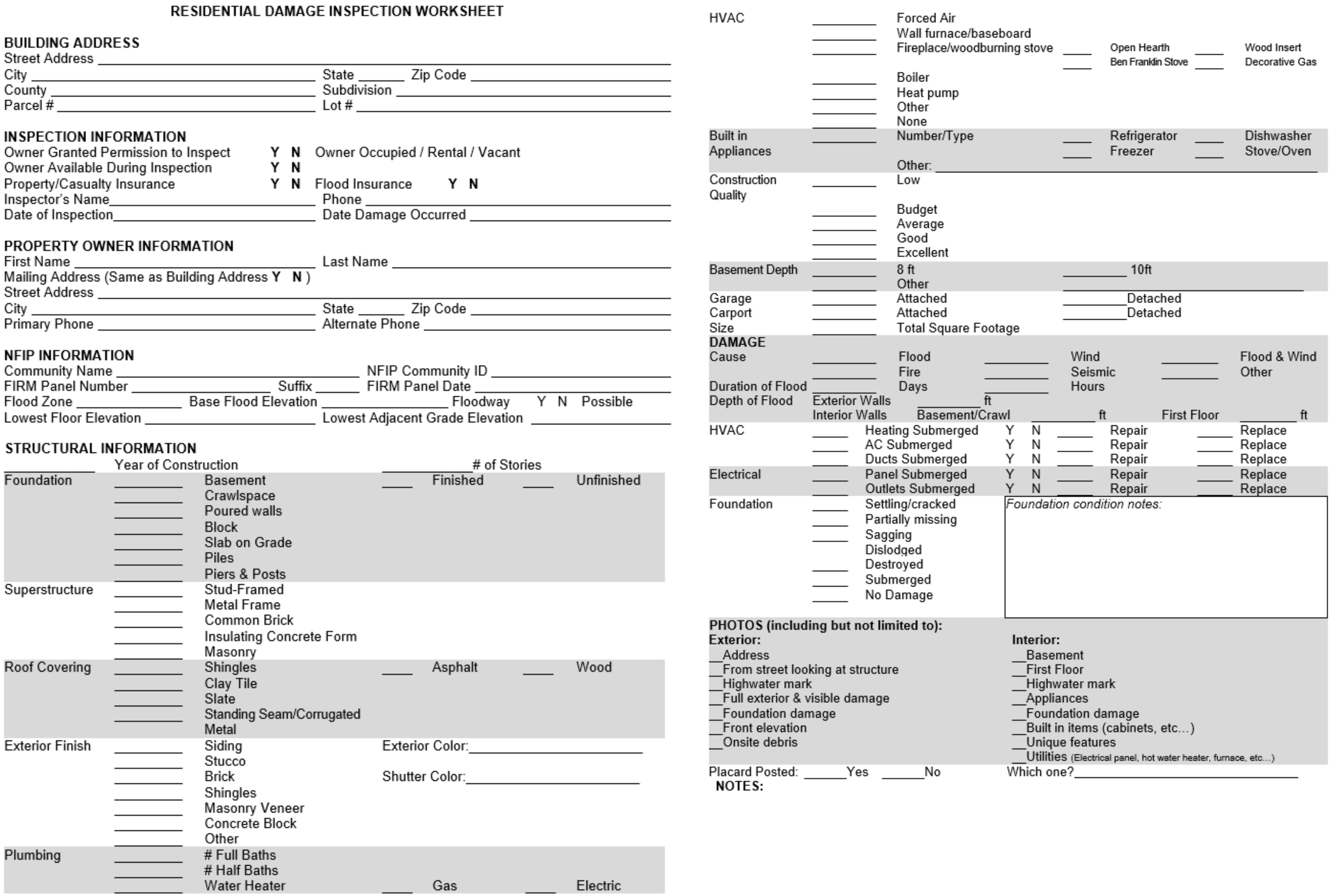
- OBOA may provide manpower, knowledge, & related equipment to the State, counties, townships, municipalities & other quasi-governmental entities requiring assistance during emergency situations when local resources are deemed insufficient.
- Participation in the DRT is voluntary.
- DRT members must undergo annual training on SD requirements & SDA.

Field Inspection Supplies

- Community flood map (i.e. FIRM)
- Parcel map with addresses map showing individual lots
- Identification showing you are a community representative
- Digital camera
- Laptop computer or IPAD
- Residential & Nonresidential Inspection Worksheets
- Floodplain Development Permit Applications
- Any other relevant permit applications
- Inspection Tags
- Tape measure (100’)
- Flashlight
- Safety footwear
- Gloves
- Masks
- Sunscreen
- Insect Repellant
- Hand sanitizer/disinfectant wipes
- Clip board
- Writing utensils
- Mobile phone
- Fact sheets for property owners
- Business car

Residential Damage Inspection Worksheet

Ohio Emergency Management Agency



RESIDENTIAL DAMAGE INSPECTION WORKSHEET

BUILDING ADDRESS

Street Address ____________________

City ____________ State ______ Zip Code ____________

County ____________ Subdivision ____________

Parcel # ____________ Lot # ____________

INSPECTION INFORMATION

Owner Granted Permission to Inspect **Y N** Owner Occupied / Rental / Vacant

Owner Available During Inspection **Y N**

Property/Casualty Insurance **Y N** Flood Insurance **Y N**

Inspector's Name____________ Phone ____________

Date of Inspection____________ Date Damage Occurred ____________

PROPERTY OWNER INFORMATION

First Name ____________ Last Name ____________

Mailing Address (Same as Building Address Y N)

Street Address ____________________

City ____________ State ______ Zip Code ____________

Primary Phone ____________ Alternate Phone ____________

NFIP INFORMATION

Community Name ____________ NFIP Community ID ____________

FIRM Panel Number ____________ Suffix ______ FIRM Panel Date ____________

Flood Zone ____________ Base Flood Elevation ____________ Floodway Y N Possible

Lowest Floor Elevation ____________ Lowest Adjacent Grade Elevation ____________

STRUCTURAL INFORMATION

__________ Year of Construction __________# of Stories

Foundation	________	Basement	____	Finished	____	Unfinished
	________	Crawlspace				
	________	Poured walls				
	________	Block				
	________	Slab on Grade				
	________	Piles				
	________	Piers & Posts				
Superstructure	________	Stud-Framed				
	________	Metal Frame				
	________	Common Brick				
	________	Insulating Concrete Form				
	________	Masonry				
Roof Covering	________	Shingles	____	Asphalt	____	Wood
	________	Clay Tile				
	________	Slate				
	________	Standing Seam/Corrugated				
		Metal				
Exterior Finish	________	Siding	Exterior Color:____________			
	________	Stucco				
	________	Brick	Shutter Color:____________			
	________	Shingles				
	________	Masonry Veneer				
	________	Concrete Block				
	________	Other				
Plumbing	________	# Full Baths				
	________	# Half Baths				
	________	Water Heater	____	Gas	____	Electric

HVAC	________	Forced Air				
	________	Wall furnace/baseboard				
	________	Fireplace/woodburning stove	____	Open Hearth	____	Wood Insert
			____	Ben Franklin Stove	____	Decorative Gas
	________	Boiler				
	________	Heat pump				
	________	Other				
	________	None				
Built in Appliances	________	Number/Type	____	Refrigerator	____	Dishwasher
			____	Freezer	____	Stove/Oven
		Other: ____________				
Construction Quality	________	Low				
	________	Budget				
	________	Average				
	________	Good				
	________	Excellent				
Basement Depth	________	8 ft	________	10ft		
	________	Other	____________			
Garage	________	Attached	________	Detached		
Carport	________	Attached	________	Detached		
Size	________	Total Square Footage				

DAMAGE

Cause	________	Flood	________	Wind	________	Flood & Wind
	________	Fire	________	Seismic	________	Other
Duration of Flood	________	Days	________	Hours		
Depth of Flood	Exterior Walls	________ ft				
	Interior Walls	Basement/Crawl ________ ft		First Floor ________ ft		

HVAC	______	Heating Submerged	Y N	______	Repair	______	Replace
	______	AC Submerged	Y N	______	Repair	______	Replace
	______	Ducts Submerged	Y N	______	Repair	______	Replace
Electrical	______	Panel Submerged	Y N	______	Repair	______	Replace
	______	Outlets Submerged	Y N	______	Repair	______	Replace

Foundation	______	Settling/cracked	*Foundation condition notes:*
	______	Partially missing	
	______	Sagging	
	______	Dislodged	
	______	Destroyed	
	______	Submerged	
	______	No Damage	

PHOTOS (including but not limited to):

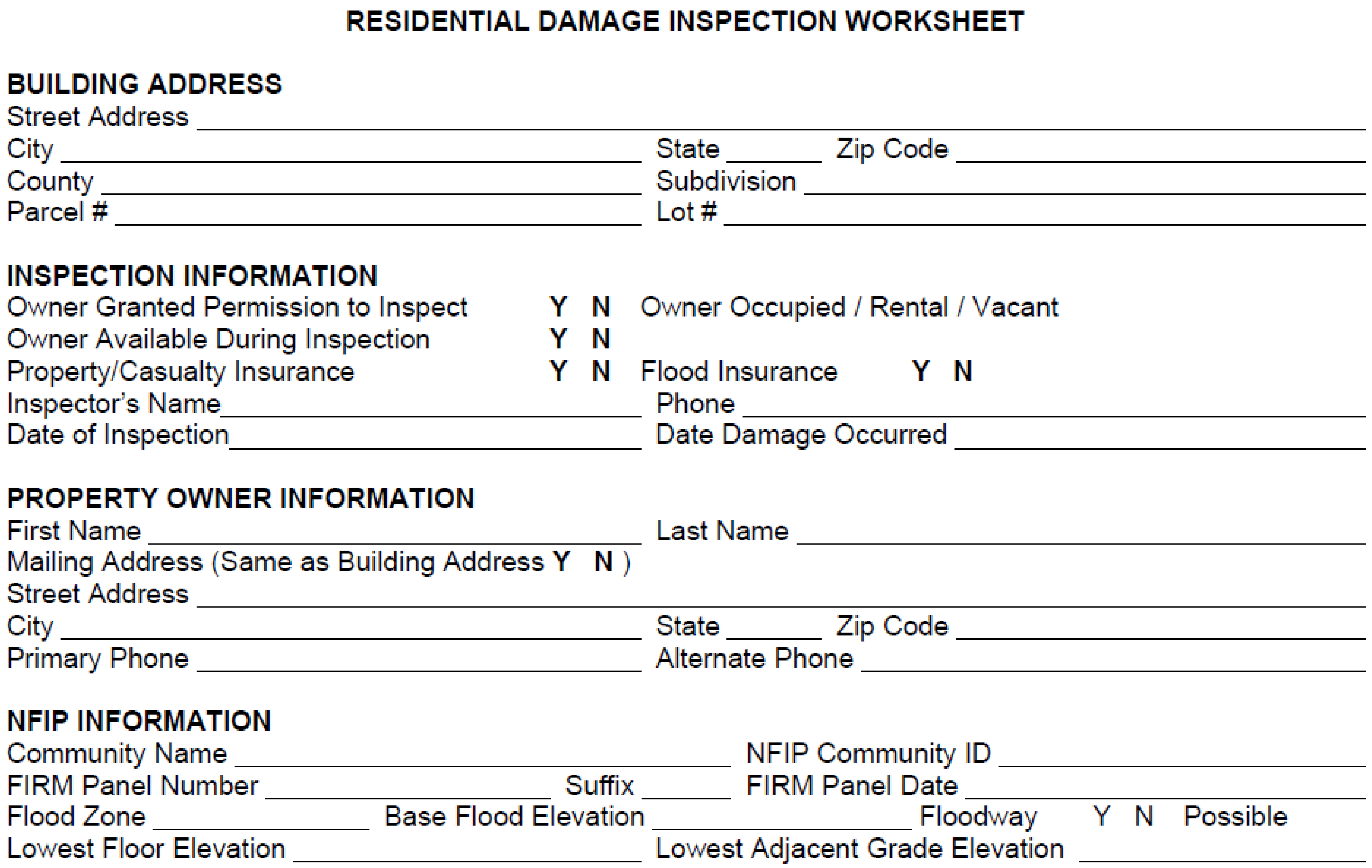
Exterior:
- __Address
- __From street looking at structure
- __Highwater mark
- __Full exterior & visible damage
- __Foundation damage
- __Front elevation
- __Onsite debris

Interior:
- __Basement
- __First Floor
- __Highwater mark
- __Appliances
- __Foundation damage
- __Built in items (cabinets, etc…)
- __Unique features
- __Utilities (Electrical panel, hot water heater, furnace, etc…)

Placard Posted: ______Yes ______No Which one?____________

NOTES:

Residential Damage Inspection Worksheet



RESIDENTIAL DAMAGE INSPECTION WORKSHEET

BUILDING ADDRESS

Street Address ________________________________
City ______________________ State ______ Zip Code ______________
County ______________________ Subdivision ______________________
Parcel # ______________________ Lot # ______________________

INSPECTION INFORMATION

Owner Granted Permission to Inspect **Y N** Owner Occupied / Rental / Vacant
Owner Available During Inspection **Y N**
Property/Casualty Insurance **Y N** Flood Insurance **Y N**
Inspector's Name ______________________ Phone ______________________
Date of Inspection ______________________ Date Damage Occurred ______________________

PROPERTY OWNER INFORMATION

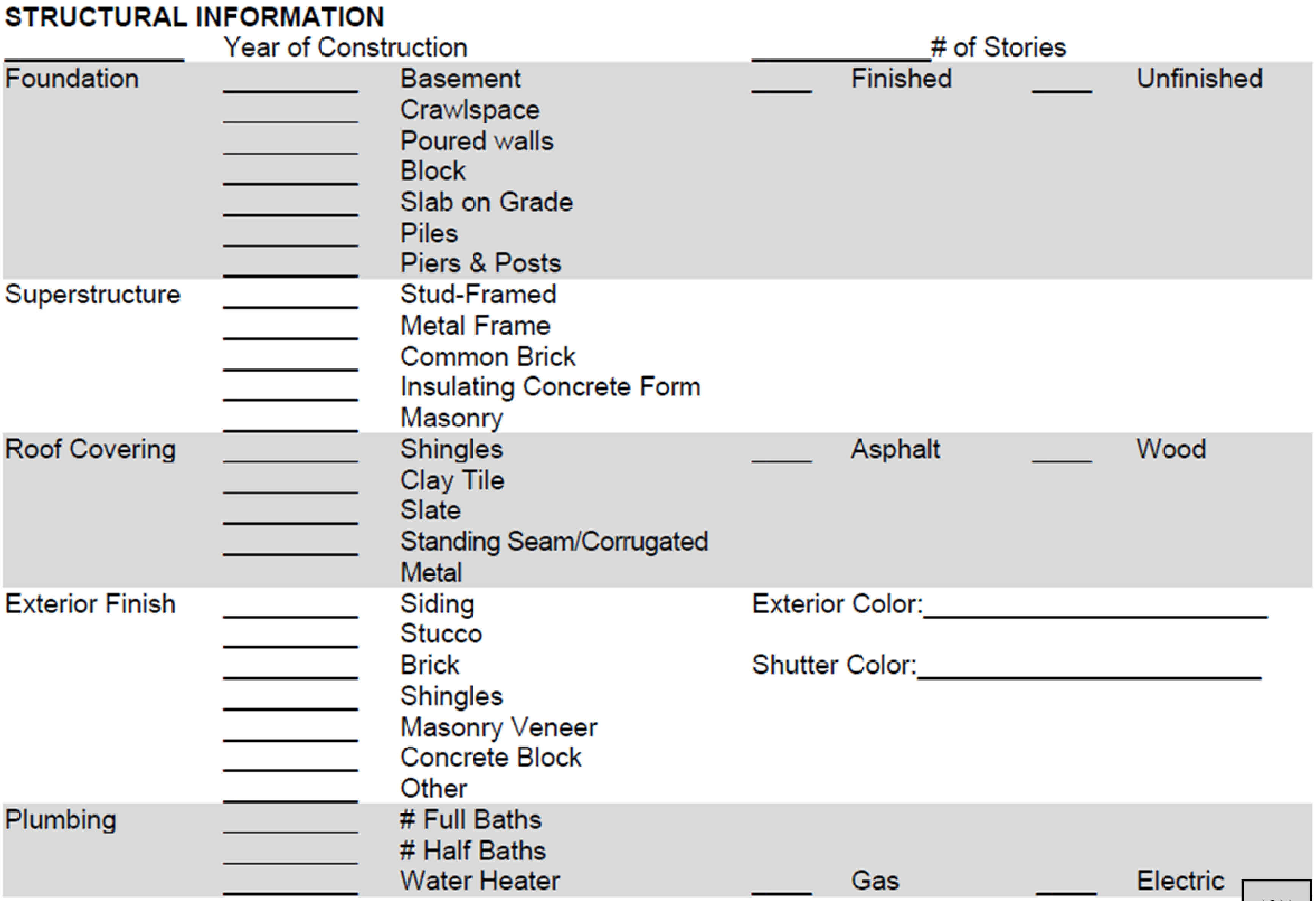
First Name ______________________ Last Name ______________________
Mailing Address (Same as Building Address **Y N**)
Street Address ________________________________
City ______________________ State ______ Zip Code ______________
Primary Phone ______________________ Alternate Phone ______________________

NFIP INFORMATION

Community Name ______________________ NFIP Community ID ______________________
FIRM Panel Number ______________ Suffix ______ FIRM Panel Date ______________________
Flood Zone ____________ Base Flood Elevation ______________ Floodway Y N Possible
Lowest Floor Elevation ______________________ Lowest Adjacent Grade Elevation ______________

OHIO EMERGENCY MANAGEMENT AGENCY

Residential Damage Inspection Worksheet



STRUCTURAL INFORMATION

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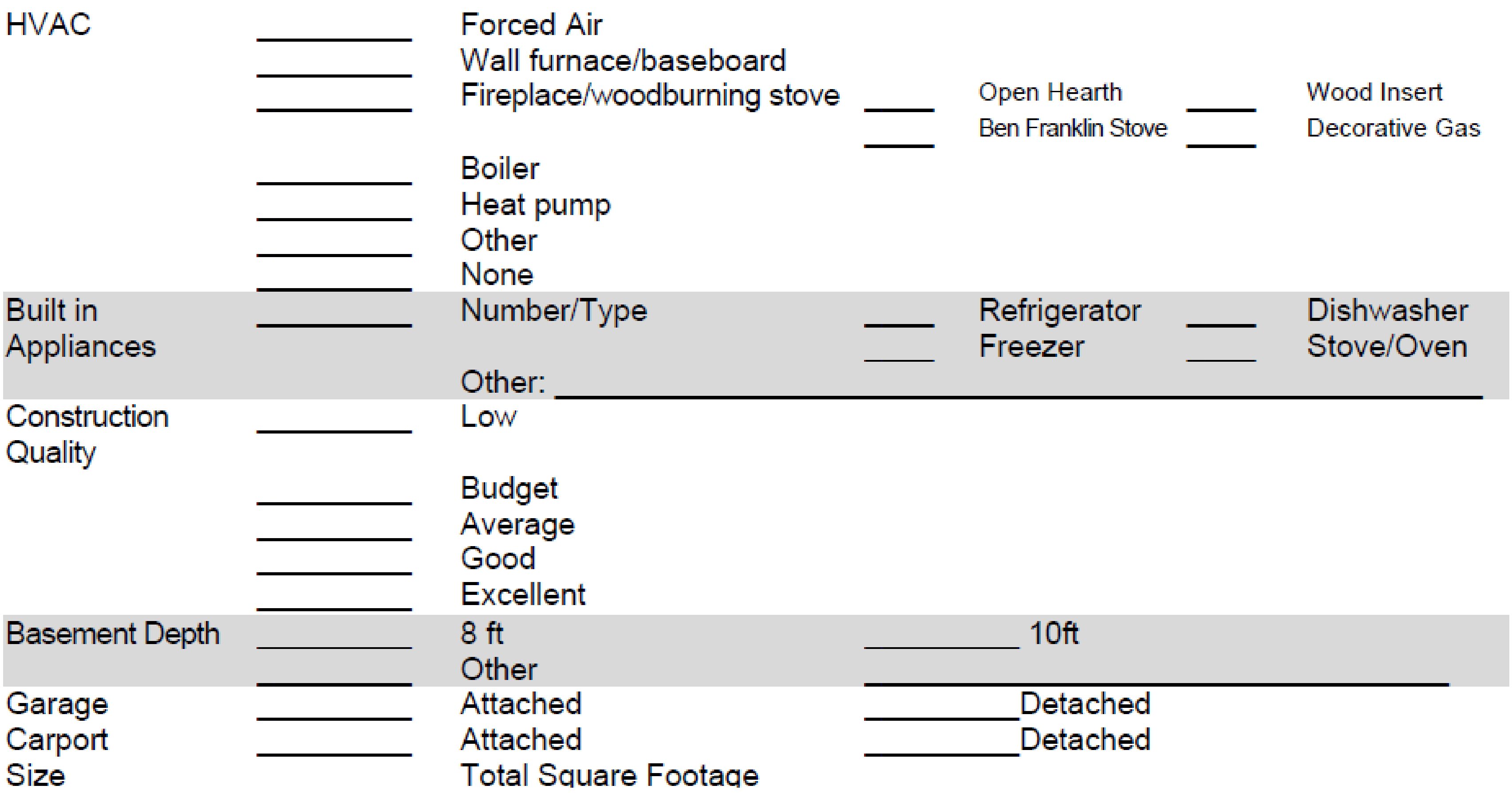
	________	Block				
	________	Slab on Grade				
	________	Piles				
	________	Piers & Posts				
Superstructure	________	Stud-Framed				
	________	Metal Frame				
	________	Common Brick				
	________	Insulating Concrete Form				
	________	Masonry				
Roof Covering	________	Shingles	____	Asphalt	____	Wood
	________	Clay Tile				
	________	Slate				
	________	Standing Seam/Corrugated Metal				
Exterior Finish	________	Siding		Exterior Color:____________________		
	________	Stucco				
	________	Brick		Shutter Color:____________________		
	________	Shingles				
	________	Masonry Veneer				
	________	Concrete Block				
	________	Other				
Plumbing	________	# Full Baths				
	________	# Half Baths				
	________	Water Heater	____	Gas	____	Electric

Ohio Emergency Management Agency

Residential Damage Inspection Worksheet



HVAC	____	Forced Air				
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	____	Fireplace/woodburning stove	____	Open Hearth	____	Wood Insert
			____	Ben Franklin Stove	____	Decorative Gas
	____	Boiler				
	____	Heat pump				
	____	Other				
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Built in Appliances	____	Number/Type	____	Refrigerator	____	Dishwasher
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		Other: ____				
Construction Quality	____	Low				
	____	Budget				
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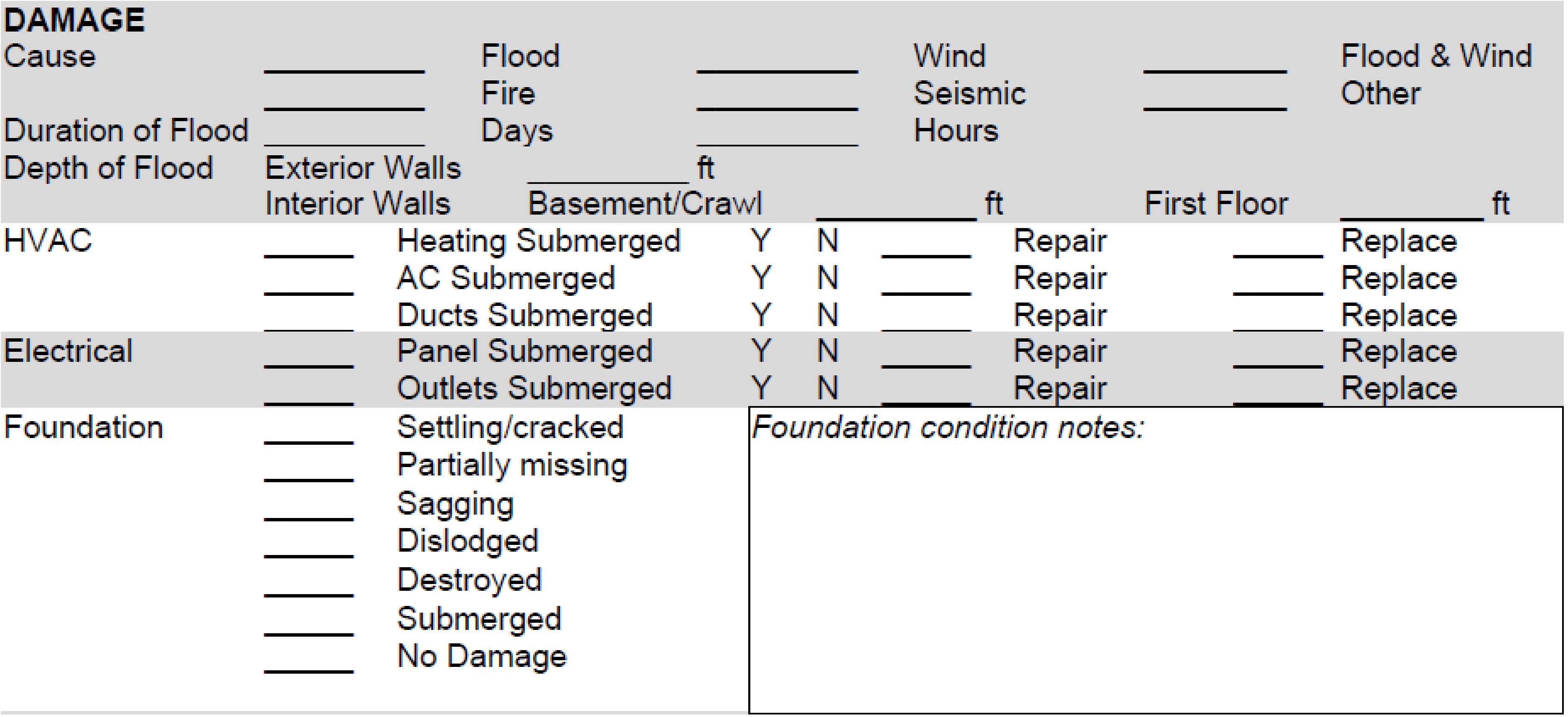
	____	Good				
	____	Excellent				
Basement Depth	____	8 ft	____	10ft		
	____	Other	____			
Garage	____	Attached	____	Detached		
Carport	____	Attached	____	Detached		
Size		Total Square Footage				

Residential Damage Inspection Worksheet

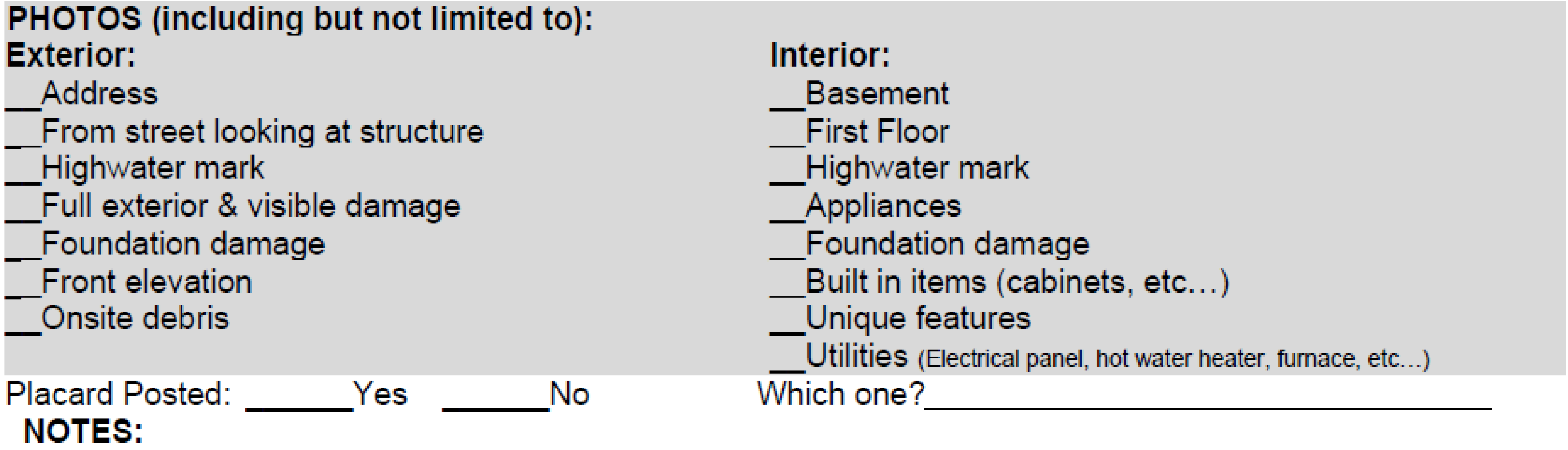


DAMAGE

Cause	______	Flood		______		Wind	______	Flood & Wind
	______	Fire		______		Seismic	______	Other
Duration of Flood	______	Days		______		Hours		
Depth of Flood	Exterior Walls		______ ft					
	Interior Walls		Basement/Crawl	______ ft		First Floor		______ ft
HVAC	______	Heating Submerged	Y	N	______	Repair	______	Replace
	______	AC Submerged	Y	N	______	Repair	______	Replace
	______	Ducts Submerged	Y	N	______	Repair	______	Replace
Electrical	______	Panel Submerged	Y	N	______	Repair	______	Replace
	______	Outlets Submerged	Y	N	______	Repair	______	Replace
Foundation	______	Settling/cracked	*Foundation condition notes:*					
	______	Partially missing						
	______	Sagging						
	______	Dislodged						
	______	Destroyed						
	______	Submerged						
	______	No Damage						

Ohio Emergency Management Agency

Residential Damage Inspection Worksheet



PHOTOS (including but not limited to):

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__Address
__From street looking at structure
__Highwater mark
__Full exterior & visible damage
__Foundation damage
__Front elevation
__Onsite debris

Interior:
__Basement
__First Floor
__Highwater mark
__Appliances
__Foundation damage
__Built in items (cabinets, etc…)
__Unique features
__Utilities (Electrical panel, hot water heater, furnace, etc…)

Placard Posted: ______Yes ______No

Which one?______________________________

NOTES:

Disaster Response & Recovery Act (DRRA) 1206

- FEMA Policy FP 204-079-01 Building Code & Floodplain Management Administration & Enforcement eff. 11/1/2020
- Intent is to provide communities with the resources needed to enforce floodplain regulations by conducting SD determinations up to 180 after the disaster declaration date
- Eligible work includes:
  - Building code administration
  - Code enforcement
  - Floodplain Management Ordinance Administration & Enforcement
- Eligible costs include but not limited to:
  - Only overtime for budgeted employees & straight time & overtime for extra hires
  - Other costs for extra hires or contracted support including: travel, accommodations & per diem
  - Costs associated with EMAC reimbursement according to PA guidance

ASFPM Disaster Assistance Response Team (DART)

- Intended to help communities expedite floodplain management duties & response/recovery tasks immediately after a natural disaster
- DART members are all skilled floodplain managers, have disaster response experience, & are fully trained.
- The DART can assist local floodplain managers by conducting: flood damage reconnaissance
    - High-water mark data collection
    - Substantial damage estimates
    - Training
    - Guidance on mitigation actions
- Ohio was asked to participate in the Pilot program
- https://www.floods.org/resource-center/disaster-assistance-response-team/

SDA Workgroup – Moving Forward

- Finalized ODNR SDA Manual
- Pilot SD Training @ 2022 Ohio Statewide FPM Conference (8/22)
- Pilot ONSITE SD Training – Fall 2022
- Example MOU for OBOA/DRT Assistance
- SD/SI Resources Webpage on ODNR Floodplain Management Program's Website
- Onsite SDA Training for Community Officials
- Annual Trainings for DRT & OBOA
- Participation in ASFPM Disaster Assessment Response Teams (DART) PILOT Project

Acknowledgements

Substantial Damage Assessment Workgroup

- Laura Adcock-Elder, Ohio EMA
- Mike Boso, City of Grove City/ICC
- Jim Decker, City of Mentor(formerly)/Safebuilt)
- Steve Ferryman, Ohio EMA
- Duane Matlack, Delaware County
- Brock Metzker, Ohio EMA
- Todd Richard City of Findlay(formerly)/Retired
- Alicia Silverio, ODNR
- Dan Spada, Geauga County
- Mike Spry, City of Cincinnati

Ohio Building Code Requirements

***Section 106.1, 2.1. Buildings or structures located in flood hazard areas**. Construction documents submitted for buildings or structures located in communities with identified flood hazard areas, pursuant to Section 1612, shall include the current FEMA "Flood Hazard Boundary Map" (FHBM), "Flood Insurance Rate Map" (FIRM) or "Flood Boundary Floodway Map" (FBFM) for the project location. The required site plan shall include building elevations using the same datum as the related flood hazard map. The owner shall be responsible for the compliance with local flood damage prevention regulations for additional critical elevation information for the project site.*

***Section 106.1.2 Special Provisions Paragraph 4.** The elevation certification provided by a registered surveyor and dry floodproofing certification, when required in Section 1612.5 for buildings or structures located in communities with identified flood hazard areas, shall be submitted to the building official.*

Section 202 Definitions. There are numerous definitions containing the word "flood." Please refer to this section for definitions.

Section 801.5 Applicability. For buildings in flood hazard areas as established in Section 1612.3, interior finishes, trim and decorative materials below the elevation required by Section 1612 shall be flood-damage-resistant materials.

Ohio Building Code Requirements

1107.7.5 Design flood elevation. The required number of Type A units and Type B units shall not apply to a site where the required elevation of the lowest floor or the lowest horizontal structural building members of nonelevator buildings are at or above the design flood elevation resulting in:

1. A difference in elevation between the minimum required floor elevation at the primary entrances and vehicular and pedestrian arrival points within 50 feet (15 240 mm) exceeding 30 inches (762 mm), and
2. A slope exceeding 10 percent between the minimum required floor elevation at the primary entrances and vehicular and pedestrian arrival points within 50 feet (15 240 mm).

1203.4 Under-floor ventilation. Paragraph 5. For buildings in flood hazard areas as established in Section 1612.3, the openings for under-floor ventilation shall be deemed as meeting the flood opening requirements of ASCE 24 provided that the ventilation openings are designed and installed in accordance with ASCE 24.

Ohio Building Code Requirements

1403.6 Flood resistance. For buildings in flood hazard areas as established in Section 1612.3, exterior walls extending below the elevation required by Section 1612 shall be constructed with flood-damage-resistant materials.

1403.7 Flood resistance for coastal high-hazard areas and coastal A zones. For buildings in coastal high-hazard areas and coastal A zones as established in Section 1612.3, electrical, mechanical and plumbing system components shall not be mounted on or penetrate through exterior walls that are designed to break away under flood loads.

1603.1.7 Flood design data. For buildings located in whole or in part in flood hazard areas as established in Section 1612.3, the documentation pertaining to design, if required in Section 1612.5, shall be included and the following information, referenced to the datum on the community's Flood Insurance Rate Map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

1. Flood design class assigned according to ASCE 24.
2. In flood hazard areas other than coastal high hazard areas or coastal A zones, the elevation of the proposed lowest floor, including the basement.
3. In flood hazard areas other than coastal high hazard areas or coastal A zones, the elevation to which any nonresidential building will be dry floodproofed.
4. In coastal high hazard areas and coastal A zones, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

Ohio Building Code Requirements

SECTION 1612 FLOOD LOADS

1612.1 General. Within flood hazard areas as established in Section 1612.3, all new construction of buildings, structures and portions of buildings and structures, including substantial improvement and restoration of substantial damage to buildings and structures, shall be designed and constructed to resist the effects of flood hazards and flood loads. For buildings that are located in more than one flood hazard area, the provisions associated with the most restrictive flood hazard area shall apply.

1612.2 Definitions. The following terms are defined in Chapter 2: Please refer to Section 202 for definitions.

1612.3 Establishment of flood hazard areas. All buildings and structures which have been determined to require flood resistant construction by the local flood plain administrator of a community participating in the “National Flood Insurance Program (NFIP),” or by the Ohio department of natural resources for communities in the “NFIP”, shall be constructed as required by the provisions of this section and the local authority’s flood damage prevention regulations. Reference to regulations in “FEMA 44 CFR Parts 59-77” in this section are adopted pursuant to Sections 121.75 and 121.76 of the Revised Code.

Ohio Building Code Requirements

1612.3.1 Design flood elevations. Where design flood elevations are not included in the flood hazard areas established in Section 1612.3, or where floodways are not designated, the building official is authorized to require the applicant to:

1. Obtain and reasonably utilize any design flood elevation and floodway data available from a federal, state or other source; or
2. Determine the design flood elevation and/or floodway in accordance with accepted hydrologic and hydraulic engineering practices used to define special flood hazard areas. Determinations shall be undertaken by a registered design professional who shall document that the technical methods used reflect currently accepted engineering practice.

1612.3.2 Determination of impacts. In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall provide a floodway analysis that demonstrates that the proposed work will not increase the design flood elevation more than 1 foot (305 mm) at any point within the jurisdiction of the applicable governing authority.

1612.4 Design and construction. The design and construction of buildings and structures located in flood hazard areas, including coastal high hazard areas and coastal A zones, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24.

Ohio Building Code Requirements

1612.5 Flood hazard documentation. The following documentation shall be prepared and sealed by a registered design professional and submitted to the building official:

1. For construction in flood hazard areas other than coastal high hazard areas or coastal A zones:

   The elevation of the lowest floor, including the basement, provided by a registered surveyor.

   1.1. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.

   1.2. For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24.

2. For construction in coastal high hazard areas and coastal A zones:

   2.1. The elevation of the bottom of the lowest horizontal structural member provided by a registered surveyor.

   2.2. Construction documents shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.

   2.3. For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m2) determined using allowable stress design, construction documents shall include a statement that the breakaway wall is designed in accordance with ASCE 24.

Ohio Building Code Requirements

RESIDENTIAL CODE OF OHIO REQUIREMENTS

- There are similar entries in the Residential Code of Ohio for flood construction. They are located in Chapter 1, Administration, Chapter 2, Definitions, Chapter 3, Building Planning, Chapter 4 Foundations.
- These chapters echo the majority of the requirements of the OBC.
- In addition, the Mechanical/Plumbing chapters toward the back of the code have requirements for appliance installations.

QUESTIONS?

OHIO EMERGENCY
MANAGEMENT AGENCY

OBOA Disaster Response Course Outline

The Ohio Department of Natural Resources, Division of Water, Floodplain Management reached out to the Ohio Building Officials Association (OBOA) several years ago to request help with implementing a team of responders to assist local municipalities with damage assessments after disasters.

The Ohio Building Officials Association (OBOA) has created an Ad-Hoc committee, Disaster Response. Jim Decker, current OBOA Treasurer, is the Chair of this committee. The purpose of the committee is to create a list of trained personnel to assist with Damage Assessments after disasters.

Background:

As a community participating in the National Flood Insurance Program (NFIP), the local floodplain administrator is tasked with performing damage assessments for structures in regulated floodplains. The program requires structures damaged beyond 50 percent of the structures market value be brought into compliance with the NFIP. Damage can be from flood, fire, wind, vehicle accidents, etc.

Post disaster damage assessments can be a daunting task. Municipalities are stressed with cleanup. And the residents are pressuring the local building departments to quickly reconstruct. The requirement to perform damage assessments is an added stress.

Task:

The Ohio Building Officials Association has agreed to become the repositor of a list of qualified individuals ready to deploy throughout the state and neighboring states to assist the local floodplain administrator with damage assessments.

Qualifications:

The Damage Assistance Response Teams (DART) personnel must be qualified to be a part of this team in three manners:

1. Be knowledgeable in the building code enforcement industry by holding any certification issued by the Ohio Board of Building Standards (Building Official, Plans Examiner, Inspector, Permit Technician); holding the duties of the local floodplain administrator; or holding the duties of a local property maintenance inspector.
2. Providing signed documentation from the responders jurisdiction of a Memorandum of Understanding (MOU) between said municipality and OBOA. The MOU will contain language that will provide protections to the responding employee following the state wide EMAC procedures and IMAC procedures.
3. Providing verification the responder has attended damage response training.

Building Code References

1. RCO Section 322
2. OBC Sections 106.1.1(2.1), 202 and 1612

Presenter Resume

Jim Decker has been employed in the building code enforcement industry for over 25 years. He maintains certifications as Building Official, Master Plans Examiner, Building Inspector, Residential Building Official and Certified Floodplain Manager. Jim has presented a Mechanical Code update to a Northeast Ohio mechanical contractors group and presented at the 2020 Ohio Statewide Floodplain Managers Association annual conference. Jim is currently the presenter/monitor of BOCONEO' Plans Examiners Round Table.

Thanks, Jim Decker

Decker Bio for Damage Assessment Course

James (Jim) E. Decker, Jr., PE, CFM
SAFEbuilt

Jim Decker works in the building code enforcement industry as a Chief Building Official and Master Plans Examiner for SAFEbuilt, primarily working for the City of Mentor. Jim has been working in this industry for over 25 years. Jim is also Treasurer of the Ohio Building Officials Association and serves as Chair of their Disaster Response Committee. Jim has been assisting the Substantial Damage Assessment Group for a couple of years.

Jim holds a Bachelor of Science degree in Civil Engineering (1983) from Tri-State University (now Trine University) in Angola, Indiana. He is a Professional Engineer registered in Ohio. Jim holds Ohio Board of Building Standards certifications as Building Official, Master Plans Examiner, Building Inspector and Residential Building Official. He also holds the ICC Building Plans Examiner Certification.